groundwater) and 4-4-14 (zinc distribution in groundwater), show some similarity, with elevated concentrations near the acid plant and former acid plant sediment drying area, as well in the lower plant site and near well DH-23. Acidic conditions in groundwater near the acid plant presumably mobilize zinc (well DH-19 shows a November 1997 concentration of 30.1 mg/L), with downgradient concentrations decreasing in the high pH zone near the former speiss pond and pit at wells DH-28 (0.023 mg/L) and DH-21 (<0.020 mg/L). Further downgradient, an additional source of zinc is indicated by elevated groundwater concentrations at well DH-24 (6.74 mg/L). Potential zinc sources in the lower plant site include soils in the lower ore storage area and the former zinc plant, located between wells DH-9 and DH-16 (Figure 4-4-14).

Similar to cadmium, zinc concentrations decrease dramatically near the plant site boundary, from greater than 6 mg/L at DH-24 to <0.020 mg/L at EH-60, EH-50, and EH-51. Coprecipitation and adsorption to iron and manganese oxides in this region is likely responsible for the attenuation of zinc downgradient of the west plant site.

In general, zinc shows more mobility than cadmium or lead in the area of the former upper ore storage area between Upper and Lower Lakes (Figure 4-4-14). Concentrations in wells APSD-9, APSD-10, and APSD-11 are slightly elevated (0.08 to 0.23 mg/L), although significantly lower than on the west plant site. In addition, zinc concentrations in wells immediately downgradient of Lower Lake (1.02 mg/L at DH-5 and 0.213 mg/L at APSD-7) remain higher than concentrations in Lower Lake (0.059 mg/L) as of November 1997 (Figure 4-4-14), suggesting that soils in the Lower Lake area are probably a source of zinc to plant site groundwater. Downgradient of the east plant site, however, groundwater zinc concentrations decrease to at or near laboratory detection limits (0.020 mg/L). The source of elevated zinc concentrations at the St. Clair residential well (0.163 mg/L) in East Helena is unclear, but is apparently localized and unrelated to the plant site, since concentrations upgradient of the St. Clair well and downgradient of the east plant site are near or below detection limits.

5. RELEASE ASSESSMENT AND EVALUATION OF REMEDIAL ACTIONS

This section consists of:

- A Release Assessment (Section 5.1) that identifies historical releases on the plant site and assesses the sources of the releases.
- An evaluation of Interim and Final Remedial Actions (Section 5.2) that describes the status of remedial activities and the effectiveness of those actions that have been implemented.

5.1 RELEASE ASSESSMENT

In accordance with paragraph 26 of the Consent Decree, a Release Assessment was conducted for the East Helena plant site which provides the following information:

- A description of the nature and extent of known or legitimately suspected release of hazardous waste and/or hazardous constituents.
- Whether the source is a solid and/or hazardous waste management unit, or other source (such as a one-time release),
- Migration pathways of releases, at or from the facility.
- The adequacy of existing data for each CC/RA area or unit on the plant site with respect to the following:

    a) CC/RA areas or units of the plant where the existing data are adequate to define releases, and supply information for identification and evaluation of interim and corrective measures;
    b) CC/RA areas or units of the plant where the existing data are adequate to demonstrate that there are, or have been, no releases of hazardous waste and/or hazardous constituents, and that no additional consideration is needed;

c) CC/RA areas of units of the plant where existing data are adequate to demonstrate that remedial work that is underway or work that has been completed results (when complete) in a remedy that is equivalent in manner and degree to the remedial goals of the RCRA corrective action program;
d) CC/RA areas or units of the plant where existing data are not adequate for such determinations;
e) Additional plant data needs, including a discussion if additional data should be obtained as an Interim Measure, or through an RFI.

A chronicle of events on the plant, including releases and remedial actions is in Exhibit 5-1-1. The assessment of plant site releases is in Table 5-1-1 and includes information on items a) through d) above. Additional data needs (item e above) are also noted in the assessment in Table 5-1-1 and are discussed in Section 5.1. Recommendations to address these data needs are in Section 6.0.

On-plant sources of hazardous waste or hazardous constituent releases to soils, surface water and groundwater have been evaluated as part of extensive site characterization studies conducted during the Process Ponds Remedial Investigation/Feasibility Study (Process Ponds RI/FS) (Hydrometrics, 1989) and the Comprehensive RI/FS (Hydrometrics, 1990a). The conclusions of the RI/FS and the result of post-RI data are previously discussed in Section 4.0.

In general, the RI/FS and Post-RI/FS investigations indicate there are no areas or operable units on the plant site that can be categorized as having no releases of hazardous waste and/or hazardous constituents from any source. However, as described in the RI/FS and based on Post-RI data, there are portions of the plant site or sub-units where releases have been determined to be minor and no additional remedial action has been specified.

TABLE 5-1-1 RELEASE ASSESSMENT SUMMARY

CC/RA AREA/ OPERABLE UNITS AND SUBUNITS	SOURCE TYPE	PATHWAY FOR POTENTIAL RELEASE	SOURCE AREA DATA QUALITY COVERAGE ISSUES				
			Are Data Adequate to Determine the Nature and Extent of Releases? (1)	Are Data Adequate to Determine Interim and Final Corrective Measures? (2)	Are Data Adequate to Determine that the Actions Implemented will meet the Equivalent of the Goals of a RCRA Corrective Action Program? (3)	Do Additional Data Need to be Collected? (4)	Comments/Description
Plant Site Soils and Ore Storage Areas Surface Soils	• Surface soils impacted from ore & concentrate stored in Lower Ore Storage Area prior to 1989. • Surface soils impacted from ore and concentrates stored in the Upper Ore storage area prior to 1989. • Surface soils in railroad track areas • Unpaved areas within the plant boundary • Unpaved areas adjacent to the plant boundary.	Potential pathways for migration of arsenic and metals are: • Plant site sources to surface soils • Surface soils to surface water runoff • Surface soils to groundwater.	Plant site soils were adequately characterized in the RI/FS to determine what metals are elevated in soils, and the area extent and general depth of elevated metals and arsenic.	Additional data will be needed to design corrective action measures for plant site soils. Refinement of volume estimates is needed for design purposes.	Additional data would be needed to confirm soil actions met design or performance standards or requirements.	Additional data are required. Collection of data could be obtained as part of an RFI or during Remedial Design. Immediate or interim data collection actions are not necessary.	

CC/RA AREA/ OPERABLE UNITS AND SUBUNITS	SOURCE TYPE	PATHWAY FOR POTENTIAL RELEASE	SOURCE AREA DATA QUALITY COVERAGE ISSUES				
			Are Data Adequate to Determine the Nature and Extent of Releases? (1)	Are Data Adequate to Determine Interim and Final Corrective Measures? (2)	Are Data Adequate to Determine that the Actions Implemented will meet the Equivalent of the Goals of a RCRA Corrective Action Program? (3)	Do Additional Data Need to be Collected? (4)	Comments/Description
Plant Site Soils and Ore Storage Areas (continued) Subsurface Soils	• Subsurface soils impacted in Process Pond areas as a result of process fluid losses • Subsurface soils in the saturation zone impacted by transport of groundwater containing elevated concentrations of arsenic and metals, and/or residual organic constituents. • Subsurface soils impacted from ore & concentrate stored in Lower Ore Storage Area prior to 1989. • Subsurface soils impacted from ore and concentrates stored in the Upper Ore storage area prior to 1989.	Potential pathways for migration of arsenic and metals are: • Plant site sources to subsurface soils • Process water to subsurface soil • Subsurface soils to groundwater • Groundwater to subsurface soil • Surface soils to subsurface soil	Plant site soils were adequately characterized in the RI/FS to determine what metals are elevated in soils, and the area extent and general depth of elevated metals and arsenic.	Additional data will be needed to design corrective action measures for plant site soils. Refinement of volume estimates is needed for design purposes.	Additional data would be needed to confirm soil actions met design or performance standards or requirements.	Additional data are required-particularly in the speiss pond area, the acid plant area. Collection of data could be obtained as part of an RFI or during Remedial Design. Immediate or interim data collection actions are not necessary.	Additional data collection is proposed for the speiss pond and pit, and acid plant areas (see below).

TABLE 5-1-1 RELEASE ASSESSMENT SUMMARY

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Surface Soils and Ore Storage Areas (continued) Slag Pile	• The RI concluded slag was not a significant source of arsenic or metals to groundwater, surface water or air quality. • Post RI/FS monitoring does not indicate slag has measurable impacts on Prickly Pear Creek water quality. Arsenic and metal concentrations during the highest flow events were lower downstream of the slag pile than upstream. While erosion of the slag pile undoubtedly occurs during flood conditions, correspondingly elevated concentrations of arsenic and metals downstream of the slag pile have not been observed.	Potential pathways for migration of arsenic and metals are: • Slag to groundwater, • Slag to surface water (Prickly Pear Creek).	The nature and extent of potential impacts to groundwater were adequately characterized during the RI. On-going monitoring provides additional detail on surface water quality (see Surface Water below).	The RI/FS concluded slag specific remedial measures were not required. Potential impacts to Prickly Pear Creek are addressed as part of Surface Water actions. Additional slag pile data are not needed to determine actions for the slag pile.	No slag specific actions will be implemented.	Additional data are not required. Potential slag impacts on Prickly Pear Creek are addressed by on-going surface water monitoring at the site.	The comprehensive RI/FS concluded slag is not a significant source of arsenic and metals to groundwater or surface water quality. Post RI/FS monitoring does not indicate slag has measurable impacts on Prickly Pear Creek water quality. Although there is presently no evidence of groundwater impacts from the slag pile, EPA has noted that additional monitoring wells in the slag may be required in the future; particularly when upgradient sources to groundwater have been eliminated and groundwater quality improves.

TABLE 5-1-1 RELEASE ASSESSMENT SUMMARY

CC/RA AREA/ OPERABLE UNITS AND SUBUNITS	SOURCE TYPE	PATHWAY FOR POTENTIAL RELEASE	SOURCE AREA DATA QUALITY COVERAGE ISSUES				
			Are Data Adequate to Determine the Nature and Extent of Releases? (1)	**Are Data Adequate to Determine Interim and Final Corrective Measures?** (2)	**Are Data Adequate to Determine that the Actions Implemented will meet the Equivalent of the Goals of a RCRA Corrective Action Program?** (3)	**Do Additional Data Need to be Collected?** (4)	**Comments/Description**
Process Ponds Lower Lake	• The RI documented contributions of arsenic and metals from Lower Lake to groundwater, soils and surface water. • Subsequent post-RI monitoring shows significant declines in Lower Lake water quality and subsequent improvement in down-gradient groundwater and surface water (see Sections 4.4.3, 4.5 and 5.2).	Potential pathways for migration of arsenic and metals are: • Process water to groundwater. • Process water to subsurface soils. • Surface water (Lower Lake) to groundwater • Groundwater to surface water (Prickly Pear Creek).	The nature and extent of Lower Lake quality and potential impacts to groundwater, surface water and subsurface soils were adequately characterized during the RI to determine corrective actions in accordance with the Process Pond ROD. On-going monitoring provides additional detail on improving Lower Lake quality and groundwater quality as a result of implemented corrective actions (see Table 5-2-1).	Adequate data were collected to develop corrective measures specific for Lower Lake. On-going long-term monitoring provides additional data required to assess the effectiveness of final corrective measures for Lower Lake (see Table 5-2-1).	The data collected are adequate to determine if the actions implemented to date are equivalent of the goals of a RCRA Corrective Action Program. However, additional data are required to monitor the effectiveness of actions implemented to date and the need to proceed with further action on Lower Lake per the Process Pond ROD.	On-going long-term data are required to monitor Lower Lake water quality and trends in groundwater and surface water as a result of changes in Lower Lake water quality. Additional results from on-going monitoring will be incorporated into the RFI.	• Inputs of arsenic and metals to Lower Lake were reduced by implementation of a series of corrective actions including treatment of plant water by the HDS facility, and dredging Lower Lake sediments (see Table 5-2-1). • The Process Pond ROD specifies treatment of Lower Lake: however, recent water quality trends in Lower Lake suggest treatment may not be necessary (see Section 6.0).
Former Thornock Lake	• The RI documented contributions of arsenic and metals from former Thornock Lake.	Potential pathways for migration of arsenic and metals are: • Process water to groundwater. • Process water to surface and subsurface soils.	The nature and extent of potential impacts to groundwater and subsurface soils were adequately characterized during the RI. On-going monitoring provides additional detail on groundwater improvements as a result of implemented corrective actions (see Table 5-2-1).	Adequate data were collected to develop final corrective measures for Thornock Lake.	The data collected are adequate to determine if the action is equivalent of the goals of a RCRA Corrective Action Program.	Additional data specific to Thornock Lake are not required.	Thornock Lake was remediated in accordance with the requirements of the Process Pond ROD (see Table 5-2-1). Although remediation was completed in accordance with CERCLA requirements, EPA has noted additional data may be needed to evaluate residual concentrations of metals as part of an RFI.

TABLE 5-1-1 RELEASE ASSESSMENT SUMMARY

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			Are Data Adequate to Determine the Nature and Extent of Releases? (1)	Are Data Adequate to Determine Interim and Final Corrective Measures? (2)	Are Data Adequate to Determine that the Actions Implemented will meet the Equivalent of the Goals of a RCRA Corrective Action Program? (3)	Do Additional Data Need to be Collected? (4)	Comments/Description
Process Ponds (continued) Former Speiss Pond	• The RI documented contributions of arsenic and metals from the former speiss pond to groundwater. • Subsequent post-RI monitoring shows continued contributions of arsenic and metals to groundwater in the speiss pond (see Sections 4.4.3 and 4.5).	Potential pathways for migration of arsenic and metals are: • Process water to groundwater. • Process water to surface and subsurface soils.	The nature and extent of potential impacts to groundwater and subsurface soils were adequately characterized during the RI to determine corrective actions in accordance with the Process Pond ROD. On-going monitoring provides additional detail on groundwater improvements as a result of implemented corrective actions (see Table 5-2-1). Additional data are needed to fully characterize groundwater conditions in the speiss storage area.	Adequate data were collected to develop interim corrective measures specifically to the speiss pond. Additional data are required to assess final remediation measures in the speiss pond area.	Additional data may be required to address future actions implemented at the speiss pond area.	Additional long-term data are required to monitor groundwater trends in the immediate speiss pond area. Data needs include: • Evaluation of surface water runoff conditions. • Evaluation of the existing surface water retention tank and runoff conveyances to the tank (see Table 5-2-1). • Long-term monitoring groundwater data. Additional data can be obtained as part of an RFI, since the overall downgradient water quality has improved. However, additional source area evaluation is proposed as an interim measure to assess on-going sources of arsenic and metals to groundwater.	• The speiss pond was remediated in accordance with the requirements of the Process Pond ROD (see Table 5-2-1). • The changeover in the speiss granulation process from water granulation to air/water mist granulation eliminated the use of the water granulation process fluid circuit. • Additional speiss pond and pit area investigation is required to assess the continuing source of elevated arsenic concentrations in groundwater at DH-21 and DH-28 (see Table 5-2-1).

TABLE 5-1-1 RELEASE ASSESSMENT SUMMARY

CC/RA AREA/ OPERABLE UNITS AND SUBUNITS	SOURCE TYPE	PATHWAY FOR POTENTIAL RELEASE	SOURCE AREA DATA QUALITY COVERAGE ISSUES				
			Are Data Adequate to Determine the Nature and Extent of Releases? (1)	**Are Data Adequate to Determine Interim and Final Corrective Measures?** (2)	**Are Data Adequate to Determine that the Actions Implemented will meet the Equivalent of the Goals of a RCRA Corrective Action Program?** (3)	**Do Additional Data Need to be Collected?** (4)	**Comments/Description**
Process Ponds (continued) Former Speiss Pit	• The RI documented contributions of arsenic and metals from the former speiss pit to groundwater. • Subsequent post-RI monitoring shows continued contributions of arsenic and metals to groundwater in the speiss pit area (see Sections 4.4.3 and 4.5).	Potential pathways for migration of arsenic and metals are: • Process water to groundwater. • Process water to surface and subsurface soils.	The nature and extent of potential impacts to groundwater and subsurface soils were adequately characterized during the RI to determine corrective actions in accordance with the Process Pond ROD. On-going monitoring provides additional detail on groundwater improvements as a result of implemented corrective actions (see Table 5-2-1). Additional data are needed to fully characterize groundwater conditions in the speiss storage area.	Adequate data were collected to develop interim corrective measures specifically to the speiss pit. Additional data are required to assess final remediation measures in the speiss pit.	Additional data may be required to address future actions implemented at the speiss pit area.	Additional long-term data are required to monitor groundwater trends in the immediate speiss pit area. Data needs include: • Evaluation of surface water runoff conditions (see Table 5-2-1). Additional data can be obtained as part of an RFI, since the overall downgradient water quality has improved. However, additional source area evaluation is proposed as an interim measure to assess on-going sources of arsenic and metals to groundwater.	• The speiss pit was remediated in accordance with the requirements of the Process Pond ROD (see Table 5-2-1). • The changeover in the speiss granulation process from water granulation to air/water mist granulation eliminated the use of the water granulation process fluid circuit. • Additional speiss pond and pit area investigation is required to assess the continuing source of elevated arsenic concentrations in groundwater at DH-21 and DH-28 (see Table 5-2-1).

CC/RA AREA/ OPERABLE UNITS AND SUBUNITS	SOURCE TYPE	PATHWAY FOR POTENTIAL RELEASE	SOURCE AREA DATA QUALITY COVERAGE ISSUES				
			Are Data Adequate to Determine the Nature and Extent of Releases? (to Define the Problem) (1)	**Are Data Adequate to Determine Interim and Final Corrective Measures?** (Design and implement Remedial Actions) (2)	**Are Data Adequate to Determine that the Actions Implemented will meet the Equivalent of the Goals of a RCRA Corrective Action Program?** (3)	**Do Additional Data Need to be Collected?** (4)	**Comments/Description**
Process Ponds (continued) Former Acid Plant Water Treatment Settling Facility	• The RI documented contribution of arsenic and metals from former acid plant water treatment settling pond and the sediment drying areas to groundwater. • Subsequent post-RI monitoring shows continued contributions of arsenic and metals to groundwater in the acid plant area (see Sections 4.4.3 and 4.5).	Potential pathways for migration of arsenic and metals are: • Process water to groundwater, • Process water to surface and subsurface soils. • Process water to surface water (Lower Lake). • Surface water (Lower Lake) to groundwater. • Groundwater to surface water (Prickly Pear Creek).	The nature and extent of potential impacts to surface water, groundwater and subsurface soils were adequately characterized during the RI to determine corrective actions in accordance with the Process Pond ROD. On-going monitoring provides additional detail on groundwater improvements as a result of implemented corrective actions (see Table 5-2-1). Additional data are needed to fully characterize groundwater conditions in the acid plant processing area.	Adequate data was collected to develop interim corrective measures specifically to the acid plant water treatment settling pond. Additional data is required to assess final remediation measures in the acid plant area.	Additional data may be required to address future actions implemented at the acid plant area.	On-going long-term data is required to monitor groundwater trends in the immediate acid plant pond area. Additional results from on-going monitoring will be incorporated into the RFI. Additional data specific to the acid plant settling pond are not necessary.	• Soil underlying the acid plant water treatment settling pond area was removed in accordance with the Process Pond ROD (see Table 5-2-1). • Although remediation was completed in accordance with CERCLA requirements, EPA has noted additional data may be needed to evaluate residual concentrations of metals as part of an RFI. • Additional post-RI/FS monitoring will provide data necessary to monitor the effects of corrective actions.

CC/RA AREA/ OPERABLE UNITS AND SUBUNITS	SOURCE TYPE	PATHWAY FOR POTENTIAL RELEASE	SOURCE AREA DATA QUALITY COVERAGE ISSUES				
			Are Data Adequate to Determine the Nature and Extent of Releases? (to Define the Problem) (1)	**Are Data Adequate to Determine Interim and Final Corrective Measures?** (Design and implement Remedial Actions) (2)	**Are Data Adequate to Determine that the Actions Implemented will meet the Equivalent of the Goals of a RCRA Corrective Action Program?** (3)	**Do Additional Data Need to be Collected?** (4)	**Comments/Description**
Process Ponds (continued) Former Acid Plant Sediment Drying Areas	• The RI documented contributions of arsenic and metals from the former acid plant water treatment settling pond and the sediment drying areas to groundwater. • Subsequent post-RI monitoring shows continued contributions of arsenic and metals to groundwater in the acid plant area (see Sections 4.4.3 and 4.5).	Potential pathways for migration of arsenic and metals are: • Process water to groundwater. • Process water to surface and subsurface soils. • Surface water (Lower Lake) to groundwater. • Groundwater to surface water (Prickly Pear Creek).	The nature and extent of potential impacts to groundwater and subsurface soils were adequately characterized during the RI to determine corrective actions in accordance with the Process Pond ROD. On-going monitoring provides additional detail on groundwater improvements as a result of implemented corrective actions (see Table 5-2-1). Additional data are needed to fully characterize groundwater conditions in the acid plant processing area.	Adequate data were collected to develop interim corrective measures specifically to address the former acid plant sediment drying areas. Additional data are required to assess final corrective measures in the acid plant area (see Table 5-2-1).	Additional data may be required to address future actions implemented at the acid plant area.	On-going long-term data are required to monitor groundwater trends in the immediate acid plant sediment drying area. Additional data are also needed to evaluate other areas of the acid plant (see Table 5-2-1). Data needs include: • Evaluation of acid plant area southwest of the former settling pond. • On-going evaluation of the former sediment drying area. • Evaluation of existing runoff patterns in the sediment drying area. • Additional source area evaluation is proposed as an interim measure to assess on-going sources of arsenic and metals to groundwater.	• Soil underlying the acid plant ~~settling~~sediment drying area near the acid plant water treatment facility was removed in accordance with the Process Pond ROD (see Table 5-2-1). Although sediment removal from the former sediment drying area near acid plant water treatment facility was completed in accordance with CERCLA requirements, EPA has noted additional data may be needed to evaluate residual concentrations of metals as part of an RFI. • The acid plant sediment drying area adjacent to Lower Lake remains to be addressed.

TABLE 5-1-1 RELEASE ASSESSMENT SUMMARY

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			Are Data Adequate to Determine the Nature and Extent of Releases? (to Define the Problem) (1)	**Are Data Adequate to Determine Interim and Final Corrective Measures?** (Design and implement Remedial Actions) (2)	**Are Data Adequate to Determine that the Actions Implemented will meet the Equivalent of the Goals of a RCRA Corrective Action Program?** (3)	**Do Additional Data Need to be Collected?** (4)	**Comments/Description**
Process Fluid Circuits Plant Water Circuit	• Incidental seepage of plant water to soil and groundwater from pressure lines, drain lines and sumps. • February 1998: Failure of underground pressure line.	Potential pathways for migration of arsenic and metals are: • Process water to groundwater, • Process water to surface and subsurface soils.	The nature and extent of process water quality and potential impacts to groundwater and subsurface soils were characterized during the RI. However, corrective actions have resulted in continuously improving plant water circuit quality. On-going monitoring provides additional detail on groundwater improvements as a result of implemented corrective actions (see Table 5-2-1). Additional data are needed to fully characterize groundwater conditions.	Data collected as part of the Plant Water Investigation allowed evaluation of the effectiveness of the replacement of sections of the plant water pressure line (see Table 5-2-1). Additional data are necessary to develop final corrective measures.	Additional data may be required to address future actions implemented for the plant water circuit.	• The Plant Water Investigation monitoring program is presently on-going to assess plant water and groundwater trends following the February 1998 plant water loss, and subsequent abandonment of most of the underground process water pressure line. • An on-going water balance is presently underway to evaluate future corrective actions for the plant water circuit (see Table 5-2-1). • On-going plant water investigation monitoring and the water balance data are being collected as part of interim actions.	• In addition to 1998 plant water circuit modifications, changes to plant water drainage systems have been implemented in the 1990s, including replacement or repair of sumps identified in the Comprehensive RI/FS as potential sources of arsenic and metals to groundwater (see Table 5-2-1).

TABLE 5-1-1 RELEASE ASSESSMENT SUMMARY

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Process Fluid Circuits (continued) Former Speiss Water Granulating Circuit	• Incidental seepage from the speiss circuit as described in the RI/FS. The speiss water granulating circuit was replaced by air/water mist granulation in 1991 (see Table 5-2-1).	Potential pathways for spills and losses from the former speiss water circuit, and resulting migration of arsenic and metals are: • Process water to groundwater. • Process water to surface and subsurface soils.	See speiss pond and pit above.	See speiss pond and pit above.	See speiss pond and pit above.	See speiss pond and pit above.	See speiss pond and pit above.
Acid Plant Water Circuit	• Incidental seepage from the acid plant water circuit as described in the RI/FS. • February 1997: Surface spill of 1,200 gallons of sulfuric acid. • January 1998: 450 gallons of scrubber blowdown water were spilled. • January 1998: 500 gallons of sulfuric acid were spilled. • August 1998: A sulfuric acid leak into the non-contact cooling water circuit results in erosion of the cooling water pipeline and subsequent losses from the line to groundwater.	Potential pathways for spills and losses from the acid plant water circuit, and resulting migration of arsenic and metals are: • Process water to groundwater. • Process water to surface and subsurface soils.	The nature and extent of acid plant water circuit quality and potential impacts to groundwater and subsurface soils were characterized during the RI. On-going monitoring provides additional detail on groundwater as a result of implemented corrective actions (see Table 5-2-1). Additional data are needed to fully characterize groundwater conditions in the acid plant area.	Additional data may be necessary to assist in implementation of interim remedial design measures. However, replacement of the acid plant water circuit line is an interim action that is being implemented by Asarco. (see Table 5-2-1). Additional data are necessary to develop final corrective measures.	Additional groundwater quality data; particularly from more acid plant specific locations are needed to assess the impacts and effectiveness of implemented corrective actions at the acid plant (see Table 5-2-1).	• Additional data specific to the acid plant operation circuit area will be needed to assess effects of spills as well as the effectiveness of corrective actions. • Collection of these data will be conducted as an interim measure.	• Acid plant corrective actions are in progress and are being coordinated with EPA RCRA personnel.

CC/RA AREA/ OPERABLE UNITS AND SUBUNITS	SOURCE TYPE	PATHWAY FOR POTENTIAL RELEASE	SOURCE AREA DATA QUALITY COVERAGE ISSUES				
			Are Data Adequate to Determine the Nature and Extent of Releases? (to Define the Problem) (1)	**Are Data Adequate to Determine Interim and Final Corrective Measures?** (Design and implement Remedial Actions) (2)	**Are Data Adequate to Determine that the Actions Implemented will meet the Equivelent of the Goals of a RCRA Corrective Action Program?** (3)	**Do Additional Data Need to be Collected?** (4)	**Comments/Description**
Surface Water Prickly Pear Creek	• The RI documented contributions of arsenic from Lower Lake. Post-RI monitoring confirmed arsenic contributions from Lower Lake. • Post RI/FS monitoring does not indicate slag has measurable impacts on Prickly Pear Creek water quality. Arsenic and metal concentrations during the highest flow events were lower downstream of the slag pile than upstream. While erosion of the slag pile undoubtedly occurs during flood conditions, correspondingly elevated concentrations of arsenic and metals downstream of the slag pile have not been observed.	Potential pathways for migration of arsenic and metals in Prickly Pear Creek are: • Plant site sources (Lower Lake or Slag) to Prickly Pear Creek. • Groundwater (Lower Lake berm) to Prickly Pear Creek. • Surface water (Prickly Pear Creek) to groundwater. • Prickly Pear Creek to animal, fish, agricultural and human receptors.	The nature and extent of potential impacts to groundwater were adequately characterized during the RI. On-going monitoring provides additional detail on surface water quality.	The RI/FS concluded only impacts from Lower Lake were measurable. Impacts from erosion of the slag pile were not measurable during the RI period. Post-RI surface water data also show no measureable impacts from slag. Additional long-term monitoring data will continue to provided information on the relationship of the slag pile and surface water quality.	Additional surface water data, collected as part of on-going monitoring efforts, ~~would~~ may be necessary to evaluate the effectiveness of any implemented action (see Table 5-2-1). On-going long-term monitoring will also provide information on present conditions.	On-going long-term monitoring will provide the necessary information on present and future conditions. Additional results from on-going monitoring will be incorporated into the RFI.	• No actions have been implemented for Prickly Pear Creek (see Table 5-2-1). On-going monitoring shows creek impacts are slight with historical affects attributed to Lower Lake and potential effects from the slag pile being too low to measure.
CC/RA AREA/ OPERABLE UNITS AND SUBUNITS	SOURCE TYPE	PATHWAY FOR POTENTIAL RELEASE	SOURCE AREA DATA QUALITY COVERAGE ISSUES				

			Are Data Adequate to Determine the Nature and Extent of Releases? (to Define the Problem) (1)	**Are Data Adequate to Determine Interim and Final Corrective Measures?** (Design and implement Remedial Actions) (2)	**Are Data Adequate to Determine that the Actions Implemented will meet the Equivalent of the Goals of a RCRA Corrective Action Program?** (3)	**Do Additional Data Need to be Collected?** (4)	**Comments/Description**
Surface Water (continued) Wilson Ditch	• The RI documented arsenic and lead in Wilson Ditch sediments but no measurable impacts in water quality. • Sediments were removed in 1992 and 1993. During removal, seepage with elevated concentrations of arsenic and metals from plant site sources into the on-plant portion of Wilson Ditch was noted (see Table 5-2-1).	Potential pathways for migration of arsenic and metals in Wilson Ditch are: • Surface water (Wilson Ditch water) to groundwater. • Wilson Ditch water to animal receptors. • Wilson Ditch water and sediments to human receptors. • Wilson Ditch water and sediment to agricultural receptors.	The nature and extent of impacts to surface water and sediment were adequately characterized during the RI. Based on the characterization, sediments were subsequently excavated in accordance with requirements of the Residential Soils requirements.	The data collected during the Comprehensive RI, as well as data obtained during sediment removal were sufficient to determine corrective measures for Wilson Ditch.	Sediment removal objectives were verified by confirmational sampling. The relocation of the plant site portion of the ditch is believed to successfully eliminate on-plant inputs to the ditch; however, additional water quality confirmational samples are recommended.	Supplemental water quality samples from Wilson Ditch during low flow periods would confirm elimination of plant site inputs to the ditch. Additional data can be obtained as part of an RFI;. T there is no need for expedited interim data collection efforts.	• Wilson Ditch bottom sediments were removed during an interim action implemented as part of the Residential Soils Consent Decree (see Table 5-2-1). • As described in Section 4.3 and in Table 5-2-1, the plant site segment of Wilson Ditch was replaced with an underground HPDE pipeline rerouted around the plant site.
Storm Water	• The Process Ponds RI identified storm water runoff from the plant site as a source of arsenic and metals to off-site receptors. • A storm water containment system was constructed in 1997 to contain storm water runoff on the plant site.	Potential pathways for migration of arsenic and metals from storm water runoff are: • Surface water (storm water runoff) to groundwater. • Surface water to surface and subsurface soils.	The nature and extent of surface water impacts were adequately determined during the Process Pond and Comprehensive RI efforts.	Adequate data were collected as part of remedial design to successfully implement the corrective action.	The data collected are adequate to determine if the action implemented to date is equivalent toof the goals of a RCRA Corrective Action Program.	Additional data are not required.	The storm water collection system is described in Section 4.3 and in Table 5-2-1.

CC/RA AREA/ OPERABLE UNITS AND SUBUNITS	SOURCE TYPE	PATHWAY FOR POTENTIAL RELEASE	SOURCE AREA DATA QUALITY COVERAGE ISSUES				
			Are Data Adequate to Determine the Nature and Extent of Releases?) (1)	Are Data Adequate to Determine Interim and Final Corrective Measures? (2)	Are Data Adequate to Determine that the Actions Implemented will meet the Equivalent of the Goals of a RCRA Corrective Action Program? (3)	Do Additional Data Need to be Collected? (4)	Comments/Description
Groundwater Inorganics	• The Comprehensive RI identified impacts to groundwater from plant site process fluid sources and plant site subsurface soils.	Potential pathways for migration of arsenic and metals from groundwater are: • Process water to groundwater. • Soil to groundwater • Groundwater to surface water. • Surface water to groundwater.	The nature and extent of potential impacts to groundwater and subsurface soils were adequately characterized during the RI to evaluate existing conditions. On-going monitoring provides additional detail on groundwater improvements as a result of implemented corrective actions on the plant site (see Table 5-2-1).	Interim and final corrective action data needs are the same as those for plant site soil, Process Pond and Process Fluid corrective action data requirements (see above).	On-going long-term monitoring is necessary to evaluate the effects of corrective actions implemented on plant site sources. Additional specific monitoring locations and analytical parameters may also be necessary to determine if site actions meet the equivalent of the goals of a RCRA Corrective Action Program.	On-going long-term monitoring is needed, as well as some additional sample locations (wells) and additional analytical parameters (based on EPA comments on the post-RI Monitoring report – Hydrometrics 1995 – See Section 4.4) Additional data can be obtained as part of an RFI.; There is no need for expedited interim data collection efforts.	• Corrective actions that have resulted in reduced concentrations of arsenic and metals in groundwater have been implemented as part of the Process Pond ROD. Additional potential corrective actions that directly address groundwater are discussed in Table 5-2-1.

TABLE 5-1-1 RELEASE ASSESSMENT SUMMARY

CC/RA AREA/ OPERABLE UNIT	SOURCE TYPE	PATHWAY FOR POTENTIAL RELEASE	SOURCE AREA DATA QUALITY COVERAGE ISSUES				
			Are Data Adequate to Determine the Nature and Extent of Releases? (to Define the Problem) (1)	**Are Data Adequate to Determine Interim and Final Corrective Measures?** (Design and implement Remedial Actions) (2)	**Are Data Adequate to Determine that the Actions Implemented will meet the Equivalent of the Goals of a RCRA Corrective Action Program?** (3)	**Do Additional Data Need to be Collected?** (4)	**Comments/Description**
Groundwater (continued) Organics	• The Comprehensive RI identified residual concentrations of weathered organic constituents of organic compounds in plant site groundwater and subsurface soils. The residual organic observed in soils and groundwater was the result of fuel oil losses in the 1920s. The product has since broken down, with no volatile and only, trace semi-volatile constituents remaining.	• The potential pathway for migration of petroleum constituents is from plant site groundwater to off plant downgradient groundwater.	EPA has requested that additional organic parameters be added to the on-going monitoring program (see Appendix 4-4-1).	EPA has requested that additional organic parameters be added to the on-going monitoring program (see Appendix 4-4-1).	EPA has requested that additional organic parameters be added to the on-going monitoring program (see Appendix 4-4-1).	EPA has requested that additional organic parameters be added to the on-going monitoring program (see Appendix 4-4-1). These additional data will be addressed as part of an RFI.	Potential groundwater corrective actions are discussed in Table 5-2-1.
	• November 1996: Routine monitoring discovered petroleum product in plant site monitoring well MW-27 and down-gradient monitoring well MW-28. The petroleum product detected in 1996 was the result of a one-time spill.	• The potential pathway for migration of petroleum constituents is from plant site groundwater to off plant downgradient groundwater.	As discussed in correspondence to EPA (January 20, 1997/August 1, 1997), the extent and nature of the hydrocarbon in the plant site wells were characterized.	Data from the affected wells continues to be collected to monitor the effects of the hydrocarbon on the two monitoring wells.	Additional data may be required to meet the equivalent of the goals of a RCRA Corrective Action Program.	Additional data collection is on-going.	The source of the hydrocarbon loss is believed to be hydraulic fluid, and possibly diesel fuel from excavation equipment used on the site. The equipment has since been repaired.

NOTES: (1) As described in Paragraph 25(c) of the Consent Decree.
(2) As described in Paragraph 25 (d) of the Consent Decree
(3) As described in Paragraph 25 (e) of the Consent Decree.
(4) As described in Paragraph 25 (f and g) of the Consent Decree.

5.2 REMEDIAL ACTION MEASURES

Remedial Action measures are shown in Table 5-2-1. In accordance with the Consent Decree (Paragraphs 27 and 28), the interim and final remedial measures implemented at the East Helena site were evaluated for criteria listed in the consent decree. Table 5-2-1 describes remedial measures for each CC/RA area or operable unit, and provides an evaluation of each action based on the following criteria:

- Interim action objectives,
- Design description,
- Construction description,
- O&M requirements,
- Effectiveness of the action,
- Is the action consistent with long-term measures and
- Potential additional measures.

The evaluation addresses actions implemented as part of the CERCLA program for the site, as well as actions implemented as part of other regulatory programs, and voluntary remedial measures implemented as part of plant site operations. The evaluation also addresses the effectiveness of the action including comparison of remedial events and water quality changes shown in Appendix 4-3-1 and in Figures 5-2-1, 5-2-2, 5-2-3, 5-2-4 and 5-2-5. The figures are water quality trend graphs similar to the plots shown in Appendix 4-3-1, but include remedial actions that are discussed in detail in the interim and final remedial action evaluation in Table 5-2-1.

All of the remediation activities and other events that affect the CC/RA areas and operable units are listed in Exhibit 5-1-1. All of the remedial actions listed on Exhibit 5-1-1 are part of the Evaluation of Interim Remedial Action Measures in Table 5-2-1. As Table 5-2-1 shows, most of the activities evaluated have potential for follow-up actions, however, some of the actions implemented are considered final. Near-final actions include construction of the stormwater containment system, and replacement of Wilson Ditch.

TABLE 5-2-1 EVALUATION OF INTERIM AND FINAL REMEDIAL ACTION MEASURES

CC/RA AREA / OPERABLE UNITS AND SUBUNITS	INTERIM REMEDIAL ACTION MEASURES	OBJECTIVES	DESIGN DESCRIPTION	CONSTRUCTION DESCRIPTION	O&M REQUIREMENTS	EFFECTIVENESS	IS ACTION CONSISTENT WITH LONG-TERM MEASURES?	POTENTIAL ADDITIONAL MEASURES
PLANT SITE SOILS AND ORE STORAGE AREAS Surface Soils • Surface soils impacted from ore & concentrate stored in Lower Ore Storage Area. • Surface soils impacted from ore and concentrates stored in the Upper Ore storage area. • Surface soils in railroad track areas • Unpaved areas within the plant boundary • Unpaved areas adjacent to the plant boundary.	• Periodic pavement within the plant.	• Capping bare soil areas to reduce the potential for runoff and reduce the potential for infiltration to groundwater. Pavement also is part of the plant dust control strategy.	• Standard concrete or asphalt pavement.	• Pavement of various areas on the plant site. Paving activities have usually been associated with other operational or remediation construction projects.	• Visual inspection of pavement • Maintenance or repair as necessary.	• Transport of metals as surface soil runoff is reduced where areas are capped. Review of groundwater data show no obvious trend in response to paving actions.	• Long-term measures other than pavement may be required in the ore storage areas.	• Subsequent actions are listed below.
	• 1989: Construction of new ore storage and handling building • May 1990: Operation of new Ore Storage building began. Ore formerly stored and handled in the open in the ore storage areas was moved inside into new ore storage and handling building.	• The ore storage handling area was enclosed to reduce fugitive dust emissions with elevated air concentrations. • Remove lead concentrations from the lower ore storage yard to reduce the potential for metal migration by surface water run-off and infiltration into groundwater.	Design features include: • 65,000 tons of enclosed ore handling area. • Ore storage and mixing bins. • Conveyor system to Sinter Process. • Dust emission filter bag house and ventilation fans	• Soils excavated during construction that passed EP Toxicity Test criteria were stored in an earth berm located in the southwest corner of the plant outside the lower ore storage area. Soils that failed TCLP criteria were stored in the lower ore storage area for smelting.	O&M requirements include: • Maintenance of ore handling equipment (conveyors, cranes, storage bins, etc.) • Maintenance of air quality systems (blowers, baghouses, air conduits, etc.) • General building maintenance	• Emissions from ore stored in the ore storage and handling building are effectively removed as sources of lead emissions to air quality and potential migration by surface water run-off and infiltration into groundwater.	• The action was consistent with strategies for the air SIP program as well as addressing ore storage as air interim action. The ore storage building remains a key element in the strategy for the ore storage area.	• Subsequent actions are listed below.
	• 1997: Storm water improvements (see Surface Water below).	• See Surface Water below.	• See Surface Water below.	• See Surface Water below	• See Surface Water below	• See Surface Water below	• See Surface Water below	The Comprehensive RI/FS evaluated remedial alternatives for plant site soils and the ore storage areas. The alternatives include: • No action • Capping, wind fences, dust suppressants, grading, diversions and containment sumps to control runoff and infiltration to groundwater • Excavation and storage on site in a RCRA compliant facility • Excavation and transport off site • Excavation and smelting • Excavation and treatment • Insitu treatment or neutralization • Deep tilling

TABLE 5-2-1 EVALUATION OF INTERIM AND FINAL REMEDIAL ACTION MEASURES

CC/RA AREA / OPERABLE UNITS AND SUBUNITS	INTERIM REMEDIAL ACTION MEASURES	OBJECTIVES	DESIGN DESCRIPTION	CONSTRUCTION DESCRIPTION	O&M REQUIREMENTS	EFFECTIVENESS	IS ACTION CONSISTENT WITH LONG-TERM MEASURES?	POTENTIAL ADDITIONAL MEASURES
PLANT SITE SOILS AND ORE STORAGE AREAS (continued)								
Subsurface Soils • Subsurface soils impacted in Process Pond areas as a result of process fluid losses • Subsurface soils in the saturation zone impacted by transport of groundwater containing elevated concentrations of arsenic and metals, and/or residual organic constituents.	• Some subsurface soils were removed as part of the remedial actions for Process Ponds. However, soil excavation in the saturation zone was limited by practical excavation limits and dewatering concerns (see Process Ponds Below).	• The objectives of Process Ponds remedial actions are described below.	• See Process Ponds Below.	• See Process Ponds Below.	• See Process Ponds Below.	• See Process Ponds Below.	• See Process Ponds Below.	The Comprehensive RI/FS evaluated remedial alternatives for plant site soils including subsurface soils. The alternatives include: • No action • Capping grading, diversions and containment sumps to control runoff and infiltration into subsurface soils and groundwater
• Subsurface soils impacted from ore & concentrate stored in Lower Ore and Upper Ore Storage Areas.	• 1989: Construction of new ore storage and handling building • May 1990: Operation of new Ore Storage building began. Ore formerly stored and handled in the open in the ore storage areas was moved inside into new ore storage and handling building.	• The ore storage handling area was enclosed to reduce fugitive dust emissions with elevated air concentrations.	• See Surface Soils above.	• See Surface Soils above.	• See Surface Soils above.	• See Surface Soils above.	• See Surface Soils above.	• Groundwater Controls • Excavation and storage of surface and subsurface soils on site in a RCRA compliant facility • Excavation and transport off site • Excavation and smelting • Excavation and treatment • Insitu treatment or neutralization • Deep tilling

TABLE 5-2-1 EVALUATION OF INTERIM AND FINAL REMEDIAL ACTION MEASURES

CC/RA AREA / OPERABLE UNITS AND SUBUNITS	INTERIM REMEDIAL ACTION MEASURES	OBJECTIVES	DESIGN DESCRIPTION	CONSTRUCTION DESCRIPTION	O&M REQUIREMENTS	EFFECTIVENESS	IS ACTION CONSISTENT WITH LONG-TERM MEASURES?	POTENTIAL ADDITIONAL MEASURES
PLANT SITE SOILS AND ORE STORAGE AREAS (continued) Stockpiles • Soil stockpiles in the Lower Ore Storage Area consisting of: Soils that exceed TCLP or EP TOX criteria. Stockpiled Lower Lake sediments in Lower Ore Storage Area.	• September 1997: Draft Design of a CAMU (Corrective Action Management Unit) soil containment facility was completed.	• Store ore storage area soils and sediment from CERCLA remedial actions in a RCRA compliant containment facility	RCRA C Compliant design including: • Double geomembrane liners. • Leachate detection and collection facilities. • RCRA compliant geomembrane soil composite cap.	• Project is in design phase. Construction has not yet been implemented. • CAMU storage facility concept has been accepted by EPA.	To be determined during final design.	• RCRA C Compliant Containment would effectively contain soils on site and prohibit off-site migration of metals by surface water run-off and infiltration into groundwater.	• The CAMU containment will be a key component of the long-term management of soils and sediments presently stored in the ore storage area.	• Construction of the CAMU containment facility is an interim action that would be a final action for stockpiled soils when completed.
	• October 1997. A geomembrane cover was installed over Lower Lake sediments stored in the lower ore storage yard.	• The objective of the cover was to eliminate the potential for fugitive dust and storm water runoff concerns.	Design elements of the cover are: • Placement of sediments on a concrete pad. • Cover using a 20 mil PVC geomembrane liner • A perimeter berm to eliminate runon and runoff from the sediment stockpile.	• Construction consisted of placement of the cover and anchorage using sand bags per the cover design.	Operation and maintenance requirements are: • Monthly inspection of liner, its anchor system, and the berm. • Patching liner as necessary.	• As an interim measure, the geomembrane cover effectively isolated sediments.	• The action meets short-term goals without limiting the potential alternatives for final corrective actions	• Placement of the sediments in a CAMU storage facility has been proposed as the subsequent action for management of soils presently stockpiled onsite (see above). When complete, the CAMU facility would be considered a final action for management of soil and sediment stockpiles.
Slag Pile • The RI concluded slag was not a significant source of arsenic or metals to groundwater, surface water or air quality. • Post RI/FS monitoring indicate some erosion of the slag pile may temporarily occur during high flow periods.	• No direct remedial measures for the slag pile have been implemented. Corrective actions for the slag are not considered necessary.	NA	NA	NA	NA	NA	NA	• Comprehensive RI/FS concluded slag is not a significant source of arsenic and metals to groundwater or surface water quality. Post-RI data suggest that occasional erosion of the slag during high flow periods can contribute arsenic and metal concentrations temporarily as sediment load to Prickly Pear Creek. No direct corrective actions for slag are proposed. Although there is no present evidence of groundwater impacts from the slag pile, EPA has noted that additional monitoring wells in the slag may be required in the future; particularly when upgradient sources to groundwater have been eliminated and groundwater quality improves. Actions for Prickly Pear Creek are addressed below.

TABLE 5-2-1 EVALUATION OF INTERIM AND FINAL REMEDIAL ACTION MEASURES

CC/RA AREA / OPERABLE UNITS AND SUBUNITS	INTERIM REMEDIAL ACTION MEASURES	OBJECTIVES	DESIGN DESCRIPTION	CONSTRUCTION DESCRIPTION	O&M REQUIREMENTS	EFFECTIVENESS	IS ACTION CONSISTENT WITH LONG-TERM MEASURES?	POTENTIAL ADDITIONAL MEASURES
PROCESS PONDS Lower Lake	• 1989. Two one-million gallon storage tanks were constructed to replace Lower Lake as surge storage in the main plant water circuit. • Also attempt to eliminate plant water gains. • Plant water circuit gains to cover lake was also addressed (see Plant Water Circuit below).	• Replace Lower Lake as surge storage for the main plant water circuit. • Eliminate main plant water discharges to Lower Lake. With Lower Lake no longer a part of the main plant water circuit, remediation of the pond could be implemented.	Tank features RCRA C Compliant design including: • Secondary containment concrete enclosure • Visual leak detection The tanks are located on a bench on the slag pile. A pumping lift station near Thornock Tank pumps water from Thornock Tank to the 2-one million gallon tanks. Optimum operation uses primarily one tank with the other tank available for extra storage for captured storm water, or for sediment removal purposes.	• A portion of the slag pile was graded and the tanks were installed in 1989. On-going gains in the main plant water circuit resulted in periodic discharges to Lower Lake as the tanks became full. Discharges take place particularly during winter when most of the gains in the main plant water circuit occurred (see Section 4.20. Periodic discharge continued until 1995. MPDES permit for the HDS effluent was obtained to discharge to Lower Lake in November 1996.	• Periodic visual inspection of secondary containment. • Periodic inspection of process water line connection points and valves. • Periodic sediment removal.	• In combination with the HDS treatment facility, the tanks effectively replaced Lower Lake as storage of plant water.	• The replacement tanks are a key element in the remediation for Lower Lake as part of the Process Pond ROD.	• The remaining Lower Lake remedial measures are discussed below.
	• April 1993. Construction of the HDS water treatment plant is initiated. • October 1993. The HDS becomes operational and shake-down tests are conducted. • January 1994. The HDS plant comes on-line for treatment of gains in the main plant water circuit and gains in the acid plant water circuit. • November 1996. An MPDES permit for discharges of treated effluent to Lower Lake is obtained. • March 1997. Optimization modifications to the HDS treatment facility are implemented.	• Treatment of plant water circuit gains, and acid plant water circuit gains. Treatment eliminates discharges of arsenic and metals in plant water and acid plant water to Lower Lake.	Design elements of the new HDS facility are: • Acid plant scrubber blowdown water not sent to the acid plant water reclaim facility is combined with excess plant water for treatment. • Addition of Hydrogen Peroxide (H_2O_2) to oxidize arsenic III to arsenic V. • Addition of Lime (CaOH) to raise pH and precipitate particulates. • A thickener and a clarifier to settle particulate sludges overflow from the thickener and clarifier is routed to the post HDS effluent steam. • A filter press to dewater sludges. Once dewatered, the sludges are smelted. • Addition of ferric sulfide to the post-HDS effluent to remove arsenic. • Addition of sodium sulfide to polish metals. • The slurry is routed to a sand filter to clarify the effluent prior to discharge to Lower Lake. The facility design capacity is 100 gpm.	• Construction of the HDS facility included a new water treatment building south of the acid water reclaim building. As plant water discharge limits were developed as part of the MPDES process, modifications to the treatment operation were implemented in March 1997.	Maintenance of all treatment components including: • Sludge removal for resmelting • Chemical supplies for treatment • Equipment upkeep • Periodic replacement of mechanical parts.	• Arsenic concentration trend plots (see Lower Lake Figure 5-2-5) show Lower Lake arsenic concentrations initiated decreasing trend that began when the HDS treatment facility came on-line. Arsenic concentrations declined from a high of about 87 mg/L in fall 1993 to a spring 1998 low of 0.05 mg/L (see Section 4.3). Lower Lake sulfate concentrations show an increasing trend and reflect the sulfide treatment for metals in the treatment plant process. Downgradient monitoring wells also show increases in sulfate. Declines in arsenic concentration in wells immediately downgradient of Lower Lake have not been observed (see Sections 4.4.4 and 4.5).	• The HDS facility presently meets its MPDES interim effluent requirements. Modifications to the treatment process are under development to meet final permit limits. MPDES permit limits are different than those that address Lower Lake remedial goals in the Process Pond ROD. An ESD (Explanation of Significant Differences) is anticipated to address the differences between MPDES requirements and ROD requirements.	• The remaining Lower Lake remedial measures are discussed below.

CC/RA AREA / OPERABLE UNITS AND SUBUNITS	INTERIM REMEDIAL ACTION MEASURES	OBJECTIVES	DESIGN DESCRIPTION	CONSTRUCTION DESCRIPTION	O&M REQUIREMENTS	EFFECTIVENESS	IS ACTION CONSISTENT WITH LONG-TERM MEASURES?	POTENTIAL ADDITIONAL MEASURES
PROCESS PONDS (continued) Lower Lake (continued)	• 1994, 1995, 1996. Lower Lake sediments are dredged. The sediments are dewatered in the former acid plant water treatment sediment drying area adjacent to Lower Lake. • Additional measures at the Lake were implemented in 1997. These include: • Installation of 450 lineal feet of residential type curb and gutter. • Placement of clean fill between the top of the curb and the lake. • Placement of topsoil on the fill and planted with grass and shrubs. • Additional surface water control measures as per the Surface Water Control Plan. • A SEP (Supplemental Environment Plan) was submitted in July 1997 to address additional measures at Lower Lake.	• Remove manmade process pond sludges with elevated concentrations of arsenic and metals to the contact with underlying marsh deposits as per the Process Ponds ROD and a June 1993 Explanation of Significant Difference (ESD). About 3 feet of process pond sediment was removed. • Complete the remedial action at Lower Lake by installing drainage controls and vegetation around the pond.	Design elements for the dredging operation were: • A floating hydraulic dredge. • Pumping of dredged sediments to the former acid plant sediment drying area for dewatering. • Portable storage tanks for primary and secondary settlement of solids. • A second hydraulic dredge that removed settled solids from the holding tank. • A vibrating screen to remove debris and coarse grained sediments and slag. • Belt filter presses to dewater sediments. • Storage bins for dewatered sediments. • Transport by front-end loader from the sediment dewatering operations to the temporary storage site in the lower ore storage yard. • A curb and gutter to control runoff to the Lake. • Soil fill and reseeding to reestablish site vegetation.	• Sediments from the lake bottom were pumped to the shore based dewatering operation. Filter cake from the dewatering operation was transported to an interim stockpile in the lower ore storage area. Dredging proceeded with seasonal shutdowns during the winter, from 1994 to August 1996, when the final series of dredge passes across the pond were completed. • Verification of attainment of ROD based performance standards was conducted by a depth survey of the lake bottom, which determined that target removal depths were met. A total volume of 31,000 cubic yards were removed. The dredging and dewatering equipment were decommissioned by September 30, 1996.	• There are no continuing O&M requirements for Lower Lake sediments.	• A post-dredging bathymetric survey showed the prescribed objectives of the June 1993 ESD were met.	• The action was consistent with the requirements of the Process Pond ROD as modified by the June 1993 ESD for Lower Lake. Sediments were removed to the design depth.	• Potential additional measures for Lower Lake are: 1. No action 2. Insitu treatment 3. Treatment using the HDS plant. 4. Hydraulic controls to limit groundwater through the area between Upper Lake and Lower Lake.

TABLE 5-2-1 EVALUATION OF INTERIM AND FINAL REMEDIAL ACTION MEASURES

CC/RA AREA / OPERABLE UNITS AND SUBUNITS	INTERIM REMEDIAL ACTION MEASURES	OBJECTIVES	DESIGN DESCRIPTION	CONSTRUCTION DESCRIPTION	O&M REQUIREMENTS	EFFECTIVENESS	IS ACTION CONSISTENT WITH LONG-TERM MEASURES?	POTENTIAL ADDITIONAL MEASURES
PROCESS PONDS (continued) Former Thornock Lake	• October 1988: Replaced Thornock Lake with a 93,000 gallon steel tank and secondary containment area.	• Remove Thornock Lake as a source of process water to groundwater.	RCRA C Compliant design including: • Secondary containment concrete enclosure. • Visual leak detection.	• Construction completed in October 1989. Tank acts as main collection and settling basin in main plant water circuit.	• Periodic visual inspection of secondary containment. • Periodic inspection of process water line connection points and valves. • Periodic sediment removal.	• The tank effectively removed Thornock Lake from the main process circuit and allowed total removal of sediments in 1991. Arsenic concentration declined from over 10 mg/L to the present value of about 1 mg/L. Fine grained sediments were partially removed in 1989. The remaining sediment removal was completed in 1991 (see Table 4-2-1).	Replacement of Thornock Lake was a necessary element for pond remediation.	None – Final Measure, Although remediation was completed in accordance with CERCLA requirements, EPA has noted additional data may be needed to evaluate residual concentrations of metals as part of an RFI.
	• 1986 through 1987: A portion of the bottom sediment from Thornock Lake excavated. • 1991: The remaining sediments were removed from Thornock Lake.	• Remove bottom sediments with elevated arsenic and metal concentrations as a potential source of arsenic and metals to groundwater	• Removal of fine-grained sediments that have elevated concentrations of metals. Excavation completed when coarse grained alluvium with relatively low metal concentrations is encountered.	• In 1989 sediment removal was not complete because of limited access to excavation equipment. Sediment removal was completed in 1991.	• None.	• Removal of fine grained sediment reduced the potential for metals mobilization. Review of the groundwater data, however, does not show an obvious response to the sediment removal action.	• Sediment removed was consistent with the Process Pond ROD.	None – Final Measure Although remediation was completed in accordance with CERCLA requirements, EPA has noted additional data may be needed to evaluate residual concentrations of metals as part of an RFI.
Former Speiss Pond	• Fall 1988: The Speiss Pond was lined with HDPE	• Stop apparent leakage from the Speiss Pond.	• The Speiss pond concrete basin was lined with 80 mil HDPE	• The liner was installed over a 30-hour period Speiss granulating water was removed from the pond to allow installation of the liner to the plant water circuit.	• Periodic inspection of liner integrity.	• Downgradient, arsenic concentrations in groundwater (at DH-21) declined in early 1990 from about 600 mg/L to about 200 mg/L. Concentrations remained at about 200 mg/L until fall 1994 when increases occurred (see Graphs in Appendix 4-3-1, Fig. 5-2-1). The liner effectively eliminated leaks from the pond itself. However, buried speiss circuit lines, the speiss pit, soils, and runoff from the speiss handling area remained as potential sources of arsenic to groundwater.	• Lining the pond was a temporary action. Additional long-term measures were implemented including conversion to air/mist granulation, storm water improvements and elimination of the Speiss Pond water circuit.	• Subsequent actions are listed below.
	• 1989 The Speiss Pond was replaced with Speiss settling tank. A portion of the Speiss Pond was demolished. Soils under the demolished portion of the pond were excavated.	• Replace the Speiss Pond with a RCRA Compliant tank. • Remove the Speiss Pond as a source of arsenic and metals to groundwater • Remove underlying soil in accordance with the Process Pond ROD.	Tank features RCRA C Compliant design including: • Secondary containment concrete enclosure • Visual leak detection Soil excavation criteria were established in the Process Ponds ROD. Soils that exceed criteria were to be removed to practical excavation limits (to the water table – a depth of about 20 feet).	• Half of the HDPE-lined pond remained in use while the remainder was demolished. Following demolition, soils were excavated in accordance with ROD requirements. Clean sand and gravel was used to backfill the excavation. The replacement tank was installed in the backfilled area.	• Periodic visual inspection of secondary containment • Periodic inspection of process water line connection points and valves. • Periodic sediment removal.	• Downgradient, arsenic concentrations in groundwater (at DH-21) declined in early 1990 from about 600 mg/L to about 200mg/L. They remained at about 200 mg/L until fall 1994 when increases occurred. Buried circuit lines, the speiss Pit, and remaining soils under the undemolished portion of the pond, and runoff from the speiss handling area remained as potential sources of arsenic and metals to groundwater.	• The action was consistent with the Process Pond ROD to address Process Pond sources. However, the action was interim and was not yet complete.	• Subsequent actions are listed below and include removal of the rest of the pond and underlying soils.

TABLE 5-2-1 EVALUATION OF INTERIM AND FINAL REMEDIAL ACTION MEASURES

CC/RA AREA / OPERABLE UNITS AND SUBUNITS	INTERIM REMEDIAL ACTION MEASURES	OBJECTIVES	DESIGN DESCRIPTION	CONSTRUCTION DESCRIPTION	O&M REQUIREMENTS	EFFECTIVENESS	IS ACTION CONSISTENT WITH LONG-TERM MEASURES?	POTENTIAL ADDITIONAL MEASURES
PROCESS PONDS (continued) Former Speiss Pond (continued)	• October 1992: The remaining portion of the Speiss Pond was removed. The remaining portion of Former Speiss Pond soils were excavated	• Remove the Former Speiss Pond as a source of arsenic and metals to groundwater • Remove underlying soil in accordance with the Process Pond ROD.	• Soil excavation criteria were established in the Process Ponds ROD. Soils that exceed EPTOX criteria were to be removed to practical excavation limits (to the water table – a depth of about 20 feet)	• The remainder of the HDPE lined pond was demolished. Following demolition, soils were excavated underlying in accordance with ROD requirements. Clean sand and gravel were used to backfill the excavation in 1993. During soil removal, a subsurface leaking plant water drain line south of the speiss pit was exposed. Temporary repairs to the plant water drain line were implemented.	• Exposed drain lines required additional repairs that were implemented in April and May 1993	• Groundwater at DH-21, adjacent to the former pond, showed no obvious response to the DH-21 action, but downgradient wells (DH-13, DH-17, and DH-24 continued a long-term decline in arsenic concentrations (see Section 4.4 and 4.5). Arsenic concentrations in well DH-28, adjacent to the Speiss Pit, increased in spring 1992 (from about 100 mg/L to 500 mg/L in spring 1993 probably as a result of drain line water leaks in the area (See Figure 5-2-1).	• The action was consistent with the Process Pond ROD to address Process Pond sources and actions for the former pond were completed. However, additional actions at the Speiss Pit area remained to be implemented.	• Subsequent actions are listed below.
	• August 1993: A concrete cap was constructed to cover the former Speiss Pond area.	• Cover the former Speiss Pond and allow the area to be used for material storage.	• The concrete pad design consisted of an 8-inch pad with water stops at the joints of the pour • A new concrete drain trench was designed to provide area storm drainage into an adjacent storm water manhole.	• The new 8-inch concrete pad was installed with water stops in all construction joints along with the new concrete drain trench. New construction back-fill and compaction was placed in area along with concrete reinforcing steel re-bars.	• Visual inspection to ensure cap cover remains unbroken. • Replacement or repair where damage occurs	• Groundwater quality shows no obvious trends related to this action. However downgradient water quality continued to show improvements. Routine maintenance is necessary for the cap to remain effective.	• Additional actions at the speiss pit remain to be implemented	Potential additional measures include: • Capping railroad track areas next to the present cap to reduce potential run-off. • Ongoing maintenance to ensure cap integrity. • Re-designed cap with underliner to prevent infiltration from run-off. • Cover or close Speiss storage area to prevent infiltration to groundwater during run-off. • Determine if primary tank leakage is the source of water in secondary containment pond. • Repair run-off pipes to tank to keep run-off in primary containment tank.
Speiss Granulation Pit	• April 1991: Water granulation was replaced by air/mist granulation. The Speiss Pond replacement tank no longer contains Speiss granulating water but is used to contain run-off from the Speiss storage area.	• Improve speiss production methods using air mist and water mist instead of water for granulation. • Removed the speiss water circuit as a source of arsenic and metals to groundwater.	• Speiss is granulated using high volume air flow and water mist instead of water granulation methods. Only a light water mist is used for air granulation and evaporates during the process.	• Plant process equipment modifications were installed in the Speiss granulating area.	• Only production oriented O&M.	• Air/mist granulation resulted in elimination of the speiss granulation circuit. Groundwater at DH-21 showed no obvious response to the action, but downgradient wells (DH-13, DH-17, and DH-24 started a long-term decline in arsenic concentrations (see Section 4.4 and 4.5 and Appendix 4-3-1).	• Removal of speiss water circuit eliminated a primary source of arsenic to groundwater.	• Subsequent actions are listed below.

TABLE 5-2-1 EVALUATION OF INTERIM AND FINAL REMEDIAL ACTION MEASURES

CC/RA AREA / OPERABLE UNITS AND SUBUNITS	INTERIM REMEDIAL ACTION MEASURES	OBJECTIVES	DESIGN DESCRIPTION	CONSTRUCTION DESCRIPTION	O&M REQUIREMENTS	EFFECTIVENESS	IS ACTION CONSISTENT WITH LONG-TERM MEASURES?	POTENTIAL ADDITIONAL MEASURES
PROCESS PONDS (continued) **Speiss Granulation Pit** **(continued)**	• April 1993: Temporary repairs of leaking plant water drain lines were implemented as a temporary measure until the lines were replaced in May 1993. • May 1993: The plant water drain lines south of the Speiss Pit were replaced.	• Remove drain line losses to groundwater in the Speiss Pit.	• Replacement piping specifications to use SCH.40 PVC pipe to replace the original SCH.40 steel pipe.	• New back-fill and sand bedding in piping trench SCH.40 PVC drain pipe was installed.	• Monitor and inspect for leaks.	• The repairs to plant water lines should have reduced or eliminated losses from the replaced portion of the drain line. However, arsenic concentrations remained at about 500 mg/L in DH-28 from 1993 to 1995 before a decline to about 100 mg/L occurred (see Appendix 4-3-1).	• Additional actions at the Speiss Pit remained to be implemented.	• Subsequent actions are listed below. —
	• June-August 1995: The new dross reverberatroy furnace building and a new Speiss granulating pit were constructed. The old speiss pit was demolished. Soil beneath the pit was excavated. • Capping exposed soils in railroad track areas next to the present cap	• Upgrade the reverberatory furnace facility to improve the dross production process. • Remove the speiss pit as a source of arsenic and metals to groundwater. • Remove underlying soil in accordance with the Process Pond ROD.	• In accordance with the Process Ponds ROD, soils in the speiss pit were to be removed and the soil beneath the speiss pit was to be excavated. The soil excavation criteria were established in the Process Ponds ROD.	• The new speiss pit was demolished and removed. Following demolition, soils were excavated in accordance with ROD requirements. Clean sand and gravel were used to backfill the excavation. A concrete cap was constructed over the backfilled area of the former pit.	• The Speiss Pit requires periodic production operation maintenance including removal of granulated speiss from the pit. Granulated speiss is periodically stored outside in open bins adjacent to the former pond and pit locations. • Cap O&M requirements include visual inspection to ensure cap cover remains unbroken; and replacement or repair where damage occurs.	• Arsenic concentrations in well DH-28 (downgradient of the Speiss Pit) showed a steep decline from over 600 mg/L in spring 1995 to about 100 mg/L in fall 1995 (see graph in Fig 5-2-2) Concentrations remained near 100 mg/L 1995 through 1997.	• The action was consistent with the Process Pond ROD.	Potential additional measures include: • Ongoing maintenance to ensure cap integrity • Redesigned cap with underliner to prevent infiltration from run-off • Alter speiss handling and management practices to reduce exposure to elements. • Cover or close speiss storage area to prevent infiltration to groundwater during run-off
Former Acid Plant Settling Pond	• April 1991: A clarifier is added to the acid plant water reclaim process allowing removal of the wooden trough fluid transport system and portable settling dumpsters. The main acid plant water settling pond remained in service for surge control in the acid plant water circuit.	• Removal of the wooden troughs and dumpsters that were potentially sources of arsenic and metals to groundwater.	• The wooden trough system was replaced with above ground PVC pipe. The dumpsters were removed. Acid plant water was piped directly to the settling pond.	• The wooden trough system was replaced with above ground PVC pipe. The dumpsters were removed. Acid plant water was piped directly into the settling pond.	• Visual inspection for leaks • Repair or replacement as necessary	• Replacement of the wooden trough system with PVC eliminated visible leakage from the acid plant water circuit. Responses in groundwater were masked by arsenic concentration increases as a result of acid plant fluid inputs to groundwater in the acid plant sediment drying area adjacent to Lower Lake.	• Replacement of the troughs and dumpsters was the first of a series of actions that were part of the Process Ponds remedial action in accordance with the Process Pond ROD.	• The remaining acid plant water remedial measures are discussed below.

TABLE 5-2-1 EVALUATION OF INTERIM AND FINAL REMEDIAL ACTION MEASURES

CC/RA AREA / OPERABLE UNITS AND SUBUNITS	INTERIM REMEDIAL ACTION MEASURES	OBJECTIVES	DESIGN DESCRIPTION	CONSTRUCTION DESCRIPTION	O&M REQUIREMENTS	EFFECTIVENESS	IS ACTION CONSISTENT WITH LONG-TERM MEASURES?	POTENTIAL ADDITIONAL MEASURES
PROCESS PONDS (continued) **Former Acid Plant Settling Pond** (continued)	• November 1992. New acid plant water reclamation facility goes on line. The new facility replaced the settling pond.	• Improve the acid plant water reclaim process. • Eliminate the use of the main acid plant settling pond so it was no longer a source of arsenic and metals to groundwater. • Eliminate the use of the main acid plant settling pond so it could be demolished and allow excavation on the underlying soils.	Elements of the new acid plant water reclaim facility are: • An air stripper to remove SO_2 from acid plant blow down water. • Neutralization by addition of Soda Ash ($NaCO_3$). • A Clarifier to settle particulates as a sludge. • A belt filter press to dewater sludge collected in the clarifier.	• Construction included removal of the existing structure and replacement with a new steel building to contain the reclaim facility components. • Construction was conducted in summer and fall of 1992 and the facility went on-line in November 1992.	Maintenance of all treatment components including: • Sludge removal for resmelting • Chemical supplies for treatment • Equipment upkeep • Periodic replacement of mechanical parts.	• The facility effectively replaced the use of the main settling pond with a state-of-the-art treatment system with a clarifier and filter press. Arsenic concentration in groundwater show a sharp decline (about 250 mg/L in fall 1992 to about 50 mg/L in spring 1993, see Well DH-19 Figure 4-3-1. Coincident in time when plant settling pond was no longer in use. The concentration increase may also be related to disturbance associated water remedial actions in the acid plant sediment drying area.	• Replacement of the main acid plant settling pond with the new reclaim facility was a key element in remediation of the acid plant water operable Pond ROD.	• The remaining acid plant water remedial measures are discussed below.
	• February 1993. The acid plant water settling pond was demolished. Demolished concrete was transported to the lower ore storage area. • May 1993. Soil under the former acid plant settling pond was excavated. Excavated soils were transported to the lower ore storage area.	• Remove underlying soil in accordance with the Process Pond ROD.	• In accordance with the Process Ponds ROD, soils under the acid plant settling pond were to be excavated. Soil excavation criteria were established in the Process Ponds ROD. Soils that exceed TCLP criteria were to be removed to practical excavation limits (to the water table – depth of about 8 feet)	• Soil was excavated to the water table in accordance with the Process Pond ROD. An attempt was made under EPA supervision to excavate soils under the water table but the excavation could not be advanced because of caving and filling conditions in the excavation. During construction a 5 gpm seep was encountered on the east side of the excavation. Field samples showed the pH value was 4.9 and arsenic concentration was 12 mg/L. Over a one-day period, the seep flow decreased to less than about ½ gpm. Several exploratory test pits were installed to find the source of the seep, but no obvious source was discovered.	• None	• The effect of demolition and soil removal is not apparent in groundwater trend data (see well DH-19 in Appendix 4-3-1 and Figure 5-2-3).	• Demolition and soil excavation concluded the actions for the settling pond in accordance with the Process Pond ROD.	• None – Final Measure. Although remediation was completed in accordance with CERCLA requirements, EPA has noted additional data may be needed to evaluate residual concentrations of metals as part of an RFI.

TABLE 5-2-1 EVALUATION OF INTERIM AND FINAL REMEDIAL ACTION MEASURES

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PROCESS PONDS (continued) **Acid Plant Sediment Drying Areas**	• July 1991. Discontinued use of sediment drying areas. Acid plant sediments were removed from the storage areas. With the addition of a filter press in the acid water reclaim facility, the sediment drying areas were no longer needed. Soils under the drying area adjacent to the main settling pond were excavated. Soils under the drying area adjacent to Lower Lake are yet to be addressed.	• Remove sludge stored in the acid plant sediment drying areas. The sludges were know sources of arsenic and metals to groundwater. • Remove soils from under the sediment drying areas in accordance with the Process Pond ROD.	• Sediments were removed from the drying areas and smelted. • In accordance with the Process Ponds ROD, soils under the acid plant sediment drying areas were to be excavated. Soil excavation criteria were established in the Process Ponds ROD. Soils that exceed TCLP criteria were to be removed to practical excavation limits (to the water table – depth of about 8 feet)	• Sediments were hauled by front-end loader and incorporated into the smelting process. • Soil in the sediment drying area next to the main acid plant water settling pond was excavated to the water table in accordance with the Process Pond ROD.	• Plant operational O&M requirements associated with routine smelting operations.	• Groundwater concentrations in well DH-29 and downgradient DH-19, show a general pattern of declining arsenic, metals, sulfate, and chloride coinciding with the removal of the acid plant sludges (see Appendix 4-3-1 and Figure 5-2-4). Arsenic concentrations declined from about 400 mg/L in early 1991 to about 70 mg/L in 1994. Based on the data, sludge removal was effective in improving groundwater quality.	• The action is consistent with actions outlined in the Process Ponds ROD.	• The sediment drying area remains to be addressed. See subsequent action below.
	• September 1993. The former acid plant sediment drying pad between Lower Lake is sealed in preparation for use as a dewatering area for dredged sediments from Lower Lake. • 1994, 1995, and 1996. The former acid plant sediment drying area is used for Lower Lake sediment dewatering (see Lower Lake below). • 1996. Lower Lake dredging and dewatering equipment is demobilized.	• Seal cracks in concrete pad and lower the potential for leakage into underlying groundwater. • Provide a logistically usable area adjacent to Lower Lake to accommodate sediment dredging operations and dewatering of dredged bottom sediments	• Application of a water proof sealant on cracks in the sediment drying pad. • Sediment dewatering is discussed as part of Lower Lake remedial actions below.	• Application of water proof sealant on cracks in the sediment drying pad. • Sediment dewatering is discussed as part of Lower Lake remedial actions below.	• Cap O&M requirements include visual inspection to ensure pad remains undamaged and replacement or repair where damage occurs.	• Review of the data from monitoring wells in the area are not conclusive (see wells DH-29, APSD-2, APSD-3, and APSD-4; Appendix 4-3-1). As described in Section 4.4, concentrations of arsenic in DH-29 and APSD-3 show a long-term decreasing pattern, but APSD-4 show an increasing trend (Figure 5-2-4).	• The action to seal the pad and use it for dewatering purposes was a Remedial Design decision for Lower Lake.	• The Process Pond ROD identified the remaining sediment drying area adjacent to Lower Lake as a soil removal area. The action has been under reconsideration by EPA and is pending review of the existing data. • On-going monitoring is appropriate to monitoring continuing groundwater trends.

CC/RA AREA / OPERABLE UNITS AND SUBUNITS	INTERIM REMEDIAL ACTION MEASURES	OBJECTIVES	DESIGN DESCRIPTION	CONSTRUCTION DESCRIPTION	O&M REQUIREMENTS	EFFECTIVENESS	IS ACTION CONSISTENT WITH LONG-TERM MEASURES?	POTENTIAL ADDITIONAL MEASURES
PROCESS CIRCUITS **Plant Water Circuit, Pressurized Water Lines, Sumps, and Drains**	• 1988 to 1989. Water balance study as part of RI/FS conducted to examine process circuit gains. The water balance indicated 50 to 70 gpm gain in the plant water circuit. • 1990 to 1991. Additional water balance work. • December 1991. Actions to reduce process circuit gains were implemented including: 1. Repair and replacement of pipes. 2. Drain sump modifications and repairs. 3. Elimination of water bleeders.	• Objective as per the RI/FS and the Process Pond ROD was to reduce process water circuit gains, with disposal of the remaining gains by evaporation or other processes. The intent was to reduce gains to the process water circuits to zero if possible and eliminate the need for a water treatment plant to address gains in the process water circuits.	Reduction of plant water gains included: • Elimination of pump sumpage from the old ore storage building (S-2 located adjacent to the acid plant water reclaim facility – see Figure 4-2-1) to Sump S-1. The old ore storage building was no longer used and the lower level was allowing groundwater to reach equilibrium. • Reconstruction of Sump S-1 also known as the well. As described in the Process Pond RI/FS and the Comprehensive RI/FS, the sump was an apparent source of seepage to groundwater. Reconstruction features consisted of lining the walls and bottom with a preconstructed concrete containment vessel. Lines from the sump were then reconnected and sealed to prevent interaction with groundwater. • Elimination of potable water bleeders. The bleeders were used to prevent freezing. Exposed pipelines were insulated and heat-taped making bleeders unnecessary.	• The modifications were constructed as per the design. These actions resulted in a reduction of about 50 gpm.	Maintenance requirements include: • Periodic inspection for wear, deterioration of seals and assessment for the possibility of leakage. • Repairs as necessary.	• The reduction of plant water gains from these actions was about 50 gpm. Approximately 25 gpm remained to be addressed. In addition modifications to the acid plant reclamation system resulted in about a 15 gpm gain also to be addressed. Total process water circuit gains of about 49 gpm remained. The decision to construct the HDS was made to address the remaining gains.	• The actions were consistent with the Process Pond ROD. The actions did not interfere with additional measures to address Lower Lake gains from the main plant water circuit or acid plant water circuit gains.	• Subsequent actions are listed below.
	• May 1993. The plant water drain lines south of the Speiss Pit were replaced. See actions for the Speiss Granulating Pit above.	• See actions for the Speiss Granulating Pit above.	See actions for the Speiss Granulating Pit above.	• See actions for the Speiss Granulating Pit above.	• See actions for the Speiss Granulating Pit above.	• See actions for the Speiss Granulating Pit above.	• See actions for the Speiss Granulating Pit above.	• Subsequent actions are listed below.
	• December 1997 to January 1998. Water proofing of main plant water circuit pumphouse (see Exhibit 4-2-1).	• Reduce or eliminate groundwater inflow into the main plant water pumphouse and eliminate plant water loss out.	• Selection of XYPEX and Phosroc as water proofing materials.	• XYPEX was applied to concrete surfaces and Phosroc to brick surfaces.	• Periodic inspection and repair as necessary.	• The water proofing action effectively eliminated seepage from the walls and floors of the pump house. The pump house sump remains to be addressed.	• The action does not interfere with additional measures that may be implemented for the plant water circuit.	• Subsequent actions are listed below.

CC/RA AREA / OPERABLE UNITS AND SUBUNITS	INTERIM REMEDIAL ACTION MEASURES	OBJECTIVES	DESIGN DESCRIPTION	CONSTRUCTION DESCRIPTION	O&M REQUIREMENTS	EFFECTIVENESS	IS ACTION CONSISTENT WITH LONG-TERM MEASURES?	POTENTIAL ADDITIONAL MEASURES
PROCESS CIRCUITS (continued) **Plant Water Circuit, Pressurized Water Lines, Sumps, and Drains (continued)**	• February 1998. Replacement of portions of the main plant water pressure line system to stop plant water losses to groundwater.	• Abandon the portion of the underground pressure line plant water system where leaks occurred. • Relocation of plant water flow to the above ground pipeline eliminates the need to use portions of the underground system where leaks occurred.	• Temporary replacement of segments of the underground pressurized pipeline with above ground HDPE piping. • Permanent replacement of the temporary pipeline with 6-inch schedule 40 steel above ground pipeline. • Heat tracing of the permanent pipeline to prevent freezing	• The temporary and permanent pipelines were installed per design requirements.	• Periodic inspection of pipeline integrity. • Period painting. • Repairs as necessary.	• Groundwater levels and water quality showed immediate response to removal of the underground pressure line (see Plant Water Investigation Report, Hydrometrics, June 1998).	• Replacement of pressure pipelines in the plant water circuit is consistent with recommendations presented in the Comprehensive RI/FS.	• The Comprehensive FS addressed several alternative actions for process water circuits including: 1. Pipeline and drainage line repair 2. Pipeline and drainage line replacement 3. Replacement of pipelines, drains, and sumps with new lines and sumps equipped with leak detection and secondary containment features. • The pumphouse sump remains to be addressed.
Acid Plant Water Circuit **(continued)**	• September 1997. The acid plant scrubber sump was rebricked.	• On-going maintenance of the acid plant scrubber sump to contain acid plant water and sludges prior to their discharge to the acid plant water treatment facility.	• The existing 8-foot diameter by 8-foot tall collection sump-spill containment sump for the acid plant scrubbers – design specifications included new acid brick lining with acid brick mortar.	• Acid brick and acid brick mortar were installed as a liner in the existing 8-foot diameter concrete sump.	• Visual inspection of sump for leaks.	• Arsenic, sulfate, and chloride concentration in downgradient well DH-22 declined sharply in fall 1992 (see Figure 5-4-3). Arsenic concentrations dropped from over 20 mg/L to 5 mg/L; sulfate concentrations dropped from 750 mg/L to less than 100 mg/L and chloride concentrations declined from about 90 mg/L to about 1 mg/L. Cadmium and zinc concentrations also declined. Based on the response in DH-22, the action of the sump was very effective in improving downgradient groundwater quality.	• Rebricking the scrubber sump is an on-going plant O&M action.	• The water quality in the immediate scrubber area is not well known, however, downgradient quality shows significant improvement. Additional long-term monitoring is appropriate.
Surface Water								
Prickly Pear Creek	• No actions relative to Prickly Pear Creek have been implemented.	• No actions relative to Prickly Pear Creek have been implemented.	• No actions relative to Prickly Pear Creek have been implemented.	• No actions relative to Prickly Pear Creek have been implemented.	• No actions relative to Prickly Pear Creek have been implemented.	• No actions relative to Prickly Pear Creek have been implemented.	• No actions relative to Prickly Pear Creek have been implemented.	The Comprehensive RI/FS evaluated several alternatives for Prickly Pear Creek. These included: • No action. • Institutional controls. • Concrete berm along the slag pile to isolate the creek from further erosion of the slag pile.

TABLE 5-2-1 EVALUATION OF INTERIM AND FINAL REMEDIAL ACTION MEASURES

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SURFACE WATER (continued) **Wilson Ditch**	• 1992 and 1993. Bottom sediments in Wilson Ditch were excavated and transported to the stockpile in the East Fields (see Section 4.3).	• Remove Wilson Ditch sediments in accordance with requirements identified in the Wilson Ditch Work Plan for Removal and Replacement of Soils, Hydrometrics, 1993 addressing Soil Remediation. Sediment exceeding 1000 mg/kg lead and 100 mg/kg arsenic were excavated. Only soils less than 500 mg/kg lead remained after the removal action was completed.	• Sediment exceeding 1000 mg/kg lead and 100 mg/kg arsenic were excavated. Only soils less than 500 mg/kg lead remained after the removal action was completed.	• Soil was removed by backhoe and transported by haul trucks to the East Fields soil stockpile.	• The excavation action itself included no long-term O&M requirements. The soil stockpile was managed as part of the East Helena Residential Soils Action.	• Soils and sediments were removed in accordance with the requirements outlined in the Residential Soils Consent Decree. Confirmational sampling and analysis by XRF confirm removal to performance standards.	• The action was consistent with requirements of the Consent Decree for Residential Soils and Wilson Ditch sediments.	• Actions that addressed the upper portion of the ditch at the plant site were discussed below.
	• 1997. Replacement of the plant site segment of Wilson Ditch between its head gate at Upper Lake to its crossing at the secondary highway at the plant site entrance road was completed.	• Remove Wilson Ditch as a conduit for transport of arsenic and metals from the plant site (see discussion on Wilson Ditch in Section 4.3).	Design features for the plant segment of Wilson Ditch include: • Relocation of the ditch along the south and west boundary of the plant site fence (see Exhibit 2-2-1). • A 30-inch buried HDPE welded seam pipeline connecting the head gate at Upper Lake to and the open earth channel portion west of the plant site boundary. • Abandonment of the on-plant segment of the ditch by inserting plugs at the Upper Lake intake and the outfall at the access highway.	• Construction was initiated in May 1997 and completed in July 1997. The construction implemented all the features per the design as described in the Wilson Ditch Construction Report (Hydrometrics 1997).	• Detail requirements from Design Report • Periodic inspection and removal of debris from headgate at Upper Lake.	• Relocation of Wilson Ditch effectively removed the ditch as a potential conduit of arsenic and metals from the plant site.	• The action is an interim measure relative to plant water circuits and groundwater issues.	• Replacement of the plant site segment of the ditch is the final remedial action for Wilson Ditch. The action will be complete with collection of confirmational water samples.

TABLE 5-2-1 EVALUATION OF INTERIM AND FINAL REMEDIAL ACTION MEASURES

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SURFACE WATER (continued) Storm Water Run-Off	• November 1996 through December 1997. Construction of the plant site storm water collection facility.	• Collection of plant site storm water run-off. Collected run-off redirected to the plant site water circuit for reuse and treatment.	The facility design includes containment (including secondary containment) of the 25-year, 24-hour storm (about 1.2 million gallons) and secondary containment of the 100-year, 24-hour storm. Design features include: • A storm water diversion channel upstream of the plant. • Culvert crossing at the access highway. • A 625,000 gallon bolted steel tank inside a reinforced concrete basin. • Collection channels, sediment basins, gravity storm sewers, a transfer station, a force main, railroad crossings, earth channels, site grading and paving. • Additional impoundment area for 100 year storm containment. Storm water improvements are discussed in Section 4.3 (Current Conditions, Surface Water).	• Construction was initiated in November 1996 and was completed in December 1997. The construction implemented all the features per the design (Final Construction Report for Storm Water System Improvement Project, Hydrometrics, 1998).	The Operations and Maintenance Manual (Hydrometrics 1998 details O&M requirements for the storm water improvements at the plant site. Maintenance elements include: • Annual maintenance of culverts, ditches, channels, sediment basins, and drains. • Periodic addition of settlement polymers • Annual inspection of the influent system and the primary holding tank • Removal of debris from the secondary concrete containment basin. • Inspection and maintenance of the 100 year containment basin and overflow weir • Operation and maintenance of pumps, valves etc. the transfer station at the tank.	• The new stormwater collection facility effectively contains surface run-off per its design.	• Aspects of the implemented action vary from Process Pond ROD requirements. The ESD is expected to address this issue.	• Once the ESD is executed the actions for containment of storm water are considered the final measure to address storm water runoff at the plant.

TABLE 5-2-1 EVALUATION OF INTERIM AND FINAL REMEDIAL ACTION MEASURES

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GROUNDWATER								
Plant Site and Off-Site Groundwater	• Most of the remedial actions implemented to date have been directed at elimination of plant site sources to groundwater (see above). No other actions specific to groundwater other than long-term monitoring have been implemented.	• No direct actions (excluding elimination of plant site sources to groundwater) relative to groundwater other than long-term monitoring have been implemented.	• No actions relative to groundwater other than long-term monitoring have been implemented. The monitoring program is described in detail in Section 4.0 (Current Conditions)	• No actions relative to groundwater other than long-term monitoring have been implemented.	• No actions relative to groundwater other than long-term monitoring have been implemented.	• No actions relative to groundwater other than long-term monitoring have been implemented. The quality and applicability of the data are discussed in Section 3.0.	• No actions relative to groundwater other than long-term monitoring have been implemented. The action is consistent with the Process Ponds ROD, and EPA direction under CERCLA.	The Comprehensive RI/FS evaluated several alternatives for Plant Site and Off-Site Groundwater. These included: • No action. • Institutional controls. • Long-term monitoring. • Isolation and containment alternatives including: 1. Pumping and injection wells 2. Slurry containment walls • Pump and Treat alternatives • In-situ treatment options.

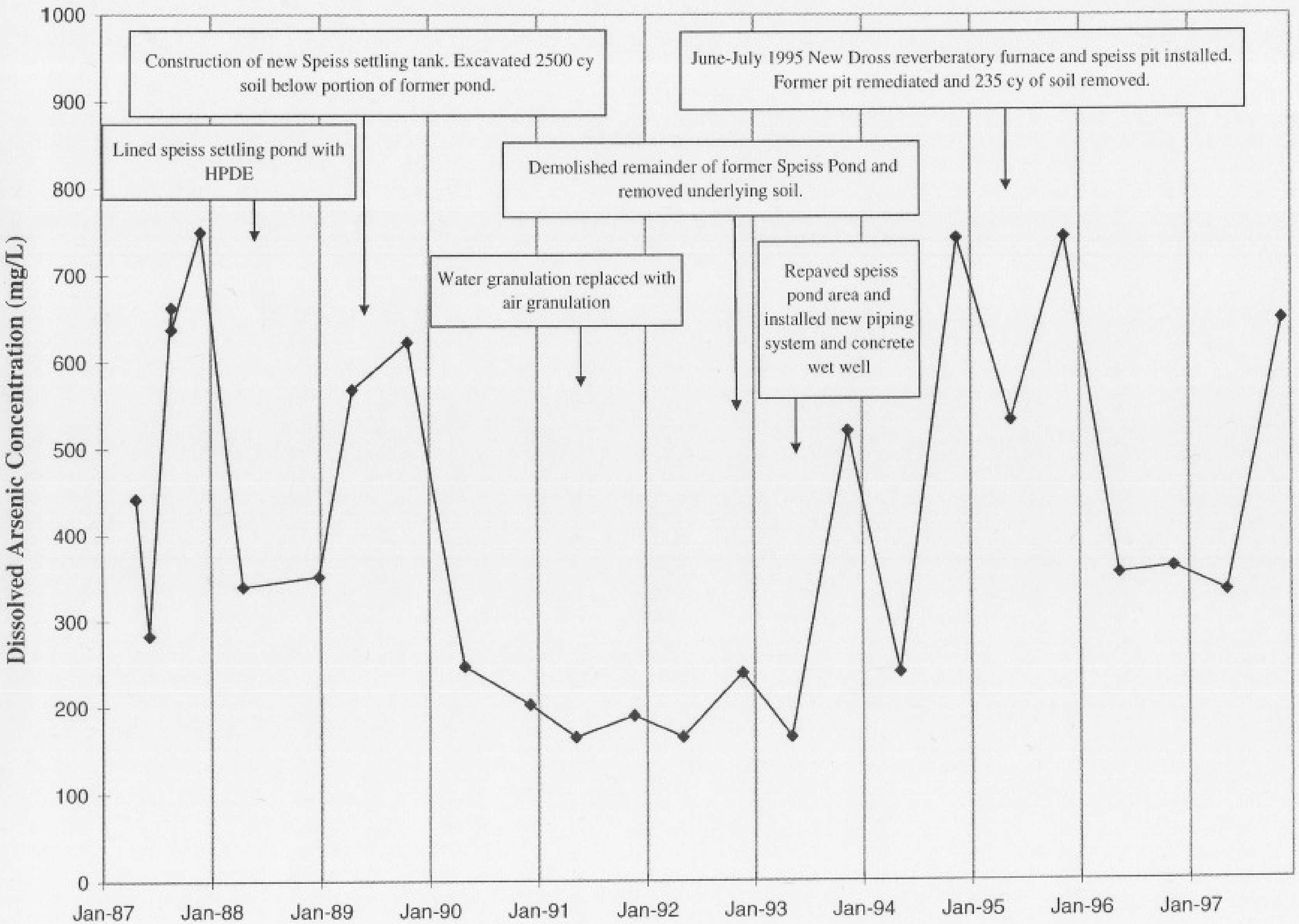

FIGURE 5-2-1. ARSENIC TREND AT MONITORING WELL DH-21 NEAR FORMER SPEISS SETTLING POND

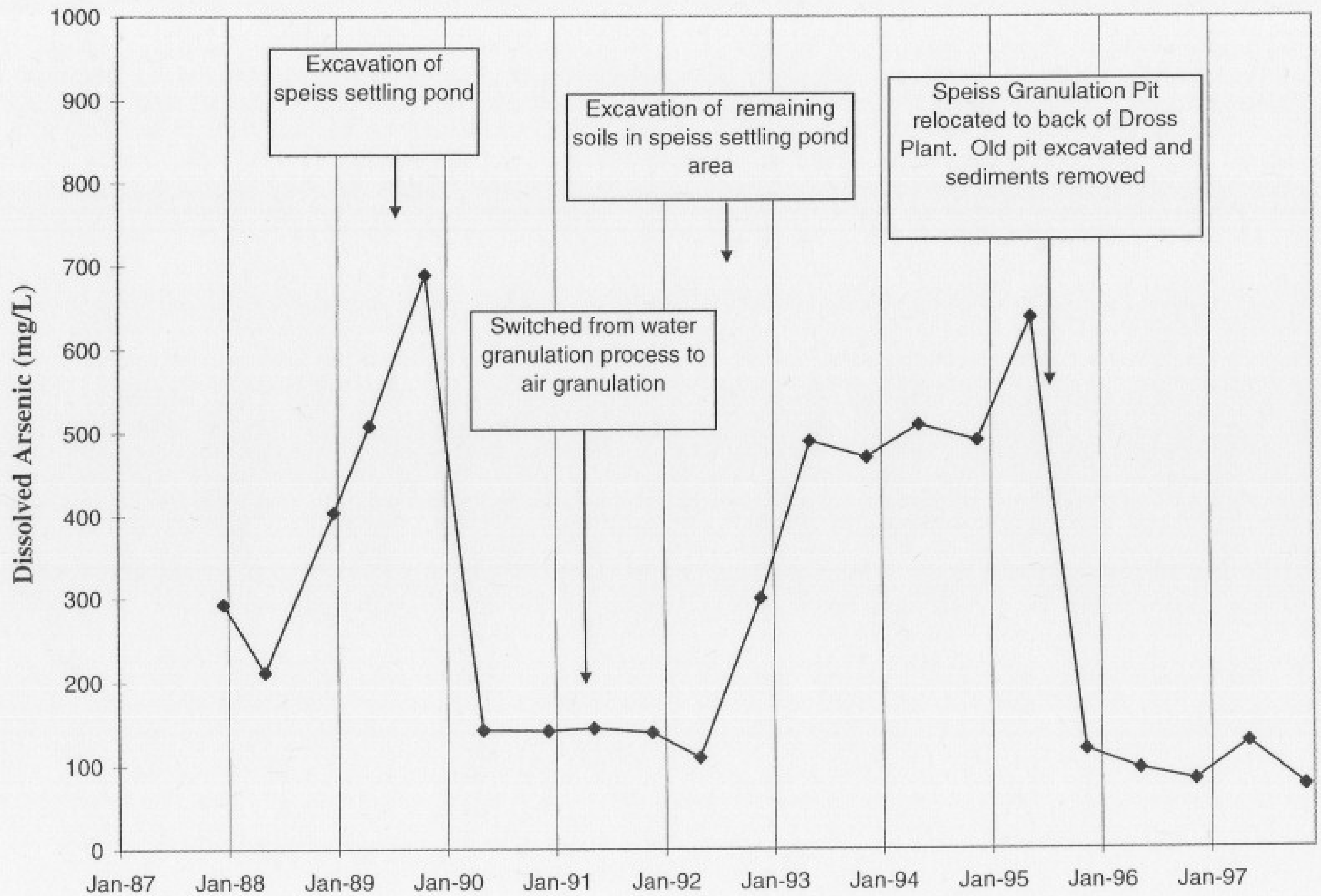

FIGURE 5-2-2. ARSENIC TREND AT MONITORING WELL DH-28 NEAR FORMER SPEISS GRANULATION PIT

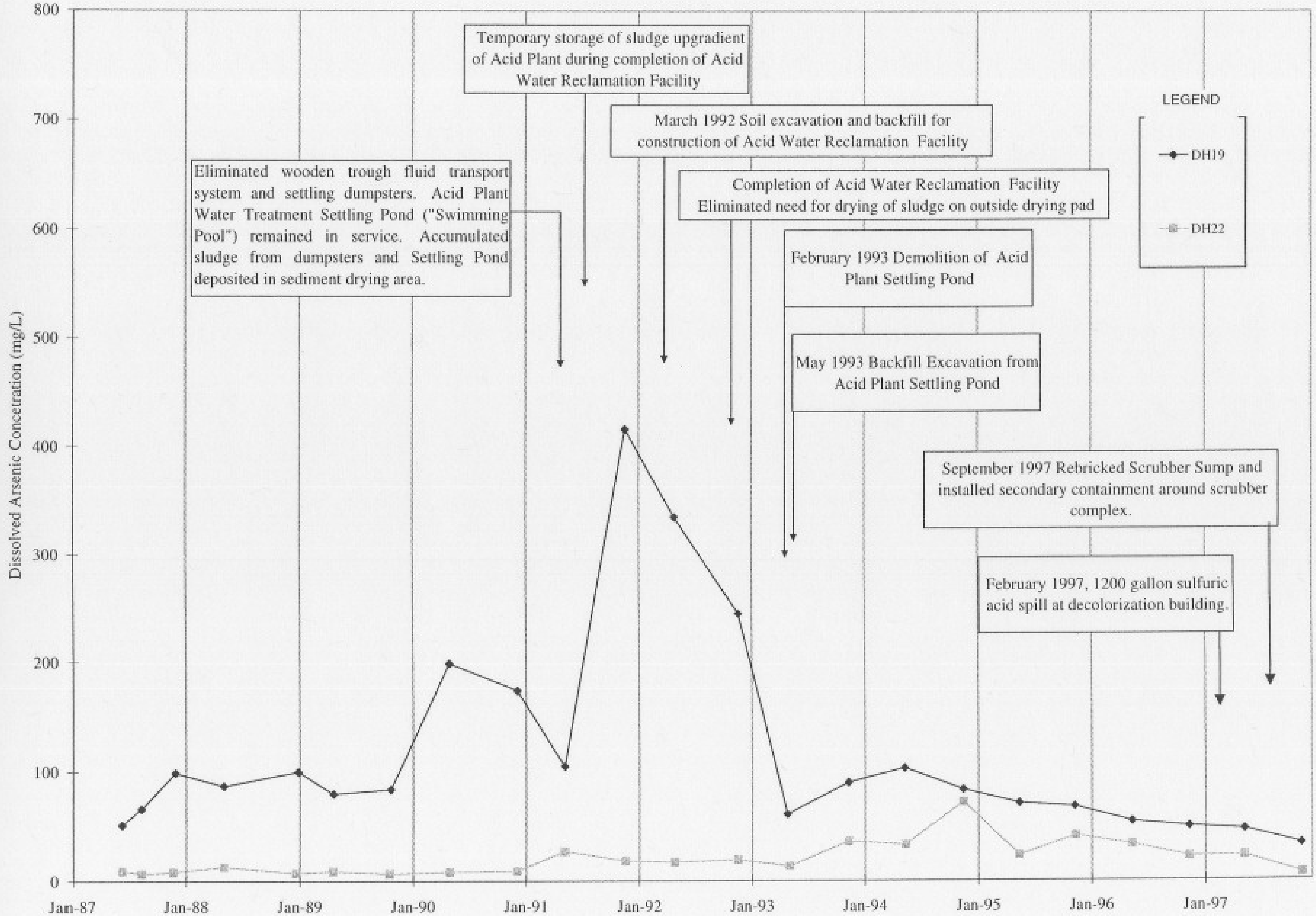

FIGURE 5-2-3. ARSENIC TRENDS AT MONITORING WELLS DH-19 & DH-22 IN ACID PLANT AREA

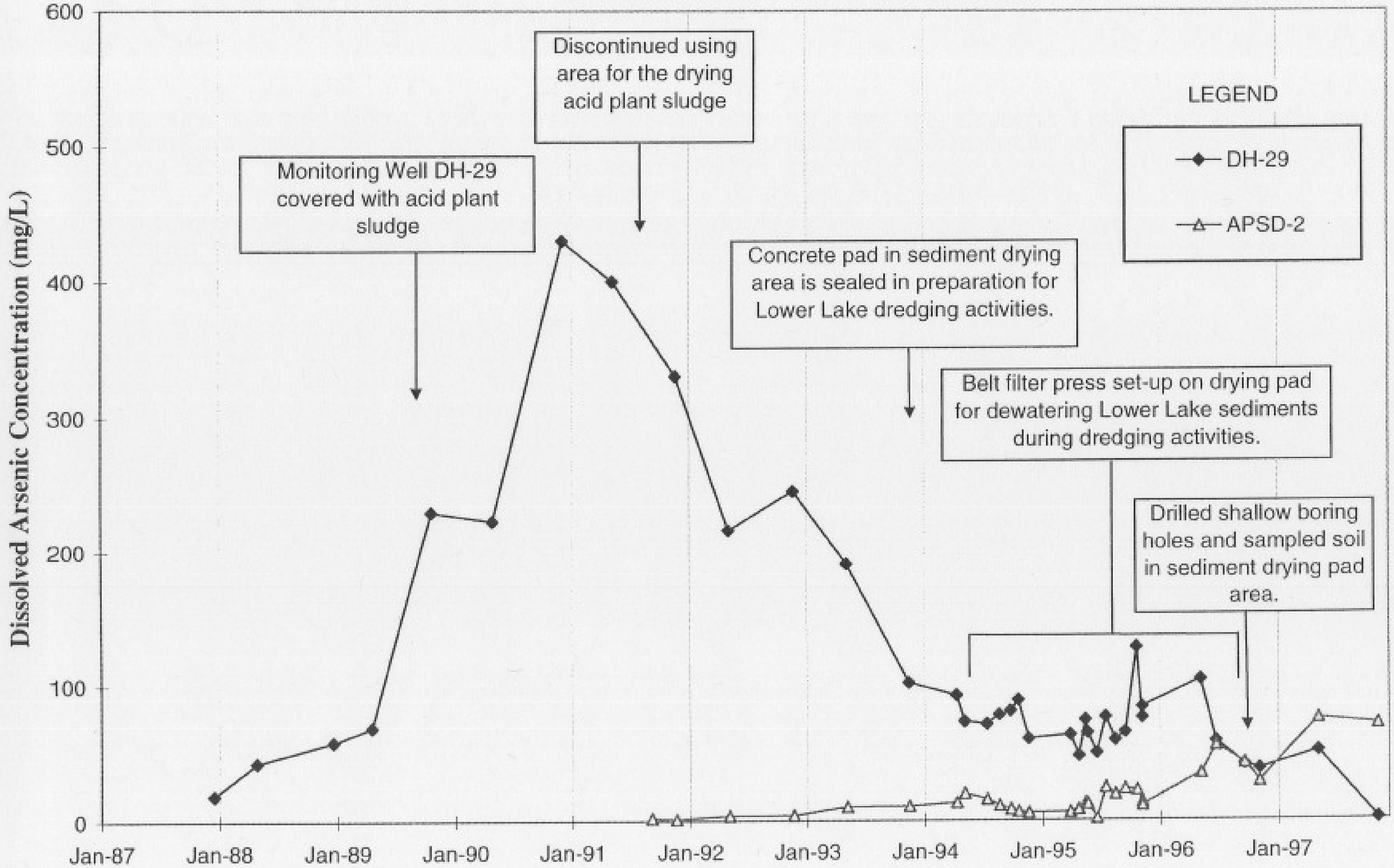

FIGURE 5-2-4. ARSENIC CONCENTRATION TRENDS IN DH-29 AND APSD-2 IN FORMER SEDIMENT DRYING AREA

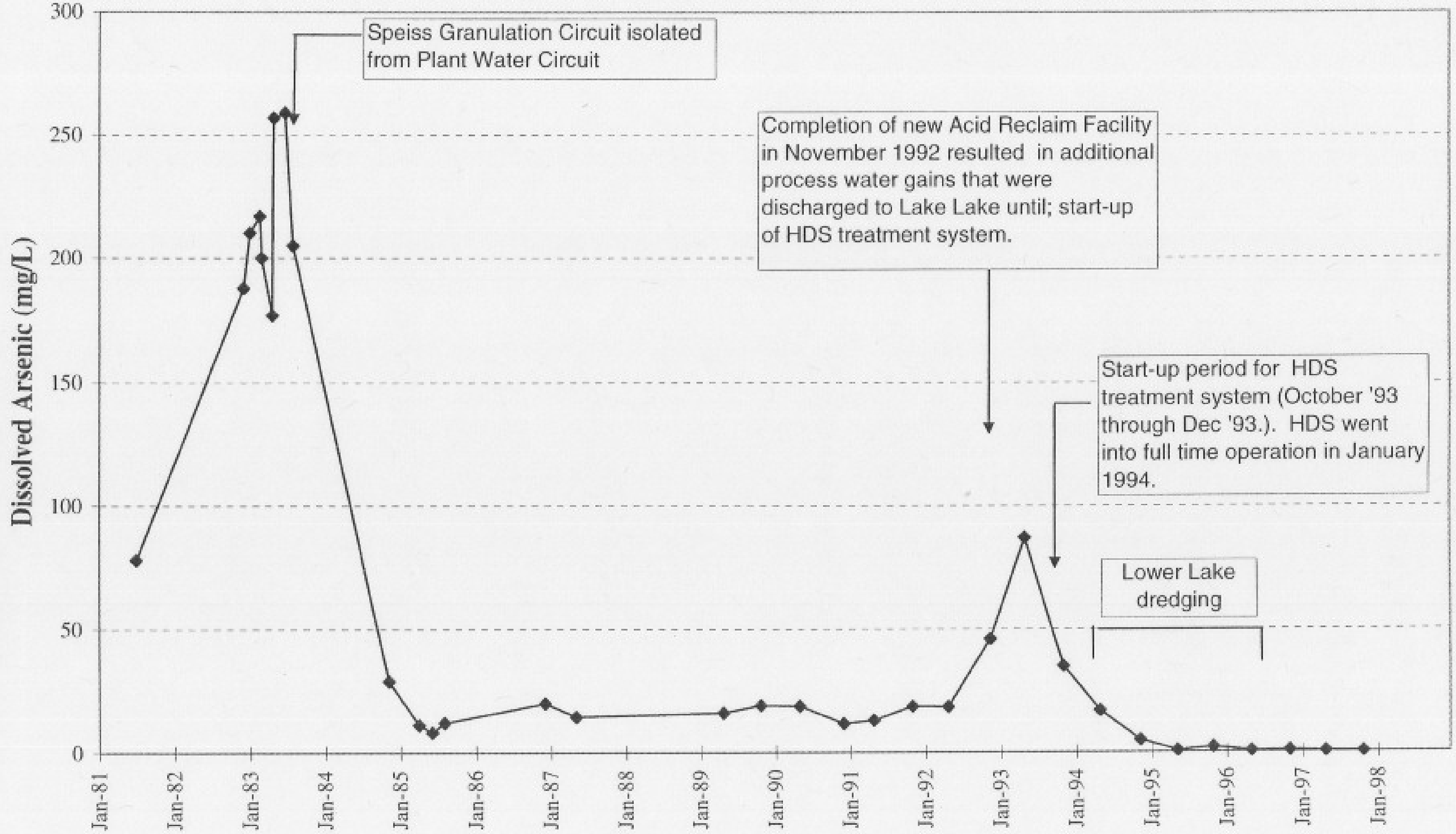

FIGURE 5-2-5. ARSENIC CONCENTRATION TREND IN LOWER LAKE (1981-1997)

6. SUMMARY AND CONCLUSIONS

As described in Section 1.0, this CC/RA included:

- A summary and description of existing data at the site and an evaluation of its quality (Section 3.0).

- An evaluation of current conditions (Section 4.0) for CC/RA areas and operable units including:

  - Plant site soils and the ore storage areas which address:

    - Surface soils
    - Subsurface soils
    - Stockpiles
    - Slag Pile

  - Process fluids (Process Ponds and Process Fluid Circuits) which address:

    - Lower Lake
    - Former Thornock Lake
    - Former Speiss Pond
    - Former Speiss Pit
    - Former Acid Plant Water Treatment Settling Facility
    - Former Acid Plant sediment drying areas
    - Plant Water Circuit
    - The Former Speiss Granulating Circuit
    - The Acid Plant Water Circuit

  - Surface Water including:

    - Prickly Pear Creek and Upper Lake
    - Wilson Ditch
    - Storm Water Runoff

  - Groundwater

- A release assessment and evaluation of interim and final remedial actions (Section 5.0).

CC/RA conclusions are presented below and address:

- The evaluation of existing data, and
- The evaluation of CC/RA operable unit areas

6.1 EXISTING DATA SUMMARY CONCLUSIONS

The primary conclusions of the Existing Data Summary (Section 3.0 above) are:

1. The existing data have been obtained as part of several investigation efforts or as part of plant operations and, as a result, the data are in several separate data bases including:

    - The RI/FS and Post RI/FS Biannual (twice yearly) Sampling Data Base
        - The Post RI/FS Plant Site Soils and Ore Storage Area Data Base
        - The Post RI/FS Process Fluid Circuit Data Base
        - The Post RI/FS Surface Water and Associated Soils Data Base
        - The Post RI/FS Groundwater Well Construction Data Base, and
        - The Plant Discharge into East Helena POTW (Publicly Owned Treatment Works) Data Base
        - General Storm Water Discharge Data Base

2. Since the investigations associated with the data bases had different objectives, there are variable levels of data quality review for the data bases. These data review levels include:

    - Laboratory internal QA/QC review prior to data release,
    - Visual validation (visual inspection for obvious errors),
    - Standard validation (visual inspection and review of field and laboratory QA and QC data), and
    - CLP level validation (validation using specific EPA procedures).

3. All the data are considered usable for CC/RA purposes.

4. Some of the data collected as part of the CERCLA investigations (Comprehensive RI/FS, Process Ponds, Surface Water/Soils) are flagged with data quality qualifiers. The qualifiers address field and analytical performance including completeness, accuracy and precision. None of the data were rejected based on EPA CLP validation criteria, or based on standard or visual level validation criteria.

5. Data collected as part of plant operations (plant water quality data for example) are also considered usable for CC/RA purposes. These data typically received a laboratory internal review, and additional validation was not performed.

6.2 EVALUATION SUMMARY FOR CC/RA OPERABLE UNITS/AREAS

6.2.1 Plant Site Soils and Ore Storage Areas

6.2.1.1 Surface Soils

Surface soils impacted by arsenic and metals were identified in the Comprehensive RI/FS in the Lower Ore Storage Area, the former Upper Ore storage area, in railroad track areas, unpaved areas on the plant site and unpaved areas adjacent to the plant.

Summary of Completion Remedial Action

- Consolidation of ore stockpiles in the new CSHB building to eliminate exposure to source material.
- Paving in selected areas of the plant.
- Storm water improvements to eliminate runoff.

Summary of Available Data

Surface soil samples were collected at 26 plant site locations as part of the Comprehensive RI/FS Investigation and analyzed for total arsenic and metals. No subsequent sampling was conducted of surface soils with the exception of sampling conducted as part of specific source area investigations or actions. Post-RI/FS groundwater quality data provide long-term water quality trends for most of the associated areas.

Storm water quality monitoring of runoff from the northwest end of the plant site has been conducted as part of MPDES permit requirements. This is the only area where runoff from exposed plant site soils would have formerly discharged from the site.

Data Adequacy

The data are sufficient to indicate that virtually all of the exposed surface soils on the plant site have been impacted by historical activities on the site. The data are also sufficient to address any interim capping requirements, but would not be sufficient for evaluating more detailed remedial action measures.

Effectiveness of Remedial Action

As indicated in the Storm Water Summary, the storm water remedial actions have been successful in controlling discharge of runoff from the site. Infiltration of rainfall through exposed soils is therefore the primary pathway for potential migration of arsenic and metals. Groundwater monitoring has not identified exposed soils as one of the primary sources of arsenic or metals to groundwater on the site. As source reductions continue to occur on site, continued monitoring will be necessary to evaluate potential groundwater impacts from exposed soils.

Need for Additional Data and/or Remedial Action

Additional data are required. Collection of data could be obtained as part of an RFI or during Remedial Design. Immediate or interim data collection actions are not necessary.

The Comprehensive RI/FS evaluated remedial alternatives for plant site soils and the ore storage areas. The alternatives include:

- No action
- Capping, wind fences, dust suppressants, grading, diversions and containment sumps to control runoff and infiltration to groundwater
- Excavation and storage on site in a RCRA compliant facility
- Excavation and transport off site
- Excavation and smelting
- Excavation and treatment
- In situ treatment or neutralization
- Deep tilling

6.2.1.2 Subsurface Soils

Subsurface soils impacted by arsenic and metals were identified in the Comprehensive RI/FS. Most of the impacted areas are associated with Process Pond sources. Highest concentrations of arsenic and metals were observed in the Acid Plant Water Treatment area and associated sediment drying areas. Elevated concentrations of arsenic and metals were also observed in the Lower Ore Storage Area, the former Upper Ore storage area between Upper and Lower Lake, with lower concentrations of subsurface soil metals in other plant areas. Off-plant subsurface soil concentrations were relatively low.

Summary of Completion Remedial Action

- Subsurface soils were removed as part of the remedial actions for Process Ponds (see Process Ponds Below)
- Some subsurface soils were removed in the saturation zone as part of remedial actions for Process Ponds. However, soil excavation in saturation zone was limited by practical excavation limits and dewatering concerns.
- Construction of new ore storage and handling building allowed the removal of ores formerly stored in the ore storage

Summary of Available Data

Subsurface soil samples were collected at 50 monitoring well and soil boring locations on and off the plant site as part of the Comprehensive RI/FS Investigation. The samples were analyzed for total arsenic and metals, EP Toxicity, and leachate characteristics. Additional subsurface soil samples were collected from Process Pond locations as part of Remedial Design and Remedial Action efforts.

Data Adequacy

Plant site soils were adequately characterized in the RI/FS to determine what metals are elevated in soils, and the areal extent and general depth of elevated metals and arsenic. Additional data will be needed to design corrective action measures for plant site soils. Refinement of volume estimates is needed for design purposes Additional data are required-particularly in the speiss pond area, the acid plant area. Collection of data could be obtained as part of an RFI or during Remedial Design. Immediate or interim data collection actions are not necessary

Effectiveness of Remedial Action

Removal of sediments and soils in process pond areas are discussed below under process ponds. With the exception of process pond areas, no actions relative to subsurface soils other than long-term monitoring have been implemented.

Need for Additional Data and/or Remedial Action

Additional data are required-particularly in the speiss pond area, the acid plant area. Collection of data could be obtained as part of an RFI or during Remedial Design. Immediate or interim data collection actions are not necessary.

The Comprehensive RI/FS evaluated remedial alternatives for plant site soils including subsurface soils. The alternatives include:

- No action
- Capping, grading, diversions and containment sumps to control runoff and infiltration into subsurface soils and groundwater
- Groundwater Controls
- Excavation and storage of surface and subsurface soils on site in a RCRA compliant facility
- Excavation and transport off site
- Excavation and smelting
- Excavation and treatment
- Insitu treatment or neutralization
- Deep tilling

6.2.1.3 Stockpiles

Ore stockpiles and soil and sediment stockpiles from plant construction and CERCLA remedial activities are potential sources for transport of arsenic and metals as surface water runoff and or by infiltration to groundwater. Interim remedial actions have been implemented to address the ore storage and handling, and to address storm water runoff from the ore storage areas. Storage of soil stockpiles in an on-site CAMU storage facility has been proposed for interim and long-term management of soil stockpiles.

Summary of Completed Remedial Action

- The new Ore Storage and Handling Building was constructed and the majority of ore stock piles were moved inside the building.
- The Lower Lake sediment stockpile was covered with a geomembrane cap.
- Remedial action on remaining soil stock piles in the lower ore storage area and in the area between Upper Lake and Lower Lake is awaiting an EPA decision on the proposed CAMU.

Summary of Available Data

Soil stock pile data include:

- Soil core sampling results from Lower Lake prior to excavation.
- Soil stockpile sampling results for the lower ore storage area and the area between Upper and Lower Lake. These sample data consist of XRF analyses for arsenic and lead.
- Test pits and soil borings in the areas between Upper Lake and Lower Lake. These data include arsenic and metals concentrations versus depth and TCLP test results.

Data Adequacy

Additional TCLP data are needed for characterization of soil stockpiles.

Effectiveness of Remedial Action

The proposed CAMU would meet RCRA remedial action goals.

Need for Additional Data and/or Remedial Action

Additional data are required. Collection of data could be obtained as part of an interim action or during Remedial Design. Construction of the CAMU containment facility is a proposed interim action to address soil stock piles. This action could be a final action for stock piled soils when completed.

6.2.1.4 Slag

The RI concluded slag was not a significant source of arsenic or metals to groundwater, surface water or air quality. Post RI/FS monitoring indicate some erosion of the slag pile may infrequently occur during high flow periods.

Summary of Completed Remedial Action
No direct remedial measures for the slag pile have been implemented. Direct corrective actions for the slag are not considered necessary. Potential erosion of the slag pile by Prickly Pear Creek is addressed in the conclusions for Surface Water below.

Summary of Available Data
The nature and extent of potential impacts to groundwater were adequately characterized during the RI. On-going monitoring provides additional detail on surface water quality.

Data Adequacy
Additional data specific to the slag pile are not required. Potential slag impacts during infrequent high flow periods on Prickly Pear Creek are addressed by on-going surface water monitoring (spring high flow period) at the site.

Effectiveness of Remedial Action
No direct remedial measures for the slag pile have been implemented. Direct corrective actions for the slag are not considered necessary. Potential erosion of the slag pile by Prickly Pear Creek is addressed in the conclusions for Surface Water below.

Need for Additional Data and/or Remedial Action
Additional data are not required. Potential slag impacts on Prickly Pear Creek are addressed by on-going surface water monitoring at the site. Comprehensive RI/FS concluded slag is not a significant source of arsenic and metals to groundwater or surface water quality. Post RI/FS monitoring does not indicate slag has measurable impacts on Prickly Pear Creek water quality. Although there is presently no evidence of measureable groundwater impacts from the slag pile, EPA has noted that additional monitoring wells in the slag may be required in the future; particularly when upgradient sources to groundwater have been eliminated and groundwater quality improves.

6.2.2 Process Fluids

6.2.2.1 Process Ponds

Lower Lake
Seepage losses from Lower Lake were identified in the Comprehensive RI/FS as a pathway for the release of arsenic and metals to underlying sediment, groundwater and Prickly Pear Creek. A series of remedial action measures were implemented to address this source. The remedial action measures were successful at reducing arsenic concentrations in Lower Lake

and removing contaminated sediments. However, final RCRA corrective action goals for water quality in Lower Lake have not yet been developed.

<u>Summary of Completed Remedial Action</u>
Remedial actions implemented on Lower Lake include:

1. Elimination of plant water discharges to Lower Lake through:

   - Construction of two 1-million gallon plant water storage tanks to replace Lower Lake surge capacity in plant water circuit.
   - Reduction in gains to the plant water circuit to eliminate excess discharge.
   - Construction of the HDS Treatment Facility to treat remaining plant water discharges

2. Dredging of Lower Lake Sediments

<u>Summary of Available Data</u>
Soil Data:

- 1987: Soil core samples were analyzed from six locations in Lower Lake for total arsenic and metals.
- 1991: Soil core samples were collected at 8 locations on Lower Lake and analyzed by EPTOX for arsenic and metals
- 1992: Additional cores samples from 9 sites were analyzed for EPTOX and TCLP arsenic and metals
- 1992: Seven previous soil core locations were resampled and analyzed for EPTOX arsenic and metals
- 1992: Five soil core samples were taken from one site over 6-inch intervals and analyzed for total arsenic and metals.

Water quality data:

- 1992: five water samples were collected concurrent with soil cores and analyzed for dissolved arsenic and metals.
- 1984 through present: Twice yearly water quality monitoring of Lower Lake and surrounding groundwater monitoring wells as part of RI and Post RI/FS monitoring programs

<u>Data Adequacy</u>
The data are sufficient to evaluate the nature and extent of releases to Lower Lake soils, identify and implement soil removal actions, and confirm compliance requirements for soil removal. The water quality data are sufficient to evaluate the nature and extent of releases to

groundwater and surface water. Additional on-going long-term monitoring is required to assess effectiveness of implemented measures.

Effectiveness of Remedial Action

Dredging of soils was successful in meeting remedial action goals specified in the ROD as modified by the 1993 ESD for Lower Lake. Lower Lake water quality has improved substantially (0.049 mg/L arsenic in 1998) as a result of implemented actions, but does not yet meet specified CERCLA remedial action goals.

Need for Additional Data and/or Remedial Action

On-going long-term data are required to monitor Lower Lake water quality and trends in groundwater and surface water as a result of changes in Lower Lake water quality. Additional results from on-going monitoring will be incorporated into the RFI. Potential additional corrective actions for Lower Lake include:

- No action
- In situ treatment
- Treatment using the HDS plant.
- Hydraulic controls to limit groundwater flow through subsurface soils in the area between Upper Lake and Lower Lake.

Former Thornock Lake

Seepage loss of plant water through the bottom of Thornock Lake was identified during the Phase I Process Ponds RI as a potential pathway for the release of arsenic and metals to shallow soils and groundwater. A series of remedial action measures were implemented to address this source. Subsequent soil and water monitoring indicate the measures were successful.

Summary of Completed Remedial Action

A steel tank was installed to replace Thornock Lake in 1986. The tank was set in a concrete vault to provide secondary leak containment. During installation of the tank, shallow soils were excavated from the area underlying the tank to a depth of 5 feet. The 1989 Process Pond ROD required testing and removal of remaining soils from the Thornock Lake area. Based on the testing results, remaining shallow soils in the former Thornock Lake area were excavated in 1991.

Summary of Available Data

- In 1987, 12 soil samples were collected from two soil borings in the excavated area around Thornock Tank and analyzed for EPTOX.
- 1n 1991, soil samples were collected from two test pits in the former Thornock Lake area prior to further excavation. The samples were analyzed for total metals and

EPTOX. Nine post-excavation soil samples from the area of soil removal were also analyzed for total metals and EPTOX.

- Since 1991 water quality monitoring has been conducted at least twice yearly in surrounding plant site and downgradient monitoring wells as part of the RI/FS and post RI/FS monitoring program.

Data Adequacy

These data were sufficient to evaluate the nature and extent of the release, identify and implement remedial action, and confirm the effectiveness of the implemented action.

Effectiveness of Remedial Action

The remedial action was determined to be effective based on the confirmatory soil sampling results.

Need for Additional Data and/or Remedial Action

No further data collection or remedial action measures are proposed in this area. The tank replacement and soil removal remedial actions serve as final measures for this source. Although remediation was completed in accordance with CERCLA requirements, EPA has noted additional data may be needed to evaluate residual concentrations of metals as part of an RFI.

Speiss Settling Pond Area

Seepage losses from the speiss settling pond (part of the speiss granulation process circuit) were identified in the Process Pond RI as a pathway for the release of arsenic to soils and groundwater. A series of remedial action measures were implemented to address this source. Groundwater quality data suggest the remedial action measures were only partially successful at eliminating the source. Some additional measures may be required.

Summary of Completed Remedial Action

- In the fall of 1988, the speiss pond was lined with HPDE as an interim measure to eliminate seepage losses.
- In 1990, the speiss pond was replaced with a new speiss settling tank with secondary leak containment. The speiss pond was demolished in the immediate area of the replacement tank and underlying soil was excavated.
- In 1991, the smelter switched from a water granulation process to an air mist granulation process. This change eliminated the need for a speiss granulation process circuit.
- In 1992, remaining portions of the speiss pond were removed. Underlying soils were excavated beneath the pond to the depth of the water table.
- In 1993, a concrete cap was constructed to cover the former speiss pond area.
- In 1993, storm water drainage improvements were made in the speiss pond and speiss tank area. Since the need for a speiss settling tank was eliminated with conversion to

air-mist granulation, the tank was converted for use solely as a collection basin for the containment of storm water runoff from the surrounding speiss handling area.

Summary of Available Data

Soils data collected in the speiss pond area consist of metals data for a single surface sample in the speiss pond area and metals data for soils from monitoring well DH-21 located immediately downgradient of the former speiss pond and adjacent to the speiss tank. No soil samples were taken during soil excavation in the speiss pond area since remediation objectives were depth-based. Water quality data have been collected at DH-21 and at downgradient wells at least twice yearly since 1987 as part of RI/FS and post-RI/FS monitoring programs.

Summary of Data Adequacy

The nature and extent of potential impacts to groundwater and subsurface soils were adequately characterized during the RI to determine corrective actions in accordance with the Process Pond ROD. On-going monitoring provides additional detail on groundwater improvements as a result of implemented corrective actions (see Table 5-2-1). Additional data are needed to fully characterize groundwater conditions in the speiss storage area.

Effectiveness of Remedial Action

Water quality trends at DH-21 are variable, but continue to show elevated concentrations of arsenic (greater than 300 mg/L) with periodic spikes as high as 600 mg/L. In contrast, plant site wells downgradient of the former speiss pond area, show pronounced decreases in arsenic concentrations that coincide with the timing of remedial activities in this area. These water quality trends suggest remedial actions in the former speiss pond area have significantly decreased arsenic loads. Arsenic trends at DH-21, however, indicate an on-going residual release of arsenic.

Need for Additional Data and/or Remedial Action

Additional long-term data are required to monitor groundwater trends in the immediate speiss pond area. Data needs include:

- Evaluation of surface water runoff conditions.
- Evaluation of the existing surface water retention tank and runoff conveyances to the tank.
- Long-term monitoring groundwater data.

Additional long-term data are required to monitor groundwater trends in the immediate speiss pit area. Data needs include an evaluation of surface water runoff conditions. Additional data, including additional monitoring wells to obtain surface and subsurface soil, and groundwater quality data, can be obtained as part of an RFI, since the overall downgradient water quality has improved. However, additional source area evaluation can be performed as an interim measure or as part of an RFI to assess on-going sources of arsenic and metals to groundwater. ~~Additional data can be obtained as part of an RFI, since the~~

overall downgradient water quality has improved. However, additional source area evaluation is proposed as an interim measure to assess on-going sources of arsenic and metals to groundwater.

Potential additional corrective measures in the speiss pond area include:

- Capping railroad track areas next to the present cap to reduce potential run-off.
- On-going maintenance to ensure cap integrity.
- Re-designed cap with underliner to prevent infiltration from run-off.
- Cover or close Speiss storage area to prevent infiltration to groundwater during run-off.
- Determine if primary tank leakage is the source of water in secondary containment pond.
- Repair run-off pipes to tank to keep run-off in primary containment tank.

Speiss Granulating Pit

Seepage losses from the speiss granulation pit (part of the speiss granulation process circuit) were identified in the Process Pond RI as a pathway for the release of arsenic to soils and groundwater. A series of remedial action measures were implemented to address this source. Groundwater quality data suggest the remedial action measures were only partially successful at eliminating the source. Some additional measures may be required.

Summary of Completed Remedial Action

- April 1991 - Water granulation process replaced with air/mist granulation eliminating potential for infiltration of excess water from pit.
- June-August 1995 - Constructed new dross reverberatory furnace building and a new speiss granulating pit. The old Speiss pit was demolished. Soil beneath the pit was excavated.
- August 1998 - Exposed soils along rail corridors adjacent to the speiss storage area near monitoring well DH-28 were paved.

Summary of Available Data

The nature and extent of potential impacts to groundwater and subsurface soils were adequately characterized during the RI to determine corrective actions in accordance with the Process Pond ROD. On-going monitoring provides additional detail on groundwater improvements as a result of implemented corrective actions (see Table 5-2-1). Additional surface soil, subsurface soil and groundwater data are needed to fully characterize groundwater conditions in the speiss storage area.

Effectiveness of Remedial Action

Water quality trends at DH-28 are variable, but continue to show elevated concentrations of arsenic (about 100 mg/L). In contrast, plant site wells downgradient of the former speiss pit area, show pronounced decreases in arsenic concentrations that coincide with the timing of remedial activities in this area. These water quality trends suggest remedial actions in the former speiss pond area have significantly decreased arsenic loads. Arsenic trends at DH-28, however, indicate an on-going residual release of arsenic.

Summary of Data Adequacy

The data are not sufficient to identify the nature of on-going impacts to soil and groundwater in the immediate speiss pit area. However, the water quality data are adequate to define the extent of impacts to groundwater. Reoccurring elevated concentrations of arsenic and sulfate at DH-28 are evidence of continuing releases in this area. The existing data are not adequate to identify the source of continued elevated arsenic concentrations at DH-28 or define additional remedial action measures.

Need for Additional Data and/or Remedial Action

Additional long-term data are required to monitor groundwater trends in the immediate speiss pit area. Data needs include an evaluation of surface water runoff conditions. Additional data, including additional monitoring wells to obtain surface and subsurface soil, and groundwater quality data, can be obtained as part of an RFI, since the overall downgradient water quality has improved. However, additional source area evaluation ~~is proposed~~ can be performed as an interim measure or as part of an RFI to assess on-going sources of arsenic and metals to groundwater.

Potential additional corrective measures for the speiss pit area include:

- On-going maintenance to ensure cap integrity;
- Redesigned cap with underliner to prevent infiltration from run-off;
- Alter speiss handling and management practices to reduce exposure to elements; and
- Cover or close speiss storage area to prevent infiltration to groundwater during run-off.

Acid Plant Water Treatment Facility and Acid Plant Water Circuit

Seepage losses from the acid plant water treatment facility were identified in the Process Pond RI as a pathway for the release of arsenic to soils and groundwater. A series of remedial action measures were implemented to address this source. The settling pond and associated sediment settling facilities were eliminated as part of acid plant water treatment modifications, resulting in significant improvements to groundwater water quality. Sediment drying areas adjacent to the setting pond were removed and underlying soils were excavated in accordance with requirements of the Process Ponds ROD. However, arsenic and metals in groundwater remain elevated. Some additional measures may be required.

Summary of Completed Remedial Action

Former Acid Plant Settling Pond

- April 1991. A clarifier was added to the acid plant water reclaim process allowing removal of the wooden trough fluid transport system and portable settling dumpsters.
- November 1992. New acid plant water reclamation facility went on-line. The new facility replaced the settling pond.
- February 1993. The acid plant water settling pond was demolished. Demolished concrete was transported to the lower ore storage area.
- May 1993. Soil under the former acid plant settling pond was excavated 8 to 11 feet below the water table. Excavated soils were transported to the lower ore storage area.
- September 1997. The acid plant scrubber sump was rebricked to eliminate leaks.

Acid Plant Sediment Drying Areas

- July 1991. Discontinued use of sediment drying areas. Acid plant sediments were removed from the storage areas. With the addition of a filter press in the acid water reclaim facility, the sediment drying areas were no longer needed.
- September 1993. The former acid plant sediment drying pad between Lower Lake is sealed in preparation for use as a dewatering area dredged sediments from Lower Lake.
- 1994, 1995, and 1996. The former acid plant sediment drying area is used for Lower Lake sediment dewatering (see Lower Lake below).
- 1996. Lower Lake dredging and dewatering equipment is demobilized.

Acid Plant Circuit

- Rebricked acid plant scrubber sump.
- Excavation of soils in area of recent acid plant cooling water release.
- Replacement of underground pipelines for the acid plant cooling water circuit is in progress.

Summary of Available Data

Soils Data:

- Soil samples were collected beneath the acid plant settling pond and the adjacent acid plant drying areas prior to soils excavation under the pond and drying areas. The soils were analyzed for total arsenic and metals and for EPTOX. Additional soils data were collected from the acid plant sediment drying area adjacent to Lower Lake as part of Remedial Design efforts for Lower Lake. These samples were analyzed for total metals and TCLP.

- 1987 – Soils samples were collected during the installation of DH-29 and analyzed for arsenic and metals.
- 1991 - Soil samples were collected during installation of four APSD monitoring wells in the acid plant sediment drying area and analyzed for EPTOX.
- 1993 - Additional boring samples were collected at additional APSD monitoring wells sites in the sediment drying pad area and analyzed for total and TCLP arsenic and metals.
- 1996 - Additional borehole composite samples were collected at nine locations and analyzed for total and TCLP arsenic and metals.

Water Quality Data:

- Three water samples from settling pond excavation were analyzed for total arsenic and metals, and arsenic speciation.
- Water quality data have been collected at DH-19 in the settling pond area and in downgradient wells at least twice yearly since 1987 as part of RI/FS and post-RI/FS monitoring programs.
- Water quality data have been collected from sediment drying areas adjacent to the former settling pond and the drying area adjacent to Lower Lake.
- Potential groundwater impacts from the acid plant water circuits, have been monitored downgradient DH-22 which is located north of the acid plant production area and scrubber sump. Water quality samples have been collected at downgradient well DH-22 least twice yearly since 1987 as part of RI/FS and post-RI/FS monitoring programs.

Data Adequacy

The nature and extent of potential impacts to groundwater and subsurface soils when the facilities were in use, were adequately characterized during the RI to determine corrective actions in accordance with the Process Pond ROD. On-going monitoring provides additional detail on groundwater improvements as a result of implemented corrective actions (see Table 5-2-1). Although the data collected during the RI/FS were adequate to determine corrective actions in accordance with the process pond ROD, EPA has noted additional surface soil, subsurface soil and groundwater data may be necessary to address RFI requirements. Additional data (collected as part of on-going long-term monitoring) are needed to fully characterize groundwater conditions in the former acid plant sediment drying areas, and in the acid plant production/scrubber area.

Effectiveness of Remedial Action

Soil underlying the acid plant settling pond area and nearby sediment drying areas were removed in accordance with the Process Pond ROD. Arsenic concentrations in groundwater have dropped from about 250 mg/L in fall 1992 to less than 35 mg/L in the fall of 1997. Some residual water quality effects in this area are related to upgradient sources (e.g., former sediment drying pad area) and short-term releases.

In the former acid plant sediment drying area adjacent to Lower Lake, groundwater concentrations in well DH-29 and downgradient DH-19, show a general pattern of declining arsenic, metals, sulfate, and chloride coinciding with the removal of the acid plant sludges (see Appendix 4-3-1 and Figure 5-2-4). Arsenic concentrations declined from about 400 mg/L in early 1991 to about 70 mg/L in 1994. Based on the data, acid plant sediment removal from the drying pads was effective in improving groundwater quality, but arsenic and metal concentrations remain elevated.

Groundwater quality improvements were also evident at DH-22 immediately following repairs to the scrubber sump in 1997. However, preliminary review of recent arsenic and metals trend from DH-22 show these concentrations remain elevated, and may be influenced by recent spills and releases from the acid plant operation.

Need for Additional Data and/or Remedial Action

On-going long-term data is required to monitor groundwater trends in the immediate acid plant pond area. Additional results from on-going monitoring will be incorporated into the RFI. Additional data specific to the acid plant settling pond are not necessary.

On-going long-term data are required to monitor groundwater trends in the immediate acid plant sediment drying area. Additional surface soil, subsurface soil and groundwater data are also needed to evaluate other areas of the acid plant. Data needs include:

- Evaluation of acid plant area south west of the former settling pond.
- On-going evaluation of the former sediment drying area.
- Evaluation of existing runoff patterns in the sediment drying area.

Additional source area evaluation can be performed as an interim measure or as part of an RFI to assess on-going sources of arsenic and metals to groundwater.

Remedial actions specific to the former settling pond are final and no additional actions are necessary. Similarly, the sediment removal action for the sediment drying area adjacent to the pond is considered a final action for this drying area. However, the sediment drying area adjacent to Lower Lake remains to be addressed. The Process Pond ROD identified the remaining sediment drying area adjacent to Lower Lake as a soil removal area. The action has been under reconsideration by EPA and is pending review of the existing data.

6.2.2.2 Process Fluid Circuits

Plant Water Circuit

The Comprehensive RI/FS identified seepage from the plant water circuit as a potential source of arsenic and metals to plant site groundwater. A failure of an underground pressurized pipeline also resulted in discharge of plant water to groundwater. Water quality and water level trends show a pronounced response to recent remedial action and additional monitoring is on-going.

Summary of Completed Remedial Action

- A water balance study was conducted as part of RI/FS identify process circuit gains and losses. Subsequent actions included: repair and replacement of pipes, drain sump modifications and repairs and, elimination of water bleeders.
- The plant water drain lines south of the Speiss Pit were replaced.
- The main plant water circuit pumphouse was waterproofed.
- In February 1998, major portions of the pressurized underground plant water circuit were replaced with above ground piping.

Summary of Available Data
Plant water quality is monitored daily (Monday through Friday) for arsenic pH and specific conductivity for purposes of process control. Plant water samples were also collected as part of RI/FS investigation (Hydrometrics, 1990a) and in 1998 as part of the recent Plant Water Investigation (Hydrometrics, 1998).

Data Adequacy
Updated water balance data and continued groundwater monitoring are necessary to evaluate the effectiveness of recent corrective actions.

Effectiveness of Remedial Action
Groundwater levels and water quality showed immediate response to the replacement of the majority of the pressurized underground plant water pipeline. The Plant Water Investigation monitoring is on-going and, in conjunction with Post RI/FS monitoring data, will provide further indication of the degree of effectiveness of the implemented actions.

Need for Additional Data and/or Remedial Action
The Plant Water Investigation monitoring program is presently on-going to assess plant water and groundwater trends following the February plant water loss, and subsequent abandonment of a most of the underground process water pressure line. An on-going water balance is presently underway to evaluate future corrective actions for the plant water circuit. The On-going plant water investigation monitoring and the water balance data are being collected as part of interim actions.

The Comprehensive FS addressed several potential alternative actions for process water circuits including:

- Pipeline and drainage line repair;
- Pipeline and drainage line replacement; and
- Replacement of pipelines, drains, and sumps with new lines and sumps equipped with leak detection and secondary containment features.

The pump house sump remains to be addressed. The need for additional action will be evaluated based on the results of the present water balance investigation and additional monitoring data.

Speiss Granulating Circuit
The Comprehensive RI/FS identified the speiss pit and the speiss settling pond as sources for releases from the speiss granulation circuit. Each of these sources has been addressed above. As noted, the speiss granulation circuit has been removed as a results of process modifications and is no longer a source for releases. Elimination of the speiss granulation circuit, therefore, serves as a final action for this source.

Acid Plant Water Circuit
The comprehensive RI identified the acid plant water treatment facility as the primary source of leakage from the acid plant circuit, which is addressed above. Spills and seepage losses from the scrubber pad area have also resulted in migration of arsenic and metals to soils and groundwater (see Process Ponds/Acid Plant Water Treatment Facility, above).

6.2.3 Surface Water

6.2.3.1 Prickly Pear Creek and Upper Lake

The RI documented minor contributions of arsenic and metals to Prickly Pear Creek from Lower Lake, but concluded there were no measurable impacts from slag. Post-RI data are consistent with RI findings, but suggest infrequent contributions of arsenic and metals may occur during short duration high flow events as a result of erosion of the adjacent slag pile.

The water quality of Upper Lake is essentially the same as for Prickly Pear Creek above the plant. Prickly Pear Creek and Upper Lake had elevated metal concentrations in bottom sediments, with Upper Lake having the higher concentrations than Prickly Pear Creek sediments.

Summary of Completed Remedial Action
No actions relative to Prickly Pear Creek or Upper Lake have been implemented with the exception of remedial action in Lower Lake, which as described above, affects Prickly Pear Creek.

Summary of Available Data

- Bottom sediments in Prickly Pear Creek (sampling locations PPC-3 through PPC-9) and Upper Lake were collected and analyzed in 1984 and 1985 for arsenic and metals as part of the process Ponds Remedial Investigation.
- Prickly Pear Creek and surface water sampling was also conducted at the PPC sites from 1984 through 1987 as part of the Process Ponds RI. Upper Lake water quality was collected 1984 to 1985.
- Since 1989, water quality and flow measurements have been collected twice yearly at six sites on Prickly Pear Creek as part of the Post RI/FS monitoring program. More frequent sampling was conducted at stations near Lower Lake in 1994 through 1996 to document the effects of on-going remedial activities in this area.

Data Adequacy
These data are sufficient to evaluate the nature and extent of water quality changes to Prickly Pear Creek and Upper Lake, and evaluate the effect of source reduction remedial activities.

Effectiveness of Remedial Action
Water quality in Prickly Pear Creek has not shown any long-term increases or decreases over the period of record. Water quality effects remain minor. On-going monitoring will further establish whether recent remedial actions address existing water quality effects. Infrequent contributions of arsenic and metals may occur during short duration high flow periods as a result of erosion of the adjacent slag pile.

Need for Additional Data and/or Remedial Action
On-going long-term monitoring will provides the necessary information on present and future conditions. Additional results from on-going monitoring will be incorporated into the RFI.

The Comprehensive RI/FS evaluated several alternatives for Prickly Pear Creek. These included:

- No action.
- Institutional controls.
- Concrete berm along the slag pile to isolate the creek from further erosion of the slag pile.

6.2.3.2 Wilson Ditch

Water and sediment quality in Wilson Ditch were evaluated as part of the Comprehensive RI/FS. Elevated concentrations of metals and arsenic were noted in sediments, while water quality was similar to that in Upper Lake and Prickly Pear Creek. In 1993, seepage into the ditch during construction activities showed elevated arsenic concentrations, suggesting the ditch might be a secondary source of arsenic and metals potentially impacting groundwater quality and sediments. To mitigate potential downstream impacts, removal and replacement of sediments in the lower portion of the ditch between sites WD-2 and WD-3 was conducted in 1993, and the portion of the ditch formerly traversing the plant site was relocated in 1997.

Summary of Completed Remedial Action

Prior to the RI/FS period (in 1984), suspected leaking joints in the plant site portion of the ditch were grouted to attempt to eliminate seepage into the ditch. In 1993, ditch sediments from WD-2 to WD-3 were removed and replaced with clean sediments. In 1997, the ditch from the Upper Lake head gate to the secondary highway west of the plant site was relocated into an underground 30” HDPE pipe running along the south and west plant boundary fence lines.

Summary of Available Data

- 41 water samples were collected during the Phase I Investigation in 1984 and 1985, analyzed for inorganic constituents.
- 4 additional water samples were collected during 1993.
- A sample of seepage into the ditch that had collected behind a dam installed during sediments excavation in 1993 was analyzed for screening level arsenic by XRF, to determine the potential for arsenic-bearing water to enter the ditch.
- 2 sediment samples were collected during the Phase I Investigation in 1984. Additional samples were collected during the 1993 construction phase (94 pre-construction samples and 178 post-construction samples).

Data Adequacy

The nature and extent of impacts to sediment were adequately characterized during the RI and sediments were subsequently excavated.

Effectiveness of Remedial Action

Sediment removal objectives were verified by confirmational (post-construction) sampling in 1993. The 1997 relocation is believed to have successfully eliminated on-plant inputs to the ditch.

Need for Additional Data and/or Remedial Action
Supplemental water quality samples from Wilson Ditch during low flow periods would confirm elimination of plant site inputs to the ditch. Additional data can be obtained as part of an RFI. There is no need for expedited interim data collection efforts.

Replacement of the plant site segment of the ditch is the final remedial action for Wilson Ditch. The action will be complete with collection of confirmational water samples.

~~1.1.1.3~~6.2.3.3 Storm Water Runoff

The Process Ponds RI identified storm water runoff from the plant site as a source of arsenic and metals to off-site receptors. However, storm water corrective actions based on the CERCLA Process Ponds ROD were implemented. The corrective actions included construction of a storm water containment system in 1997. The storm water system reduces the potential for off-site impacts to groundwater or subsurface soils from storm water infiltration.

Summary of Remedial Action
A storm water containment facility, consisting of a primary capture and settling tank (625,000 gallons), a secondary containment basin (1.2 million gallons), and a downstream containment impoundment sized to contain the 100-year, 24-hour storm was completed in December 1997.

Summary of Available Data

- Five storm water runoff samples were collected in 1987 on and adjacent to the plant site as part of the Phase II Investigation, and analyzed for inorganic parameters.
- Additional storm water runoff samples were collected from 1993 through 1997 using automated samplers to collect both "first flush" and composite samples during storm events of sufficient magnitude to satisfy the requirements of the storm water discharge permit.

Data Adequacy
Adequate data were collected as part of remedial design to successfully implement the corrective action.

Effectiveness of Remedial Action
Construction of the storm water capture system has effectively eliminated runoff from the west plant site (ore storage yard, ore concentrate handling and storage building, and miscellaneous access roads and parking areas). Only runoff exceeding the 100-year, 24-hour storm event has potential to discharge under extreme events to off-plant areas.

Need for Additional Data and/or Remedial Action

Additional data are not required. Construction of the storm water capture system is a final action for plant storm water control.

6.2.4 Groundwater

RI and Post-RI water quality sampling showed shallow groundwater (upper 10 feet of saturation) under the plant and, to a lesser extent, groundwater downgradient has elevated arsenic concentrations. Water samples from the next water bearing zone underlying the shallow-most aquifer do not have elevated arsenic concentrations. Concentrations in private wells were generally low and were below MCLs for arsenic and metals. No private wells are used as potable water supplies and all of the wells have been replaced with city water.

A northwest trending, relatively high concentration arsenic plume has been delineated in the shallow alluvial groundwater system on the plant site. Primary sources of this plume include the former speiss pond and pit area, and the acid plant water treatment facility and its associated sediment drying areas. This multi-source plume is superimposed on a relatively broad, lower concentration arsenic plume that is associated with Lower Lake. The lower concentration plume also extends to the north and northwest in the general direction of groundwater flow. Arsenic concentrations drop significantly in East Helena and are near or below MCLs (0.05 mg/l) at the north edge of the community.

Calculated groundwater flow and groundwater stratigraphic geochemical analyses indicate geochemical and physical reactions are attenuating the arsenic plumes. Primary relationships are arsenic and oxidation state with higher arsenic mobility where groundwater conditions are more reducing. Increases in oxidation state, particularly in East Helena where groundwater is influenced by oxygenated water from Prickly Pear Creek, result in lower arsenic concentrations. Trace or residual petroleum constituents are also present in some groundwater wells and downgradient of the plant; however, statistical evaluation shows no relationships with arsenic mobility.

Concentration trend data shows groundwater quality has generally improved downgradient of the plant site and generally reflects responses to remedial efforts on the plant site. The arsenic concentration plumes have generally contracted indicating lower concentrations in most downgradient sites. Exceptions are groundwater in the former speiss pond and pit area where concentrations remain similar to those measured before the pond and pit were removed, and one downgradient well on the south edge of East Helena where arsenic concentrations have steadily risen. Arsenic concentrations in the acid plant sediment drying area also remain high.

Potential remaining sources in the speiss pond and pit area include infiltration of runoff from the speiss storage area and soils with elevated metals within the aquifer. Acid plant sediments adjacent to Lower Lake also appear to continue to be a source of elevated groundwater arsenic concentrations. Fluid losses from the process fluid circuits including the main plant water circuit, and the acid plant circuit also remain potential sources of elevated arsenic in groundwater.

Groundwater arsenic concentrations downgradient of Lower Lake have declined as a result of water quality improvements in this former process pond. Groundwater sulfate concentrations downgradient of Lower Lake have increased and reflect the increasing sulfate in Lower Lake as a result of the HDS treatment process.

Summary of Completed Remedial Action

Most of the remedial actions implemented to date have been directed at elimination of plant site sources to groundwater (see above). No other actions specific to groundwater other than long-term monitoring have been implemented.

Summary of Available Data

Groundwater quality trends and water levels in plant site and surrounding monitoring wells have been sampled twice yearly since 1987 as part of RI and Post RI/FS monitoring programs.

Data Adequacy

The data are adequate to identify the nature and extent of contamination. Recommendations for additional source area data collection have been proposed as part of remedial action measures in specific source areas as described above. Although there is little evidence of measureable groundwater impacts from the slag pile, EPA has noted that additional monitoring wells in the slag may be required in the future; particularly when upgradient sources to groundwater have been eliminated and groundwater quality improves.

Effectiveness of Remedial Action

Groundwater quality has shown widespread improvement on the plant site area as a result of remedial actions implemented since the RI/FS. Elevated arsenic and metals remain present in groundwater on the plant site. However, there has been limited migration of the higher concentration arsenic plume downgradient of the plant site in the vicinity of well EH-60. ~~There has been limited migration of the higher concentration arsenic plume downgradient in the vicinity of EH-60 and elevated arsenic and metals remain present in groundwater.~~ The former speiss pond area and former acid plant sediment drying pad are presently the areas of the plant site with the highest arsenic concentrations.

Need for Additional Data and/or Remedial Action

On-going long-term monitoring is needed, as well as some additional sample locations (wells) and additional analytical parameters (based on EPA comments on the post-RI Monitoring report – Hydrometrics 1995 – See Section 4.4). Additional data can be obtained as part of an RFI, there is no need for expedited interim data collection efforts.

The Comprehensive RI/FS evaluated several alternatives for Plant Site and Off-Site Groundwater. These included:

- No action
- Institutional controls
- Long-term monitoring
- Isolation and containment alternatives including:
    - Containment walls
    - Pumping and injection wells
    - Slurry Pump and Treat alternatives
- In-situ treatment options
- Pump and treat options

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APPENDIX 2-2-1

DETAILED DESCRIPTION OF PLANT SITE FEATURES AND SMELTER OPERATIONS

APPENDIX 2-2-1

DETAILED DESCRIPTION OF PLANT SITE FEATURES AND SMELTER OPERATIONS

PLANT SITE FEATURES

Administrative Buildings and Infrastructure

Administrative Buildings that support the operation, administration and support of production operations are located on the northwest corner of the facility. Administration buildings and infrastructure include: the administrative office building, employee changehouse, medical office, power house, and maintenance buildings.

Maintenance Buildings including the paint shop, welding shop, various storage buildings, and locomotive repair shop are located in close proximity to the administration office buildings. Maintenance buildings also include a machine shop, blacksmith shop, carpenter shop, and warehouse located within the main Plant facility area southeast of the blast furnace.

Material Handling

The first step in material handling involves the unloading, sampling, storage, crushing, blending, mixing, and proportioning of incoming feed material. The outside ore storage area is used to store certain fluxes, fuels, by products, slags, and dusts used in the smelting process. All fluxes and secondary materials are stored on a concrete pad with the exception of limerock, coke, and silica based material. Sediments dredged from the Lower Lake area are also stored on the concrete pad and covered with an impermeable geotextile fabric. Historically, excavated soils generated from past, on-site construction activities are stored off the concrete pad in the ore storage area. The thawhouse serves to thaw frozen feed materials, typically contained in solid bottom railcars, prior to unloading the material in the concentrate storage and handling building (CSHB) or by a large backhoe. Portion of the plant, is the direct smelt building (DSB) located in the central used to store feed materials that can be direct charged to the blast furnace.

Material Processing

Sintering consists of roasting a mixture of moistened concentrates, flux, and fuel on a bed of traveling grates to reduce the sulfur content in the unprocessed ore concentrate and produce a porous agglomerated material (sinter) acceptable for the blast furnace smelting process. The sinter plant is located south of the CSHB on the western side of the facility.

Sinter produced during the sintering operation is combined with coke and other direct charge materials and placed in a charge car which is hoisted by cable to the top of the blast furnace. The blast furnace, located in the center of the Plant facility, is a water jacketed rectangular column in which the charge is smelted.

Lead bullion produced at the blast furnace operation is transported to the dross plant, located north of the blast furnace, for further processing. At the dross plant the lead bullion is cooled and a copper bearing material, called dross, separates and floats to the top. The dross is skimmed off the lead bullion and transported to the reverberatory furnace. The reverberatory furnace, located in the dross plant, allows the dross to be further refined by separating the copper bearing materials, called matte and speiss, from the entrained lead.

Slag is generated as the waste material in the blast furnace operation. Slag, which has the chemical composition of sand, with the inclusion of trace amounts of heavy metals, is stored in a pile on the northeast corner of the Plant site.

Process and Ventilation Gas Control

Process and ventilation gas control is provided by several different types of devices. The strong process gas generated in the sintering process is controlled by an electrostatic precipitator, open and packed scrubbers, and a mist precipitator prior to being directed to the sulfuric acid plant. Weak ventilation gases are controlled by the high efficiency baghouse prior to being exhausted to the Sinter Plant stack. In some instances, both process and ventilation gas are controlled by high efficiency baghouses.

Acid Plant Features

Strong gases from the sinter plant are drawn through an electrostatic precipitator which removes 99% of the particulate. Scrubbers and mist precipitators aid in the removal of the remaining particulate to produce an optically clear gas.

Three steel tanks, each having a maximum capacity of 660,000 gallons, are on the western perimeter of the sulfuric acid plant complex. Food grade sulfuric acid is stored in these tanks prior to shipment via rail or truck. An earthen berm encircles the entire tank battery area and provides containment for at least one tank volume.

Two aluminum (pickled) tanks containing 50 percent hydrogen peroxide, each having a maximum storage capacity of 13,000 gallons, are south and adjacent to the sulfuric acid storage tanks. Hydrogen peroxide is used in the decolorization process to produce optically clear sulfuric acid. The earthen berm encircling the sulfuric acid tanks is also utilized as secondary containment for these tanks.

Surface Water Features

Prickly Pear Creek flows along the east and north boundaries of the East Helena Plant site. This perennial stream has its headwaters in the Elkhorn and Boulder Mountains about 30 miles south and west of the Plant. Prickly Pear Creek drains into Lake Helena approximately seven miles north of the Plant site. Upper Lake receives flow from a diversion on Prickly Pear Creek about one-half mile south of the Plant. Upper Lake provides plant make-up water and supplies irrigation water to Wilson Ditch. There are no discharges to Upper Lake from Plant site facilities. Lower Lake, with a capacity of approximately 22 million gallons since dredging (completed in 1996), is a man-made pond, formed in the 1940's by dividing the northern portion of Upper Lake with a berm of fill and slag. Prior to 1989, it provided storage for recirculation water for Plant processes. In 1990 Lower Lake was replaced as the surge pond/storage facility for plant waters by two one-million gallon steel storage tanks and associated two-million gallon concrete secondary liner at the Tank Farm as part of the 1990 CERCLA Process Ponds ROD. However, occasional discharges of excess plant water to Lower Lake occurred until 1994. These discharges are the reason Asarco secured a MPDES permit. Sludges and sediments in Lower Lake were removed by dredging in 1993, 1994, 1995 and 1996.

The Wilson irrigation ditch draws water from Upper Lake which is transported to agricultural fields northwest of the East Helena Site. The ditch is comprised of approximately 3,000 feet of buried 36 inch HDPE plastic pipe. The piped portion of the ditch discharges to an open ditch on the west side of the Plant. The open ditch conveys irrigation water to agricultural lands north of the Asarco Plant.

Existing Process Water Features

Thornock Tank was installed 1986 to replace the former Thornock Lake and occupies the area just northwest of the former Thornock Lake. Thornock Tank is a 90,000-gallon circular steel sedimentation tank with secondary containment (a concrete vault). All Plant water drains to Thornock Tank (except the acid plant blowdown water and storm water originating from the Plant). Water is pumped from Thornock Tank to one of the large tanks at the Tank Farm where it is again recirculated into the plant water system.

Two one-million gallon storage tanks are used to store recycled plant water. Water is continuously being added and withdrawn from these tanks as needed. Water is gravity fed to the pump house and distributed at approximately 600-800 gallons per minute throughout the Sinter Plant for cooling and indoor washing purposes. Excess plant water is treated by the HDS treatment plant and discharged to Lower Lake under MPDES Permit No. MT-0030147. These tanks are located on the east margin of the Plant and replaced Lower Lake as a storage pond in 1990.

The Speiss granulating tank stored excess speiss granulating water until 1993. The speiss granulating process was modified in 1993 and no longer generates excess water. The speiss granulating tank now serves as a localized storm water holding tank. The collected storm water is pumped off periodically and used for dust suppression in the CSHB.

The storm water containment facility was constructed in 1997 to contain the majority of site runoff from the northern end of the facility including the ore storage yard. Storm water originating from the rest of the facility either infiltrates directly on-site or, in the case of the central portion of the facility, is collected in sumps and routed to Thornock Tank for inclusion into the Plant water circuit. The storm water containment facility (tank plus secondary containment) is designed for the 25 year, 24 hour storm event with water routed back to the smelter's plant water circuit for treatment by the HDS water treatment plant. There is a depression storage area as part of this system that is designed to contain the 100 year, 24 hour event.

The high density sludge (HDS) water treatment plant, located just west of the direct smelt building, is used to treat excess plant water and scrubber blowdown water resulting from the water gains that occur within the smelting circuit. HDS plant effluent is directed to either the internal plant water system for reuse or to Lower Lake via MPDES Permit MT-0030147.

The sanitary sewer treatment plant (SSTP), located northeast of the administration buildings was installed in November 1997. This facility treats all sanitary wastewater (toilets) generated at the facility. All gray water from sinks and showers is discharged to the plant water circuit. The SSTP is a fixed media, extended aeration treatment facility and chlorination is utilized for disinfection. Effluent from the SSTP is introduced into the plant water for recirculation and reuse with eventual treatment by the HDS plant.

Abandoned Process Water Features

In 1990, a CERCLA Record of Decision (ROD) was executed for the East Helena site process ponds. The ROD required construction of tanks to replace existing surface impoundments. As part of this construction, Thornock Lake, the former speiss pond and pit, and the former acid plant settling pond were abandoned.

Thornock Lake was constructed in 1971 in a low area in the northeast section of the Plant. The lake served to recirculate process fluids, functioning as a collection and settling pond for those fluids as well as for storm water runoff. Construction in 1986 and 1987, replaced the lake with a 90,000 gallon steel holding tank and secondary containment.

The former speiss granulating pond was taken out of service and replaced with a steel above ground tank in 1990. The speiss granulating pond was located immediately south of the present speiss tank. A portion of this speiss pond area was remediated at the time of construction of the replacement tank. The remainder of the former speiss pond structure was removed and remediated in 1992. Remediation of the pit area was conducted in conjunction with the construction of a new dross reverberatory furnace in 1995.

In the summer/fall of 1989, a new speiss tank with secondary leak detection was constructed to replace the former speiss granulating pond. The speiss tank is located to the north of the dross plant. The speiss tank collects storm water runoff from the surrounding area where speiss is stockpiled prior to loading on rail cars.

The former acid plant settling pond, previously located on the east side of the acid plant, was demolished and remediated in 1993. A portion of scrubber blowdown water is neutralized and clarified by the acid plant neutralization water treatment plant which was constructed in 1992.

DESCRIPTION OF SMELTER OPERATIONS

DESCRIPTION OF EAST HELENA SMELTER OPERATIONS

Major Operations at the East Helena Smelter

The East Helena smelter processes a wide variety of feed materials that are obtained from sources outside the facility. These materials include ore concentrates, crude ores, residues, by products, fluxes, dusts, slags, and other metal bearing materials. Fluxing reagents such as limerock and fuels such as coke are also critical components in the smelting process. The majority of the feed materials (estimated at 70% of all receipts) are received in solid bottom railcars with a smaller percent being received in haul trucks or in enclosed containers.

Sample Mill

Most in-coming feed material that is received into the East Helena Plant is carefully sampled to determine the metal composition and moisture content. Although most in-coming feed materials are sampled prior to being processed, those feed materials requiring crushing are first sized to less than one inch in the crushing mill before sampling.

The sample mill determines the moisture content of the material and prepares a smaller sub-set of the original sample for laboratory analyses. Emissions from the handling of materials within the sample mill are controlled by the sample mill baghouse and then exhausted through the sample mill baghouse stack.

Crushing Mill

The crushing mill is used to reduce the size of certain in-coming feed materials and for obtaining representative samples of these materials. Materials scheduled for crushing can be temporarily stored in the ore storage area or can be placed directly in the crushing mill area hopper (the first stage of the crushing operation). The crushing mill is located on the north end of the concentrate storage and handling building.

Laboratory

The laboratory analyzes the in-coming feed material samples received from the sample mill. The gold and silver content of the samples is determined by fire assay while determinations for other metal parameters are by wet chemistry or x-ray diffraction. Emissions from the laboratory are exhausted through the laboratory assay stacks.

Thawhouse

Feed materials (and sometimes fuels such as coke) contain appreciable amounts of water that will freeze in sub-freezing temperatures. When feed materials are frozen, unloading of these materials is impossible. Feed materials, typically contained in solid bottom railcars, are warmed in the gas-fired thawhouse to soften the material. The thawhouse has the capacity to hold 14 railcars.

High Grade Building Dumping Area

A small percentage of feed materials received at the East Helena smelter arrives in sealed containers such as supersacks, boxes, and drums. Material handling steps, including the unloading, weighing, and reclaiming of the feed material in these sealed containers is typically performed in the high grade building area.

Hopto Unloading and Blast Furnace Dust Reclaiming Area

Metal bearing slags, select crude ores, and other byproducts are unloaded from railcars using a “hopto” backhoe and dumped into bins located in the hopto unloading and blast furnace dust reclaiming area.

A pneumatic dust handling system was in operation in January 1997. Dust generated during the blast furnace baghouse cleanout is pneumatically conveyed to either the blast furnace charge area for recycling or to the loadout area for off-site shipment. The railcar loadout area consists of a totally enclosed railcar loadout hopper and cement-type enclosed railcars, both ventilated using a new railcar loadout baghouse.

Ore Storage Yard

The ore storage yard is used to unload, sort, and reclaim certain fluxes, fuels, byproducts, slags, and dusts used in the smelting process. Limerock and other silica-based fluxes are delivered by haul trucks to this area for unloading and storage. Surplus coke is occasionally transported by haul truck from the coke unloading and storage area to the ore storage yard for temporary holding. Metal bearing byproducts (skims, and other byproducts) that are unloaded in the hopto unloading and blast furnace dust reclaiming area are stored in the ore storage yard. Incoming shipments of byproduct slag are also unloaded from boxcars in the ore storage yard. Blast furnace baghouse dust may be transported from the hopto unloading and blast furnace dust reclaiming area to the ore storage yard for temporary holding. All materials stored in the ore storage area are reclaimed by front-end-loader.

Concentrate Storage and Handling Building

All in-coming feed materials that are received into the East Helena Plant (except those materials that are handled in the ore storage yard, hopto unloading and blast furnace dust reclaiming area, or high grade building area) are handled in the concentrate storage and handling building (CSHB). This building is designed to enclose and ventilate the unloading, storage, mixing, blending, and conveying operations of the great majority of material that is to be smelted. The unloading of feed material from solid bottom railcars is performed inside the building using two overhead cranes. Feed materials are placed into open storage bins within the CSHB for temporary holding. The CSHB is equipped with seven truck doors that allow for haul trucks to directly transfer feed materials into the CSHB. Feed material is transferred by overhead crane from the storage bins to twelve belt feeder bins. The belt feeder bins are designed to proportion the feed material onto a main feed belt. The main feed belt transfers the feed mixture to the sinter belt through a conveyor gallery.

The CSHB ventilation system is designed so that the building remains under negative pressure even when several of the truck doors are open. Emissions generated inside the CSHB, including the feeder area and the acid dust agglomerator building are controlled by three baghouses that discharge to the CSHB stack. The sinter plant ventilation system baghouse (see following discussion) also discharges to the CSHB stack.

Sinter Plant

The charge to the sinter plant is made-up of carefully measured amounts of feed materials from each of the twelve feeders that are located in the CSHB. The feed material is conveyed via beltlines from the CSHB to a hammermill located in the sinter plant building where it is thoroughly pulverized. The charge is then mixed with return sinter—a previously roasted and sized material from which most of the sulfur has been removed.

The purpose of sintering is to reduce the sulfur content of the feed material to approximately 1.5% and to produce a porous agglomerated material, called sinter, which is visibly similar to volcanic lava and suitable for blast furnace smelting. Sintering consists of roasting the mixture of moistened feedstocks, flux, and coke breeze on a bed of traveling grates—a belt loop of revolving cast steel pallet sections. The mixture is ignited and burned under forced updraft in the enclosed and ventilated sinter machine. The machine produces final sinter which is crushed and segregated before being conveyed to the sinter storage hopper or the sinter storage building.

Gases produced in the sintering process contain high levels of particulate and approximately 2%-3% sulfur dioxide. These gases, also referred to as process gases, must be cleaned in an elaborate system before being directed into the acid plant. First, process gases are drawn through an electrostatic precipitator (ESP), or hot cottrell, that uses high-voltage electricity to remove 99% of the dust contained in the process gases. Next, the process gases pass through a scrubber tower. The scrubber tower contains two sets of open and packed water scrubbers which remove the final traces of particulates. Finally, the process gases are routed through mist precipitator to remove any acid mist droplets and to produce an optically clear gas for the acid plant.

The sinter building also has an extensive ventilation system that captures dusts and low levels of sulfur dioxide generated during the transferring of feed material, the tail end of the sinter machine, and the crushing of sinter. The gases collected in this ventilation system are routed to the sinter plant baghouse for cleaning before being vented to the sinter plant stack. The particulate matter captured by the hot cottrell and sinter plant baghouse is conveyed to the acid dust handling facility.

Local exhaust ventilation in the sinter building is supplied by the sinter plant ventilation system (SPVS). This system captures dust emissions at 18 locations within the sinter building. The gases collected by this ventilation system are routed to the SPVS baghouse for cleaning before being discharged to the CSHB stack.

Acid Plant

Process gases generated in the sinter operation that are cleaned by the electrostatic precipitators, wet scrubber, and mist precipitators are directed to the acid plant. The gas stream is dried by direct contact with 93% sulfuric acid in a drying tower. The clean, cool, dry gas is then heated to 800° F or higher before entering the acid plant converter. At this temperature, the sulfur dioxide reacts with oxygen in the presence of a vanadium and cesium-promoted catalyst to form sulfur trioxide.

In the process, the sulfur trioxide is removed from the converted gas by passing this gas, cooled to about 380° F, through an interstage absorbing tower to form 98% sulfuric acid. Because 98% acid freezes at 30° F, the acid is fed back through the drying tower and diluted to 93% strength prior to shipment. Emissions from the acid plant operations are vented to the acid plant stack.

Acid Dust Handling

Dust collected by the hot cottrell, sinter plant cyclone, and sinter plant ventilation baghouse is conveyed to an enclosed storage bin located in the acid dust handling building.

The dust is pneumatically conveyed to an agglomerator building connected to the CSHB. Within the agglomerator building, the dust is mixed, moistened, and conveyed in the CSHB prior to reprocessing. Any emissions generated within the agglomerator building are captured by the CSHB ventilation system.

Sinter Handling

Final sinter is conveyed on pan conveyors to the sinter storage hopper located in the blast furnace charge building. When the production of sinter out-paces its consumption by the blast furnace, sinter is transferred from the sinter charge hopper to the sinter storage building. Emissions generated in the sinter storage building are controlled by the sinter storage baghouse and vented to the sinter plant baghouse stack. The discharge from the baghouse is re-routed to the dross plant stack.

Sinter is removed from the sinter storage building by front-end loader (when the capacity of the sinter storage building is exceeded) and stored along the blast furnace flue or in the direct smelt building (DSB). Sinter is reclaimed by front end loader, on an as needed-basis, and placed in the blast furnace charge car for smelting.

Direct Smelt Bins and Direct Smelt Building (DSB)

Direct smelt materials are defined as materials that contain less than 2% sulfur and are compatible with charging directly to the blast furnace. Direct smelt materials include high grade and byproduct carbons, dusts, slags, and other feed materials that fit the direct smelt materials definition.

Direct smelt materials are transported from the CSHB, ore storage yard, and hopto unloading and blast furnace dust reclaiming area to the direct smelt bins or to the direct smelt building (DSB) by use of haul trucks or front-end loaders. The DSB is designed to enclose the majority of storage, mixing, and blending of material that is direct charged to the blast furnace. Front-end loaders reclaim direct charge materials from the direct smelter and DSB bins and place them into the charge car.

Direct charge feed materials are placed into open storage bins within the DSB for temporary storage. The DSB is equipped with three truck doors that allow for payloaders or trucks to directly transfer direct charge material into the DSB.

Coke Unloading and Storage

Hopper-type railcars are used to transport coke to the blast furnace area. These hopper-type railcars are positioned on an elevated rail line over open bins where the bottom-dump hoppers are released. Coke drops into the open bins and is either transferred to the coke storage area or placed onto a screen for sizing. The larger pieces of coke that pass over the screen are placed onto a conveyor that feeds the coke hopper located in the charge floor building.

Blast Furnace Charge Building

Feed material directed to the blast furnace for smelting is first handled in the blast furnace charge building. Feed material handled in the blast furnace charge building is conveyed to the blast furnace using the blast furnace charge car.

Blast furnace feed material consists of sinter, coke, byproduct dusts, direct smelt materials, filter cake, and scrap iron. Sinter and coke are typically loaded directly to the blast furnace charge car from enclosed hoppers. The only exception is when stockpiled sinter and coke are loaded from the storage area near the blast furnace to the charge car by front-end loader.

Blast furnace baghouse dust to be recycled in the blast furnace is pneumatically conveyed from the blast furnace dust cleanout area to an enclosed storage silo located adjacent to the blast furnace charge building. Dust from this silo is conveyed to an enclosed charge hopper located inside the charge building. The blast furnace baghouse dust is gravity fed from the charge hopper to one of two agglomerators where it is blended and mixed with water prior to exiting into the blast furnace charge car. Ventilation for the blast furnace baghouse dust storage is provided by two small baghouses that exhaust to the dross plant stack. Ventilation for the charge hopper is also provided by a small baghouse that will exhaust into the sinter storage baghouse.

Ventilation to the agglomerators is provided by a ventilation fan that will discharge into the sinter storage baghouse.

Finally, direct smelt materials, filter cakes, and other byproduct materials are loaded directly by front-end loaders to the charge car. Scrap iron is loaded to the charge car from a pan conveyor.

Blast Furnace Feed Floor

The bottom-dump charge cars are hoisted up an inclined rail by cable from the blast furnace charge building to the blast furnace feed floor. The charge car is positioned on a transfer carrier at the top of the incline. The transfer carrier is connected to laterally moving cables that position the charge car over one of four sections of the blast furnace. The bottom doors of the charge car are pneumatically actuated to release the furnace charge to the blast furnace thimble floor.

Blast furnace feed emissions are routed to the blast furnace baghouse, which is vented to the blast furnace baghouse stack.

Blast Furnace Tapping Platform

The blast furnace is a water jacketed, rectangular column in which the charge is smelted. Smelting occurs when oxygen enriched air is injected into the bottom of the blast furnace through a number of pipe-like openings called tuyeres. The blast air burns the coke, providing heat to melt the charge, and provides an agent to reduce the lead oxide formed in the sinter process. As the molten lead flows through the charge, it absorbs other metals such as gold, silver, copper, and relatively small amounts of antimony, bismuth, and tin. The molten furnace lead and molten slag (comprised primarily of silica, iron, lime, and zinc) are tapped continuously from the bottom of the furnace.

The molten mixture flows by gravity into a primary settler where the furnace lead separates from the slag. Since the furnace lead has a higher density than the slag, it will descend to the bottom of the primary settler. Furnace lead is then forced from the primary settler through a goose-neck siphon into a 5 ton lead pot. Slag, being less dense than furnace lead, will float on top of the liquid in the primary settler. The slag will overflow into a secondary settler or jitney. Additional separation of the furnace lead and slag will occur in the jitney. The slag flows from the jitney into a slag pan where it is allowed to air cool. The molten furnace lead is transported in 5 ton pots to the dross plant for further treatment.

Local ventilation is provided to the primary settler, lead pot tapping area, and the slag pan tapping area. The emissions are controlled by the blast furnace baghouse.

Slag Handling Facility and Dumping

Slag pans are transferred from the blast furnace tapping platform to the slag handling area where they are allowed to air cool and harden. The solid slag is dumped from the pans at the slag handling facility. The slag is then transported by front-end loader to the slag pile dumping area. The slag is composed of primarily aluminum, silica, and iron with trace amounts of heavy metals.

Blast Floor Building

The breaking floor building receives cooled settlers and jitneys from the blast furnace tapping platform. The outer casings of the settlers and jitneys are disassembled and removed within the breaking floor building. The large, solid material that remains is broken by a large steel ball that is dropped by an overhead crane. Cast iron that is too large to charge to the blast furnace is also broken in the breaking floor. Material broken in the breaking floor building are returned to the blast furnace for re-processing.

Reagent Bins

Wood chips and coke breeze are stored in the reagent bins adjacent to the dross plant. Wood chips are transported directly to the reagent bins by haul truck. Coke breeze can be either transported directly to the direct reagent bins by haul trucks, front-end loaders, or by hopper-bottom railcars. Wood chips, coke, coke breeze, and soda ash are reclaimed by front-end loader.

Dross Plant

Molten lead is transferred to the dross plant in 5-ton lead pots. The molten lead is poured into the Number 4 kettle using an overhead crane. The lead bullion is cooled which causes the copper-bearing material (dross) that is soluble at high temperatures to precipitate out of the bullion and float to the surface of the kettle. The dross is skimmed off with a clamshell bucket connected to the overhead crane. The dross is transported by the overhead crane and charged to the dross reverberatory furnace. Once the dross is removed from the surface of the lead, the remaining lead bullion is transferred by a large ladle into one of two finishing kettles. The lead bullion receives further treatment in the kettles, with soda ash, wood chips, and sulfur to form additional dross. The dross is skimmed off the surface of the lead bullion and treated in the dross reverberatory furnace. Once drossing is complete, the remaining lead bullion is pumped into molds. The cooled lead bullion is sent off-site for further processing.

The drosses are treated in the reverberatory furnace with flux, soda ash, and coke, remelted, and separated into three components: matte, speiss, and lead. Matte and speiss are tapped from the furnace and cooled for shipment. The lead is returned to the finishing kettles to be treated.

Extensive ventilation is provided to control emissions from the dross kettles' process gases, dross reverberatory furnace (including charging and tapping operations), and dross building. The dross building is enclosed to contain dross plant emissions. All these emissions are controlled by the dross plant baghouse and exhausted through the dross plant stack.

Speiss/Matte Handling Facility

Speiss and matte are tapped from the dross reverberatory furnace into an air-mist granulator bunker to create a speiss/matte composite. Front-end loaders remove the speiss/matte composite from the bunker and transport it to a bin in the speiss/matte handling facility adjacent to the dross plant. The composite is loaded into railcars for shipment.

Blast Furnace Baghouse Cleanout

The blast furnace baghouse dust cleanout activities take place within the blast furnace baghouse dust unloading and reclaiming enclosure. Blast furnace baghouse dust is removed from the blast furnace baghouse dust cellars by using small front-end loaders. The loaders dump the dust into a receiving hopper and delumper where it will be properly sized. Depending upon the cadmium concentration, the dust is either pneumatically transferred to a blast furnace baghouse storage silo for recycling in the blast furnace or to a railcar where it is transported off-site.

APPENDIX 3-1-1

DATA SOURCES INVENTORY

APPENDIX 3-1-1. EXISTING DATA AND RELATED INFORMATION SOURCES USED TO DEFINE THE NATURE AND EXTENT OF ANY HAZARDOUS WASTE OR HAZARDOUS WASTE CONSTITUENT RELEASES AT, OR MIGRATING FROM THE ASARCO EAST HELENA FACILITY

LINE NO.	NAME AND DESCRIPTION OF FILE OR DOCUMENT	PUBLICATION DATE	REPORT LOCATION	HAS DATA QUALITY BEEN EVALUATED	LEVEL OF DATA QUALITY REVIEW	HAS EPA BEEN ISSUED A COPY	INTENDED RETENTION TIME	PRIVILEGED OR CONFIDENTIALITY CLAIMS?	ADDITIONAL INFORMATION
	COMPREHENSIVE RI/FS AND POST RI/FS DATA								
1	**COMPREHENSIVE PRE-REMEDIAL INVESTIGATION**								
2	Hydrogeological Investigation of AEH Plant, Preliminary Evaluation	1984	Archived Box 95 (H)	No		No	+6 Years	No	
3	Hydrogeological Investigation of AEH Plant, Water Resources Monitoring Plan - Phase I	Jun-84	Archived Box 95 (H)	N/A		No	+6 Years	No	
4	Quality Assurance / Protection Plan, AEH Plant Water Resources Investigation	Sep-84	Archived Box 309 (H)	N/A		No	+6 Years	No	
5	Water Resources Monitoring Plan - Phase II AEH Plant	Aug-86	Archived Box 95 (H)	N/A		Unknown	+6 Years	No	
6	Water Resources Investigation - Phase II RI Work Plan	Jun-87	Archived Box 95 (H)	N/A		Yes	+6 Years	No	
7									
8	**COMPREHENSIVE REMEDIAL INVESTIGATION AND POST-RI MONITORING**								
9	**Reports and Plans**								
10	Comprehensive RI/FS Plan - AEH	Oct-87	Archived Box 95 &309 (H)	N/A		Yes	+6 Years	No	
11	Comprehensive RI/FS Site Safety Plan - AEH	Oct-87	Archived Box 309 (H)	N/A		Yes	+6 Years	No	
12	Comprehensive Preliminary FS	Apr-88	Archived Box 95 &309 (H)	No		Yes	+6 Years	No	
13	Quality Assurance Project Plan for Air Quality Monitoring	Feb-89 (Rev Jun-89)	Archived Box 309 (H)	N/A		Yes	+6 Years	No	
14	Treatability Work Plan for Comprehensive FS - AEH	Aug-89	Archived Box 309 (H)	N/A		Yes	+6 Years	No	
15	Comprehensive Remedial Investigation/Feasibility Study	Mar-90 (Rev Jun-90)	L00000610 (H)	N/A		Yes	+6 Years	No	
16	Post-RI Well and Surface Water Monitoring Report 1990-1994	Jun-95 (Rev Sep-95)	Archived Box Z-2 (370) (H)	Yes	CLP	Yes	+6 Years	No	
17									
18	**Comprehensive RI and Post-RI Data Validation Reports**								
19	Data Validation Summary for the Asarco E. Helena RI/FS , 88	Apr-89	Archived Box QC-208 (H)	Yes	CLP	Yes	+6 Years	No	GW & SW Inorganics, Soil Inorg., Slag Water Inorg., Plant Proc Fluids Inorg., Proc Fluid Sediments Inorg. for Fall 86, Spring 87, Fall 87, Spring 88
20	Sequential Extraction and EP Toxicity Data Validation Report	Jan-89	Archived Box QC-208 (H)	Yes	CLP	Yes	+6 Years	No	Soil EP Tox and Extractions (Inorganics) Fall 86, Fall 87, Fall 88
21	EP Toxicity and Sequential Extraction Data Validation for Holes DH- and DH-21.	Sep-89	Archived Box QC-208 (H)	Yes	CLP	Yes	+6 Years	No	Soil EP Tox and Extractions (Inorganics) Spring and Fall 88
22	Validation Summary of Organics Data	Nov-89	Archived Box QC-208 (H)	Yes	CLP	Yes	+6 Years	No	Soil Organics for Fall 86, Spring and Fall 87; GW Hydrocarbons Only for June 87 through April 89
23	Validation Summary of Organics Data, Fall 88 through Spring 90	Dec-90	Archived Box QC-208 (H)	Yes	CLP	Yes	+6 Years	No	GW Organics for Fall 88, Fall and Spring 89, Spring 90
24	Data Validation Summary for the Asarco East Helena Post RI Monitoring	Oct-90	Archived Box QC-208 (H)	Yes	CLP	Yes	+6 Years	No	GW & SW Inorganics for Fall 88, Spring and Fall 89
25	Data Validation Summary for the Asarco East Helena Post RI Monitoring	Aug-91	Archived Box QC-208 (H)	Yes	CLP	Yes	+6 Years	No	GW & SW Inorganics for Spring and Fall 90
26	Validation Summary of Organics Data, Post RI Monitoring Spring 91 - Spring 92	Aug-92	Archived Box QC-208 (H)	Yes	CLP	Yes	+6 Years	No	GW Organics for Spring and Fall 91, Spring 92
27	Validation Summary of Inorganics Data, Asarco East Helena 91 Post RI Monitoring	Jul-92	Archived Box QC-208 (H)	Yes	CLP	Yes	+6 Years	No	GW & SW Inorganics for Spring and Fall 91
28	Validation Summary of Organics Data, Post RI Monitoring Fall 92 - Fall 93	Sep-94	Archived Box QC-208 (H)	Yes	CLP	Yes	+6 Years	No	GW Organics for Fall 92, Spring and Fall 93
29	Validation Summary of Inorganics Data, Asarco East Helena Spring 92 Post RI Monitoring	Mar-93	Archived Box QC-208 (H)	Yes	CLP	Yes	+6 Years	No	GW & SW Inorganics for Spring 92
30	Validation Summary of Inorganics Data, Asarco East Helena Fall 92 Post RI Monitoring	Sep-94	Archived Box QC-208 (H)	Yes	CLP	Yes	+6 Years	No	GW & SW Inorganics for Fall 92
31	Validation Summary of Inorganics Data, Asarco East Helena Spring 93 Post RI Monitoring	Sep-94	Archived Box QC-208 (H)	Yes	CLP	Yes	+6 Years	No	GW & SW Inorganics for Spring 93
32	Validation Summary of Inorganics Data, Asarco East Helena Fall 93 Post RI Monitoring	Nov-94	Archived Box QC-208 (H)	Yes	CLP	Yes	+6 Years	No	GW & SW Inorganics for Fall 93
33	Validation Summary Asarco East Helena Post RI Monitoring 94 Organics	Jun-95	Archived Box QC-208 (H)	Yes	CLP	Yes	+6 Years	No	GW Organics for Spring and Fall 94
34	Validation Summary of Inorganics Data Asarco East Helena Spring 94 Post RI Monitoring	Jun-95	Archived Box QC-208 (H)	Yes	CLP	Yes	+6 Years	No	GW & SW Inorganics for Spring 94

APPENDIX 3-1-1. EXISTING DATA AND RELATED INFORMATION SOURCES USED TO DEFINE THE NATURE AND EXTENT OF ANY HAZARDOUS WASTE OR HAZARDOUS WASTE CONSTITUENT RELEASES AT, OR MIGRATING FROM THE ASARCO EAST HELENA FACILITY

	NAME AND DESCRIPTION OF FILE OR DOCUMENT	PUBLICATION DATE	REPORT LOCATION	HAS DATA QUALITY BEEN EVALUATED	LEVEL OF DATA QUALITY REVIEW	HAS EPA BEEN ISSUED A COPY	INTENDED RETENTION TIME	PRIVILEGED OR CONFIDENTIALITY CLAIMS?	ADDITIONAL INFORMATION
35	Validation Summary of Inorganics Data Asarco East Helena Fall 94 Post RI Monitoring	May-96	Archived Box QC-208 (H)	Yes	CLP	Yes	+6 Years	No	GW & SW Inorganics for Fall 94
36	Validation Summary of Inorganics Data Asarco East Helena Spring 95 Post RI Monitoring	Mar-97	Archived Box QC-208 (H)	Yes	CLP	Yes	+6 Years	No	GW & SW Inorganics for Spring 95
37	Validation Summary of Inorganics Data Asarco East Helena Fall 95 Post RI Monitoring	Mar-97	Archived Box QC-208 (H)	Yes	CLP	Yes	+6 Years	No	GW & SW Inorganics for Fall 95
38	Validation Summary of Inorganics Data Asarco East Helena Spring 96 Post RI Monitoring	Aug-97	Archived Box QC-208 (H)	Yes	CLP	Yes	+6 Years	No	GW & SW Inorganics for Spring 96
39	Validation Summary of Inorganics Data Asarco East Helena Fall 96 Post RI Monitoring	Dec-97	Archived Box QC-208 (H)	Yes	CLP	Yes	+6 Years	No	GW & SW Inorganics for Fall 96
40	Validation Summary of Organics Data Asarco East Helena Fall 90 Post RI Monitoring	Apr-98	Archived Box QC-208 (H)	Yes	STD	No	+6 Years	No	GW Organics for Fall 90
41									
42	**Comprehensive RI and Post-RI Laboratory Analytical Data Packages**								
43	Comp RI/FS (Phase I) - Inorganics (water)	Fall 84 to Fall 85	Archived Box QC- #3 (H)	Yes	VISUAL	Yes	+6 Years	No	
44	AEH Data Summary Packages	1986 - 1987	Archived Box 180, 182, 185, 222	Yes	CLP	Yes	+6 Years	No	
45	Comp RI/FS Analytical Data - Fall 86 Extractions (soil); Fall & Winter 86 Inorganics (water); Arsenic Spec. Winter 86 and Spring 87 (water); Fall 87 Extractions(soil); Jan and Feb 87 Inorganics (water); Fall 86 and Spring 87 Extract (soil);	Fall 86 to Fall 87	Archived Box QC-32 (H)	Yes	CLP	Yes	+6 Years	No	
46	Comp RI/FS Analytical Data - 87 & 88 Biological Monitoring(blood), Spring & Fall 88 EPTOX and Extractions (soil); Spring 88 Arsenic Spec (water); Spring and Fall 88 Inorganics (water & soil); June 87 through April 89 Organics (water)	Spring 88 to Spring 89	Archived Box QC-33 (H)	Yes	CLP	Yes	+6 Years	No	
47	Post Comp RI/FS Analytical Data - Speciation and Analytical results (water).	Spring 88 to Spring 89	Archived Box QC- #95(H)	Yes	CLP	Yes	+6 Years	No	
48	Post Comp RI/FS Analytical Data - Inorganics (includes arsenic speciation), organics (water)	Spring 90 to Fall 90	Archived Box QC-196 (H)	Yes	CLP	Yes	+6 Years	No	
49	Post Comp RI/FS Analytical Data - Lab and field data, CLP data, speciation samples, flows (water)	1991-1992	Archived Box QC- #65 (H)	Yes	CLP	Yes	+6 Years	No	
50	Post Comp RI/FS Analytical Data - Inorganics (includes speciation) and Organics (water)	Fall 92 to Fall 93	Archived Box QC- #132(H)	Yes	CLP	Yes	+6 Years	No	
51	Post Comp RI/FS Analytical Data - 93 Special Samples (water)	Spring 93 to Fall 93	Archived Box QC- #118(H)	Yes	CLP	Yes	+6 Years	No	
52	Post Comp RI/FS Analytical Data - Organics, Field Notes (water)	Spring 93 to Fall 93	Archived Box QC-119 (H)	Yes	CLP	Yes	+6 Years	No	
53	Post Comp RI/FS Analytical Data - Organics and Inorganics (water)	Spring 94 to Fall 94	Archived Box QC-118 (H)	Yes	CLP	Yes	+6 Years	No	
54	Post Comp RI/FS Analytical Data - Speciation Data (water)	Spring 93 to Fall 94	Archived Box QC- #120(H)	Yes	CLP	Yes	+6 Years	No	
55	Post Comp RI/FS Analytical Data - Inorganics (includes speciation)	Spring 95 to Fall 95	Archived Box QC- #160(H)	Yes	CLP	Yes	+6 Years	No	
56	Post Comp RI/FS Analytical Data - Organics (water)	Spring 95 to Fall 95	Active QA/QC (H)	Yes	CLP	Yes	+6 Years	No	
57	Post Comp RI/FS Analytical Data - Inorganics, Arsenic Speciation (water)	Spring 96 to Fall 97	Active QA/QC (H)	Yes	CLP	Yes	+6 Years	No	
58	Post Comp RI/FS Analytical Data - Organics (water)	Spring 96 to Fall 97	Active QA/QC (H)	Yes	CLP	No	+6 Years	No	
59									
60	**CERCLA PROCESS FLUIDS OPERABLE SUB-UNIT**								
61									
62	**PROCESS PONDS OPERABLE SUB-UNIT**								
63	Process Pond RI/FS Work Plan	Jun-87	Archived Box 209 (H)	No		Yes	+6 Years	No	
64	Process Pond Remedial Investigation/Feasibility Study	Jun-89 (Rev Sep-89)	L00000610 (H)	N/A		Yes	+6 Years	No	
65	USEPA Record of Decision, Process Ponds Operable Unit	Nov-89	L00000618 (H)	N/A		Yes	+6 Years	No	
66	USEPA Statement of Work	1990	L00000618 (H)	N/A		Yes	+6 Years	No	
67	Comprehensive RD/RA Work Plan for Process Ponds	Jul-90	Archived Box F-3 (375) (H)	N/A		Yes	+6 Years	No	
68	Comprehensive RD/RA Process Pond Sampling and Analysis Plan (incl. QAPP)	Aug-90	Archived Box 309 (H)	N/A		Yes	+6 Years	No	
69	Asarco Process Ponds Operable Unit Monthly CERCLA Reports (Numbered 01 - 88)	Oct-90 to Present	1994 to present L00000616 pre-1994 in Box 376 (H)	N/A		Yes	+6 Years	No	
70	Consent Decree Process Ponds 12/27/90	Dec-90	Archived Box F-3 (375) (H)	N/A		Yes	+6 Years	No	
71	New Construction Preliminary Design Report, Process Ponds Operable Unit	Apr-91	Archived Box P-2 (365) (H)	N/A		Yes	+6 Years	No	
72	Process Pond Analytical Data	May-91 & Aug-91	QC BOX #77 (H)	Yes	CLP	Yes	+6 Years	No	
73	Process Ponds RD/RA Soil Excav. & Demolit. Smelter Treatment and Design Demonstration	Sep-91	Archived Box P-2 (365) (H)	No		Yes	+6 Years	No	

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74	Final Design Report, Remedial Design for Sediment & Soil Excavation and Smelting	Dec-91	Archived Box P-2 (365) (H)	N/A		Yes	+6 Years	No	
75	Pre-Final Design Report New Construction, Process Ponds Operable Unit	Dec-91	Archived Box O-2 (364) (H)	N/A		Yes	+6 Years	No	
76	USEPA Explanation of Significant Differences, Process Ponds Operable Unit	Jun-93	L00000618 (H)	N/A		Yes	+6 Years	No	
77	USEPA Pre Design Report Review Comments 11/4/94	Nov-94	Archived Box F-3 (375) (H)	N/A		Yes	+6 Years	No	
78									
79	**Lower Lake**								
80	Plans and Reports								
81	Laboratory Scale Testing Work Plan for In Situ Treatment of Lower Lake	Dec-89	Archived Box G-3 (376) (H)	N/A		Yes	+6 Years	No	
82	Pilot Scale Testing for In Situ Treatment of Lower Lake Water Final Report, Vol 1 & 2	Nov-90	Archived Box P-2 (309 & 365) (H)	No		Yes	+6 Years	No	
83	Remedial Design for Lower Lake Asarco East Helena Site Process Ponds Operable Unit	Apr-91	Archived Box O-2 (364) (H)	No		Yes	+6 Years	No	
84	AEH Lower Lake Bulk Sediment Survey (appendix to 90% Design Report)	Dec-91	Archived Box P-2 (365) (H)	No		Yes	+6 Years	No	
85	Field Data RD/RA Sediment and Sludge Analysis (appendix to 90% Design Report)	1991-92	Archived Box #311 (H)	No		Yes	+6 Years	No	
86	Bench Scale and Field Studies of Dredging, Handling & Treatment of Lower Lake Sludge and Sediments (appendix to 90% Design Report)	Jun-92	Archived Box P-2 (365) (H)	Yes	CLP	Yes	+6 Years	No	
87	Sampling & Laboratory Examination of the Treatment of Lower Lake Process Sludge, Marsh Deposits & In Situ Treatment Precipitates - Completion Report, Process Ponds Operable Unit	Aug-93	L00000612 (H)	No		Yes	+6 Years	No	
88	Dredging & Dewatering Pilot Test (appendix to 90% Design Report)	Nov-93	Archived Box F-3 (375) (H)	N/A		Yes	+6 Years	No	
89	Hydraulic Dredging & Dewatering Pilot Scale Test, Final Report (appendix to 90% Design Report)	Feb-94	Archived Box N-2 (363) (H)	N/A		Yes	+6 Years	No	
90	Sampling & Analysis Plan, Process Ponds Operable Sub-Unit (appendix to 90% Design Report)	Mar-94	Archived Box W-1 (357) (H)	N/A		Yes	+6 Years	No	
91	Pre-Final (90%) Design Report, Lower Lake	Mar-94	L00000612 (H)	No		Yes	+6 Years	No	
92	Establishing Process Sludge and Marsh Deposits Removal Targets Summary Report	Aug-95 (Rev Dec-95)	Archived Box V-1 (356) (H)	N/A		Yes	+6 Years	No	
93	Lower Lake Stockpile Treatability	Nov-95 & Feb-96	Active QA/QC (H)	No		Yes	+6 Years	No	
94	Long-Term Storage Facility for Dredged Lower Lake Process Sludge and Marsh Deposits	Sep-96	L00000616 (H)	N/A		Yes	+6 Years	No	
95	Short-Term Storage Facility for Dredged Lower Lake Process Sludge and Marsh Deposits	Jan-97 (Rev Sep-97)	L00000618 (H)	N/A		Yes	+6 Years	No	
96									
97	Lower Lake Data Validation Reports								
98	Lower Lake In Situ Treatment Pilot Testing Data Validation Summary	Feb-91	Archived Box P-2 (365) (H)	Yes	STD	Yes	+6 Years	No	SW Inorganics for Feb '90 to Sep '90
99	Asarco East Helena Site Process Ponds Operable Unit - August 1991 - Data Validation Summary for Storm Pond and Acid Plant Drying Area EP Toxicity Soil Samples	Jun-92	Archived Box V-1 (356) (H)	Yes	CLP	Yes	+6 Years	No	Soil EPTOX for Aug '91
100	Asarco East Helena Site Process Ponds Operable Unit - August 1991 - Data Validation Summary for Slag Samples	Jun-92	Archived Box V-1 (356) (H)	Yes	CLP	Yes	+6 Years	No	Slag Inorganics for Aug '91
101	Asarco East Helena Site Process Ponds Operable Unit - October 1991 - Data Validation Summary for Lower Lake Soil Samples	Jun-92	Archived Box V-1 (356) (H)	Yes	CLP	Yes	+6 Years	No	Soil Inorganics, EPTOX for Oct '91
102	Asarco East Helena Site Process Ponds Operable Unit - September 1991 - Data Validation Summary for Groundwater Samples	Jun-92	Archived Box V-1 (356) (H)	Yes	CLP	Yes	+6 Years	No	GW Inorganics for Sep '91
103	Asarco East Helena Site Process Ponds Operable Unit - Spring 1992 - Data Validation Summary for Lower Lake TCLP & EP Toxicity Soil Samples	Jul-92	Archived Box V-1 (356) (H)	Yes	CLP	Yes	+6 Years	No	Soil TCLP, EPTOX for Spring '92
104	Process Ponds Operable Unit - October 1991 - Data Validation Summary for Groundwater Samples	Jul-92	Archived Box V-1 (356) (H)	Yes	CLP	Yes	+6 Years	No	GW Inorganics for Oct '91 (RD/RA)
105	Validation Summary of Sludge, Sludge Leachate, Marsh Deposit and Decant Water Data Lower Lake 6/92 to 10/92	Nov-93	Archived Box O-2 (364) (H)	Yes	CLP	Yes	+6 Years	No	Sediment Inorganics and Adit (water) for Jun '92 to Oct '92
106	Lower Lake Remediation -- Data Quality Review, 1st Sampling Event -- March 28, 1994	Apr-94	QA/QC Files	Yes	STD	No	+6 Years	No	SW and GW Inorganics for Mar '94
107	Lower Lake Remediation -- Data Quality Review, 2nd Sampling Event -- April 11-12, 1994	May-94	QA/QC Files	Yes	STD	No	+6 Years	No	SW and GW Inorganics for Apr '94
108	Lower Lake Remediation -- Data Quality Review, 3rd Sampling Event -- May 5-6, 1994	May-94	QA/QC Files	Yes	STD	No	+6 Years	No	SW and GW Inorganics for May '94
109	Lower Lake Remediation -- Data Quality Review, 1st Week of Construction-- May 17 and 19, 1994	May-94	QA/QC Files	Yes	STD	No	+6 Years	No	SW and GW Inorganics for May '94
110	Lower Lake Remediation Water Quality Report for March and April 1994	May-94	Archived Box CC-165 (H)	Yes	STD	No	+6 Years	No	SW and GW Inorganics for Mar and Apr '94
111	Lower Lake Remediation -- Data Quality Review, 2nd Week of Construction-- May 24 and 26, 1994	Jun-94	QA/QC Files	Yes	STD	No	+6 Years	No	SW and GW Inorganics for May '94

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112	Lower Lake Remediation -- Data Quality Review, 3rd Week of Construction-- May 31and June 2, 1994	Jun-94	QA/QC Files	Yes	STD	No	+6 Years	No	SW and GW Inorganics for May and Jun '94
113	Lower Lake Remediation -- Data Quality Review, 4th Week of Construction-- June 6, 1994	Jun-94	QA/QC Files	Yes	STD	No	+6 Years	No	SW and GW Inorganics for Jun '94
114	Lower Lake Remediation -- Data Quality Review, 5th Week of Construction-- June 13, 1994	Jun-94	QA/QC Files	Yes	STD	No	+6 Years	No	SW and GW Inorganics for Jun '94
115	Lower Lake Remediation Water Quality Report for May 1994	Jun-94	Archived Box QC-165 (H)	Yes	STD	No	+6 Years	No	SW and GW Inorganics for May '94
116	Lower Lake Remediation Water Quality Report for June 1994	Aug-94	Archived Box QC-165 (H)	Yes	STD	No	+6 Years	No	SW and GW Inorganics for Jun '94
117	Lower Lake Remediation -- Data Quality Review, Data from August 10 Sampling Event	Sep-94	Archived Box QC-165 (H)	Yes	STD	No	+6 Years	No	SW and GW Inorganics for Aug '94
118	Lower Lake Remediation -- Data Quality Review, Data from August 19th, 22nd Sampling Event	Sep-94	Archived Box QC-165 (H)	Yes	STD	No	+6 Years	No	SW and GW Inorganics for Aug '94
119	Lower Lake Remediation -- Data Quality Review, Data from August 26th Sampling Event	Sep-94	Archived Box QC-165 (H)	Yes	STD	No	+6 Years	No	SW and GW Inorganics for Aug '94
120	Lower Lake Remediation Water Monitoring Data Quality Report for July 1994 and August 1994	Oct-94	QA/QC Files	Yes	STD	No	+6 Years	No	SW and GW Inorganics for July and August '94
121	Lower Lake Remediation Water Quality Report for September 1994	Apr-95	Archived Box QC-165 (H)	Yes	STD	No	+6 Years	No	SW and GW Inorganics for Sep '94
122	Lower Lake Remediation Water Quality Report for Samples Collected During October and November 1994	Apr-95	Archived Box QC-165 (H)	Yes	STD	No	+6 Years	No	SW and GW Inorganics for Oct and Nov '94
123	Lower Lake Remediation Water Monitoring Data Quality Report March 1995	Jun-95	Archived Box QC-165 (H)	Yes	STD	No	+6 Years	No	SW and GW Inorganics for Mar '95
124	Lower Lake Remediation Water Monitoring Data Quality Report April 1995	Jun-95	Archived Box QC-165 (H)	Yes	STD	No	+6 Years	No	SW and GW Inorganics for Apr '95
125	Lower Lake Remediation Water Monitoring Data Quality Report May 1995	Jan-96	Archived Box QC-165 (H)	Yes	STD	No	+6 Years	No	SW and GW Inorganics for May '95
126	Lower Lake Remediation Water Monitoring Data Quality Report June 1995	Jan-96	Archived Box QC-165 (H)	Yes	STD	No	+6 Years	No	SW and GW Inorganics for Jun '95
127	Lower Lake Remediation Water Monitoring Data Quality Report July 1995	Jan-96	Archived Box QC-165 (H)	Yes	STD	No	+6 Years	No	SW and GW Inorganics for Jul '95
128	Lower Lake Remediation Water Monitoring Data Quality Report August 1995	Jan-96	Archived Box QC-165 (H)	Yes	STD	No	+6 Years	No	SW and GW Inorganics for Aug '95
129	Lower Lake Remediation Water Monitoring Data Quality Report September 1995	Jan-96	Archived Box QC-165 (H)	Yes	STD	No	+6 Years	No	SW and GW Inorganics for Sep '95
130	Lower Lake Remediation Water Monitoring Data Quality Report October 1995	Jan-96	Archived Box QC-165 (H)	Yes	STD	No	+6 Years	No	SW and GW Inorganics for Oct '95
131	Lower Lake Remediation Water Monitoring Data Quality Report November 1995	Jan-96	Archived Box QC-165 (H)	Yes	STD	No	+6 Years	No	SW and GW Inorganics for Nov '95
132	Lower Lake Stockpile Treatability (TCLP) Composite Sludge Samples for Feburary 1996	May-96	QA/QC Files	Yes	STD	No	+6 Years	No	Sludge TCLP for Feb '96
133	Lower Lake Remediation Water Monitoring Data Quality Report for Samples Collected in May 1996	Aug-96	QA/QC Files	Yes	STD	No	+6 Years	No	SW and GW Inorganics for May '96
134	Lower Lake Remediation Water Monitoring Data Quality Report for Samples Collected in June 1996	Aug-96	QA/QC Files	Yes	STD	No	+6 Years	No	SW and GW Inorganics for Jun '96
135	Lower Lake Remediation Water Monitoring Data Quality Report for Samples Collected in September 1996	Nov-96	QA/QC Files	Yes	STD	No	+6 Years	No	SW and GW Inorganics for Sep '96
136	Lower Lake Remediation Water Monitoring Data Quality Report for Samples Collected in November 1996	May-97	QA/QC Files	Yes	STD	No	+6 Years	No	SW and GW Inorganics for Nov '96
137									
138	**Lower Lake Construction Reports**								
139	Construction Records	1991 - 1995	Archived G-3 (376) (H)	N/A		No	+6 Years	No	
140	Lower Lake Remediation Weekly Construction Reports	May 94 - Aug 96	Archived G-3 (376) (H)	N/A		Yes	+6 Years	No	
141	Lower Lake Remediation Project, Volume of Sediment Removed from Lower Lake During 1994	Feb-95 (Rev Mar-95)	L00000616 (H)	No		Yes	+6 Years	No	
142	Sampling of Lower Lake Marsh Deposits Following Dredging	Jan-96	L00000616 (H)	No		Yes	+6 Years	No	
143	Lower Lake Remediation Project, Volume of Materials Dredged from Lower Lake During 1995	Mar-96	L00000616 (H)	N/A		Yes	+6 Years	No	
144	Surface water runoff improvements to Lower Lake Weekly Construction Reports #1 - #12	May - Jun 97	L00000616 (H)	N/A		Yes	+6 Years	No	
145	Lower Lake Sediment Stockpile Weekly Construction Reports #1 - #5	Oct - Nov 97	L00000616 (H)	N/A		Yes	+6 Years	No	
146									
147	**Lower Lake Misc Data Files**								

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148	Lower Lake Sediment & Sludge Analysis	Oct-91	Archived Box #311 (H)	Yes	CLP	Yes	+6 Years	No	
149	Lower Lake Analytical/Field Data - Marsh Deposits - Bore Hole XRF - Sludge Data	Aug-93 to Sep-94	QC BOX #133(H)	No		Yes	+6 Years	No	
150	Field Data (Plant Washdown/Lower Lake)	Mar-95 to Present	L00000618 (H)	No		Yes	+6 Years	No	
151	Lower Lake Sludge Project Information, Analytical Data, and Validation File	Apr - Aug 95	Active QA/QC (H)	N/A		No	+6 Years	No	
152	Lower Lake Sludge XRF Analytical Results for Core samples	Apr-95	Archived Box V-1 (356) (H)	No		No	+6 Years	No	
153	Lower Lake Analytical XRF (Non-Input)	Jun - May 95	Active QA/QC (H)	No		No	+6 Years	No	
154	Lower Lake Monitoring - Project Information, Analytical Data, and Validation File	Sep-95 to Nov 96	Active QA/QC (H)	N/A		Yes	+6 Years	No	
155									
156	**Speiss Settling Pond**								
74	Final Design Report, Remedial Design for Sediment & Soil Excavation and Smelting	Dec-91	Archived Box P-2 (365) (H)	N/A		Yes	+6 Years	No	
157	Speiss Pond Remediation Construction Documents	Aug - Nov 92	L611 (H) & East Helena Files	N/A		Yes	+6 Years	No	
158									
159	**Speiss Granulating Pit**								
160	Speiss Pit Construction Documents	Jul-95	L617 (H) & East Helena Files	N/A		Yes	+6 Years	No	
161									
162	**Acid Plant Water Treatment Facility**								
163	Acid Water Reclaim Facility Construction Documents and Weekly Reports	Feb - Nov 92	L611 (H) & East Helena Files	N/A		Yes	+6 Years	No	
164	Acid Plant Settling Pond Demolition Construction Documents	Feb - Jun 93	L617 (H) & East Helena Files	N/A		Yes	+6 Years	No	
35	Asarco East Helena Acid Plant Sediments - Non-Input Data	Aug - Sep 96	Active QA/QC (H)	No		Yes	+6 Years	No	
166	Acid Plant Water Treatment Facility Demolition & HDS Facility Construction - Project Information and Analytical Data File	Apr - May 93	Active QA/QC (H)	N/A		No	+6 Years	No	
167									
168	**Thornock Lake**								
169	Data Validation Summary for Former Thornock Lake Soil Samples (Appendix to RA Report) June 1991 Sampling	Jun-91	Data Validation Files (H)	Yes	CLP	Yes	+6 Years	No	
170	Data Validation Summary for Former Thornock Lake Soil Samples (Appendix to RA Report) December Sampling	Dec-91	Data Validation Files (H)	Yes	CLP	Yes	+6 Years	No	
171	Remedial Action Report - Excavation of Bottom Sediments from Former Thornock Lake	May-92 (Rev Jun-92)	Archived Box P-2 (365) (H)	Yes	CLP	Yes	+6 Years	No	
172									
174	**Storm Water Permitting**								
175	Storm Water Discharge Permit Hydrologic Modeling (2 yr - 24 hr)	1992	L00000612 (H)	N/A		No	+6 Years	No	
176	MPDES Application to Discharge Storm Water from the Asarco East Helena Plant	Sep-92	L00000616 (H)	N/A		No	+6 Years	No	
177	Storm Water Management Plan (for Storm Water Discharge Permit No. MTR-000072)	Feb-93 (Rev Nov-93)	L00000616 (H)	N/A		No	+6 Years	No	
178	Analytical Data - Storm Water surface water and soil samples	May-93 to Mar-97	Active QA/QC (H)	Yes	VISUAL	No	+6 Years	No	
179	MPDES Storm Water Sampling data and semi-annual report requirements, Asarco East Helena Storm Water Permit MTR-000072, for 2nd half of 1993	Jan-94	L00000616 (H)	Yes	VISUAL	No	+6 Years	No	
180	MPDES Storm Water Sampling data and semi-annual report requirements, Asarco East Helena Storm Water Permit MTR-000072, for 1st half of 1994	Jul-94	L00000616 (H)	Yes	VISUAL	No	+6 Years	No	
181	Revised Storm Water Management Plan (for Storm Water Discharge Permit No. MTR-000072)	Sep-94	L00000616 (H)	N/A		No	+6 Years	No	
182	MPDES Storm Water Sampling data and semi-annual report requirements, Asarco East Helena Storm Water Permit MTR-000072, for 2nd half of 1994	Jan-95	L00000616 (H)	Yes	VISUAL	No	+6 Years	No	
183	MPDES Storm Water Sampling data and semi-annual report requirements, Asarco East Helena Storm Water Permit MTR-000072, for 1st half of 1995	Jul-95	L00000616 (H)	Yes	VISUAL	No	+6 Years	No	
184	MPDES Storm Water Sampling data and semi-annual report requirements, Asarco East Helena Storm Water Permit MTR-000072, for 2nd half of 1995	Jan-96	L00000616 (H)	Yes	VISUAL	No	+6 Years	No	
185	1995 Annual Facility Storm Water Program Site Inspection Report (for Storm Water Discharge Permit No. MTR-000072)	Jan-96	L00000616 (H)	N/A		No	+6 Years	No	
186	Revised Storm Water Management Plan (for Storm Water Discharge Permit No. MTR-000072)	Feb-96	L00000616 (H)	N/A		No	+6 Years	No	
187	MPDES Storm Water Sampling data and semi-annual report requirements, Asarco East Helena Storm Water Permit MTR-000072, for 1st half of 1996	Jul-96	L00000616 (H)	N/A		No	+6 Years	No	

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188	Asarco East Helena Storm Water Event Summary (for the period January 1, 1996 to June 30, 1996)	Aug-96	L00000616 (H)	N/A		No	+6 Years	No	
189	MPDES Storm Water Sampling data and semi-annual report requirements, Asarco East Helena Storm Water Permit MTR-000072, for 2nd half of 1996	Nov-96	L00000616 (H)	Yes	VISUAL	No	+6 Years	No	
190	1996 Annual Facility Storm Water Program Site Inspection Report (for Storm Water Discharge Permit No. MTR-000072)	Nov-96	L00000616 (H)	N/A		No	+6 Years	No	
191	Revised Storm Water Management Plan Addendum No. 1 (for Storm Water Discharge Permit No. MTR-000072)	Feb-97	L00000616 (H)	N/A		No	+6 Years	No	
192	Asarco East Helena, Storm Water Event Summary for May 1, 1996	Jun-97	L00000616 (H)	N/A		No	+6 Years	No	
193	MPDES Storm Water Sampling data and semi-annual report requirements, Asarco East Helena Storm Water Permit MTR-000072, for 1st half of 1997	Jul-97	L00000616 (H)	Yes	VISUAL	No	+6 Years	No	
194	1997 Annual Facility Storm Water Program Site Inspection Report (for Storm Water Discharge Permit No. MTR-000072)	Dec-97	L00000616 (H)	N/A		No	+6 Years	No	
195	MPDES Storm Water Sampling data and semi-annual report requirements, Asarco East Helena Storm Water Permit MTR-000072, for 2nd half of 1997	Jan-98	L00000616 (H)	No		No	+6 Years	No	
196									
197	**Storm Water Improvements**								
198	Storm Water Excavation Well Development Log, Test Hole Logs	1991	L00000617 (H)	N/A		Yes	+6 Years	No	
199	Preliminary (30%) Design Report for Storm Water Improvements	Sep-94	L00000612 (H)	N/A		Yes	+6 Years	No	
200	Storm Water Sediment Removal Study for Storm Water System Improvement Facilities	Jun-95	L00000617 (H)	N/A		No	+6 Years	No	
201	Examination of the Fate of Storm Water Discharged from the ASARCO East Helena Plant under MPDES Storm Water Discharge Permit No. MTR000072	Dec-95	L00000617 (H)	N/A		No	+6 Years	No	
202	On-Site Hydrology, Upgradient Hydraulic Comps, Conceptual Design Comps	Aug-96	L00000617 (H)	N/A		No	+6 Years	No	
203	Storm Water System Improvement Project, Design Criteria and Conceptual Design Summary	Oct-96	L00000617 (H)	N/A		No	+6 Years	No	
204	Construction Documents for Storm Water System Improvements	Apr-97	L00000616 (H)	N/A		No	+6 Years	No	
205	Construction Records	May - Dec 97	L00000617 (H)	N/A		No	+6 Years	Yes	
206	Final Construction Report for Storm Water Systems Improvement Project	Feb-98	L00000617 (H)	N/A		No	+6 Years	No	
207									
208	**PROCESS CIRCUITS OPERABLE SUB-UNIT**								
209	**Main Plant Process Water**								
210	Asarco Process Monitoring Plant Water Circuit Analytical Data (arsenic data)	1989 to Present	East Helena Files (A)	No		No	+6 Years	No	*Arsenic (As) data in electronic format (H)
211	Initial Report on Pilot Scale Study of Excess AEH Plant Process Water - Tetra Tech Disk	Aug-91	Archived Box N-2 (363) (H)	No		No	+6 Years	No	
212	Pre-Final Design Report, Reduction of Process Circuit Gains	Dec-91	Archived Box P-2 (365) (H)	No		No	+6 Years	No	
213									
214	**HDS Plant Related**								
215	Tetra Tech HDS Water Treatment Facility 30% Design Report	Nov-91	East Helena Files (A)	Unknown		Unknown	+6 Years	No	By Tetra Technologies, Inc.
216	Pre-final (90%) Design Report for HDS Water Treatment Facility	Sep-92	East Helena Files (A)	Unknown		Unknown	+6 Years	No	By Tetra Technologies, Inc.
217	HDS Baseline Monitoring	Sep-93	QC BOX #119(H)	No		Yes	+6 Years	No	
218	East Helena HDS Soil and Water Sample Data	May-93	Active QA/QC (H)	No		Yes	+6 Years	No	
219	ASARCO HDS Water Treatment Discharge to East Helena POTW Baseline Monitoring Report	Oct-93	L00000617 (H)	No		Yes	+6 Years	No	
220	HDS Facility Construction Reports	Mar-93 to Jan-94	East Helena Files (A)	N/A		Yes	+6 Years	No	
221	308 A.O./HDS Effluent	Dec-94 to Jun-95	East Helena Files (A)	Yes	VISUAL	Yes	+6 Years	No	
222	309 A.O./HDS Effluent	Oct-95 to Oct-96	East Helena Files (A)	Yes	VISUAL	Yes	+6 Years	No	
223	East Helena HDS Effluent Data and Validation Report, Optimization Study	Jul-95 to Feb-96	Active QA/QC (H)	Yes	VISUAL	Yes	+6 Years	No	
224	Results of Bench-Scale Treatability Tests for Improving Effluent Quality from the HDS Plant	Revised Oct-95	L00000617 (H)	No		No	+6 Years	No	
225	East Helena HDS Treatability Study Data	Jul-95 to Apr-96	Active QA/QC (H)	No		Yes	+6 Years	No	
226	HDS Facility Status Reports #1 - #5	Jan - May 96	L00000618 (H)	No		Yes	+6 Years	No	
227	Interim Results and Recommendations for Improving Effluent Quality from the HDS Plant at AEH	Mar-96	L00000618 (H)	No		Yes	+6 Years	No	
228	30% Design Report for HDS Plant Improvements	May-96	L00000612 (H)	No		Yes	+6 Years	No	
229	Final Process Design Report for Improvements to the Asarco East Helena HDS Plant	Oct-96	L00000612 (H)	No		Yes	+6 Years	No	
230	MPDES Permit Application	Nov-96	L00000617 (H)	No		No	+6 Years	No	
231	MPDES Monitoring Information (Monthly DMR Submittals)	Nov 96 - Present	East Helena Files (A)	No		No	+6 Years	No	
232	Work Plan for Meeting the MPDES limit for Thallium at the HDS Plant	Aug-97	L00000618 (H)	No		No	+6 Years	No	
233	Monthly Zeolite Pilot Test Report	Nov-97 to Feb-98	L00000618 (H)	No		Yes	+6 Years	No	
234	Zeolite Pilot Test Summary Letter	Mar-98	L00000618 (H)	No		Yes	+6 Years	No	

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235									
236	**Acid and Sinter Plants**								
237	*See Lead SIP and SO2 SIP Sections for documents relating to Acid and Sinter Plant as well.								
238									
239	**Blast Furnace and Dross Plant**								
240	*See Lead SIP and SO2 SIP Sections for documents relating to Blast Furnace and Dross Plant as well.								
241									
244									
245	**GROUNDWATER OPERABLE UNIT**								
246	*See the Comprehensive RI and Post-RI Section								
248	Correspondence regarding the December 1996 organic sampling at monitoring wells DH-27 and DH-28	Jan-97	East Helena Files (A)	N/A		Yes	+6 Years	No	
249	Correspondence regarding the May 1997 organic sampling at monitoring wells DH-27 and DH-28	Aug-97	East Helena Files (A)	N/A		Yes	+6 Years	No	
250									
251	**SURFACE WATER / SOILS OPERABLE UNIT**								
252									
253	**SURFACE SOILS OPERABLE SUB-UNIT**								
255	**Plant Site Soils**								
256	Plant Site Soils Addressed in Comprehensive RI								
257									
258	**East Helena Residential Soils**								
259	Remedial Investigation/Feasibility Study for Residential Soils, Wilson Ditch Sediments	Mar-91	Archived Box Z-2 (370) (H)	No		Yes	+6 Years	No	
260	Engineering Evaluation / Cost Analysis (EE/CA) by EPA	Jun-91	EPA	N/A		Yes	+6 Years	No	
261	Consent Decree Residential Soils 7/19/91	Jul-91	Hydrometrics Files (H)	N/A		Yes	+6 Years	No	
262	Work Plan for Excavation and Removal of Residential Soils	Jul-91	Hydrometrics Files (H)	N/A		Yes	+6 Years	No	
263	East Helena Residential Soils Removal Action Year End Reports 1991-1996	Feb-92 to Mar-97	L00000611 (H) & East Helena Files (H)	N/A		Yes	+6 Years	No	
264	Human Health Risk Assessment for Residential Soils	Jan-94	L00000611 (H)	Yes	VISUAL/STD	Yes	+6 Years	No	
265	Focused Feasibility Study on Location and Method of Disposal of East Helena Soils, Vol 1, 2.	Feb-94	L00000610 (H)	Yes	CLP	Yes	+6 Years	No	
266	Residential Soils Sector Sampling Summary	Mar-95	L00000616 (H)	Yes	VISUAL	Yes	+6 Years	No	
267	Residential Soils Removal Action Grass Yield and Metal Loadings From Eight Treatments at Three Lead Isocontours in the Asarco East Field 1994 Treatability Test Plot Results	Apr-96	L00000610 (H)	Yes	VISUAL	Yes	+6 Years	No	
268									
271									
282	**FISH AND WATERFOWL OPERABLE SUB-UNIT**								
283									
284	**Fish, Qualitative Biological Assessment of Upper Lake, Migratory Waterfowl**								
285	Assessment of Potential Exposure Pathways of Metal Contaminants from Migratory Waterfowl at Upper Lake to Human Receptors	Sep-88	Archived Box 309 (H)	Yes	VISUAL	Yes	+6 Years	No	
286									
287	**SURFACE WATER OPERABLE SUB-UNIT**								
289	**Prickly Pear Creek**								
290	SedCAD Modeling of Sediment Loading to Prickly Pear Creek	Apr-88	Archived Box 309 (H)	No		No	+6 Years	No	
291	Information and Analytical Data - A.O. 308 Prickly Pear Creek (water)	1995	Active QA/QC (H)	Yes	STD	Yes	+6 Years	No	
292	Information and Analytical Data - A.O. 309 Prickly Pear Creek (water)	1996	Active QA/QC (H)	Yes	STD	Yes	+6 Years	No	
293	A.O 308&309 Prickly Pear Validation Reports	1995-1996	Archive Box QC-198	Yes	STD	Yes	+6 Years	No	
294	*See also Comprehensive RI and Post-RI Monitoring								
295									
296	**Wilson Ditch**								
297	Wilson Ditch Work Plan for removal and replacement of soils	Mar-93	L00000617 (H)	No		No	+6 Years	No	
298	Review of Wilson Ditch and Remedial Alternatives	Nov-93	L00000617 (H)	No		Yes	+6 Years	No	
299	Wilson Ditch Statistics	Apr-94	QC BOX #121(H)	N/A		Yes	+6 Years	No	
300	AEH Smelter, Inspection of Wilson Ditch Summary Report	Nov-94	L00000617 (H)	No		No	+6 Years	No	
301	AEH Smelter, Review of Wilson Ditch Alternatives for Corrective Action and Estimated Costs	Aug-96	L00000617 (H)	No		No	+6 Years	No	

APPENDIX 3-1-1. EXISTING DATA AND RELATED INFORMATION SOURCES USED TO DEFINE THE NATURE AND EXTENT OF ANY HAZARDOUS WASTE OR HAZARDOUS WASTE CONSTITUENT RELEASES AT, OR MIGRATING FROM THE ASARCO EAST HELENA FACILITY

LINE NO	NAME AND DESCRIPTION OF FILE OR DOCUMENT	PUBLICATION DATE	REPORT LOCATION	HAS DATA QUALITY BEEN EVALUATED	LEVEL OF DATA QUALITY REVIEW	HAS EPA BEEN ISSUED A COPY	INTENDED RETENTION TIME	PRIVILEGED OR CONFIDENTIALITY CLAIMS?	ADDITIONAL INFORMATION
302	Wilson Ditch Relocation Plans	Apr-97	Hydrometrics Files (H)	N/A		No	+6 Years	No	
303	Construction Records	May - Jul 97	Hydrometrics Files (H)	N/A		No	+6 Years	No	
304									
305	**SLAG PILE OPERABLE UNIT**								
306	Addressed in Comprehensive RI/FS								
307									
308	**ORE STORAGE YARD AREA OPERABLE UNIT**								
309	Ore Storage Area - Analytical Data	Oct-94	Active QA/QC (H)	Yes	VISUAL	No	+6 Years		
310	Ore Storage Area - Stockpile Characterization	Oct-94	L00000617 (H)	No		No	+6 Years		
311	Design Report Asarco East Helena Corrective Action Management Unit (Draft)	Aug-97	L00000618 (H)	N/A		Yes	+6 Years	No	
312	Also Addressed in Comprehensive RI/FS								
313	OTHER								
314	Toxic Chemical Release Inventory - Form R Reporting	Annual (1989-1996)	East Helena Files (A)	No		Yes	+6 Years	No	
315	Section 312, Tier II Reports	Annual 1992-1996)	East Helena Files (A)	No		No	+6 Years	No	
316	Montana Hazardous Waste Report	Annual (1993-1996)	East Helena Files (A)	No		No	+6 Years	No	
317	Comprehensive Environmental Response, Compensation and Liability Act (CERCLA) Hazardous Substances Release Reporting to NRC/State/Local Authorities	On-going	East Helena Files (A)	No		Yes	+6 Years	No	
318	Design Report Asarco East Helena Corrective Action Management Unit (CAMU)	September 1997	Hydrometrics Files (H)	Yes	Visual	Yes	+6 Years	No	
319									
320	**FACILITY DISCHARGES TO CITY OF EAST HELENA POTW**								
321	MH-29/City Monitoring Station for POTW Discharges	April 11, 1989 - January 30, 1996	East Helena Files (A)	No			+6 Years	No	
322	POTW Validation File - Analytical File	May-93 to Dec-94	QC BOX #117(H)	Yes	VISUAL	Yes	+6 Years	No	
323	MH-29/City Monitoring Station for POTW Discharges	Jul-93	East Helena Environmental Sciences (A)	No		No	+6 Years		So2 SIP - NAWC
324	POTW F1 Recorder Charts - Influent and Effluent Flow Rates	Jan-92 to Dec-95	QC BOX #138(H)	Yes	VISUAL	Yes	+6 Years	No	
325	POTW Project Information and Analytical Data	Jul-94 & Apr - Oct 95	Active QA/QC (H)	No		Yes	+6 Years	No	
326	Sampling and Analysis Report for Chemical and Physical Parameters- City of East Helena POTW	Oct-94	L00000618 (H)	Yes	VISUAL	Yes	+6 Years	No	
327	Examination of Sanitary Sewer Flow Rates, AEH	Nov-94	L00000618 (H)	N/A		No	+6 Years	No	
328	Sanitary Sewer System Flow Analysis	1995	L00000618 (H)	No		Yes	+6 Years	No	
329	308 A.O./POTW Discharges	Mar-95	East Helena Files (A)	Yes	SLC Lab	Yes	+6 Years	No	
330	Determination of Non-Sanitary Flows in East Helena Plant Sanitary Sewer System	Mar-95	L00000618 (H)	No		Yes	+6 Years	No	
331	Sanitary Sewer Water Quality Data Collected at MH-31	Mar-95 to Nov-97	East Helena Files (A)	Yes	STD	Yes	+6 Years	No	
332	MH-31 Sanitary Sewer Weekly Flow Data Reports	Mar-95 to Jan-98	L00000612 (H)	Yes	VISUAL	Yes	+6 Years	No	
333	MH-31 Sanitary Sewer Flow Data Backup Files	Mar-95 to Jan-98	L00000612 (H)	No		No	+6 Years	No	
334	Letter POTW Results, Kellner, Kris McLean, U.S. Attorney	Apr-95	L00000618 (H)	No		Yes	+6 Years	No	
335	April 1995 and Early May 1995 Sanitary Sewer Monitoring Report to EPA	Apr-May 95	L00000618 (H)	No		Yes	+6 Years	No	
336	May 1995 Sanitary Sewer Monitoring Report to EPA	May-95	L00000618 (H)	No		Yes	+6 Years	No	
337	Late May and Early June 1995 Sanitary Sewer Monitoring Report to EPA	May-Jun 95	L00000618 (H)	No		Yes	+6 Years	No	
338	June 1995 Sanitary Sewer Monitoring Report to EPA	Jun-95	L00000618 (H)	No		Yes	+6 Years	No	
339	July 1995 Sanitary Sewer Monitoring Report to EPA	Jul-95	L00000618 (H)	No		Yes	+6 Years	No	
340	Water Quality and Quantity Data of Asarco's Discharge to the City of East Helena POTW	Jul - Oct 95	L00000618 (H)	No		Yes	+6 Years	No	
341	August 1995 Sanitary Sewer Monitoring Report to EPA	Aug-95	L00000618 (H)	No		Yes	+6 Years	No	
342	September 1995 Sanitary Sewer Monitoring Report to EPA	Sep-95	L00000618 (H)	No		Yes	+6 Years	No	
343	Water Quality Data Compilation in Response to Tentative MPDES Permit for the East Helena POTW	May-96	L00000618 (H)	Yes	VISUAL	No	+6 Years	No	
344	Sewer Cleaning Assessment and Examination of Sewage Treatment Plant Options	Apr-97	Hydrometrics Files (H)	No		No	+6 Years	No	
345	AEH Smelter Sewage Treatment Plant Plans and Specifications	Jul-97	Hydrometrics Files (H)	No		No	+6 Years	No	

APPENDIX 3-1-1. EXISTING DATA AND RELATED INFORMATION SOURCES USED TO DEFINE THE NATURE AND EXTENT OF ANY HAZARDOUS WASTE OR HAZARDOUS WASTE CONSTITUENT RELEASES AT, OR MIGRATING FROM THE ASARCO EAST HELENA FACILITY

LINE NO.	NAME AND DESCRIPTION OF FILE OR DOCUMENT	PUBLICATION DATE	REPORT LOCATION	HAS DATA QUALITY BEEN EVALUATED	LEVEL OF DATA QUALITY REVIEW	HAS EPA BEEN ISSUED A COPY	INTENDED RETENTION TIME	PRIVILEGED OR CONFIDENTIALITY CLAIMS?	ADDITIONAL INFORMATION
346	Sewage Treatment Plant Operation and Maintenance Manual (Draft)	Nov-97	Hydrometrics Files (H)	No		No	+6 Years	No	
347	Construction Records - Sewer Treatment Plant	Aug - Dec 97	Hydrometrics Files (H)	No		No	+6 Years	No	
348									
349	**EPA Information Request Submittals**								
350	Response to September 1994 Clean Water Act Section 308 Information Request	October 7, 1994	East Helena Files (A)	No		Yes	+6 Years	No	
351	Supplemental Response to October 7, 1994 Response	November 30, 1994	East Helena Files (A)	No		Yes	+6 Years	No	
352	Response to December 6, 1994 Clean Water Act Section 308 Information Request	January 9, 1995	East Helena Files (A)	No		Yes	+6 Years	No	
353	And Corresponding 6 Months of Reports	January 5, 1995	East Helena Files (A)	No		Yes	+6 Years	No	
354	Response to March 14, 1995 Clean Water Action Section 308 Information Request	Apr-Sep 95	East Helena Files (A)	No		Yes	+6 Years	No	
355	Response to State of Montana March 8, 1995 Information Request	June 7, 1995	East Helena Files (A)	No		Yes	+6 Years	No	
356	Response to June 22, 1995 Clean Water Act Section 308 Information Request	August 9, 1995	East Helena Files (A)	No		Yes	+6 Years	No	
357	Response to State of Montana September 18, 1995 Information Request	October 20, 1995	East Helena Files (A)	No		Yes	+6 Years	No	
358	Response to State of Montana August 11, 1995 Information Request	October 20, 1995	East Helena Files (A)	No		Yes	+6 Years	No	
359	Response to Administrative Order CWA-VIII-95-08-C Dated October 12, 1995	Oct-95 to Oct-96	East Helena Files (A)	No		Yes	+6 Years	No	
360	Thirteen Monthly Reports from October 1995-October 1996								
361	Response to September 12, 1995 RCRA Section 3007 Information Request	November 8, 1995	East Helena Files (A)	No		Yes	+6 Years	No	
362	Response to September 12, 1995 RCRA Section 3007 Information Request	November 30, 1995	East Helena Files (A)	No		Yes	+6 Years	No	
363	Response to September 12, 1995 RCRA Section 3007 Information Request	December 5, 1995	East Helena Files (A)	No		Yes	+6 Years	No	
364	Response to May 13, EPA Section 3007 Information Request	May 29, 1996	East Helena Files (A)	No		Yes	+6 Years	No	
365	Response to June 4, 1996 EPA information request	June 24, 1996	East Helena Files (A)	No		Yes	+6 Years	No	
366	Response to EPA Weal Request for information made during August 28, 1996 Inspection	September 9, 1996	East Helena Files (A)	No		Yes	+6 Years	No	

NOTES:

* - (H) = Hydrometrics Helena Offices

(A) = Asarco East Helena Plant

N/A - Not Applicable

Explanation on level of data quality review is provided in Section 3.0 of CC/RA Report.

APPENDIX 3-1-2

WATER QUALITY DATABASE

INDEX

Page	Site Code	Site Name	Site Type	Elevation MP	Well Depth
401	AMCHEM1	American Chemet 1	Private Well	3845	
401	AMCHEM2	American Chemet 2	Private Well	3893.3	162
407	AMCHEM3	American Chemet 3	Private Well	3896.5	140
407	AMCHEM4	American Chemet 4	Private Well	3885(Map)	160
335	AP-1	AP-1	Plant Process Fluids		
337	AP-2	AP-2	Plant Process Fluids		
340	AP-3	AP-3	Plant Process Fluids		
1	APSD-1	APSD-1	Groundwater		11.75
5	APSD-2	APSD-2	Groundwater		18.0
10	APSD-3	APSD-3	Groundwater		12.5
14	APSD-4	APSD-4	Groundwater		14.0
19	APSD-7	APSD-7	Groundwater		
33	APSD-8	APSD-8	Groundwater		
42	APSD-9	APSD-9	Groundwater		
46	APSD-10	APSD-10	Groundwater		
50	APSD-11	APSD-11	Groundwater		
54	APSD-12	APSD-12	Groundwater		
57	APSD-13	APSD-13	Groundwater		
61	APSD-14	APSD-14	Groundwater		
342	APTF	ACID PLANT	Plant Process Fluids		
411	ASRWELL	ASARCO WELL	Private Well		
610	AS\W\1SUMP	ASARCO WATER SUMP 1	Water		
610	AS\W\2SUMP	ASARCO WATER SUMP 2	Water		
610	AS\W\3SUMP	ASARCO WATER SUMP 3	Water		
412	BERRY	BERRY	Private Well		
412	BRNHM1	BURNHAM 1	Private Well		
413	CASEY	CASEY	Private Well		
414	COX	E. COX	Private Well		
62	DH-1	DH-1	Groundwater	3907.99	50
69	DH-2	DH-2	Groundwater	3935.34	65.5
76	DH-3	DH-3	Groundwater	3946.09	55
83	DH-4	DH-4	Groundwater		24
99	DH-5	DH-5	Groundwater		20
109	DH-6	DH-6	Groundwater	3886.96	25
116	DH-7	DH-7	Groundwater	3895.83	28.5
122	DH-8	DH-8	Groundwater	3914.40	50
128	DH-9	DH-9	Groundwater	3894.67	17
133	DH-10	DH-10	Groundwater	3884.92	10
138	DH-10A	DH-10A	Groundwater		
139	DH-11	DH-11	Groundwater	3910.26	29
146	DH-12	DH-12	Groundwater	3908.46	30
153	DH-13	DH-13	Groundwater	3908.02	45
169	DH-14	DH-14	Groundwater		
180	DH-15	DH-15	Groundwater	3885.9	50
182	DH-16	DH-16	Groundwater	3903.17	30
184	DH-17	DH-17	Groundwater	3902.28	41
191	DH-18	DH-18	Groundwater	3907.55	68
198	DH-19	DH-19	Groundwater	3916.04	30
202	DH-20	DH-20	Groundwater		31
210	DH-21	DH-21	Groundwater	3907.80	30
216	DH-22	DH-22	Groundwater	3922.09	35
220	DH-23	DH-23	Groundwater	3913.23	20
224	DH-24	DH-24	Groundwater	3897.55	35
230	DH-26	DH-26	Groundwater	3913.07	35
233	DH-27	DH-27	Groundwater	3908.47	30
240	DH-28	DH-28	Groundwater	3908.63	36
246	DH-29	DH-29	Groundwater		17.00
414	DHULST	D. HULST	Private Well	3920(Map)	137
419	DUEL	DUEL	Private Well	3868.9	100
254	EH-50	EH-50	Groundwater	3886.10	45
259	EH-51	EH-51	Groundwater	3877.10	30
265	EH-52	EH-52	Groundwater	3877.14	13
271	EH-53	EH-53	Groundwater	3870.35	35
276	EH-54	EH-54	Groundwater	3866.54	18
282	EH-57A	EH-57A	Groundwater	3882.10	45
285	EH-58	EH-58	Groundwater	3884.59	35
290	EH-59	EH-59	Groundwater	3873.13	18
294	EH-60	EH-60	Groundwater	3884.90	29
311	EH-61	EH-61	Groundwater	3885.92	45
318	EH-62	EH-62	Groundwater	3871.52(M)	46.5
324	EH-100	EH-100	Groundwater	3886.36	60

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Page	Site Code	Site Name	Site Type	Elevation MP	Well Depth
326	EH-101	EH-101	Groundwater	3877.29	45
330	EH-102	EH-102	Groundwater	3877.14	35
423	EHC1	E.H. CITY 1	Private Well		
425	EHC2	E.H. CITY 2	Private Well		
342	EHSE	SEWAGE OUT	Plant Process Fluids		
343	EHSI	SEWAGE IN	Plant Process Fluids		
426	ERNST	ERNST	Private Well	3870(Map)	76
428	FLAGE	FLAGE	Private Well	3865(Map)	32
428	HELFERT	HELFERT	Private Well	3885(Map)	180
430	HOFF	HOFF	Private Well	3871.3	38
431	JENSA1	JENSEN A1	Private Well	3875(Map)	84
432	JENSA2	JENSEN A2	Private Well	3872.5	160
434	KAMRMN	KAMMERMAN	Private Well	3875(Map)	~20
436	KHULST	K. HULST	Private Well		
436	LAMPC	LAMPING C	Private Well	3860(Map)	110
438	LAMPF1	LAMPING F1	Private Well	3920(Map)	46.5
439	LAMPR	LAMPING R	Private Well	3867.2	41
441	LHULST	L.HULST	Private Well	No Meas	170
343	LL-1	Composite of LL-1a, 1b, and 1c	Plant Process Fluids		
345	LL-1D	Lower Lake Deep	Plant Process Fluids		
351	LL-1S	Lower Lake Surface	Plant Process Fluids		
358	LL-2	LL-2	Plant Process Fluids		
466	LOWER LAKE	Lower Lake	Surface Water		
446	MANION	MANION	Private Well	3870.4	80
447	MCD1	MCDONALD 1	Private Well	3882	130
448	NORDSTR	NORDSTROM	Private Well	3870(Map)	46
473	PPC-3	PPC-3	Surface Water		
495	PPC-3A	PPC-3A	Surface Water		
495	PPC-4	PPC-4	Surface Water		
507	PPC-5	PPC-5	Surface Water		
525	PPC-6	PPC-6	Surface Water		
537	PPC-7	PPC-7	Surface Water		
553	PPC-8	PPC-8	Surface Water		
563	PPC-9	PPC-9	Surface Water		
566	PPC-29A	PPC-29A	Surface Water		
567	PPC-30A	PPC-30A	Surface Water		
569	PPC-31A	PPC-31A	Surface Water		
571	PPC-32A	PPC-32A	Surface Water		
573	PPC-33A	PPC-33A	Surface Water		
575	PPC-34A	PPC-34A	Surface Water		
575	PPC-35A	PPC-35A	Surface Water		
576	PPC-36A	PPC-36A	Surface Water		
576	PPC-37A	PPC-37A	Surface Water		
577	PPC-38A	PPC-38A	Surface Water		
577	PPC-40A	PPC-40A	Surface Water		
579	PPC-101	PPC-101	Surface Water		
584	PPC-102	PPC-102	Surface Water		
590	PPC-103	PPC-103	Surface Water		
448	ROMASKO	ROMASKO	Private Well	3871.7	61
360	S-1	S-1	Plant Process Fluids		
364	S-2	S-2	Plant Process Fluids		
368	S-3	S-3	Plant Process Fluids		
596	SEEP-1	SEEP-1	Surface Water		
372	SHOWER	SHOWER	Plant Process Fluids		
449	SIMAC	SIMAC	Private Well		
463	SITEA	SITE A	Runoff		
463	SITEE	SITE E	Runoff		
463	SITEF	SITE F	Runoff		
465	SITEG	SITE G	Runoff		
465	SITEH	SITE H	Runoff		
372	SP-1	SP-1	Plant Process Fluids		
377	SP-2	SP-2	Plant Process Fluids		
377	SP-3	SP-3	Plant Process Fluids		
379	SP-4	SP-4	Plant Process Fluids		
381	SP-5	SP-5	Plant Process Fluids		
382	ST-1	ST-1	Plant Process Fluids		
385	ST-2	ST-2	Plant Process Fluids		
451	STCLAIR	ST. CLAIR	Private Well	3810(Map)	65
389	TRWASH	TRUCK WASH	Plant Process Fluids		
389	TT-1	TT-1 - THORNDOCK LAKE	Plant Process Fluids		
395	UPPER LAKE	UPPER LAKE	Plant Process Fluids		

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