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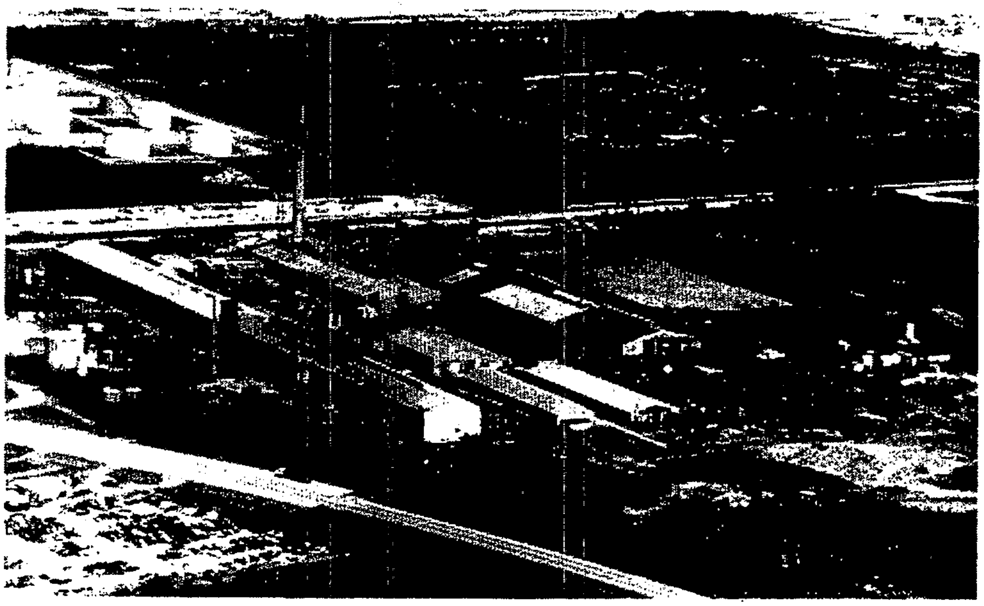
EPA Superfund
Record of Decision:

Texas Tin Corporation Site OU 1
Texas City, TX
5/17/1999



RECORD OF DECISION
TEX-TIN SUPERFUND SITE
Texas City, Texas

May 17, 1999

U. S. Environmental Protection Agency
Region 6
Dallas, TX

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TEX TIN CORPORATION SUPERFUND SITE
OPERABLE UNIT NO. 1
TEXAS CITY, TEXAS

DECLARATION FOR THE RECORD OF DECISION

1 **Site Name and Location.** The Tex-Tin Superfund Site (CERCLIS ID # TXD062113329) is located in the cities of Texas City and La Marque, Galveston County, Texas.

1.1 Statement of Basis and Purpose. This decision document presents the selected remedy for the first operable unit of the Tex-Tin Superfund Site, the Tex Tin Corporation smelter facility (OU1). The remedial action was chosen in accordance with the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA), 42 U.S.C. § 9601, as amended, and, to the extent practicable, the National Oil and Hazardous Substance Pollution Contingency Plan (NCP), 40 C.F.R. Part 300.

1.1.1 The State of Texas, through the Texas Natural Resource Conservation Commission (TNRCC), concurs with the selected remedy.

1.1.2 The Proposed Plan of Action for OU1 was released for public comment on September 9, 1998. In response to a request, the original thirty-day comment period was extended for an additional thirty days, ending on November 9, 1998. A public meeting was held on Oct. 6, 1998. EPA received numerous comments, which were considered in making the final remedy selection. Responses to the comments received during the formal comment period are included in the Responsiveness Summary. This final remedy decision is based upon review and consideration of public comment and the entire administrative record.

1.1.3 The Administrative Record contains the documents that form the basis for the selection of a response action. The Administrative Record is available for review at the EPA Region 6 offices at 1445 Ross Ave., Suite 1200, Dallas, Texas 75202; the Moore Memorial Public Library, 1701 Ninth Avenue North, Texas City, Texas 77590; and the Texas Natural Resource Conservation Commission, Technical Park Center, Building D, 12118 North IH-35, Austin, Texas 78711-3087.

1.2 Assessment of the Site. The response action selected in this ROD is necessary to protect the public health or welfare or the environment from actual or threatened releases of hazardous substances into the environment.

1.3 Description of Selected Remedy. Operable Unit No.1 is one of four operable units which are part of the Tex Tin Corporation Superfund Site. OU1 is an inactive tin smelter which lies on approximately 140 acres at the intersection of FM 519 and State Highway 146 in Texas City, Texas. Process buildings, unused since the facility ceased operations in 1991, exhibit varying stages of structural deterioration. There are a number of ponds on-site, including wastewater treatment ponds and a four-acre Acid Pond with a pH of less than 2, the base of which is hydraulically connected with shallow groundwater. Slag from the smelting process is heaped across the property, as are drums and piles of spent catalyst and other secondary smelting materials.

1.3.1 Operable Unit No. 2 refers to the Amoco property (also known as Parcel H of the Tex Tin Site), approximately 27 undeveloped acres located adjacent to OU1. Operable Unit No. 3 refers to a residential area located in LaMarque, Texas, approximately 2,000 ft. west-northwest from OU1, and Operable Unit No. 4 refers to the Swan Lake Salt Marsh area located between the Texas City Hurricane Levee and Swan Lake.

1.3.2 EPA has identified several contaminant sources at OU1 to be principal threat wastes: liquids and sediments from the Acid Pond, slag containing radioactive material, slag or soil that leaches contaminants in excess of Synthetic Precipitation Leaching Procedure (SPLP) standards, sludge remaining in above-ground storage tanks, and drums containing spent catalyst. Low-level threat materials present at OU1 include surface water and groundwater that exceed drinking water maximum contaminant levels (MCLs) but which can be discharged under National Pollutant Discharge Elimination System (NPDES) criteria, as well as soils and slag which do not leach contaminants into the environment but which pose an unacceptable risk or hazard identified in the baseline risk assessment.

1.3.3 The selected remedy for OU1 uses treatment, off-site disposal, on-site stabilization and containment, and institutional controls to mitigate the carcinogenic risk and non-carcinogenic hazards at the site (see Box 1.3.4). The major components of the selected remedy are to: treat Acid Pond liquids and discharge them to the Wah Chang ditch; place a geomembrane containment wall around the Acid

Pond; stabilize onsite and construct a cover for sediments, drummed materials, slag, and soil that pose an unacceptable carcinogenic risk or non-carcinogenic hazard; cover the low level radioactive landfill; discharge the wastewater pond liquids to the Wah Chang ditch and backfill the ponds; cover soil exceeding remedial action cleanup levels with 24 inches of compacted clay; dispose of organic and inorganic sludge contained in the above-ground storage tanks; implement a long-term perimeter monitoring program for the Shallow, Medium and Deep Transmissive Zones to ensure no further degradation of groundwater; remove the dust and asbestos from the buildings; demolish the buildings where appropriate and finally, bury all debris below grade in an on-site landfill.

Box 1.3.3 - Components of Selected Remedy

Treatment.

Neutralize and filter Acid Pond liquids, and discharge to the Wah Chang ditch.

Off Site Disposal.

Ship organic and inorganic sludges found in above-ground storage tanks (ASTs) off-site for disposal.

Engineering Controls.

Stabilize contaminated sediments, slag, soil and drummed material that pose an unacceptable carcinogenic risk or non-carcinogenic hazard. Dispose of stabilized materials in on-site landfill.

Construct a cover or enhance existing covers over the low-level radioactive landfill and stabilized materials and soils which do not leach contaminants in concentrations which pose unacceptable carcinogenic risks or non-carcinogenic hazards.

Implement long-term groundwater monitoring.

Demolish buildings and other surface structures; landfill on site.

Institutional Controls.

File deed notices in the Galveston County property records describing the nature and location of hazardous substances landfilled on-site and the location and concentrations of hazardous substances in groundwater.

1.3.4 The remedial alternatives EPA evaluated are summarized in Section 3.9, "Description of Remedial Alternatives." The selected alternative is described in detail in Section 3.10, "Selected Remedy - SW3: On-site Stabilization, Compacted Clay Cover, Groundwater Monitoring, Asbestos Removal and Building Demolition."

1.4 Statutory Determinations. The Selected Remedy is protective of human health and the environment, complies with Federal and State requirements that are applicable or relevant and appropriate to the remedial action, is cost-effective, and utilizes permanent solutions and alternative treatment technologies to the maximum extent practicable. This remedy also satisfies the statutory preference for treatment as a principal element of the remedy to reduce the toxicity, mobility or volume of materials comprising principal threats. Because this remedy will result in hazardous substances remaining on-site above levels that allow for unlimited use and unrestricted exposure, a statutory review will be conducted within five years after initiation of the remedial action to ensure that the remedy continues to provide adequate protection of human health and the environment.

2 ROD DATA CERTIFICATION CHECKLIST

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

- Chemicals of concern (COCs) and their respective concentrations.
- Baseline risk represented by the COCs.
- Cleanup levels established for COCs and the basis for the levels.
- Current and future land and groundwater use that will be available at the site as a result of the selected remedy.
- Estimated capital, operation and maintenance (O&M), and total present worth costs; discount rate; and the number of years over which the remedy costs estimates are projected.
- Decisive factor(s) that led to selecting the remedy.

Greg A. Cooke 5-17-99

Greg Cooke
Regional Administrator
U.S. Environmental Protection Agency
Region 6

Date

3 THE DECISION SUMMARY.

The Decision Summary provides an overview of the site characteristics, alternatives evaluated, and the analysis of those options. It identifies the selected remedy, explaining how the remedy fulfills statutory and regulatory requirements. Finally, it provides a substantive summary of the information, available in the site Administrative Record, which was used to characterize the site and evaluate cleanup alternatives.[1]

3.1 Site Name, Location and Description. The Tex-Tin Superfund Site (CERCLIS ID # TXD062113329) is located in Texas City and La Marque, Galveston County, Texas (Figure 3.1, "Site Location"). Operable Unit No. 1 (OU1), the subject of this Record of Decision, is a smelter which closed in 1991; other industrial processes were conducted there as well. OU1 encompasses approximately 140 acres, including process buildings, slag piles, an acid pond, drums of spent catalyst and other metal-bearing materials, above-ground storage tanks of organic wastes, and assorted other materials. After the Remedial Investigation was completed by a landowner PRP, EPA assumed the lead on this project.

3.2 Site History and Enforcement Activities. OU1 of the Tex-Tin Superfund Site is located in Texas City, Texas. EPA's investigations show there is an unacceptable threat posed by contamination from the uncontrolled release of hazardous substances, including carcinogens and systemic toxins, from various sources such as the Acid Pond, radioactive materials, process wastewater, waste oils, drummed spent catalyst and slag left on-site. As the lead agency responsible for administering the cleanup, EPA reviewed data from site investigations and identified contamination from specific hazardous substances, discussed in the following sections, which pose threats to the environment.[2]

3.2.1 Site Activities That Led to the Current Problems. While information about the operational history of the site is still being developed, the following paragraphs describe generally some of the industrial processes conducted on OU1 that led to the present condition of the property.

3.2.2 Tin Smelting and Ferric Chloride Production. From 1941 through 1989, tin was the primary product of the smelter plant on OU1. Other industrial processes were also conducted there at various points in the operational history of the plant; a 1980 products list for the Texas City facility includes the following: ammonium vanadate, calcium molybdate, calcium tungstate, copper oxide, ferric chloride, an fused vanadium oxide, molybdenum oxide (technical), tin (electrolytic), and tin(fire refined). In approximately 1988, the smelter began copper production as well.

3.2.3 The particular components of the tin smelting process varied over time, as plant owner/operators attempted to maximize recovery of marketable metal from ores and secondary smelting materials which varied widely in metal content. Basically, tin smelting produced pure tin and waste products, including ferrous chloride, an iron-rich liquid acid, and solid tin slag. Much of the slag remains in large piles on the site. The liquids were transferred to ponds 18 through 21 south of the main plant and possibly some to ponds 2 through 14. For a time, ferrous chloride was reportedly converted to ferric chloride by combining an iron-rich source, such as scrap iron or spent iron-rich catalyst, with chlorine gas. The ferric chloride was sold as a flocculating agent for wastewater treatment facilities until 1983 when ferric chloride production ceased. After production of ferric chloride ceased, the remaining solution was eventually stored in what is now the Pond 6, the Acid Pond.

3.2.4 The OU1 tin smelter was originally designed in 1941 to smelt high grade tin concentrates. The high amount of impurities in available low-grade concentrates reportedly limited the success of the process. Ore delivered to the plant was weighed, crushed, sampled, and stored in separate piles or mixes. From storage piles, the ore was transported by lift trucks to the roasting department. The ore was transferred to rotating kilns for roasting, which was done to eliminate sulphur, antimony, arsenic, and lead, and to reduce the iron, making it more soluble in acid. The roasted ore was then discharged from the kilns and transported to the leaching plant, where impurities in the ores were leached with hydrochloric acid. The residue (coarse, leached ore) was discharged into buckets, which were transported by truck back to the roasting department to dry, and then by truck to the smelting department. Liquids and fine particles of ore were discharged into pits and pumped to thickeners where the slimes were separated from the liquids. The clear solution from the thickeners was originally pumped into an estuary of

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Superscripts reference the end notes in Section 5, "End Notes."

Figure 3.1
Site Location

Map
Operable Unit 1
Surrounding Land Uses

Galveston Bay; after mid-1944, it was stored in holding ponds on-site. The slimes were neutralized with lime and filtered; the liquid was sent to acid waste ponds, and the cake was re-pulped with water and sent to a dressing plant, where concentrates were separated from "rejects." The concentrates were re-routed through the smelting operation. In 1951, an acid recycling plant went into operation.

3.2.5 Except for the addition of an electrolytic tin refining plant by Wah Chang Corporation in 1963, variations on the same basic smelting process described above are recorded in articles about the smelter dating from 1970. After acquisition of the plant in the early 1970s, Associated Metals and Minerals initiated a plant upgrade. A pilot plant was reportedly installed in 1972; in 1974 a new reverberatory furnace was added. A ferric chloride system was installed in 1976 and removed in 1984. In the late 1970s, the smelter expanded its activities in metals other than tin. It began production of ferric chloride for water treatment and was a major producer of purified nickel solutions which were used as catalysts by surrounding chemical industries. It recovered metals from various spent catalysts, and uranium tailings. It produced molybdenum, vanadium, antimony, bismuth, nickel, cobalt, and copper in the form of oxides or solutions. A Kaldo (rotary) furnace and feed system was installed in 1978. A chloride wash system was built in 1979 and removed in 1984. A facility for the production of tungsten chemicals from spent catalysts, tin-tungsten bearing slags, and other tungsten residues was constructed in the early 1980s. A sulphur dioxide scrubber system was built in 1981. A new facility for the production of copper sulfate begin operations in 1982. Tin operations reportedly ceased in 1989, but copper recovery continued until 1991.

3.2.6 According to a 1970 article on tin smelting at the Texas City plant, Gulf Chemical and Metallurgical Corporation (GCMC, a division of Associated Metals and Minerals at the time) contracted to receive 15,000 tons of Bolivian tin ore concentrates, containing high concentrations of arsenic, annually. The concentrates were roasted in a furnace during which sulfur and some arsenic were removed. Crushed coke was added in part to volatilize the arsenic. Gases were routed to the ambient air through the main 250-foot stack. After roasting, the concentrates were subjected to two rounds of leaching with heated hydrochloric acid, rinsed with water to bring the pH up to 5.0, and then smelted in a reverberatory furnace. The acid leach liquor was subjected to a cementation process, resulting in recovery of silver, copper, and other soluble metals.

3.2.7 Waste Water Treatment. By about 1970, many of the ponds south and southeast of the production area were filled with tin slags and possibly other waste products from the production processes. In the 1970s a wastewater treatment facility was constructed by GCMC. That facility neutralized and precipitated heavy metals from the process wastewater stream. Surface water runoff from the southern areas of the Site also emptied into the wastewater treatment system. Wastewater was neutralized by adding lime slurry. The lime slurry precipitated metal hydroxides which settled to the bottom of the pond. The neutralized wastewater was subsequently discharged into the Wah Chang ditch under National Pollutant Discharge Elimination System (NPDES) Permit No. TXOOO4855. Precipitated metals were not removed from the pond and no provisions appear to have been made to prevent the migration of dissolved contaminants vertically or laterally out of the ponds.

3.2.8 Air Pollution Controls. During 1980, a scrubber system was installed to remove gaseous sulfur dioxide (SO_2) from the tin smelting process[3]. The $S0_2$ was generated because of a change in the smelting process from multiple-furnace smelting to a single, high-speed rotary Kaldo furnace procedure. Calcium sulfate (gypsum) scrubber sludge was generated from the new procedure. This sludge was placed in Pond 7 from 1980 through 1984. After Pond 7 was completely filled, the scrubber material was placed on the southern portion of the property in the vicinity of former Ponds 17 through 21.

3.2.9 Secondary Copper Smelting. Secondary copper smelting began during 1989. In general, the copper process resembled the tin process with the copper process producing a copper end slag and the tin process producing a tin end slag. Copper smelting also required using a scrubber system; however, the scrubber system only used water and did not produce any waste sludge. Copper production continued until April 1991, when the furnace collapsed and the manufacturing process was shut down.

3.2.10 Antimony Recovery. During the 1970s, GCMC purchased various spent catalysts containing metals and brought them to the plant to store for a GCMC plant in Freeport, Texas and to a lesser extent, for smelting or resale. Efforts were made to recover antimony from uranium/antimony catalyst, but the process was not successful.

3.2.11 Waste Oil Recovery. Between 1982 and 1983, Morchem Resources operated a still bottoms and waste oil recovery plant in the northwest corner, Area A, of the Site (Figure 3.2.11, "Site Features"). These bottoms consisted of high boiling glycols from propylene glycol and t-butyl alcohol manufacture, which contained approximately 1 percent molybdenum. Morchem merged with Royster Chemical Company on November 1, 1982 and the company name was changed to Roychem Associates. Morchem bought the operation in May 1983 and the name was again changed to Morchem Resources, Inc. The new company no longer processed still bottoms, but began processing waste oil from chemical and refining companies. In December 1983, Morchem's lease with GCMC was terminated and it was given 30 days to vacate the premises. Morchem was requested to remove all waste oils and oil contaminated soil from the site. The site was inspected by the TDWR (Texas Department of Water Resources) on May 12, 1984 to evaluate the adequacy of the site cleanup and closure. The inspection found contaminated soil and two sumps overflowing with oily water. These contaminants had not been removed as requested. Morchem, after bankruptcy, abandoned the Site, leaving behind drums and tanks of waste materials.

3.2.12 Permit Violations. During its operating life, the plant was cited a number of times by state and local authorities for wastewater and air emissions permit violations. In two separate enforcement actions, the Texas Water Commission and the Texas Air Control Board, predecessor agencies to the Texas Natural Resource Conservation Commission (TNRCC), put the company on court-ordered compliance plans to bring the facility into compliance with then-current environmental permitting and operating standards. Ultimately, the TNRCC referred the site to EPA to be evaluated for placement on the National Priorities List (NPL). The NPL is a list of sites having uncontrolled hazardous substance releases that are prioritized for evaluation and long term remedial response pursuant to CERCLA.

3.2.13 NPL Listing. EPA proposed this site for listing on the National Priorities List in 1988. A final rulemaking, placing the site on the NPL, was published in 1990; Tex Tin Corporation filed a petition for review in the U.S. Court of Appeals for the District of Columbia Circuit. In 1991, the court remanded the final rulemaking to EPA. EPA supplemented the administrative record supporting the rulemaking. In a decision issued on May 11, 1993, the court removed the site from the NPL. In June, 1993, EPA referred the site to the State of Texas. TWC conducted additional on-site and off-site sampling and, in October, 1994, referred the site back to EPA for evaluation for the NPL, using the Hazard Ranking System revised in 1990. EPA conducted additional sampling in 1994-95. The site was proposed for the NPL on June 17, 1996, and a final rulemaking placing the site on the NPL was published on September 18, 1998. Tex Tin Corporation filed a petition for review with the D.C. Circuit Court of Appeals on Dec.11, 1998.

3.2.14 Site Investigations - Remedial Investigation. Two phases of field investigations were conducted to prepare the June 1993 Remedial Investigation Report for the Site. Phase I of the investigation was conducted by ERM-Southwest between November 1990 and April 1991, and Phase II was conducted by Woodward-Clyde Consultants between February and August of 1992. EPA performed additional site sampling to supplement the 1993 Remedial Investigation Report. The results of investigation known as the Supplemental Remedial Investigation were reported in March 1997. The 1993 and 1997 reports are both part of the Administrative Record. In addition to the aforementioned investigations TNRCC sampled residential areas located adjacent and west-northwest of the OU1 facility in Feb. 1994. In late 1994 and early 1995, EPA's Technical Assistance Team (TAT) conducted additional site assessment sampling for arsenic and other metals in a primary target area defined by air dispersion modeling and data from the TNRCC assessment. EPA subsequently conducted an Expanded Site Investigation, a Human Health Risk Assessment, Ecological Risk Assessment, and Feasbility Study. The results of these investigations are also filed in the administrative record. Through the remedial investigation process, EPA determined that the liquid wastes in the Acid Pond (Pond 6), spent catalyst, sludge in the above ground storage tanks, and Naturally Occurring Radioactive Material (NORM) slag waste piles are principal threat wastes, because the chemicals of concern contained in these sources are highly toxic (acid pond liquids and sludges, spent catalyst, radioactive emissions from NORM slag), or highly mobile (sludge in ASTs) and cannot be reliably contained. On the other hand, the water in the wastewater ponds, Wah Chang Ditch sediments, surface and subsurface soils and non-NORM slag waste piles are low level threat wastes because they are not highly mobile and they present a low carcinogenic risk or non-carcinogenic hazard in the event of an exposure. Based

Figure 3.2.11
Site Features

upon the site characterization and risk assessment, EPA determined that principal threat and low level threat wastes present a carcinogenic risk or non-carcinogenic hazard in the event of an exposure. Consequently, EPA established remedial action goals to protect human healh and the environment. These goals were developed by considering:

- Applicable or relevant and appropriate Federal and state requirements;
- Acceptable exposure levels to which humans may be exposed without hazard;
- Acceptable exposure levels representing a less than a 1 chance in 10,000 excess lifetime cancer risk.

3.2.15 Enforcement Activities At the Site. As noted above, the Tex Tin Corporation plant washistorically the subject of numerous enforcement actions. EPA took its first enforcement action pursuant to CERCLA in 1988, when it issued a unilateral order to Tex Tin Corporation to fence the facility. Corporations identified from Tex Tin business records received general notice letters and information requests in 1988-89; special noticefor RI/FS was issued in November 1989. In 1990, Tex Tin Corporation and Amoco Chemical Company entered into an Administrative Order on Consent (AOC) with EPA to conduct the RI/FS on their properties. Tex Tin Corporation ceased performance in 1991, leaving Amoco Chemical Company to complete the work. The AOC was terminated in 1993, when the sitewas removed from the NPL by order of the U.S. Court of Appeals for the D.C. Circuit.

3.2.16 In 1996, Tex Tin Corporation and Amoco Chemical Company filed separate lawsuits under CERCLA 113 in the U.S. District Court for the Southern District of Texas, Galveston Division, against the United States Dept. of the Treasury and the General Services Administration, and a number of corporate PRPs, for response costs incurred in conducting the Tex Tin RI. EPA filed counterclaims against Tex Tinand Amoco for past and future CERCLA response costs. In 1997, Tex Tin Corporation and Associated Metals and Minerals filed for bankruptcy protection in White Plains, New York. The District Court in Galveston placed the CERCLA 113 action on administrative closure, which was subsequently lifted effective Aug. 31, 1998. The district court action is proceeding as to all parties except Tex Tin and Associated Metals pursuant to a scheduling order issued on Sept. 18, 1998.

3.3 Community Participation. Prior to sampling in areas adjacent to the Site in 1994and 1995, EPA and TWC held a public meeting to discuss the sampling effort with the community. Individual homeowners whose properties were sampled in 1994-5 received individual written notification of results of samples taken on their property. Beginning in 1996, EPA has periodically briefed Texas City officials and responded to congressional inquiries concerning this Site. In September 1998, immediately prior to releasing the proposed plan, EPA discussed site developments which included land reuse and the availability of a new Technical Assistance Grant (TAG), with local officials. The Proposed Plan of Action was released for public comment on September 9, 1998; the Administrative Record file was made available for public review concurrently at each of the three repositories listed below. On October 6, 1998, EPA held a public meeting to provide a site update and receive comments from the public. In response to a request, the original thirty day comment period was extended for an additional thirty days, ending on November 9, 1998. EPA received numerous comments; the written and oral comments and EPA's responses are summarizedin the "Responsiveness Summary" section of this ROD. After reviewing all comments EPA determined that no significant changes to the Proposed Plan were necessary.

Box 3.3 Site Repositories

Moore Memorial Public Library 1701 Ninth Avenue North Texas City, Texas 77590 (409) 643-5979	U.S. Environmental Protection Agency 12th Floor Library 1445 Ross Avenue Dallas, Texas 75202-2733 (214) 665-6427	Texas Natural Resource Conservation Commission Technical Park Center, Building D 12118 North I-H 35 Austin, Texas 78711-3087 (512) 239-2920

3.4 Scope and Role of the Operable Unit. Due to the fact that many Superfund sites are complex with multiple components, they are sometimes divided into operable units (OU) to facilitate managing a site wide response. Operable units are specific response actions that comprise incremental steps toward comprehensively addressing site problems. As noted above, the Tex-Tin Superfund Site consists of four operable units. This Record of Decision for OU1 addresses contaminant sources at the Tex Tin smelter property to abate any release or threat of release of hazardous substances at or from the plant site. The other operable units for this site are:

- Operable Unit 2, the 30-acre Amoco property east of the smelter property. Amoco completed a response action at Operable Unit 2 in 1998 pursuant to the Texas Voluntary Cleanup Program.

- Operable Unit 3, the off-site residential property. An Action Memorandum for soil removal in this operable unit was signed in Sept. 1998. A time-critical removal action was initiated by EPA in March of 1999.

- Operable Unit 4, Swan Lake Salt Marsh. Field investigations of the Swan Lake Salt Marsh are complete and preparation of the report is underway. No response action has been selected for OU4.

3.4.1 Operable Unit 1 Management Strategy. The approach to remediation of OU1 is to provide for beneficial reuse while protecting human health and the environment, by reducing the carcinogenic risks and non-carcinogenic hazards from OU1 contaminant sources to acceptable levels. The objective will be accomplished by a CERCLA cleanup that treats principal threat wastes and contains low level threat wastes so that release mechanisms or exposure pathways which allow exposure of human or ecological receptors to hazardous substances, which pose carcinogenic risks and/or non-carcinogenic hazards, are eliminated.

3.4.1.1 Principal Threat Wastes. EPA has identified several contaminant sources at the site to be principal threat wastes. These include the acid pond liquids and sediments with low pH levels; NORM slag; slag or soil that leaches contamination; above ground storage tank sludge, and drums containing spent catalyst and other materials.

3.4.1.2 Low Level Threat Wastes. There are several low-level threat materials present at OU No.1 of the Site. These include groundwater that exceeds drinking water maximum contaminant levels (MCLs); surface water that exceeds drinking water maximum contaminant levels (MCLs) but which can be discharged under NPDES criteria; as well as soils and slag which do not leach contaminants into the environment but pose an unacceptable carcinogenic risk or non-carcinogenic hazard to human health or the environment.

Box 3.4.1 Principal Threat and Low Level Threat Wastes*

Principal threat wastes are those hazardous wastes, systemic toxins and carcinogenic source materials (Source materials act as the reservoir source from which contamination migrates to the groundwater, surface water, air or is a source for direct exposure.) containing chemicals of concern materials considered to be highly toxic or highly mobile that generally cannot be reliably controlled and present a significant risk to human health and the environment should exposure occur. Low level threats are those contaminated waste sources that can be reliably contained with little likelihood of migration and present a low risk in the event of exposure.

*Reference "A Guide to Principal Threat and Low Level Threat Wastes," Superfund Publication 9380.03-06FS, November 1991.

3.4.2 Scope of the Problems Addressed By This Operable Unit. EPA establishes specific remedial action objectives and non-carcinogenic hazards cleanup levels appropriate for the site given anticipated future land use. Assuming future industrial use of OU1, EPA concluded that there are unacceptable carcinogenic risks and non-carcinogenic hazards to future construction or industrial workers from exposures to hazardous substances, including systemic toxins and carcinogens, found in the soil and groundwater.

3.4.3 Authority Under Which This Action Will Be Taken. This remedial action will be taken in accordance with the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA), 42 U.S.C. § 9601, as amended, and, to the extent practicable, the National Oil and Hazardous Substance Pollution Contingency Plan (NCP), 40 C.F.R. Part 300.

3.5 Site Characteristics and Site Conceptual Model. EPA must characterize the site to develop a site conceptual model for use in the baseline risk asessment, and ultimately, in remedy selection. This model, described in Section 3.5.27, "Site Conceptual Model," illustrates the contaminant sources, release mechanisms, exposure pathways, migration routes, and potential human and ecological receptors.

3.5.1 Surrounding Geography. The operable unit site is approximately 140 acres and is located in Texas City, Texas. Texas City lies within the Texas coastal prairies, a region characterized by more than 36 inches of rain each year[4] and heavy clay soils covered with a heavy growth of grass.[5] The site is located approximately 10 miles north of Galveston, in the southeast quadrant of the intersection of State Highways 146 and 519. The city of La Marque is located to the northwest of the site. Major surface water bodies located near the site include Galveston Bay, Jones Bay, and West Bay. Land use north and east of the site is dominated by large petrochemical facilities, with the eastern boundary being shared with the Amoco Chemical Corporation facility. A La Marque residential neighborhood is located 1000 to 1500 feet northwest of the facility. More than 10,000 people reside within 1 mile of the site. A municipal golf course, an industrial waste disposal facility, and marsh areas are located less than 0.5 mile to the south and southwest of the site.

3.5.2 Physical Features. Although the natural topography is flat, ore processing activity left ore and slag piles scattered across the site. Various ponds were also constructed on site for ferric chloride production and industrial wastewater treatment. Six of these ponds remain on site. Another major site feature is the Wah Chang drainage ditch which collected site drainage and received discharge from the wastewater treatment ponds. Numerous structures remain on site, but there have not been any archeological or historical areas discovered at the site. Most of the remaining structures are associated with the smelting process or the Morchem Resources still bottoms and waste oil recovery plant. The most significant structures in those areas are the smelter, ore storage, roasting and leaching, maintenance, warehouse, engineering, laboratory, office, garage and generator buildings and above ground storage tanks. Some of these structures have deteriorated, are in disrepair, and could collapse during high winds.

3.5.3 Site Drainage. Previously, a portion of site runoff, primarily from the Process Area and slag piles, was routed through ditches into the site wastewater treatment facility. When the wastewater treatment facility was in use, all on-site ditches were directed into Wastewater Treatment Pond 1. The wastewater pH was adjusted and then discharged through a permitted NPDES outfall into the Wah Chang Ditch. At the far southern boundary, runoff flows into the shallow depression area identified as Pond 23. This depression receives surface runoff from several areas including a shallow ditch outside and parallel to the western fence line. Water flowing along the site's southern boundary flows either into the Wah Chang Ditch or into Pond 23. Runoff from the western portion of the Process Area including the Morchem Facility (Area L) and from the northern slag and raw material piles flows westward into the ditch that parallels Highway 146. This flow travels through a culvert beneath the highway and ultimately into a borrow pit known as Pond 22 west of the site.

3.5.4 Site Partitioning. Since the site has various unique surface physical and geographic features its surface was partitioned into Areas A through P while the aquifer was partitioned into Shallow, Medium and Deep Transmissive Zones. These partitions facilitated site investigations and remedial decisions allowing EPA to determine the specific carcinogenic risks and non-carcinogenic hazards within each area. Those areas are shown on Figure 3.2.11, "Site Features" and described in the sections below.

3.5.5 Area A encompasses approximately 10.2 acres of open land located outside of the Tex-Tin site perimeter fence line. Construction debris brought on site as fill material and two tin slag piles are located in this area

3.5.6 Area B encompasses approximately 12.4 acres and contains copper silicon, tin, and copper slag and sludge piles, plus 80 fifty-five gallon drums believed to contain spent catalyst material. The slag was generated from the tin and copper smelting processes.

3.5.7 Area C contains four closed Acid Ponds (Ponds 18 through 21) that were used to store ferric chloride solution generated during the tin smelting process. Process-generated slag and sludge were used as backfill to close the ponds. In addition to the ponds, piles of slag scrubber sludge, and river muds are present in Area C. The river muds were brought to the Tex-Tin site to fill the ponds in addition to construction debris obtained from local contractors in the 1980's.

3.5.8 Area D consists of 11.4 acres and consists of three separated areas on site. One area is located to the north of Pond 1 and includes backfilled Ponds 7 and 8 which occupy 3.5 and 0.5 acres, respectively. The second area is located to the south of Pond 1 and occupies approximately 3 acres. The third area is locate to the south of Pond 6 and includes backfilled Pond 17, which occupies an area of 4.4 acres. Pond 7 was used to store calcium sulfate scrubber sludge generated from 1980 through 1984. It is uncertain how Pond 8 was utilized. Pond 17 was probably a ferrous chloride storage pond, similar to Ponds 18 through 21. Tex Tin Corporation used construction debris from local contractors to backfill these ponds.[6]

3.5.9 Area E is centrally located on the site, encompassing approximately 7 acres bordering the west side of the Wah Chang ditch. Area E includes filled Ponds 15 and 16 and approximately 4,200 drums believed to contain spent catalyst.Ponds 15 and 16 were used to store acidic liquid waste materials and were backfilled with slag and other site-related wastes.

3.5.10 Area F. The Wah Chang Ditch, which is the primary drainage feature on site, runs through Area F, a 12-acre parcel of land located in the north central area of the site. Historical photographs indicate that Area F was used as a slag holding area.

3.5.11 Area G. The Wah Chang Ditch also runs through Area G, towards the south-southeast. Approximately 9 acres in size, Area G also contains major drainage pathways that feed into the Wah Chang Ditch which discharges into borrow pits known as Pond 24 and Pond 25. The North Central Ditch leads from the Process Area north of Pond 7 to the Wah Chang Ditch. Another ditch located in Area G drains Areas B and C, flows northward along the railroad tracks to south of the ore storage building in Area J, andenters the wastewater treatment facility located in Area K. A third ditch leads from west of the site to Pond 22 and drains into a borrow pit next to the hurricane levee.

3.5.12 Area H occupies approximately 29 acres and includes backfilled Ponds 9 through 14. These ponds were used to store waste acid solutions generated during tin smelting operations. These ponds were closed in 1988, and a dike was constructed around the area to prevent site area runoff. The area is currently owned and maintained by the Amoco Chemical Company. EPA has designated Parcel H as Operable Unit No. 2 of the Tex-Tin site. Amoco remediated contamination in this area under the Texas Voluntary Cleanup Program.

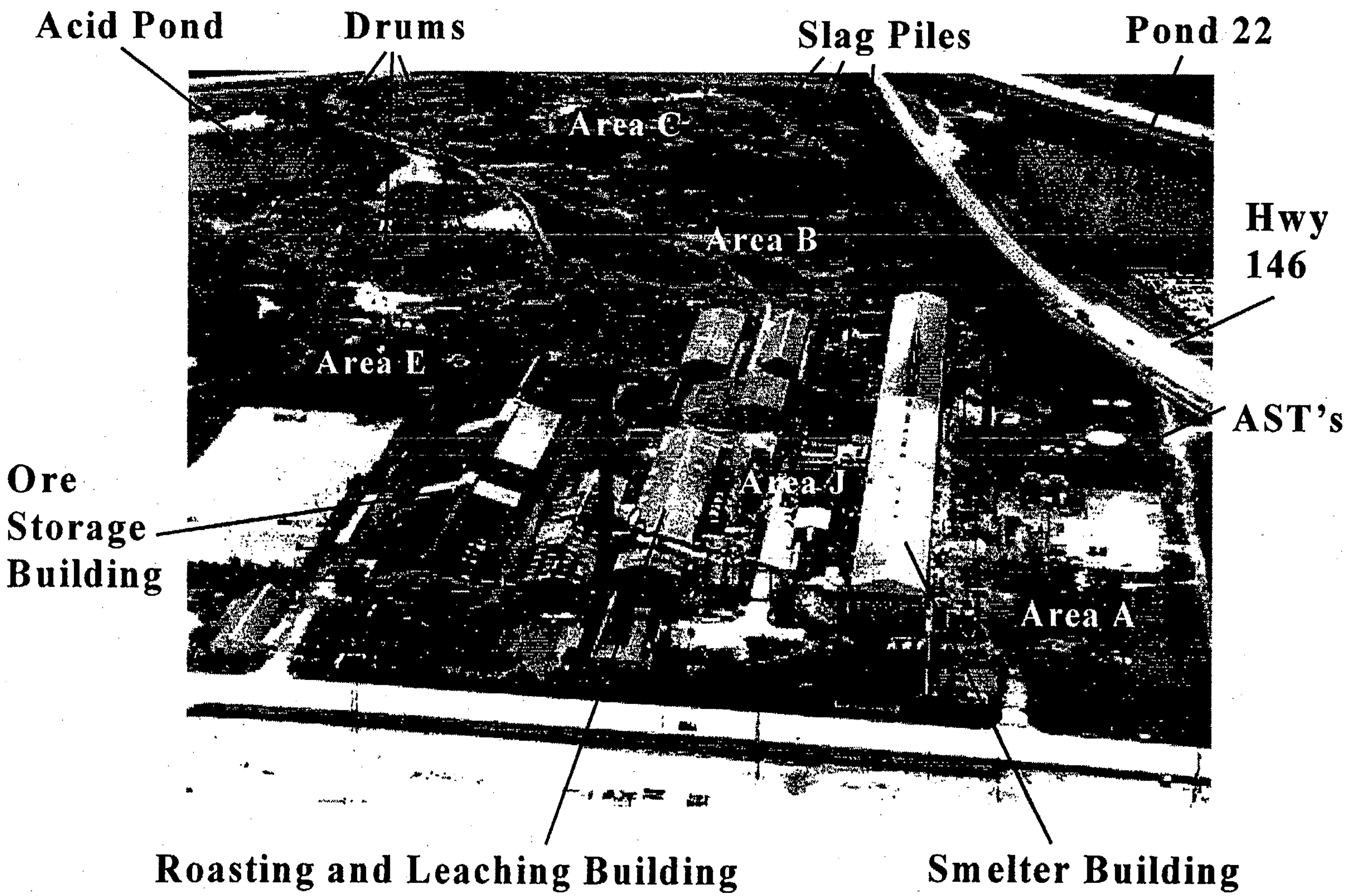
3.5.13 Area I. This area includesthe off site Ponds 22 through 25. These ponds will be investigated during the OU4 remedial investigation.

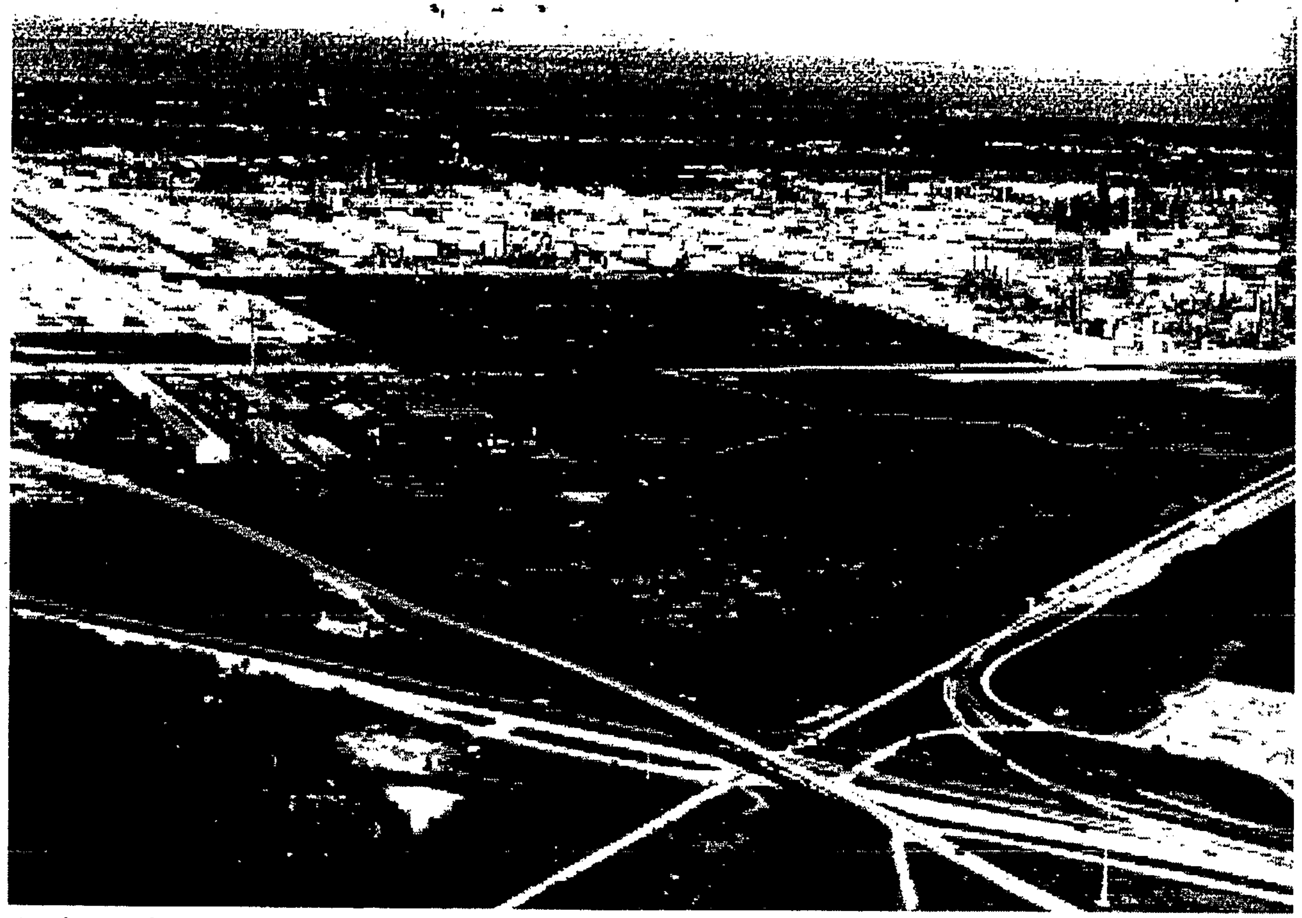
3.5.14 Area J is the Process Area where the smelting operations were conducted. Occupying 25 acres, the former Process Area contains 18 processing and storage facilities that were used for production. The major production units located in Area J include the following structures:

- Smelter Building with associated Kaldo Buildings and ancillary structures
- Ore Storage Building
- Roasting and Leaching (R&L) Building
- Maintenance Building
- Warehouse Nos. 1 through 3
- Engineering Building
- Laboratory and Office Building
- Change Room and Garage
- Generator House

The majority of the buildings in the Process Area are steel-framed, open warehouses with asbestos cement (transite) siding and roofing; however, the engineering and laboratory buildings are wood-framed with brick exteriors and shingle or tile roofs. Some buildings within the Process Area have significant structural

Significant Site Features





A view of the Tex Tin Site (center) toward the northeast. This view shows the heavy industrial land use near the facility.

deterioration resulting from the corrosive and heat-intensive nature of the processes conducted in these buildings. Since these structures are contaminated, the collapse or destruction of a building during high winds could release contaminants into the environment.* A structural survey[7] indicated building structures are corroding and some buildings would require repairs to make them useable.

3.5.15 Area K. Ponds 1 through 6 are located in Area K and were used as settling basins for the wastewater treatment facility, which currently treats stormwater runoff. Ponds 1 through 5 are currently used as storm water detention ponds and encompass approximately 22 acres. Pond 6, the Acid Pond covers 4 acres and currently holds approximately 8.5-million gallons of acidic ferric chloride solution.

3.5.16 Area L. The Morchem Facility is located in Area L, which is a drum and tank storage area. Sixteen above ground storage tanks (ASTs) with volumes ranging from approximately 1,500 to 500,000 gallons are located in this area. The majority of these tanks are empty, but a few contain sludge believed to be associated with the still bottoms and the waste oil recovery process carried out by Morchem. Additionally, approximately 219 drums containing process wastes are present in this area. The central and southern portions of this area have a concrete pad and berm to reduce runoff from the area. Several pipeline metering stations not belonging to the Tex-Tin Corporation are also located in this area.

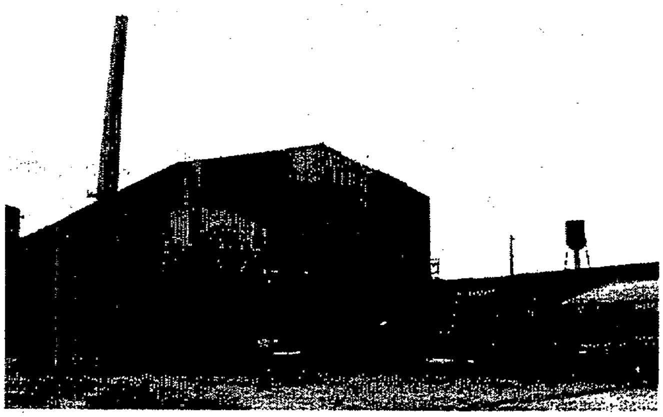
3.5.17 Area M. Located in the northwest portion of the site, Area M covers approximately 2 acres and houses a fuel storage tank and generator house, as well as three fuel oil tanks.

3.5.18 Area N. Catalyst tanks are located in Area N. Five 11,000 gallon ASTs formerly used in the Process Area to store fuel oils were moved to this location in the 1970s. The tanks currently contain catalyst. An earthen berm surrounds the tanks.

3.5.19 Area O comprises off site residential properties which are being addressed in Operable Unit 3.

3.5.20 Area P. The Radioactive Landfill (Texas License No. RW 1270), located in the southwest corner *of the site and designated as Area P, is just larger than* half an acre. Low-level radioactive material that was not smelted for its antimony content was buried here beginning in July 1975. The landfill was closed in 1978 and a clay cover was placed over the landfill. Heavy vegetative growth covers the surface to provide erosion control. Thermoluminescent dosimeter monitoring by the state near the landfill showed results that were below the limits of Texas Regulations for Control of Radiation. The landfill does not appear to pose a potential or actual threat to public health if public access remains prohibited.

3.5.21 Groundwater Characterization. The site is atop the Upper Chicot Aquifer which extends from the surface downward approximately 250 feet. Within the upper 150 feet of the aquifer crossection there are three confining zones and three transmissive zones (Figure 3.5.21, "Representative Geological Crossection"). These transmissive zones are of most interest since they could be considered potential groundwater sources. The three zones are the "Shallow Transmissive Zone" (Zone 2), "Medium Transmissive Zone" (Zone 4) and "Deep Transmissive Zone" (Zone 6). The "Shallow" and "Medium Transmissive Zones" are classified by the Texas Groundwater Classification System as a moderately saline groundwater with a potential use for drinking water if fresh or slightly saline water is unavailable. The "Deep Transmissive Zone" is classified as slightly saline and useable for drinking water if fresh water is unavailable. The confining zone above each transmissive zone consist of clays and silty sandy clays, while the transmissive zones consist of silty and clayey sands.



Roasting and Leaching Building.

* The upper Texas Gulf Coast is prone to exceptionally destructive winds. Since 1900, eight major hurricanes have hit the coast between Port O'Connor and Port Arthur.

3.5.22 Site Groundwater Hydrology[8] During the RI, three saturated sand units (termed the Shallow, Medium, and Deep Transmissive Zones) were described as the water-bearing zones beneath the site. The Shallow Transmissive Zone is about 5 to 30 feet below grade; the Medium Transmissive Zone is variable and occurs between 45 and 55 feet below grade; the Deep Transmissive Zone is about 100 to 140 feet below grade. All three transmissive zones are part of the upper Chicot Aquifer.

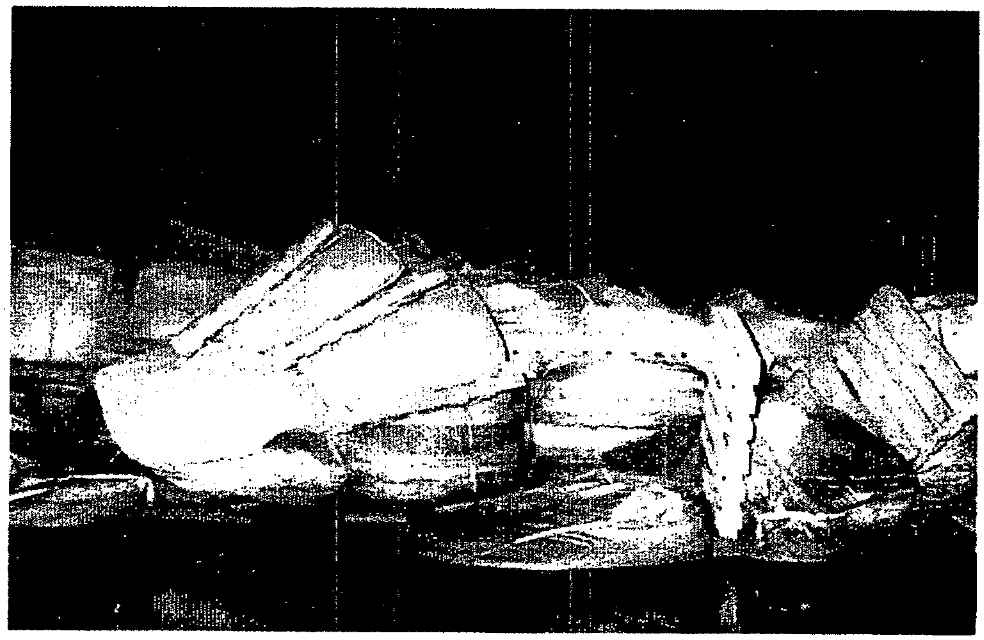
3.5.23 Shallow and Medium Transmissive Zones. According to information obtained from the Woodward-Clyde Phase II RI, the Shallow and Medium Transmissive Zones do not appear to have been used for any economic purposes in the past, and there is no record of down gradient water wells producing water from any of the three transmissive zones. However, according to the RI, some of the wells completed in the Shallow and Medium Transmissive Zones have Total Dissolved Solid (TDS) values less than 3,000 mg/l. The average of eight wells in the Shallow and Medium Transmissive Zone have TDS values of 3,950 mg/L and 4,350 mg/L, respectively. In addition, pumping tests in these transmissive zones revealed potential yields geater than 150 gallons/day. These results indicate that on-site groundwater from the Shallow and Medium Transmissive Zones could potentially be used as a drinking water source. These zones are classified by the Texas Groundwater Classification System as a moderately saline groundwater with a potential use for drinking water if fresh or slightly saline water is unavailable. With regard to the Deep Zone, based on information obtained during the RI, it has a relatively low TDS value (1,193 mg/L average) and exhibits the ability to maintain sufficient yield. There are several domestic wells within a 1-mile radius of the site that are screened in the Deep Transmissive Zone. This zone is not a source of drinking water for the Texas City/La Marque area, but has the potential to be used for economic purposes, including drinking water. Vertical flow measured between the Shallow Transmissive Zone," and the "Medium Transmissive Zone," as well as between the "Medium Transmissive Zone" and the "Deep Transmissive Zone" indicated the zones are hydraulically interconnected. The "Shallow Transmissive Zone," Wah Chang Ditch and Ponds 4, 5, 6, 24 and 25 also appear to be hydraulically interconnected. Such a connection could be a migration pathway for contamination of the "Shallow Transmissive Zone." [9, 10]

3.5.24 Groundwater Flow. In this region the Upper Chicot aquifer is characterized by horizontal flow towards the south and southeast. Locally, horizontal flow in the "Shallow Transmissive Zone" is to the east and in the "Medium" and "Deep Transmissive Zones" is to the south. Groundwater monitoring activities during the RI indicated that the flow direction in the Shallow Transmissive Zone was influenced greatly by surface activities. For example, Ponds 1 through 5, the former wastewater treatment ponds, lie at a higher elevation than the surrounding area. When the wastewater treatment system was in use, a steep radial gradient from the ponds outward into the Wah Chang Ditch was seen through measured groundwater elevations. In the southern section of the site, another steep gradient was seen from northwest to southeast where pumping of the borrow pits had lowered the shallow water table. Consequently, shallow groundwater may migrate from the site to the borrow ditches. The shallow groundwater is characterized by low pH and elevated dissolved metal concentrations. The groundwater flow direction in the Medium and Deep Transmissive Zones is consistently towards the southeast. The gradient is generally flat and appears to steepen toward the south, but is variable across the site depending on location.

3.5.25 Sampling Strategy. Considering overall site conditions, during the remedial investigations EPA developed a strategy to collect air, soil, surface water, groundwater and contaminant source samples to determine the carcinogenic risks and non-carcinogenic hazards the contaminant sources might pose to human health or the environment. Two phases of field investigations were conducted to prepare the 1993 Remedial Investigation at the Site. Phase I of the investigation was conducted by ERM Southwest between November 1990 and April 1991, and Phase II was conducted by Woodward-Clyde Consultants between February and August of 1992. EPA performed additional site sampling in 1994-95, particularly in the residential area now designated OU3.

Figure 3.5.21
Representative Geological Crossection

3.5.26 Types of Contamination and the Affected Media. The remedial investigation sampling strategy confirmed that industrial operations contaminated the site with heavy metals, acids, radioactive isotopes and organic compounds. Some of these contaminants pose unacceptable carcinogenic risks and non-carcinogenic hazards at the concentration levels found on site. The specific health effects posed by these contaminants are listed on Table 3.5.2.26 - 1, "Health Effects and Concerns." Based upon the sampling, EPA estimated the volume of contaminated sources and media to be those quantities shown on Table 3.5.26 - 2, "Estimated Volumes of Primary, Secondary and Tertiary Contaminant Sources *Requiring Remediation.*" *Lastly* EPA used the sampling results to determine if the contaminant sources included any RCRA (Resource Conservation and Recovery Act) listed or characteristic hazardous wastes with chemical specific cleanup requirements. Sampling indicated that there is a high enough lead concentration in the sludge in the tank bottoms located in Area L to classify this sludge as a K0052 Hazardous Waste. There are also wastes exhibiting the RCRA characteristic of corrosivity and toxicity as shown on Table 3.5.26 - 3, "Characteristic Hazardous Wastes." Some tank bottom sludges also exhibited these hazardous waste characteristics.



Supersacks stored inside the ore storage building.

Table 3.5.26 - 1 Health Effects and Concerns	
Contaminants of Concern	**Health Effects and Concerns**
1,2 - Dichloroethane	Breathing very high levels of 1,2 - Dichloroethane vapor is deadly; the long term human health effects after exposure to low concentrations of 1,2 - Dichloroethane are not known.[11]
Antimony	Breathing air contaminated with antimony can cause heart and lung problems, lead to stomach pain, diarrhea, vomiting and stomach ulcers. It is not known if antimony is a carcinogen.[12]
Arsenic	Inorganic arsenic has been recognized as a human poison since ancient times, and large doses can produce death. Inhalation exposure to arsenic increases the risk of lung cancer.[13]
Asbestos	Workers who breath in asbestos may slowly develop scar-like tissue in their lungs and in the membrane surrounding their lungs. This tissue makes breathing difficult. This disease is called asbestosis.[14]
Barium	Eating or drinking very large amounts of readily soluble barium compounds such as barium acetate, barium carbonate, barium chloride, barium hydroxide, barium nitrate, and barium sulfide may cause paralysis or death in a few individuals. There is no reliable information to tell if barium causes cancer. [15]
Benzene	The U.S. Department of Health and Human Services has determined that benzene is carcinogenic. Leukemia (cancer of the tissues that form the white blood cells) and subsequent death from cancer have occurred in some workers exposed to benzene for periods of less than 5 and up to 30 years.[16]
Beryllium	Beryllium can damage the lungs when breathed. Breathing large amounts of soluble beryllium compounds can cause a disease resembling pneumonia. Some people are allergic to beryllium and develop chronic inflammatory reactions to doses of beryllium which would not cause an effect on most other people. Both the pneumonia like disease and the chronic inflammatory reactions can be fatal. Some studies have shown beryllium to be a probable human carcinogen. [17]
Cadmium	Breathing air with high levels of cadmium severely damages the lungs and can cause death. Breathing lower levels of cadmium for years leads to a build-up of cadmium in the kidneys that can cause kidney disease. Workers who inhale cadmium for a long time may have an increased chance of contracting lung cancer.[18]
Chloroform	Chloroform affects the central nervous system, brain, liver, kidneys after a person breathes air or drinks liquids that contain large amounts of chloroform. Studies of persons who drank chlorinated water showed a possible link between the chloroform in chlorinated water and the occurrence of colon and urinary bladder cancer. Consequently chloroform is a possible human carcinogen.[19]
Chromium	The U.S. Department of Health and Human Services has determined that chromium and certain chromium compounds are known carcinogens. Long-term exposure of workers to airborne levels of chromium higher than those in the natural environment has been associated with lung cancer. Lung cancer may occur long after exposure to chromium has ended.[20]
Copper	Very large single or daily intakes of copper can be harmful. Long term exposure to copper dust can irritate the nose, mouth and eyes, and cause headaches, dizziness, nausea, and diarrhea. Drinking water that contains higher than normal levels of copper may cause vomiting, diarrhea, stomach camps and nausea. Intentionally high intakes of copper can cause liver and kidney damage and even death. Copper is not known to cause cancer.[21]
Lead	Exposure to high levels of lead can cause the brain and kidneys of adults and children to be badly damaged.[22]
Mercury	Long-term exposure to either organic or inorganic mercury can permanently damage the brain and kidneys. Short-term exposure to high levels of inorganic and organic mercury will have similar health effects; but full recovery is more likely after short-term exposures, once the body clears itself of the contamination.[23]
Radium 226 & 228	There is no clear evidence that long-term exposure to radium at the levels normally present in the environment is likely to result in harmful health effects. However, exposure to higher levels of radium over a long period of time may result in harmful effects including anemia, cataracts, cancer and possibly death.[24]
Selenium	Selenium is an essential nutrient, however when taken in amounts five to ten times the recommended dietary allowance, selenium can be harmful. In extreme cases, people may lose feeling and control in arms and legs. However these effects have been seen only in cases where people were exposed to doses from about 1 to 25 µg/kg/day for several months or years Studies show that most selenium compounds do not cause cancer. [25]
Thorium 228, 230 & 232	Studies on thorium workers have shown that breathing thorium dust may cause an increased chance of developing lung disease and cancer or pancreatic cancer after many years of exposure.[26]
Uranium	Uranium is a radioactive chemical which may cause kidney damage or a bone cancer. However, cancer from an exposure to naturally occurring Uranium 238 is unlikely. Most cancer is caused by an exposure to enriched uranium.[27]

Table 3.5.26 - 2 Estimated Volumes of Primary, Secondary and Tertiary Contaminant Sources Requiring Remediation		
	Quantity	Units
Acid Pond Surface Water	8,500,000	gallons
Acid Pond Sludge and Berms and Wah Chang Ditch Sediments	63,000	cubic yards
Wastewater Pond (Ponds 1 - 5) Sediments	164,320	cubic yards
Spent Catalyst (Drum and Supersack Contents)	1,600	cubic yards
Aboveground Storage Tanks	289,850	gallons
Surface and Subsurface Soils	549,800	cubic yards
NORM Slag Piles	14,100	cubic yards
Non-NORM Slag Piles	52,000	cubic yards

Table 3.5.26 - 3 Characteristic Hazardous Wastes	
Waste	**Hazardous Waste Classification Characteristic[28]**
Acid Pond Liquid	Corrosive - pH < 2
Spent Catalyst (Drums . Sacks and Buckets)	Toxicity - Contents exceeded established regulatory levels for arsenic, lead and cadmium leachability.
Above Ground Storage Tanks Waste Stream	WS1 Corrosive - pH < 2 Toxicity - Waste stream exceeded established regulatory levels for cadmium and lead leachability. WS2 Corrosive - pH < 2 Toxicity - Waste stream exceeded established regulatory levels for cadmium, chromium and lead leachability. WS3 Corrosive - pH < 2 Toxicity - Waste stream exceeded established regulatory levels for cadmium, chromium, lead and selenium leachability. WS5 Toxicity - Waste stream exceeded established regulatory levels for chromium leachability. WS6 Corrosive - pH < 2 WS8 Toxicity - Waste stream exceeded established regulatory levels for cadmium leachability.
Non-NORM Slag Piles Numbers 1, 11,19, 27, 28, 29, 52, 56, 57, 58, 62[29]	Toxicity Characteristic - Except for pile 62 contents exceeded established regulatory levels for lead leachability. Pile 62 exceeded established regulatory levels for mercury leachability.

3.5.27 Site Conceptual Model. The site conceptual model is based upon the aforementioned site characteristics and illustrates how the contaminants are released from their primary, secondary or tertiary sources, move down a pathway and potentially expose human and ecological receptors. The model considers current and potential site resources and uses and is supported by the cross sections, maps, site diagrams and tables found in Section 3.5, "Site Characteristics and Site Conceptual Model." Two site conceptual model illustrations [Figures 3.5.27- 1, "Conceptual Site Model Soil Waste Piles and Drums" and 3.5.27 - 2 "Conceptual Site Model Sediment and Surface Water"] were drawn to explain the relationship between the source, release mechanism, pathway, exposure route and receptors.

3.5.28 Release Mechanism. The models show how a release mechanism from the primary, secondary or tertiary contaminant source can contaminate the pathway and exposure route to a receptor. The site's state of disrepair, severe weather, high rainfall, characteristic hazardous waste, and shallow groundwater provide mechanisms to release contaminants into the environment. The future land use as an industrial facility provides a receptor to complete the exposure route, thus creating a possible carcinogenic risk or non-carcinogenic hazard.

3.5.29 Contaminant Sources. Since a variety of contaminant sources remain on site, the receptor's carcinogenic risk and non-carcinogenic hazard was assessed through direct pathways and exposure routes from the contaminant sources described in Box 3.5.29, "Contaminant Sources."

Box 3.5.29 Contaminant Sources

Drums (spent catalyst) in Areas B, E, J, and L contain primary contaminant sources. Exposed drum materials (spent catalyst) create pathways via leaks and spills to industrial and construction workers through exposure routes such as accidental ingestion or dermal contact during work activities. As is shown in subsequent sections the spent catalyst found in many of the drums appear to be highly toxic and the drums are severely deteriorated; consequently EPA considers the spent catalyst to be a principal threat waste since the contents are source materials of highly toxic materials which are not currently reliably contained.

Aboveground storage tank sludge in Area L is a primary contaminant source. Leaking or spilled sludge creates a pathway to industrial and construction workers through exposure routes such as accidental ingestion or dermal contact during work activities. As is shown in subsequent sections the sludge has a low pH and is therefore considered highly toxic and a principal threat waste. Sludge is classified as RCRA K0052 hazardous waste.

Buildings, structures and on-site process units in Area J are primary contaminant sources. These facilities contain spilled contaminants from the smelting process and can be assumed to be covered with contaminated dust. Spilled contaminants and dust from smelting create pathways to industrial and construction workers through exposure routes such as accidental ingestion or dermal contact during work activities. These contaminants are highly mobile and considered a principal threat. The 1993 *Remedial Investigation Report* indicated there was asbestos in some of the the buildings.

Soil in Areas A through F, J, and L through N are secondary as well as tertiary contaminant sources. Exposure to soils create pathways to industrial and construction workers through exposure routes such as accidental ingestion, inhalation of radon gas released from the soil, or dermal contact. In addition workers in these areas may come into contact with surface soil or subsurface soil (which may be brought to the surface via soil excavation activities) through maintenance or construction activities. Unless soils are highly toxic or leach contaminants EPA will consider soil a low level threat. In addition any waste pile that leaches contaminants in excess of the concentrations listed in Table 3.11.3.1, "Soil, Sediment, Slag and Sludge Remedial Action Cleanup Level," is also considered a principal threat since the contaminant is mobile. Waste piles which do not leach contaminants in excess of the leachate concentrations listed in Table 3.11.3.1 are considered a low level threat since they are not considered to be mobile or highly toxic.

Waste piles in Areas A through F, and J, are primary contaminant sources. Exposure to these piles creates a pathway via soil to industrial and construction workers through exposure routes such as accidental ingestion, inhalation of radon gas released from the soil or dermal contact during work activities. EPA considers the NORM slag waste piles to be principal threat wastes since they are generally highly toxic source materials.

Sediments in Areas G and K are secondary as well as tertiary contaminant sources. Exposure to sediments creates a pathway to industrial and construction workers through exposure routes such as accidental ingestion and dermal contact. Workers in these areas may come into contact with sediments through maintenance or construction activities. EPA considers sediments in area G to be low level threats since they are not generally highly toxic nor highly mobile; however EPA considers sediments in area K to be a principal threat because the low pH makes them highly toxic.

Surface water in Areas G & K. Exposure to contaminants in suface water associated with on-site drainage ditches and on-site ponds was evaluated through dermal contact with surface water. The Acid Pond in Area K is a primary contaminant source while Area G becomes a secondary or tertiary source dependent upon the release mechanism shown on Figure 3.5.27 - 2. Workers may be exposed to surface waters during work activities. Accidental ingestion of on-site surface water was not evaluated because on-site surface water bodies (drainage and ponds) are shallow; therefore, EPA assumed that accidental ingestion of surface water would be an unlikely route of exposure. EPA does not consider the surface water in Area G to be a principal threat since it is not a source material.

Groundwater. The Shallow, Medium and Deep Transmissive Zones were each evaluated through ingestion and noningestion exposure routes (i.e., dermal contact while showering, and inhalation of volatiles through showering). These exposure routes were selected because future on-site industrial workers may use on-site groundwater for showering or drinking. EPA does not consider the groundwater to be a principal threat waste since it is not a source material.

Figure 3.5.27 - 1
Conceptual Site Model
Soil Waste Piles and Drums

Figure 3.5.27 - 2
Conceptual Site Model
Sediment and Surface Water

3.6 Current and Potential Site and Resource Uses. This section defines the current and potential site and resource use assumptions EPA used to assess the current and future carcinogenic risks and non-carcinogenic hazards at the site. The site and resource uses are necessary to identify receptors, pathways, exposure routes and receptors through which someone may be exposed to a carcinogenic risk or non-carcinogenic hazard.

3.6.1 Land Uses. Since the industrial operations ceased in 1991, all the land within the boundaries of Operable Unit 1, shown on the map "Operable Unit 1 Surrounding Land Use," is idle and the facilities are in disrepair. Many structures on site are contaminated, so the collapse or destruction of a building during high winds could release the contaminants contained in the buildings into the environment. In addition since the owner is bankrupt there does not appear to be any ongoing facility maintenance to ensure the buildings do not continue to deteriorate. Consequently, EPA considers there can be little if any current use of the facility without significant decontamination, demolition, renovation or construction. Surrounding land is used for residential, industrial or transportation purposes. Land south of the site is within the 100 year flood plain as shown on the "Operable Unit 1, Surrounding Land Uses" map. Most of the land to the north, east, and south is used primarily for chemical manufacturing and petroleum refining. Nonchemical manufacturing companies and residential areas are located west and northwest of the site. The nearest residential location is in La Marque approximately 1,000 to 1,500 feet from the site. Nearby bay and estuary waters are used for commercial and sport fishing, recreation, and transportation.[30] While there is currently no *specific* future use identified for the site, based upon the surrounding land use, conversations with local officials and public comment, EPA assumes industrial activity is the most reasonable anticipated *general* future site use.[31] Therefore, EPA assessed the carcinogenic risk and non-carcinogenic hazards to future construction and industrial workers at the site with the assumption that the buildings will continue to deteriorate and significant construction is required before the facility can be returned to a beneficial industrial use.

3.6.2 Groundwater Uses. Although the site is atop a drinking water aquifer, since there are no current operations at the site there is no curent site groundwater use. The groundwater immediately beneath the site is classified by the Texas Groundwater Classification System as a moderately saline groundwater with a potential use for drinking water if fresh or slightly saline water is unavailable. The "Deep Transmissive Zone" is classified as slightly saline and useable for drinking water if fresh water is unavailable. However, the Harris Galveston Coastal Subsidence District (HGCSD) has the regulatory authority to limit groundwater withdrawals at the site to prevent "... subsidence which contributes to or precipitates flooding, inundation, or overflow of any area within the district..."[32] To prevent subsidence the HGCSD, through the "District Plan," has limited groundwater withdrawals in this area to ten percent of an industrial facility's total water use. Consequently, EPA does not believe future groundwater withdrawals from the site are likely.[33] But since there is a potential for limited human or natural resource groundwater use, the risk to future industrial workers using the water for showering was evaluated in the risk assessment.[34]

3.6.3 Drinking Water. The Texas City area is supplied by both groundwater and surface water sources. Two major aquifers underlie the region, the Chicot Aquifer and the Evangeline Aquifer. The Chicot Aquifer is a primary drinking water source in the region while the Evangeline Aquifer, the deeper of the two, is considered unsuitable for use as drinking water in the Texas City area due to its high salinity.

Deteriorated column in Roasting and Leaching building

3.7 Site Carcinogenic Risks and Non-carcinogenic Hazards. In previous sections EPA identified receptors potentially affected by site contaminant sources. This section explains how carcinogenic risks and non-carcinogenic hazards from contaminant sources - for which there are no applicable, relevant or appropriate contaminant specific remediation goals - were assessed in the *Baseline Human Health Risk Assessment* (BHHRA). In addition, this section presents the nature of the most significant carcinogenic risks and non-carcinogenic hazards posed to human health and the environment to demonstrate that the basis for the remedial action selected in this ROD is warranted.[35] This section also provides a brief summary of the ecological risk assessment. Note, because of the uncertainty associated with the lack of chemical-specific absorption factors, carcinogenic risks and non-carcinogenic hazards from dermal contact exposure routes were not considered in EPA's remedy decision. However, as explained in the following sections there are sufficient carcinogenic risks and non-carcinogenic hazards within each area in this operable unit to require remedial action without considering a risk or hazard from dermal exposure. The uncertainties associated with dermal exposures are explained in the BHHRA, Section 6.0., "Uncertainty Analysis."

3.7.1 Summary of Human Health Risk Assessment The baseline risk assessment estimates what carcinogenic risks and non-carcinogenic hazards the primary, secondary and tertiary contaminant sources pose to the receptors identified in the site conceptual models if no environmental response action were taken. From this assessment EPA identified the contaminant sources, and chemicals within these sources, requiring remediation. Since any site reuse will require significant restoration, EPA looks to mitigate risks to future construction or industrial workers in specific site areas (Areas A - G, J - N and W1 - W3). Consequently, EPA has focused this ROD on exposure pathway scenarios which include future uses. Using the data from the investigations, EPA first decided whether or not a chemical carcinogenic or radionuclide carcinogenic risk warranted a remedial action. If a significant carcinogenic risk was not present, EPA then decided if a remedial action was necessary to remediate the non-carcinogenic hazards.

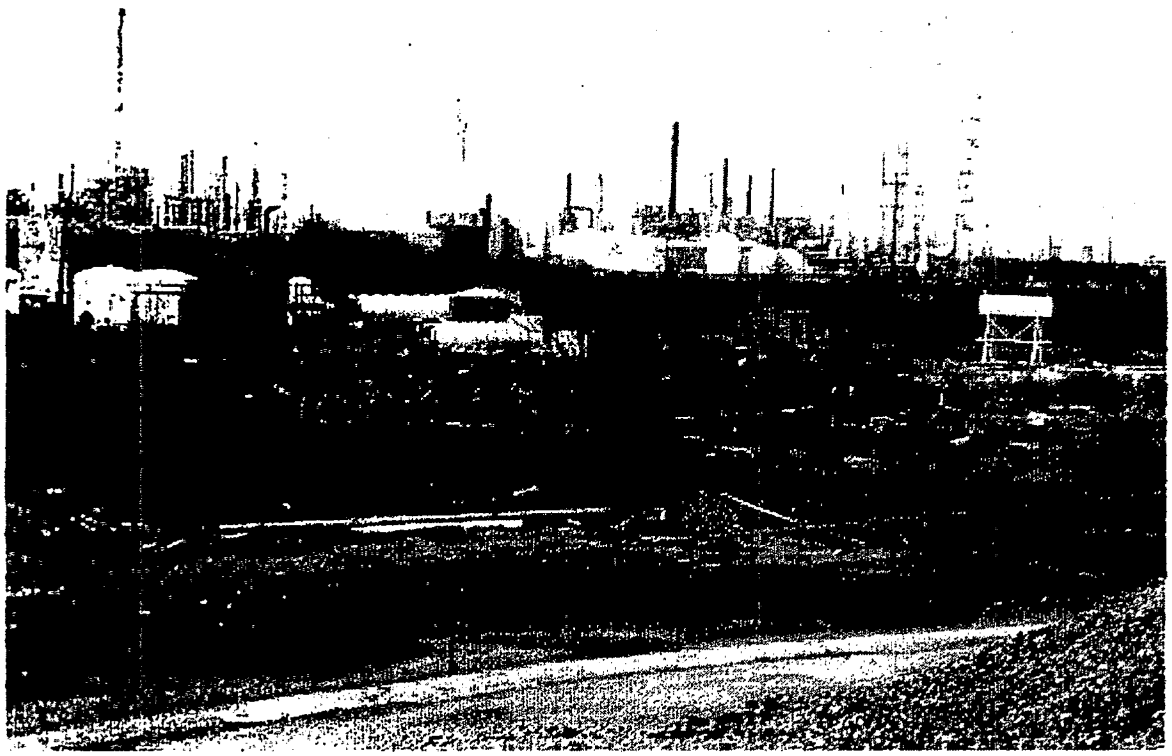
3.7.1.1 Identification of Chemicals of Concern. The chemicals of concern are specific chemicals contained in the contaminant sources on site which pose an unacceptable risk to human health and the environment. The detailed criteria used to select a chemical of concern is described in the *Baseline Human Health Risk Assessment, Tex-Tin Corporation, Texas City, Texas,* March 1997, which is consistent with EPA's guidance described by the *Risk Assessment Guidance for Superfund (RAGS) Volume 1: Human Health Evaluation Manual - Part A.* and the *Supplemental Region VI Risk Assessment Guidance.* In summary the fundamental criteria used to select a chemical of concern was detecting the chemical which has a remedial action goal established by a chemical specific Federal or State requirement or which poses an unacceptable carcinogenic risk or non-carcinogenic hazard in more than 95 percent of the samples analyzed. Based upon this criteria, EPA selected the chemicals of concern listed in Table 3.7.1.1, "Site Wide Summary of Chemicals of Concern." This table indicates where chemicals of concern were found and their concentration range. The table also shows the frequency each contaminant of concern was found in the source or media analyzed.

3.7.1.1.1 Exposure Point Concentration.[36] For each receptor and chemical of concern EPA developed Table 3.7.1.1.1 - 1, "Exposure Point Concentrations," which shows the concentration EPA used to determine the receptor's risk from the pathways and scenarios described by the site conceptual model. Sampling data were used to estimate exposure point concentrations which serve to determine the exposure dose. In accordance with EPA guidance, potential risks are typically based (with the exception of groundwater) on 95% upper confidence limit (UCL) concentrations of the mean. However at this site since the 95% UCL was greater than any concentrations found on site, so the maximum detected concentration was used as the exposure point concentration.[37] In the case of groundwater, EPA estimated potential risks for on-site groundwater upon the mean concentration of chemicals of concern in on-site wells with chemical concentrations equaling or exceeding primary drinking water standard maximum contaminant levels.[38] Since the organic compounds concentration present in the groundwater was well below their solubility concentrations, EPA does not believe a dense non-aqueous phase liquid lies beneath the surface. Wells which equaled or exceeded drinking water standards are listed in Table 3.7.1.1.1 - 2, "Monitoring Wells Exceeding Primary Drinking Water Standard Maximum Contaminant Levels," and shown on Figure 3.7.1.1.1, "Locations of Monitoring Wells and Piezometers." For soil-related pathways surface soil data were used to develop exposure point concentrations for the current/future scenarios.

Table 3.7.1.1 Site Wide Summary of Chemicals of Concern [39]					
Source or Media	Contaminant of Concern	Concentration Detected		Units	Detection Frequency
		Min	Max		
Drums (Spent Catalyst)	Arsenic	0.57	440200	ppm	249 / 290
	Copper	1.5	595000	ppm	209 / 217
	Lead	0.59	198800	ppm	288 / 297
	Molybdenum	7.7	161000	ppm	77 / 89
Groundwater[1, 2]	Antimony	0	0.0298	ppm	12 / 94
	Arsenic	0.05	15.9	ppm	16 / 94
	Barium	2	7.25	ppm	26 / 94
	Benzene	0	0.98	ppm	4 / 85
	Beryllium	0	1.18	ppm	27 / 94
	Cadmium	0.02	16.2	ppm	45 / 94
	Chloroform	0.11	0.11	ppm	1 / 85
	Chromium	0.41	15.2	ppm	7 / 94
	Copper	2.19	746	ppm	42 / 94
	Lead	0.05	1480	ppm	39 / 94
	Mercury	0	0.99	ppm	22 / 94
	Radium 226	1.2	6.1	pCi/l	7 / 21
	Radium 228	7	7	pCi/l	2 / 21
	Selenium	0.06	0.3	ppm	31 / 94
	Thorium 228	0.7	13.6	pCi/l	9 / 21
	Thorium 230	1.2	2.6	pCi/l	3 / 21
	Thorium 232	0.6	12.7	pCi/l	10 / 21
	Uranium 234	1.85	29.3	pCi/l	9 / 20
	Uranium 235	1.2	1.3	pCi/l	2 / 20
	Uranium 238	3.2	28.7	pCi/l	9 / 20
	1,2 Dichloroethane	0.06	0.21	ppm	4 / 85
Sediment	Arsenic	1	19256	ppm	153 / 153
Surface / Subsurface Soils / Waste Piles	Arsenic[3]	17.1	4990	ppm	349 / 555
	Copper[3]	34.2	108409	ppm	339 / 555
	Lead[3]	220.4	27362	ppm	281 / 555
	Radium - 226	0.527	177	pCi/g	91/102
	Radium - 228	0.29	92.6	pCi/g	66/66
	Thorium - 228	0.21	212	pCi/g	98/111

1. Minimum groundwater concentration detected represents the lowest concentration exceeding the primary drinking water standard maximum contaminant levels.
2. Groundwater detection frequency indicates the number of wells per the total number of wells sampled had groundwater concentrations exceeding the primary drinking water standard maximum contaminant levels
3. Minimum concentration is the background level established by the Supplemental Remedial Investigation. The detection frequency is the number of times the sample concentration exceeded the background concentration per the total number of samples analyses performed.[40]

These scenarios are based on the assumption thatthe soil is not disturbed, and only surface soil is available for direct contact and for the generation of airborne particulates. Both surface and subsurface soil data (0 to 15 ft.) were used to develop exposure point concentrations for the inhalation of volatiles exposure route because chemicals may be emitted from both surface and subsurface soil, even when the soil is undisturbed. Surface and subsurface soil data (0 to 15 feet) were used to develop exposure point concentrtaions for all exposure routes for the future industrial and construction worker scenarios assuming future work would require soil excavation. Note, 15 feet was the maximum depth evaluated; only Area C had soil samples collected to a depth of 15 feet. Direct and indirect exposure to both surface and subsurface contaminants could potentially occur in a construction worker scenario during excavation, or as a result of soil regrading ina future industrial worker scenario. The exposure assessment was based upon the previously described site characteristics and site conceptual model. The default statistic used to determine the exposure point concentration is the 95 percent upperconfidence limit of the mean, in other words a value for which EPA is 95 percent confident that the mean concentration is equal to or less than the exposure point concentration shown. However, because the number of samples collected was limited, in cases were the 95 percent upper confidence limit exceeded the maximum concentration detected on site, EPA used the maximum concentration as the exposure point concentration.



Drums in Area E.

Figure 3.7.1.1.1
Locations of Monitoring Wells and Piezometers

Table 3.7.1.1 .1 - 1
EXPOSURE POINT CONCENTRATIONS

Exposure Pathway Receptor Scenario	Chemical of Concern	Exposure Point Concentration	Units	Statistical Measure
Area A				
Future Exposure Surface / Subsurface Soil and Waste Piles	Arsenic	245	ppm	Maximum Concentration
	Radium - 226	23.8	pCi/g	
	Radium - 228	92.6	pCi/g	
Area B				
Future Exposure Surface / Subsurface Soil and Waste Piles	Arsenic	170	ppm	Maximum Concentration
	Copper	108000	ppm	
	Radium - 226	93.6	pCi/g	
	Radium - 228	91.8	pCi/g	
	Thorium - 228	212	pCi/g	
Area C				
Future Exposure Surface / Subsurface Soil and Waste Piles	Arsenic	1820	ppm	Maximum Concentration
	Antimony	2850	ppm	
	Radium - 226	21.6	pCi/g	
	Radium - 228	14.0	pCi/g	
	Thorium - 228	18.2	pCi/g	
Area D				
Current/Future Exposure Surface Soil and Waste Piles	Arsenic	238	ppm	Maximum Concentration
	Antimony	315	ppm	
	Manganese	48300	ppm	
	Radium - 226	1.26	pCi/g	
	Radium - 228	1.48	pCi/g	
	Thorium - 228	1.99	pCi/g	
Area E				
Future Exposure Surface / Subsurface Soil and Waste Piles	Arsenic	996	ppm	Maximum Concentration
	Radium - 226	17.6	pCi/g	
	Radium - 228	20.6	pCi/g	
	Thorium - 228	15.9	pCi/g	
Future Exposure Drums (Spent Catalyst)	Copper	595,000	ppm	Maximum Concentration
	Molybdenum	93,800	ppm	
	Nickel	226,000	ppm	
Area F				
Future Exposure Surface / Subsurface Soil and Waste Piles	Arsenic	776	ppm	Maximum Concentration
	Antimony	186	ppm	
	Radium - 226	73.9	pCi/g	
	Radium - 228	63.7	pCi/g	
	Thorium - 228	36.8	pCi/g	
Area G				
Current Exposure Sediment	Arsenic	1500	ppm	Maximum Concentration
Current Exposure to Surface Water	Arsenic	.506	ppm	
Area J				
Current / Future Exposure Drums (Spent Catalyst)	Arsenic	440,200	ppm	Maximum Concentration
	Molybdenum	76391	ppm	
	Copper	496728	ppm	
	Antimony	4950	ppm	
	Nickel	17600	ppm	
Future Exposure Surface / Subsurface Soil and Waste Piles	Arsenic	612	ppm	Maximum Concentration
	Antimony	263	ppm	
	Copper	45,500	ppm	

Table 3.7.1.1 .1 - 1 EXPOSURE POINT CONCENTRATIONS				
Exposure Pathway Receptor Scenario	**Chemical of Concern**	**Exposure Point Concentration**	**Units**	**Statistical Measure**
Area K(Ponds 1-5)				
Current/Future Exposure Sediment	Arsenic	10,700	ppm	Maximum Concentration
Area L				
Future Exposure Surface / Subsurface Soil	Arsenic	946	ppm	Maximum Concentration
Future Exposure to Drums (Spent Catalyst)	Molybdenum	161,000	ppm	
Area M				
Future Exposure Surface / Subsurface Soil	Arsenic	263	ppm	Maximum concentration
Area N				
Future Exposure Surface / Subsurface Soil	Arsenic	598	ppm	Maximum Concentration
Shallow Transmissive Zone				
Future Exposure Groundwater	Arsenic	0.605	ppm	Mean Concentration Within the Plume
	Beryllium	0.1	ppm	
	Cadmium	2.63	ppm	
	Copper	112	ppm	
	Manganese	187	ppm	
	Mercury	903	ppm	
	Silver	14.1	ppm	
	Zinc	250	ppm	
Medium Transmissive Zone				
Future Exposure Groundwater	Arsenic	.035 5	ppm	Mean Concentration Within the Plume
Deep Transmissive Zone				
Future Exposure Groundwater	Arsenic	.032 3	ppm	Mean Concentration Within the Plume

Table 3.7.1.1.1 - 2 Monitoring Wells Exceeding Primary Drinking Water Standard Maximum Contaminant Levels.[41]	
MW-03S	Lead, Selenium
MW-07S	Barium, Cadmium, Copper, Lead, Nickel, Radionuclide
MW-09S	Beryllium, Barium, Cadmium, Copper, Lead, Mercury, Nickel, Selenium
MW-10S	Arsenic, Beryllium, Cadmium, Copper, Lead, Nickel
MW-11S	Cadmium, Copper, Selenium
MW-12D	Arsenic, Lead, Selenium
MW-12M	Lead
MW-12S	Barium, Cadmium, Copper, Lead, Mercury, Selenium
MW-14M	Arsenic, Lead, Selenium
MW-14P	Barium, Beryllium, Cadmium, Chromium, Copper, Lead, Mercury, Nickel, Selenium
MW-14S	Copper, Lead
MW-15S	Barium, Beryllium, Cadmium, Copper, Lead, Mercury, Nickel, Selenium
MW-17D	Benzene, Lead, Selenium
MW-16S	Selenium
MW-17S	Barium, Beryllium, Cadmium, Copper, Lead, Mercury, Nickel
MW-18S	Arsenic, Barium, Beryllium, Cadmium, copper, Lead, Mercury, Nickel, Selenium.
MW-19S	Barium, Beryllium, Cadmium, Lead, Copper
MW-20S	Barium, Cadmium, Copper, Lead, Selenium
MW-25M	Selenium
MW-25S	Arsenic, Barium, Beryllium, Cadmium, copper, Lead, Mercury, Nickel, Selenium.
MW-33S	Arsenic, Barium, Beryllium, Cadmium, Chromium, Copper, Lead, Mercury, Nickel, Selenium
MW-34S	Arsenic, Barium, Beryllium, Cadmium, Chromium, Copper, Lead, Mercury, Nickel
MW-35S	Antimony
MW-36S	Arsenic
MW-38M	Lead
MW-38S	Cadmium, Copper, Lead, Selenium
MW-39S	Barium, Beryllium, Cadmium, Copper, Lead, Selenium
MW-40M	Lead
MW-40S	Barium, Cadmium, Copper, Lead
MW-42S	1,2-Dichloroethane, Cadmium, Copper, Lead and Selenium
MW-43S	Arsenic, Barium, Beryllium, Cadmium, Copper, Lead, Mercury, Nickel
MW-44S	Beryllium, Cadmium, Copper, Lead, Nickel
MW-45S	Antimony
MW-46S	Arsenic, Barium, Beryllium, Cadmium, Copper, Lead, Mercury, Selenium
MW-47S	1,2-Dichloroethane, 1,1,2-Trichloroethane, Chloroform, Beryllium, Chromium, Selenium
MW-48S	1,2-Dichloroethane, 1,1,2-Trichloroethane, Benzene, Beryllium.
MW-52S	Beryllium, Lead
MW-53S	Cadmium, Copper, Lead
MW-53S	Beryllium, Lead
MW-54S	Barium, Cadmium, Copper, Lead, Selenium
MW-55S	Cadmium, Lead
MW-55S	Barium, Beryllium, Lead, Selenium
MW-56S	Lead
MW-57S	Beryllium, Lead
MW-6S	Arsenic
MW-8M	Lead
MW-8S	Lead, Selenium

3.7.1.1.2 Exposure Assessment.[42] Using the site conceptual models described in Section 3.5.27, "Site Conceptual Model," an exposure assessment was conducted with mathematical models to estimate the contaminant dose (exposure) receptors may receive through the pathways identified in the model. In the exposure assessment, reasonable maximum exposure estimates were developed for the industrial land use identified in the site characterization. The objectives of the exposure assessment are to characterize potentially exposed human populations in the on- and off-site areas associated with the Tex-Tin site, to identify actual or potential exposure pathways, and to determine the extent of exposure. The exposure assessment involves several key elements including the following:

- Definition of local land and water uses (See Section, 3.6, "Current and Potential Future Site and Resource Uses")
- Identification of the potential receptors/exposure scenarios.
- Identification of exposure routes.
- Estimation of exposure point concentrations.
- Estimation of daily doses.

3.7.1.1.3 Identification of Potentially Exposed Populations. This step of the assessment involves predicting the activity patterns of potentially exposed populations and selecting the current and future receptors under a reasonable maximum exposure (RME) scenario. It is based on current and potential use of the site for industrial purposes. The RME estimate is designed to measure "high-end exposure." Box 3.7.1.2.1, "Receptor Exposure," below describes the exposure duration and frequency to the receptors identified in Section 3.5.27, "Site Conceptual Model" and the media of concern for each scenario. (Note the "On-Site Smokestack Emissions" shown on Figure 3.5.27 are not addressed in this operable unit but will be addressed in Operable Unit 3.) The sample locations chosen as exposure points are described in the *Baseline Human Health Risk Assessment* (BHHRA), Section 2.2, "Summary of Sampling Data For Media of Concern." Major exposure assumptions are summarized in Table 3.7.1.2.1, "Major Exposure Assumptions."

Drums in the ore storage building.

Box 3.7.1.2.1 - 1 Receptor Exposure

Drummed Material (Spent Catalyst). The evaluated receptors include current/future industrial workers and future construction workers potentially exposed to drummed material. Note, drummed materials have been evaluated separately from soil and/or waste piles that occur in the same area.

Above Ground Storage Tanks. The evaluated receptors include current/future industrial workers and future construction workers potentially exposed to tank sludge if the sludge leaks or spills from the tank.

Buildings, Structures and Process Units. The evaluated receptors include current/future industrial workers and future construction workers potentially exposed to contaminated dust, spilled process wastes such as slag and spent catalyst inside these facilities.

Soil and Waste Piles. The evaluated receptors include current/future industrial and construction workers potentially exposed to on-site surface soil and on-site waste piles, and future industrial and construction workers potentially exposed to on-site surface and subsurface soil and on-site waste piles. Workers were assumed to be exposed to soil and waste piles during work activities.

On Site Drainages. The evaluated receptors include current trespassers and current/future industrial workers potentially exposed to on-site sediment and surface water associated with on-site drainages (including the Wah Chang Ditch). EPA assumes that a trespasser would be more likely to frequent the on-site drainage locations than other on-site areas because these areas would be most likely to attract trespassers on a regular basis. However, the evaluation of a current worker scenario at these areas is a conservative approach that ensures the protection of the occasional trespasser. Swimming was assumed to be an unlikely occurrence because the drainages are relatively shallow, therefore the receptors would more likely engage in wading activities. Current/future industrial workers were assumed to be exposed to surface water/sediment during work activities. For current/future industrial workers, exposure durations of 25 years were used. The current/future industrial worker was estimated to be on the site for approximately 1.0 and 0.5 hours per exposure event, respectively.

Ponds. The evaluated receptors include current/future industrial workers potentially exposed to on-site sediment in Ponds 1 through 6 and on-site surface water in Ponds 4 and 6. It should be noted that sediment and surface water in the Acid Pond, the only remaining waste acid pond, were evaluated separately from sediment in Ponds 1 through 5 and surface water in Ponds 4 and 5. Pond 6, the Acid Pond, was evaluated separately from Ponds 1 through 5 because it is a waste acid pond and not a former wastewater treatment pond.

Groundwater. The evaluated receptors include future industrial workers potentially exposed to on-site groundwater from the Shallow, Medium or Deep Transmissive Zones through showering or drinking. Exposure times for showering were assumed to be 0.2 hours per day.

Table 3.7.1.2.1 Major Exposure Assumptions.			
Source	Receptor	Exposure	
		Duration	Frequency
Soil and Waste Piles	Current and Future Industrial Workers	25 years	250 days / year
	Future Industrial Workers	25 years	250 days / year
	Construction Workers	6 months	5 days / week
Drums (Spent Catalyst)	Current and Future Industrial Workers	25 years	250 days / year
	Future Industrial Workers	25 years	250 days / year
	Construction Workers	6 months	5 days / week
Sediment and Surface Water	Current and Future Industrial Workers	25 years	100 hrs / year
	Future Industrial Workers	25 years	100 hrs / year
	Trespasser	10 years	150 hrs / year
Groundwater	Future Industrial Workers	25 years	250 days / year

3.7.1.1.4 Identification of Exposure Pathways and Routes. The exposure pathway is the unique course through which an individual comes in direct contact (i.e, accidental ingestion, dermal contact and inhalation) with a contaminant source. The exposure route is the means by which a hazardous substance enters the body. The pathways and routes identified for the Tex-Tin site are presented in Table 3.7.1.2.2, "Exposure Pathways / Routes." Box 3.7.1.2.2, "Evaluated Exposure Pathways and Routes," identifies the various exposure pathways and routes which were evaluated for each of the on-site and off-site areas. Additional discussion regarding the exposure pathways and routes is found in the BHHRA, Section 3.3, "Identification of Exposure Routes.

Table 3.7.1.2.2 Exposure Pathways/Routes			
Exposure Pathways and Receptor Scenarios	**Receptors**	**Exposure Routes**	**Samples Used For Evaluation**
Area A			
Future Exposure to Surface and Subsurface Soils and Waste Piles	I	- Accidental ingestion - Inhalation of particulates - Inhalation of volatiles[1] - Inhalation of radon gas - External Radiation (ground)	Surface and subsurface soil samples 0 to 10 ft. Composite samples from three tin slag piles. Radionuclide s- Surface soil samples 0 to .5 ft. Composite sample from one tin slag pile.
Area B			
Future Exposure to Surface and Subsurface Soils and Waste Piles	I	- Accidental ingestion - Inhalation of particulates - Inhalation of volatiles[1] - Inhalation of radon gas - External Radiation (ground)	Surface and subsurface soil samples 0 to 10 ft. Composite samples from 18 piles of metallic ore and/or slag Radionuclides - Surface soil samples 0 to .5 ft. Composite samples from two piles of metallic ore and /or slag

Table 3.7.1.2.2
Exposure Pathways/Routes

Exposure Pathways and Receptor Scenarios	Receptors	Exposure Routes	Samples Used For Evaluation
Area C			
Current and Future Exposure to Surface Soils and Waste Piles	I	- Accidental ingestion - Inhalation of particulates - Inhalation of volatiles[1]	Surface soil samples 0 to 0.5 ft. Composite samples from 15 piles of slag, scrubber sludge, and/or river mud. Surface and subsurface soil samples 0 to 15 ft. (for inhalation of volatiles only)
Future Exposure to Surface and Subsurface Soil Waste Piles	I	- Accidental ingestion - Inhalation of particulates -Inhalation of volatiles[1] - Inhalation of radon gas - External Radiation (ground)	Surface and subsurface (fill material) soil samples 0 to 15 ft. Composite samples from 15 piles of slag, scrubber sludge. and/or river mud.
Future Exposure to Surface and Subsurface Soil			Radionuclide - Surface and Subsurface (fill material) soil samples - 0 to 12 ft.
Area D			
Future Exposure to Surface and Subsurface Soil and Waste Piles	C	-Accidental ingestion -Inhalation of particulates -Inhalation of volatiles[1]	Surface and subsurface (fill material) soil samples 0 to 10 ft. One composite sample from a catalyst pile.
Current and Future Exposure to Surface Soil	I	-Accidental ingestion -Inhalation of particulates -Inhalation of volatiles[1] - Inhalation of radon gas - External Radiation (ground)	Radionuclide - Surface soil samples 0 - 0.5 ft.
Area E			
Future Exposure to Surface and Subsurface Soil and Waste Piles	I	-Accidental ingestion -Inhalation of particulates -Inhalation of volatiles[1]	Surface and subsurface (fill material) soil samples 0 to 5 ft. Composite samples from 5 catalyst piles.
Future Exposure to Surface and Subsurface Soil	I	-Accidental ingestion -Inhalation of particulates -Inhalation of volatiles[1] - Inhalation of radon gas - External Radiation (ground)	Radionuclide. Surface and subsurface (fill material) soil samples - 0 to 10 ft.
Future Exposure to Drums (Spent Catalyst)	C	-Accidental ingestion -Inhalation of particulates	Drum samples from 5% of drums in Area E.
Area F			
Future Exposure to Surface and Subsurface Soil and Waste Piles	C	-Accidental ingestion -Inhalation of particulates -Inhalation of volatiles[1]	Surface and subsurface soil samples 0 to 5 ft. Composite samples from two piles of metallic ore and slag
Current and Future Exposure to Surface and Waste Piles	I	-Accidental ingestion -Inhalation of particulates -Inhalation of volatiles[1] - Inhalation of radon gas - External Radiation (ground)	Surface soil samples - 0 to .5 ft. Composite samples from one pile of metallic ore and slag.
Area G			
Current and Future Exposure to Sediment and Surface Water	I	-Accidental ingestion	Sediment from on-site drainage ditches.
Area J			
Future Exposure to Surface and Subsurface Soil and Waste Piles	I C	-Accidental ingestion -Inhalation of particulates -Inhalation of volatiles[1]	Surface and subsurface soil samples 0 to 10 ft. Composite samples from three piles of catalyst materials.
Current and Future Exposure to Drums (Spent Catalyst)	I	-Accidental ingestion -Inhalation of particulates	Drum samples from 5% of drums in Area J.

Table 3.7.1.2.2
Exposure Pathways/Routes

Exposure Pathways and Receptor Scenarios	Receptors	Exposure Routes	Samples Used For Evaluation
Future Exposure to Drums (Spent Catalyst)	C	-Accidental ingestion -Inhalation of particulates	Drum samples from 5% of drums in Area J.
		Area K	
Current and Future Exposure to Sediments (Ponds 1-5)	I	-Accidental ingestion	Sediment from on-site Ponds 1 through 5.
Current and Future Exposure to Surface Water (Ponds 4 and 5)[2]	I	-Dermal contact.	Surface water from on-site Ponds 4 and 5.
Current and Future Exposure to Acid Pond Sediment	I	-Accidental ingestion	Sediment from the Acid Pond
Current and Future Exposure to Acid Pond Surface Water	I	-Dermal contact with acid water.	Surface water from the Acid Pond.
		Area L	
Future Exposure to Surface and Subsurface Soil	I	-Accidental ingestion -Inhalation of particulates -Inhalation of volatiles	Surface and subsurface soil samples 0 to 10 ft.
Future Exposure to Drums (Spent Catalyst)	I	-Accidental ingestion -Inhalation of particulates	Drum samples from 5% of drums in Area L.
		Area M	
Future Exposure to Surface and Subsurface Soil	C	-Accidental ingestion -Inhalation of particulates -Inhalation of volatiles	Surface and subsurface soil samples 0 to 10 ft.
		Area N	
Future Exposure to Surface and Subsurface Soil	I	-Accidental ingestion -Inhalation of particulates -Inhalation of volatiles	Surface and subsurface soil samples 0 to 10 ft.
Future Exposure to Surface and Subsurface Soil	C	-Accidental ingestion -Inhalation of particulates -Inhalation of volatiles	Surface and subsurface soil samples 0 to 10 ft.
		Shallow Transmissive Zone	
Future Exposure to Groundwater from the Shallow Transmissive Zone.	I	-Ingestion -Dermal contact while showering -Inhalation of volatiles through showering	Groundwater samples from on-site monitoring wells established in the Shallow Transmissive Zone.
		Medium transmissive zone	
Future Exposure to Groundwater from the Medium Transmissive Zone.	I	-Ingestion -Dermal contact while showering -Inhalation of volatiles through showering	Groundwater samples from on-site monitoring wells established in the Medium Transmissive Zone.
		Deep transmissive zone	
Future Exposure to Groundwater from the Deep Transmissive Zone.	I	-Ingestion -Dermal contact while showering -Inhalation of volatiles through showering	Groundwater samples from on-site monitoring wells established in the deep transmissive zone.

[1] Inhalation of volatiles was evaluated only for the soil pathway. The soil depth interval used to evaluate inhalation was 0 feet to a maximum depth of 15 feet.
[2] Ponds 1-3 are dry and were not evaluated through the surface water exposure route.
I - Future Industrial Worker
C - Future Construction Worker

Box 3.7.1.2.2 Evaluated Exposure Pathways and Routes.

On-Site Exposed Spent Catalyst (Drummed Material). Exposure to drummed material was evaluated through direct contact (e.g. accidental ingestion, dermal contact, and inhalation) with wind blown particulates released from drummed material. These are potential exposure routes for industrial and construction workers who may come into contact with drummed material located in these areas through work activities.

On-Site Soil. Exposure to contaminants in on-site surface and subsurface soil was evaluated through direct contact (e.g. accidental ingestion, dermal contact, and inhalation) with particulates released from soil, and inhalation of volatiles released from soil. The receptors selected for these areas were industrial or construction workers who may come into contact with surface soil and subsurface soil during maintenance or construction excavations.

On-Site Waste Pile. Exposure to contaminants in on-site waste piles was evaluated through direct contact (e.g. accidental ingestion, dermal contact, and inhalation) with wind blown particulates released from waste piles. These are potential exposure routes for industrial and construction workers who may come into contact with waste piles located in these areas through work activities.

On-Site Shallow, Medium and Deep Groundwater Zones. Exposure to contaminants in groundwater was evaluated through direct contact (e.g. accidental ingestion, dermal contact, and inhalation) while showering, and inhalation of volatile compounds while showering. These exposure routes were selected because future on-site industrial workers may use on-site groundwater for showering and drinking.

On-Site Sediment. Exposure to contaminants in sediment associated with on-site drainage ditches and on-site ponds was evaluated through dermal contact with sediment and accidental ingestion of sediment. These exposure routes were selected because industrial workers and trespassers in Area G may come into direct contact with sediment in these areas while working or trespassing, respectively.

On-Site Surface Water. Exposure to contaminants in surface water associated with on-site drainage ditches and on-site ponds was evaluated through dermal contact with surface water. These exposure routes were selected because industrial workers and trespassers in Area G only may come into contact with surface water in these areas while working or trespassing, respectively. Accidental ingestion of on-site surface water was not evaluated because on-site surface water bodies are shallow; therefore EPA assumes accidental ingestion of surface water would be an unlikely route of exposure. The Acid Pond was not evaluated through surface water ingestion because it is a waste acid pond and will not likely be used for wading or swimming activities.

3.7.1.1.5 Identification of Exposure Models and Assumptions. This step of the risk assessment presents the mathematical model results used to calculate the chemical intake for each receptor hrough the previously identified exposure routes, frequencies, times, and durations described above. The mathematical models used to calculate intakes are presented in the BHHRA Tables 3-2 through 3-20 and Tables 7.3-1 through 7.3-11. Each table defines the variables used in estimating intake and includes the assumptions (i.e., exposure parameters) used in the model. In general, the exposure parameters that were used are standard values recommended by national and regional EPA guidance. Intakes were calculated for chemical carcinogens and non-carcinogens and these values are shown on Tables 3.7.1.2.3 - 1, "Chemical Carcinogenic Chronic Daily Intake (CDI) Values" and 3.6.1.2.3(b), "Non-Carcinogenic Chronic Daily Intake (CDI) Values." The chemical carcinogenic and non-carcinogenic intakes are shown as the Chronic Daily Intake (CDI). The CDI and total intake (TI) values are expressed as milligrams of contaminant consumed per kilogram of body weight during a single day.

Discarded catalyst.

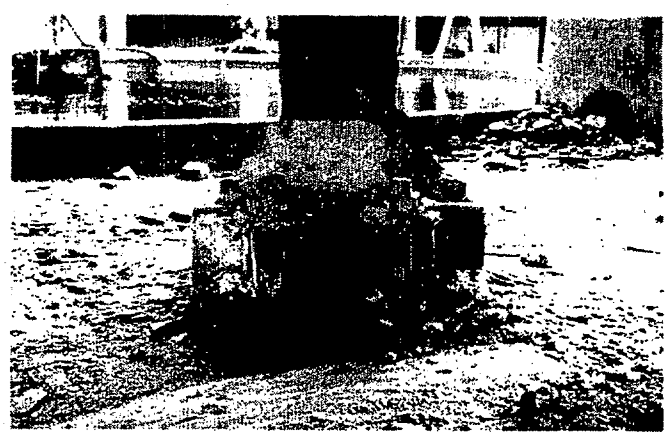
Table 3.7.1.2.3 - 1 Chemical Carcinogenic Chronic Daily Intake (CDI) Values				
Exposure Pathway & Receptor Scenario	**Receptor**	**Chemical**	**Exposure Route**	**CDI (mg / kg - day)**
Area B				
Future Exposure to Surface and Subsurface Soil and Waste Piles	I	Arsenic	Accidental Ingestion of Surface and Subsurface Soil	1.96E-04
Area C				
Future Exposure to Surface and Subsurface Soil and Waste Piles	I	Arsenic	Accidental Ingestion of Surface and Subsurface Soil	3.29E-04
Area D				
Future Exposure to Surface and Subsurface Soil and Waste Piles	C	Arsenic	Accidental Ingestion of Surface and Subsurface Soil	8.27E-04
Area E				
Future Exposure to Surface and Subsurface Soil and Waste Piles	I	Arsenic	Accidental Ingestion of Surface and Subsurface Soil	1.67E-04
Area F				
Future Exposure to Surface and Subsurface Soil and Waste Piles	I	Arsenic	Accidental Ingestion of Surface and Subsurface Soil	1.33E-04
Area G				
Current/Future Exposure to Sediment and Surface Water	I	Arsenic	Accidental Ingestion of Sediment	1.15E-04
Area J				
Future Exposure to Surface and Subsurface Soil and Waste Piles	I	Arsenic	Accidental Ingestion of Surface and Subsurface Soil	1.06E-04
Current/Future Exposure to Drums (Spent Catalyst)	I	Arsenic	Accidental Ingestion of Drum Material	4.15×10^{-4}
Area K(Ponds 1-5)				
Current/Future Exposure to Sediment and Surface Water	I	Arsenic	Accidental Ingestion of Sediment	8.19E-04
Area L				
Future Exposure to Surface and Subsurface Soil	I	Arsenic	Accidental Ingestion of Surface and Subsurface Soil	1.81E-04
Area N				
Future Exposure to Surface and Subsurface Soil	I	Arsenic	Accidental Ingestion of Surface and Subsurface Soil	1.04E-04
Shallow Transmissive Zone				
Future Exposure to Groundwater	I	Arsenic	Ingestion of Groundwater	2.11E-03
		Beryllium		3.49E-04
Medium transmissive zone				
Future Exposure to Groundwater	I	Arsenic	Ingestion of Groundwater	1.24E-04
Deep transmissive zone				
Future Exposure to Groundwater	I	Arsenic	Ingestion of Groundwater	1.70E-04

I - Industrial Worker
C - Construction Worker

Table 3.7.1.2.3 - 2 Non-Carcinogenic Chronic Daily Intake (CDI) Values				
Exposure Pathway Scenario	**Receptor**	**Chemical**	**Exposure Route**	**CDI (mg / kg - day)**
Area A				
Future Exposure to Surface and Subsurface Soil and Waste Piles	C	Arsenic	Accidental Ingestion of Surface and Subsurface Soil	6.8E-04
Area B				
Future Exposure to Surface and Subsurface Soil and Waste Piles	C	Copper	Accidental Ingestion of Surface and Subsurface Soil and Waste Piles	2.44E-01
Area C				
Future Exposure to Surface and Subsurface Soil and Waste Piles	C	Antimony	Accidental Ingestion of Surface and Subsurface Soil Waste Piles	4.59E-03
Area D				
Future Exposure to Surface and Subsurface Soil and Waste Piles	C	Antimony	Accidental Ingestion of Surface and Subsurface Soil	7.69E-04
		Arsenic		5.79E-03
		Manganese		1.18E-01
Area E				
Future Exposure to Surface and Subsurface Soil and Waste Piles	C	Antimony	Accidental Ingestion of Surface and Subsurface Soil	1.38E-03
Future Exposure to Drums (Spent Catalyst)	C	Copper	Accidental Ingestion of Drum Material	3.7E-01
		Molybdenum		4.38E-01
		Nickel		1.05E-01
Area F				
Future Exposure to Surface and Subsurface Soil and Waste Piles	C	Antimony	Accidental Ingestion of Surface and Subsurface Soil	5.76E-04
		Arsenic		1.89E-04
Area J				
Future Exposure to Surface and Subsurface Soil and Waste Piles	C	Antimony	Accidental Ingestion of Surface and Subsurface Soil	1.27E-04
		Copper		2.21E-02
Future Exposure to Drums (Spent Catalyst)	C	Antimony	Accidental Ingestion of Drum Material	6.53E-04
		Copper		6.55E-02
		Molybdenum		1.01E-02
		Nickel		2.32E-02
Area L				
Future Exposure to Drums (Spent Catalyst)	C	Molybdenum	Accidental Ingestion of Drum Material	3.85E-02
Area M				
Future Exposure to Surface and Subsurface Soil	C	Arsenic	Accidental Ingestion of Surface and Subsurface Soil	6.48E-04
Area N				
Future Exposure to Surface and Subsurface Soil	C	Antimony	Accidental Ingestion of Surface and Subsurface Soil	1.47E-03

Table 3.7.1.2.3 - 2 Non-Carcinogenic Chronic Daily Intake (CDI) Values				
Shallow Transmissive Zone				
Future Exposure to Groundwater	I	Cadmium	Ingestion of Groundwater	2.57E-02
		Copper		1.1E-01
		Manganese		1.83
		Mercury		8.84E-04
		Silver		1.38E-01
		Zinc		2.45
Medium transmissive zone				
Future Exposure to Groundwater	I	Arsenic	Ingestion of Groundwater	3.47E-04
Deep transmissive zone				
Future Exposure to Groundwater	I	Arsenic	Ingestion of Groundwater	3.16E-04
I - Industrial Worker C - Construction Worker				

3.7.1.2 Toxicity Assessment.[43] Whereas Table 3.5.26 - 1 lists the contaminants of concern and their health effects, this section presents the risk assessment toxicity values which were applied to the chronic daily intakes described in Section 3.7.1.2.3, "Identification of Exposure Models and Assumptions," to determine the carcinogenic risk or non carcinogenic hazard posed by a specific chemical of concern. In risk assessment terms, "toxicity" refers to the property of a chemial that causes morphological and/or biochemical tissue or organ damage, whereas as previously used in this Record of Decision, "toxicity" referred to a regulatory standard at 40 C. F. R. §261.24 to determine whether a waste is hazardous under RCRA. The methods used to assess he toxicity of a specific chemical of concern are presented in BHHRA, Section 4, "Toxicity Assessment"and Section 7.4, "Toxicity Assessment." Table 3.7.1.3 - 1, "EPA Categorization of Carcinogens," provides a summary of the Carcinogenic Categories Table 3.7.1.3 - 2, "Cancer Slope Factors and EPA Carcinogenicity Classifications" and Table 3.7.1.3 - 3, provides the classification and slope factors for the chemical and radionuclide carcinogenic toxicity, and Table3.7.1.3 - 4 provides the reference doses and target organs for non-carcinogenic toxicity. Carcinogenic and non-carcinogenic effects of a chemical depend on the dose, on the route of administration, on the duration and frequency of exposure, and on the species tested or measured. Generally the lower the dose necessary to produce an adverse effect, the more toxic the chemical. After a single (acute) high dose, some chemicals may produce toxic effects that range from respiratory and/or skin irritation to lethality. However, acute exposures are generally easily recognized and controlled, and hus they are not usually the main focus of concern in a BHHRA. Exposure for a continual period of months or years (chronic) at low exposure levels is potentially more significant from a human health viewpoint. Only chronic effects were evaluated in this BHHRA. Chemicals are potentially capable of producing adverse effects through inhalation, ingestion, and dermal contact. Some chemicals may produce toxicity only through one route. Others may cause toxicity through a combination of some or all routes. Consequently, each chemical is evaluated for cancer and non-cancer toxicity by determining its potency through each exposure route, as identified in the site conceptual model.



Deteriorated column base in the Roasting and Leaching Building.

Table 3.7.1.3 - 1 EPA Categorization of Carcinogens					
HUMAN EVIDENCE	ANIMAL EVIDENCE				
	Sufficient	Limited	Inadequate	No Data	No Evidence
Sufficient	A	A	A	A	A
Limited	B1	B1	B1	B1	B1
Inadequate	B2	C	D	D	D
No Data	B2	C	D	D	E
No Evidence	B2	C	D	D	E

Key:

Group A — Human carcinogen (sufficient evidence from epidemiological studies).
Group B1 — Probable human carcinogen (at least limited evidence of carcinogenicity to humans).
Group B2 — Probable human carcinogen (a combination of sufficient evidence in animals and inadequate data in humans).
Group C — Possible human carcinogen (limited evidence in animals in the absence of human data).
Group D — Not classified (inadequate animal and human data).
Group E — No evidence for carcinogenicity (no evidence for carcinogenicity in at least two adequate animals tests in different species, or in both epidemiological and animal studies).

Table 3.7.1.3 - 2 Cancer Slope Factors and EPA Carcinogenicity Classifications

Chemical	EPA Carcinogenicity Classification		Slope Factors				
			Oral		Dermal[a]	Inhalation	
	Category	Reference[a]	(mg/kg-day)$^{-1}$	Reference	(mg/kg-day)$^{-1}$	(mg/kg-day)$^{-1}$	Reference[a]
1,2-Dichloroethane	B2	IRIS	9.1E-02	IRIS	9.1E-02	9.1E-02	IRIS
Arsenic	A	IRIS	1.5E+00	IRIS	7.5E+00	1.5E+01	IRIS
Benzene	A	IRIS	2.9E-02	IRIS	2.9E-02	2.9E-02	IRIS
Beryllium	B2	IRIS	4.3E+00	IRIS	8.6E+01	8.4E+00	IRIS
Cadmium	B1	IRIS	NTV	–	NTV	6.3E+00	IRIS
Chloroform	B2	IRIS	6.1E-03	IRIS	6.1E-03	8.1E-02	IRIS
Chromium VI	A	IRIS	NTV	–	NTV	4.2E+01	IRIS
Nickel	A	IRIS	NTV	–	NTV	8.4E-01	IRIS

IRIS = Integrated Risk Information System (IRIS, 1996).

[a] Calculated by dividing the oral slope factor by 1.0 for organics and 0.05 for inorganics, with the exception of arsenic. The oral slope factor for arsenic was divided by 0.20.

[b] Slope factors for carcinogenic polycyclic aromatic hydrocarbons (PAHs) were derived by multiplying the slope factor for benzo(a)pyrene by a relative potency factor (EPA, 1995b).

[c] Classification is for divalent mercury and methyl mercury.

[d] Inhalation slope factor for nickel refinery dust.

NTV = No toxicity value available.

Table 3.7.1.3 - 3 Radionuclide Cancer Slope Factors and EPA Carcinogenicity Classification						
Radionuclide of Potential Concern	**EPA Weight of Evidence Carcinogenicity Classification**		**Oral Slope Factor (risk/pCi)**	**Inhalation Slope Factor (risk/pCi)**	**External Radiation Slope Factor (risk/year per pCi/g soil)**	**Reference**
	Category	Reference				
Radium-226 [1]	A	EPA, 1995	2.96E-10	2.75E-09	6.74E-06	EPA, 1995
Radium-228 [1]	A	EPA, 1995	2.48E-10	9.94E-10	3.28E-06	EPA, 1995
Thorium-228 [1]	A	EPA, 1995	2.31E-10	9.68E-08	6.20E-06	EPA, 1995

[1] Slope factor includes the contributions from short-lived decay products, assuming equal activity concentrations (i.e., secular equilibrium) with the principal nuclide in the environment.
EPA, *Health Effects Assessment Summary Tables (HEAST), FY-1995 Annual.* EPA540-R-95-36. PB94-921199, May 1995.

Box 3.7.1.3.1 Slope Factors.

After EPA determines the weight-of-evidence for a chemical,the carcinogenic potency of the chemical is determined. The carcinogenic potency of a chemical describes the ability of a chemical to produce cancer over a lifetime. Cancer slope factors (CSFs)are used to express this potency. CSFs are expressed as risk per unit dose ($[mg/kg\text{-}day]^{-1}$). A cancer toxicity value quantitatively defines the relationship between exposure and carcinogenic response for a chemical. The larger the CSF for a given carcinogen, the greater is the risk of cancer occurring at a specific exposure level.

3.7.1.2.1 Assessment of Chemical Carcinogenic Toxicity. Carcinogens are evaluated in a two-phases, first, the weight-of-evidence for causing cancer is determined, and then a cancer toxicity value is derived if sufficient data are available. Both human and animal cancer data are reviewed to determine the likelihood that a chemical is a human and/or animal carcinogen. EPA's weight-of-evidence classifications are defined in Table 3.7.1.3 - 1, "EPA Categorization of Carcinogens." Only those chemicals classified in Group A have sufficient evidence of carcinogenicity in human studies to be classified as known human carcinogens . Carcinogens that have probable or possible human cancer-causing potential are classified in Groups B and C, respectively. Group B and C carcinogens have varying degrees of animal data to support their cancer-causing potential. These two groups comprise the greatest number of carcinogens classified by the EPA. Those classified in Group D have inadequate human and animal evidence of carcinogenicity. Based on adequate studies, chemicals classified in Group E have no human or animal evidence supporting their potential for cancer. The BHHRA typically evaluates Group A, B, and C carcinogens for which cancer toxicity values are available. In some cases, EPA may withdraw a criterion from IRIS (Integrated Risk Information System) before the review is completed using instead the value cited in EPA's Health Effects Assessment Summary Tables (HEAST).[44] In cases when a cancer toxicity value is not available for a potential carcinogen of concern, it is discussed qualitatively in the risk characterization.

3.7.1.2.2 Assessment of Non-Carcinogenic Toxicity. The toxicity values used to evaluate potential non-cancer health effects are termed reference doses (RfDs). Unlike the approach used in evaluating cancer risk, it is assumed for non-cancer effects that a threshold exposure dose exists below which there is no potential for human toxicity. Non-cancer toxicity values were developed by EPA to refer to the daily intake (RfD) of a chemical to which an individual can be exposed without any expectation of non-carcinogenic effects (e.g, organ damage, biochemical alterations, birth defects) occurring during a given exposure duration. The RfD is derived from a no-observed-adverse-effect level (NOAEL) or lowest-observed-adverse-effect level (LOAEL) obtained from human or animal studies. A NOAEL is the highest dose or exposure level of a chemical at which no toxic effects are observed in any test. In contrast to a NOAEL, a LOAEL is the lowest dose or exposure level at which a toxic effect is observd in any test. LOAELs are used to derive an RfD in the absence of a suitable NOAEL. EPA has derived chronic RfDs to evaluate human exposures of greater than 7 years. In this risk assessment, the non-cancer toxicity values were expressed as Chronic RfDs.

Table 3.7.1.3 - 4 Chronic Reference Doses (RfD) and Toxicity Endpoints

Chemical	Reference Dose (mg / kg - day)					
	Oral	Target Organ	Reference[a]	Inhalation	Target Organ	Reference[a]
Antimony	4.0E-04	Increased mortality; altered blood glucose and cholesterol	IRIS	NTV		
Arsenic	3.0E-04	Hyperpigmentation and keratosis; possible vascular complications	IRIS	NTV		
Barium	7.0E-02	Increased blood pressure	IRIS	1.0E-04	Fetotoxicity	HEAST
Beryllium	5.0E-03	No observed adverse effects	IRIS	NTV		
Cadmium	1.0E-03	Proteinuria (protein in urine)	IRIS	NTV		
	5.0E-04	Proteinuria (protein in urine)	IRIS			
Chromium III	1.0E+00	No observed adverse effects	IRIS	NTV		
Chromium VI	5.0E-03	No observed adverse effects	IRIS	NTV		
Copper	3.7E-02	Gastrointestinal irritation	HEAST	NTV		
Manganese	1.4E-01	Central nervous system effects	IRIS	NA		
	4.7E-02	Central nervous system effects	IRIS	1.4E-05	Impairment of neurobehavioral function	IRIS
Mercury (inorganic)	3.0E-04	Kidney effects	IRIS	8.6E-05[b]	Neurotoxicity	HEAST
Molybdenum	5.0E-03	Increased uric acid levels in blood	IRIS	NTV		
Nickel	2.0E-02	Decreased body weight and organ weights	IRIS	NTV		
Silver	5.0E-03	Argyria (silver deposition in skin)	IRIS	NTV		
Zinc	3.0E-01	Decrease in red blood cell superoxide dismutase	IRIS	NTV		

[a] HEAST = Health Effects Assessment Summary Tables (EPA, 1995a).
IRIS = Integrated Risk Information System (IRIS, 1996).
[b] Value is for elemental mercury

3.7.1.3 Carcinogenic Risk and Non-Carcinogenic Hazard Characterization.[45] The objective of this characterization is to integrate the information from the Exposure Assessment and the Toxicity Assessment to decide if there is a carcinogenic risk or non-carcinogenic hazard associated with any one of the chemicals of concern on-site. An unacceptable carcinogenic risk or non-carcinogenic hazard fom any single chemical of concern would warrant remedial action. Consequently this subsection presents an analysis of the nature of the most significant carcinogenic risks and non-carcinogenic hazards posed to the receptors identified in the "Site Conceptual Models." It is these specific carcinogenic risks and non-carcinogenic hazards which justify EPA's decision to take remedial action at this site. Potential carcinogenic and non-carcinogenic effects of pollutants are discussed separately because of the different toxicological endpoints, relevant exposure durations, and methods employed in characterizing risk. The general approaches to evaluating carcinogenic and non-carcinogenic risks are presented in the BHHRA Subsection 5.2 and the general approaches to evaluating the health effects of lead are presented in the

BHHRA Subsection 5.3. The results of the risk and hazard evaluation are summarized in Section 3.7.1.47, "Summary of Results." Uncertainties associated with the risk estimates are discussed in Section 3.7.1.4.8.

3.7.1.3.1 Carcinogenic Risk. The Remedial Investigation discovered chemical carcinogens as well as radioactive carcinogens on site. In this document the risks from these carcinogens are expressed as the incremental probability of an individual developing cancer over a lifetime as the result of exposure to the carcinogen. These probabilities are expressed in scientific notation, e.g. 1×10^{6} or 1E -06. An excess lifetime cancer risk of 1×10^{6} indicates that an individual experiencing the reasonable maximum exposure estimate has a 1 in 1,000,000 chance of developing cancer as a result of site-related exposure. This is referred to as an "excess lifetime cancer risk" because it would be in addition to the risks of cancer individuals face from all othercauses which has been estimated to be as high as one in three. EPA's generally acceptable risk range for site-related exposure is 1 in 10,000 to 1 in 1,000,000.

3.7.1.3.2 Calculating Carcinogenic Risk. Excess lifetime carcinogenic riskis calculated from the equation in Box 3.7.1.4.2 - 1. Excess lifetime radioactive carcinogenic risk is calculated from the equation in Box 3.7.1.4.2 - 2. Unlike cancer slope factors developed for chemical carcinogens, radionuclide slope factors are the best estimates of the age-averaged, lifetime excess total cancer risk per unit of intake of a radionuclide (e.g., per pCi inhaled or ingested) or per unit external radiation exposure (e.g., pCi/g of soil). As discussed in the BHHRA, Subsection 7.4, radionuclide slope factors have been calculated for individual radionuclides based on their unique chemical, metabolic, and radiological propertis and using a non-threshold, linear dose-response model This model accounts for the amount of each radionuclide absorbed into the body from the gastrointestinal tract (by ingestion) or through the lungs (by inhalation), the distribution and retention of each radionuclide in body tissues and organs, as well as the age, sex, and the weight of an individual at the time of exposure. The model then averages the risk over the lifetime of that exposed individual (i.e., 70 years). Consequently, radionuclide slope factors are not expressed as a function of body weight or time, and do not require corrections for gastrointestinal absorption or lung transfer efficiencies.

Box 3.7.1.4.2 - 1
Chemical Cancer Risk

Cancer Risk = CDI x SF

Cancer Risk	=	a unitless probability (e.g. 2×10^{-5}) of an individual's developing cancer
CDI	=	Chronic daily intake averaged over a 70-year lifetime) (mg/kg-day)
SF	=	slope factor expressed as $(mg/kg\text{-}day)^{-1}$

3.7.1.3.3 Non-Carcinogenic Hazards. The potential for non-carcinogenic hazards is evaluated by comparing an exposure level over a specified time period (e.g. life-time) with a reference dose (RfD) derived from a similar exposure period. An RfD represents a level that an individual may beexposed to that is not expected to cause any deleterious effect. The ratio of exposure to toxicity is called a hazard quotient (HQ). An HQ less than one indicates thata receptor's dose of a single contaminant is less than the RfD, and that toxic non-carcinogenic effects from that chemical are unlikely. The Hazard Index (HI) is generated by adding the HQs for all chemical(s) of concern that affect the same target organ or systems (e.g. liver) within a medium or across all media to which a given individual may reasonably be exposed. An HI less than one indicates that, based on the sum of all HQs from different contaminants and exposure routes, toxic non-carcinogenic effects from all contaminants are unlikely. An HI greater than one indicates that site-related exposures may present a hazard to human health. The HQ is calculated as shown in Box 3.7.1.4.3., "Non-Carcinogenic Hazard."

Box 3.7.1.4.2 - 2
Radioactive Cancer Risk

Cancer Risk=TI / EE x CSF

Cancer Risk	=	Cancer incidence, expressed as unitless probability
TI	=	Estimated total intake (intake during time of exposure) (pCi)
EE	=	Estimated external exposure (pCi/g of soil)
CSF	=	Radionuclide and route-specific cancer slope factor (risk/pCi or risk/year per pCi/g of soil)

3.7.1.3.4 Health Effects From Lead. Because no carcinogenic and non-carcinogenic toxicity values for lead have been verified by EPA headquarters,[46] lead risks cannot be evaluated quantitatively by the traditional risk assessment process. However, the neurological effects produced in young children from lead exposure are viewed by the scientific and regulatory communities as the critical non-carcinogenic effect of public health concern.[47] The Centers for Disease Control[48] has stated that chronic lead exposure resulting in blood levels as low as 10 µg/dL may be associated with these effects. Consequently, at this site EPA promotes a pro-active program to ensure women of child bearing age are protected by ensuring there is less than a five percent chance that fetal blood lead levels will exceed 10 µg / dL.

3.7.1.3.5 Predicting Fetal Blood Lead Levels. The methodology used to predict fetal blood lead levels is in accordance with draft guidance provided by EPA[49] for calculating lead cleanup levels for soil based on fetal exposure (i.e., "Adult Lead Cleanup Level" Model). The draft EPA Region 6 guidance is a modification of a model developed by Bowers et al. (1994). For Areas A through F, J, and L through N fetal blood lead levels were calculated for the current/future industrial worker, the future industrial worker, and the future construction worker. The blood lead levels for the current/future industrial worker scenario were based on the accidental ingestion of surface soil and/or waste pile material. The blood lead levels for the future industrial and construction worker scenarios were based on the accidental ingestion of surface/subsurface soil and/or waste pile material. In addition, for Areas B, E, J, and L, fetal blood levels were calculated for a current/future industrial worker and a future construction worker based on the ingestion of drum material only. A detailed discussion including site-specific default exposure assumptions used in the model are presented in the BHHRA Subsection 5.5.4 and Appendix K.

Box 3.7.1.4.3.
Non-Carcinogenic Hazard

Non-cancer HQ = CDI / RfD

CDI = Chronic daily intake

RfD = Reference Dose

CDI and RfD are expressed in the same units and represent the same exposure period (i.e., chronic, subchronic or short-term.)

3.7.1.3.6 Adult Lead Cleanup Level Model Results. The fetal blood levels calculated based on the Adult Lead Cleanup Level Model are summarized in the BHHRA Table 5-5. The EPA and Centers for Disease Control recommend that there be no more than a five percent likelihood that a child would exceed a blood lead level of 10 µg/dL Using the modified Bowers[50] model, predicted fetal blood lead levels exceeded 10 µg/dL for the following scenarios based on exposure to soil and/or waste piles:

- Area A Future Construction Worker.
- Area B Current/Future and Future Industrial Worker and Future Construction Worker.

- Area C Current/Future Industrial Worker and Future Construction Worker.
- Area D Future Construction Worker.
- Area E Current/Future and Future Industrial Worker and Future Construction Worker.
- Area J Current/Future and Future Industrial Worker and Future Construction Worker.
- Area L Current/Future and Future Industrial Worker and Future Construction Worker.
- Area M Current/Future and Future Industrial Worker and Future Construction Worker.
- Area N Current/Future and Future Industrial Worker and Future Construction Worker.

Predicted fetal blood lead levels exceeded 10µg/dL for the Area J "Current/Future Industrial Worker and Future Construction Worker" scenario. These results suggest that for those scenarios inwhich predicted fetal blood levels exceeded 10 µg/dL,there is a potential for lead toxicity in the infants of female workers.

3.7.1.3.7 Summary of Results. Table 3.7.1.4.7, "Carcinogenic Risk or Non-Carcinogenic Hazards Justifying Remedial Action," summarizes the exposure pathway scenario for which there is a carcinogenic risk or non-carcinogenic hazard justifying a remedial response. The results shown in the table should be interpreted with an understanding of the associated uncertainties described in the BHHRA Section6.0 and 7.0.

Table 3.7.1.4.7 - Carcinogenic Risk or Non-Carcinogenic Hazards Justifying Remedial Action

Exposure Pathway & Receptor Scenario	Receptor	Chemical	Risk	Hazard Index	Exposure Route
		Area A			
Future Exposure to Surface and Subsurface Soil and Waste Piles	I	Radium - 226	4.5E-03		Inhalation of radon gas. External Radiation
		Radium - 228	1.3E-03		
	C	Arsenic		2.3	Accidental ingestion.
		Area B			
Future Exposure to Surface and Subsurface Soil and Waste Piles	I	Radium - 226	2.3E-02		Inhalation of radon gas. External Radiation
		Radium - 228	1.9E-02		
		Thorium - 228	7.5E-03		
	C	Arsenic		3.7	Accidental ingestion.
		Copper		6.6	
		Area C			
Future Exposure to Surface and Subsurface Soil	I	Radium - 226	6.1E-04		Inhalation of radon gas. External Radiation
		Radium - 228	1.0E-04		
		Thorium - 228	2.0E-04		
Current and Future Exposure to Surface Soils	I	Arsenic	6.2E-04		Accidental ingestion
Future Exposure to Surface and Subsurface Soil and Waste Piles	C	Arsenic		15.3	Accidental Ingestion
		Antimony		14.8	
		Area D			
Future Exposure to Surface and Subsurface Soil	C	Radium - 226	2.4E-04		Inhalation of radon gas
Future Exposure to Surface and Subsurface Soil and Waste Piles		Arsenic		19.3	Accidental ingestion.
		Antimony		1.9	
		Manganese		3.0	
		Area E			
Current and Future Exposure to Surface	I	Radium - 226	5.5E-04		External Radiation
		Radium - 228	1.1E-04		
		Thorium - 228	1.7E-04		

Table 3.7.1.4.7 - Carcinogenic Risk or Non-Carcinogenic Hazards Justifying Remedial Action					
Exposure Pathway & Receptor Scenario	**Receptor**	**Chemical**	**Risk**	**Hazard Index**	**Exposure Route**
Future Exposure to Surface and Subsurface Soil and Waste Piles	C	Arsenic	2.5E-04	7.9	Accidental Ingestion
Future Exposure to Drums (Spent Catalyst)	C	Molybdenum		8.8	Accidental Ingestion
		Copper		7.5	
		Nickel		5.3	
Area F					
Future Exposure to Surface and Subsurface Soil and Waste Piles	I	Radium - 226	3.7E-03		External Radiation
		Radium - 228	1.0E-04		
		Thorium - 228	1.8E-04		
		Arsenic	2.0E-04		Accidental Ingestion.
	C	Antimony		3.5	Accidental ingestion.
Area G					
Current/Future Exposure to Sediment and Surface Water	Current and I	Arsenic	1.6E-04		Accidental Ingestion of Sediment
Area J					
Future Exposure to Surface and Subsurface Soil and Waste Piles	I	Arsenic	1.6E-04		Accidental Ingestion
	C	Copper		3.0	
		Antimony		4.9	
Current and Future Exposure to Drums (Spent Catalyst)	I	Arsenic	6.3E-03		Accidental Ingestion
Future Exposure to Drums (Spent Catalyst)	C	Arsenic		193.5	Accidental Ingestion
		Molybdenum		2.0	
		Copper		1.8	
		Antimony		1.6	
		Nickel		1.2	
Area K(Ponds 1-5)					
Current/Future Exposure to Sediment and Surface Water	I	Arsenic	1.1E-03		Accidental Ingestion of Sediment
Area L					
Future Exposure to Surface and Subsurface Soil	I	Arsenic	2.5E-04		Accidental Ingestion of Surface and Subsurface Soil
Future Exposure to Drums (Spent Catalyst)	C	Molybdenum		7.7	Accidental Ingestion
Area M					
Future Exposure to Surface and Subsurface Soil	C	Arsenic		2.1	Accidental Ingestion
Area N					
Future Exposure to Surface and Subsurface Soil	I	Arsenic	1.6E-04		Accidental Ingestion
	C	Antimony		3.0	
Shallow Transmissive Zone					
Future Exposure to Groundwater	I	Arsenic	3.2E-03		Ingestion of Groundwater
		Beryllium	1.5E-03		
		Cadmium		51.5	
		Manganese		39.0	
		Copper		29.7	
		Silver		27.6	

Table 3.7.1.4.7 - Carcinogenic Risk or Non-Carcinogenic Hazards Justifying Remedial Action					
Exposure Pathway & Receptor Scenario	**Receptor**	**Chemical**	**Risk**	**Hazard Index**	**Exposure Route**
		Zinc		8.2	
		Mercury		2.9	
Medium transmissive zone					
Future Exposure to Groundwater	I	Arsenic	1.9E-04	1.2	Ingestion of Groundwater
Deep transmissive zone					
Future Exposure to Groundwater	I	Arsenic	1.7E-04	1.1	Ingestion of Groundwater

I - Industrial Worker
C - Construction Worker

3.7.1.3.8 Uncertainty. Virtually every step in the risk assessment process requires numerous assumptions, all of which contribute to uncertainty in the risk evaluation which are described in detail inthe BHHRA Sections 6.0 and 7.0. In the absence of empirical or site-specific data, assumptions are developed based on best estimates of data quality, exposure parameters, and dose-response relationships. To assist in the development of these estimates, EPA provides guidelines and standard default exposure factors to be used in risk assessments prepared under the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA).[51] [52] The use of these standard factors is intended to promote consistency among risk assesments where assumptions must be made. However, their usefulness in accurately predicting risk depends on their applicability to the site-specific conditions discussed in the Baseline Human Health Risk Assessment (BHHRA).

3.7.2 Summary of Ecological Risk Assessment. In addition to the BHHRA, in 1997 an Ecological Risk Assessment (ERA)[53] was prepared to evaluate the risk to the environment posed by existing levels of contamination in the soil, water, and sediment on and in the vicinity of the Site. The ERA was developed in response to the results of the screening level risk assessment which suggested that ecological receptors were exposed to and adverselyaffected by contaminants of potential concern at the Site.

3.7.2.1 Objectives. The objectives of the ERA were to:

- Collect analytical, ecological, and toxicological data from the site.

- Determine, using direct analyses and food chain accumulation models, if exposure to site contaminants is resulting in adverse ecological effects.

- Develop site-specific ecologically based cleanup target levels.

3.7.2.2 Habitat. The terrestrial and aquatic portions of the site represent poor quality wildlife habitat. About half of the site consists of production facilities, paved areas and roads, and disposal areas, while the remainder is in scrub/shrub uplands and open fields that have been disturbed by production and disposal activities. Although several species of wildlifewere observed at the Tex-Tin site and raccoon and deer tracks were observed, the upland vegetative community offers low quality wildlife habitat. A number of lagoons, low-lying depressions, borrow pits, hurricane protection levees, and ditches have formed or were constructed on the site and along the periphery of the site. Some of these are inhabited by fin fish and macroinvertebratesandare used by wading birds and other aquatic and semiaquatic vertebrates. In addition to the presenceof contamination, the origin, history, management, and often ephemeral nature of the water, substantially reduces the habitat quality and value.

3.7.2.3 Preliminary Risk Assessment. A preliminary risk assessment was conductedto compare the maximum concentrations of contaminants detected in soil, water, and sediment to various benchmark values. Using the hazard quotient method, existing contamination data were screened relative to exposure concentrations that potentially cause adverse effects. The exposure concentrations were the highest concentration for each contaminant detected in the current study. Results showed that nearly all inorganic benchmarks and numerous organic benchmarks were exceeded in soil, surface water, and sediment.

3.7.2.4 Definitive Risk Assessment. A definitive risk assessment was conducted to compare the maximum concentrations of contaminants detected in site-specific matrices (soil, sediment, water, and tissue) to various benchmark values. Using the hazard quotient method, existing contamination data were screened relative to exposure concentrations that potentially cause adverse effects. The exposure concentrations were the highest concentration for each contaminant detected in the current study. Of significance in this assessment was the use of site-specific tissue values rather than estimates based on assumptions of bioavailability and accumulation. The concentrations that potentially cause adverse effects were concentrations above the no observed adverse effect level (NOAEL) and the lowest observed adverse effect level (LOAEL) values based on known chemical behavior and toxicity. The values used in the risk assessment were derived from available literature that included specialized laboratory tests. The endpoints of these tests are based on nonlethal effects including subtle changes in biochemical pathways and histopathology. The results of the definitive assessment suggest that the organic contaminants do not represent a substantial risk to any of the receptors used in the assessment. Most inorganic contaminants are present at concentrations that result in a risk to receptors. However, because of the uncertainty associated with the foodchain exposure models and receptor behavior/characteristics, the target cleanup levels presented in the ecological risk assessment should be viewed as guidelines only and not as definitive remediation goals. Information presented in the ecological assessment indicates that the risks to ecological receptors falls within acceptable ranges given the uncertainty associated with the evaluation process, assuming the site is remediated to achieve RAOs (Remedial Action Objectives) established for the protection of human health.

3.7.2.5 Future Exposure. A screening level ecological risk assessment of future exposure conditions to ecological receptors was conducted for OU1 as part of this feasibility study. Although the selected remediation alternative was not yet known, some features common to most or all alternatives were identified, and these were assumed as a basis for calculation and analysis. Assumptions included removal or covering of much of the contaminated soil, as well as filling of many of the ponds on the site. Given these new conditions, many of the previously-apparent ecological receptor exposure routes were found to no longer be complete. An evaluation of future exposure conditions, assuming the new soil characteristics, was conducted for three terrestrial receptors: the cotton rat, the American woodcock, and the coyote. Exposure modeling was conducted using site information-- site-derived accumulation factors and ecological receptor tissue concentrations. A large part of the site will likely be covered by clean soil, so reference area soil, tissue, and accumulation factors were used. For those remaining areas left uncapped, Area B soil (below human health based levels), tissue and accumulation factors were used and assumed to represent exposure conditions for the non-capped portions of the site. Results of the on-site terrestrial receptor modeling indicate minimal risk potential. Mobile organisms such as the woodcock and coyote are at little to no risk since the site provides only a portion of their foraging range. Much of the site is not a viable habitat due to the high amounts of physical disturbance which do not support a natural setting for ecological receptors to thrive. Evaluation of small organisms that may rely solely upon the site area for their home and forage range, such as the hispid cotton rat, indicates no risk in the remediated areas. Areas which may be left uncapped, such as Area J, may be of concern. However, these areas are industrial settings and do not support ecological receptor occurrence. Future land use will likely be industrial also.

3.7.2.6 Conclusions. Conservative assumptions (i.e. using maximum observed concentrations etc) were used as part of the exposure and risk evaluation. Results of the ecological evaluation, based on future remedial actions at the site, indicate that risk to on-site terrestrial receptors and off site receptors are not significant.

3.8 Remedial Action Objectives. RAOs for contamination sources at the Tex Tin site are described in this section. RAOs have been developed for those chemicals from those sources on the Tex Tin site that pose significant carcinogenic risk or non carcinogenic hazards to human health and the environment based on ARARs (Applicable, Relevant and Appropriate Requirements) and site-specific risk calculations. The RAOs refer to specific sources, contaminants, pathways, and receptors. The RAOs developed for Tex Tin are shown in Box 3.8, "Remedial Action Objectives."

Box 3.8 Remedial Action Objectives

- Prevent direct contact,ingestion, and inhalation of surface and subsurface soil, sediments, waste piles, drums (spent catalyst) and groundwater materials containing contaminants that exceed a carcinogenic risk of 1.0E-04 or a hazard index of 1.

- Prevent the release of contaminants from Acid Pond, wastewater ponds, drums (spent catalyst), above ground storage tanks, and slag piles to surface and subsurface soils, surface water, and groundwater. Protect off site ecological receptors by preventing off site contaminant migration as a result of on-site releases.

- Prevent external radiation exposure and prevent direct contact, ingestion and inhalation of soils and slag piles that contain radium-226 material that exceeds 40 C.F.R. Part 192 criteria.

- Prevent further degradation of Shallow and Medium Transmissive Zone groundwater outside the operable unit boundaries.

- Prevent migration for contaminated groundwater outside the operable unit boundaries in the Deep Transmissive Zone.

- Prevent the release of friable asbestos-containing materials in buildings and structures on-site.

3.9 Description and Comparative Analysis of Remedial Alternatives. This section briefly explains the remedial alternatives developed to accomplish the remedial action objectives forthe contaminant sources on site. The description of each alternative in this section contains enough information so that the comparative analysis of alternatives in the following sections can focus on the differences or similarities among the alternatives with respect to the nine evaluation criteria specified in the NCP, 40 C.F.R. §300.430(e)(9)(iii). Additional details necessary to designeach remedy are found in the August 4, 1998 Feasibility Study Report, Section 3.0, "Development and Screening of Remedial Alternatives." Each of the following sections describe the alternatives to accomplish the remedial action objectives for the contaminant sources. In each section EPA also included an estimate for the capital, O &M and present worth cost of each alternative. The present worth was calculated as the present worth cost for thirty years of O & M plus the capital cost. For each remedial alternative the present worth cost was calculated using an eight percent discount rate. EPA did not convert the capital cost to a present worth since EPA expects each alternative to be designed, competitively bid and constructed in less than 36 months. Therefore, EPA believes it is reasonable to assume, for the sake of comparing alternatives, that the capital cost is equivalent to a single charge at the start of the cleanup. In addition to including the cost comparison, each section also includes tables showing the key ARARs for each contaminant source as well as a table comparing each remedial alternative to the nine evaluation criteria specified in the NCP.

3.9.1 Description of Remedy Components. The objective of this section is to provide a brief explanation of the remedial alternatives developed for the site. The description of each alternative contains the information used for a comparative analysis of alternatives.

3.9.1.1 Acid Pond (AP) and Wah Chang Ditch. The following alternatives were developed to address the Acid Pond and the Wah Chang Ditch to the area where the ditch discharges to the off-site ponds. The Phase II RI discovered a large transmissive sand channel near the northeast corner of the Acid Pond that allows direct hydrogeologic communication between the pond and the Wah Chang Ditch[54] (Woodward-Clyde, 1993). It is for this reason that the Acid Pond and the ditch were paired as one contaminant source unit for the purpose of developing a remedial alternative. The components of each alternative are shown in Box 3.9.1.1, "Components of Each AP Remedial Alternative," and the common elements and distinguishing features of each alternative are described in paragraphs 3.9.1.2 through 3.9.1.6. The following alternatives address isolation of the Acid Pond from the shallow groundwater and describe technologies to treat the principal threats from the Acid Pond liquid and sediment, as well as the Wah Chang Ditch sediment. The key ARARs for each alternative are shown in Table 3.9.1.1 - 1 "Key ARARs For AP Remedial Alternatives," and the fundamental components along with the cost of each alternative are shown in Box 3.9.1.1, "Components of Each AP Remedial Alternative." A comparison of each alternative to the nine evaluation criteria specified in the NCP is shown in Table 3.9.1.1 - 2, "AP Remedial Alternative Comparison."

Table 3.9.1.1 - 1
Key ARARs For AP Remedial Alternatives

Requirement	AP1	AP2	AP3	AP4	AP5
Underground Injection Control (UIC) Program 40 C.F.R. Part 144, 42 USC 300(f)	N/A	N/A	N/A	N/A	YES
40 C.F.R. Part 264 Standards for Owners and Operators of Hazardous Waste Treatment, Storage, and Disposal Facilities	YES	YES	YES	YES	YES
40 C.F.R. Parts 122 to 125, National Pollutant Discharge Elimination System (NPDES)	YES	YES	YES	YES	N/A
40 C.F.R. Part 268, Land Disposal Restrictions	YES	YES	YES	YES	YES
30 TAC. Environmental Quality, Part I, Texas Natural Resource Conservation Commission. Chapter 335, Industrial Solid Waste and Municipal Hazardous Waste, Subchapter S, Risk Reduction Standards.	YES	YES	YES	YES	YES

Box 3.9.1.1 Components of Each AP Remedial Alternative

Alternative AP2: Geomembrane Wall, Metals Precipitation Treatment System, Sediment Stabilization.

- Treatment Components
  - Metals precipitation for acid pond water.
  - Stabilization for sediments and sludge
- Containment Components
  - Geomembrane wall to prevent groundwater from recharging the acid pond.
- Institutional Control Components
  - Deed Record to notify potential buyers that excavation on site may cause a release.
- Cost

Capital	$6,960,000		
Present Worth O&M	$135,000	Annual O&M	$12,000
Total Present Worth	$7,095,000		

Alternative AP3: Geomembrane Wall, Filter Press - GAC Treatment System, Sediment Stabilization.

- Treatment Components
  - Granulated activated carbon (GAC) treatment to remove metals from acid pond water
  - Stabilization for sediments and sludge
- Containment Components
  - Geomembrane wall to prevent groundwater from recharging the acid pond.
- Institutional Control Components
  - Deed Record to notify potential buyers that excavation on site may cause a release.
- Cost

Capital	$6,430,000		
Present Worth O&M	$135,000	Annual O&M	$12,000
Total Present Worth	$6,565,000		

Alternative AP4: Geomembrane Wall, Metals Precipitation Treatment System

- Treatment Components
  - Metals precipitation for acid pond water.
- Containment Components
  - Geomembrane wall to prevent groundwater from recharging the acid pond.
- Institutional Control Components
  - Deed Record to notify potential buyers that excavation on site may cause a release.
- Cost

Capital	$3,090,000		
Present Worth O&M	$135,000	Annual O&M	$12,000
Total Present Worth	$3,225,000		

Alternative AP5: Geomembrane Wall, Deep Well Injection of Liquid and Sediment.

- Treatment Components - None.
- Containment Components
  - Geomembrane wall to prevent groundwater from recharging the acid pond.
  - Deep well injection of sediments and acid pond water
- Institutional Control Components
  - Deed record to prevent disturbance of the plugged injection well.
- Cost

Capital	$10,900,000		
Present Worth O&M	$135,000	Annual O&M	$12,000
Total Present Worth	$11,035,000		

Table 3.9.1.1. - 2
AP Remedial Alternative Comparison

Criterion	AP1	AP2	AP3	AP4	AP5
Overall protection of human health and the environment	Provides no protection of human health or the environment.	Achieves protection by treating Acid Pond liquid and sediment, and Wah Chang Ditch sediments.	Achieves protection by treating Acid Pond liquid and sediment, and Wah Chang ditch sediments.	Achieves protection by treating Acid Pond Liquid and isolating Acid Pond and Wah Chang Ditch Sediments	Achieves protection by deep well injecting Acid Pond liquid and Acid Pond and Wah Chang Ditch Sediments
Compliance with ARARs	Does not meet ARARs.	Discharge to ditch must comply with NPDES limits.	Discharge to ditch must comply with NPDES limits.	Discharge to ditch must comply with ARARs.	Must comply with numerous state and Federal ARARs governing deep well injection.
Long-term effectiveness and permanence	Not effective or permanent.	Provides long-term effectiveness by stabilizing sediments. Final cover would prevent direct contact.	Provides long-term effectiveness by stabilizing sediments. Final cover would prevent direct contact.	May present long-term risk to groundwater if the impermeable cover or the geomembrane wall fail to prevent water infiltration.	Provides long-term effectiveness if injection well is properly utilized and abandoned, and no contamination of usable aquifers occurs during injection.
Reduction of toxicity, mobility, or volume through treatment	Provides no reduction of waste toxicity, mobility, or volume.	Provides reduction in toxicity and mobility, but sediment volume would increase due to stabilization	Provides reduction in toxicity and mobility, but sediment volume would increase due to stabilization.	Provides no reduction in sediment toxicity, mobility, or volume, but sediment would be isolated from the environment.	Provides no reduction in toxicity, mobility, or volume, but waste would be injected to a point below any usable aquifers.
Short-term effectiveness	No associated risk to workers. Nearby residents may be affected by continued off-site migration of waste.	Potential short-term exposure of workers during stabilization and water treatment.	Potential short-term exposure of workers during stabilization and water removal phases.	Potential short-term exposure to workers during sediment excavation and placement and water treatment.	Potential short-term exposure to workers during waste excavation and injection activities
Implementability					
Implementability Technical	No action required, therefore, technically feasible.	Geomembrane technology has been effectively used at other sites. Metals precipitation is a proven treatment process. Stabilization and covering are established construction procedures.	Geomembrane technology has been effectively used at other sites. Filter press - GAC system appears suitable for water treatment. Stabilization and covering are established construction procedures.	Geomembrane technology has been effectively used at other sites. Metals precipitation is a proven treatment process. Covering is an established construction procedure.	Deep well injection has been performed previously at the site.
Implementability Administrative	No action required, therefore, administratively feasible.	May have difficulty achieving NPDES limits for Chemical Oxidation Demand.	No anticipated problems achieving NPDES limits with filter press - GAC treatment system.	May present difficulties in preventing leaching to shallow groundwater which would not provide compliance with ARARs	May be difficult to comply with state and Federal ARARs requirements for deep well injection
Implementability Availability of services and materials	Services and materials are not required.	Limited vendors can provide the Geomembrane technology. Stabilization and water treatment processes have established suppliers and operators.	Geomembrane Systems are provided by limited vendors. Water treatment processes have established suppliers and vendors.	Limited vendors can provide the Geomembrane technology. Water treatment processes have established suppliers and vendors.	Limited vendors can provide the mechanism for creating the waste slurry from sediment.
State Acceptance	Other than rejecting AP1 and AP5, the State did not express a preference for any of the other alternatives.				
Community Acceptance	While there was no specific preference for alternatives AP1 through AP4, two comments were received favoring deep well injection, AP5.				

3.9.1.2 Alternative API: No Action. Under this alternative, no action would be taken to remove, treat, or contain the water and sediments in the Acid Pond and the sediments in the Wah Chang Ditch. Because contaminated media would remain in place, the potential for off-site migration of contaminants would not be mitigated. The No Action alternative has been included for each of the units included in the feasibility study (FS) as a requirement of the NCP and to provide a basis of comparison for the remaining alternatives.

3.9.1.3 Alternative AP2: Geomembrane Wall, Metals Precipitation Treatment System, Sediment Stabilization. In this alternative, a geomembrane wall would be installed beneath the surface around the Acid Pond to form a vertical barrier. This vertical barrier and the natural clay confining layer beneath the pond would prevent groundwater from recharging the pond while the pond sediments are stabilized. The Acid Pond liquid would be neutralized through treatment (i.e., raising the pH). This treatment would form metal species which would precipitate. The treated effluent would be discharged to the Wah Chang Ditch under the requirements of Tex Tin Corporation's NPDES permit limits. Sediments from the Wah Chang Ditch and the Acid Pond would be stabilized in-situ.[55] The water treatment precipitates would also be stabilized. Once stabilization is complete an impermeable cover would be placed over the Acid Pond. Acid Pond sediments would be stabilized through an in situ process to immobilize the metal contaminants. Before the start of stabilization, sediment from an approximately 3,200-foot long section of the Wah Chang Ditch (an estimated 16,000 cubic yards) would be excavated, placed into the Acid Pond, and mixed with the Acid Pond sediments. After all stabilization was completed, common fill would be added to the Acid Pond, if necessary, to fill in voids and slope the surface to drain. Once a slight slope was achieved, an impermeable cover consisting of a 60-mil HDPE (high density poly-ethylene) geomembrane liner and 12 inches of compacted clay would be placed over the former pond area and topped with a 6-inch topsoil layer. The topsoil layer would be covered with grass chosen for long-tem erosion control. The impermeable cover would be designed to promote drainage away from the former pond. Stabilized contaminant sources for other areas on site may also be used to fill the Acid Pond These could include: drummed materials and supersack contents, inorganic above ground storage tank contents, non-NORM slag that exceeds the contaminant leachate remedial action cleanup level (see Table 3.11.3.1). These materials could be treated in-situ in the Acid Pond or stabilized elsewhere on site prior to use as Acid Pond fill The operation and maintenance (O&M) activities associated with this alternative would include inspection of the impermeable cover and maintenance of the topsoil layer. Groundwater monitoring for the Acid Pond has been included as a component of the groundwater alternatives. Because the contaminated sediments, although treated, would remain on-site, this alternative would include a deed record to prevent potential exposure to site contaminants.

3.9.1.4 Alternative AP3: Geomembrane Wall, Filter Press - Granulated Activated Carbon (GAC) Treatment System, Sediment Stabilization. In this alternative, the Acid Pond would be isolated from groundwater and the surrounding soils by a geomembrane barrier wall. This wall would form a vertical barrier while the natural clay confining layer beneath the pond would form a horizontal barrier to prevent groundwater from recharging the pond while the pond sediments are stabilized. The liquid within the Acid Pond would be pumped out, treated with a filter press and GAC system on-site, and then discharged to the Wah Chang Ditch under the requirements of the NPDES limits. Sediments from the Wah Chang Ditch and the Acid Pond would be stabilized in-situ. Once stabilization is complete, an impermeable cover would be placed over the Acid Pond. Acid Pond sediments would be stabilized through an in situ process to immobilize the metal contaminants. Before the start of stabilization, sediment from an approximately 3,200-foot long section of the Wah Chang Ditch (an estimated 16,000 cubic yards) would be excavated, placed into the Acid Pond, and mixed with the Acid Pond sediments. After all stabilization was completed, common fill would be added to the Acid Pond, if necessary, to fill in voids and slope the surface to drain. Once a slight slope was achieved, an impermeable cover consisting of a 60-mil HDPE (high density poly-ethylene) geomembrane liner and 12 inches of compacted clay would be placed over the former pond area and topped with a 6-inch topsoil layer. The topsoil layer would be covered with grass chosen for long-tem erosion control. The impermeable cover would be designed to promote drainage away from the former pond. Stabilized contaminant sources for other areas on site may also be used to fill the Acid Pond These could include: drummed materials and supersack contents, inorganic above ground storage tank contents, non-NORM slag that exceeds the contaminant leachate remedial action cleanup level (see Table 3.11.3.1). These materials could be treated in-situ in the Acid Pond or stabilized elsewhere on site prior to use as Acid Pond fill

The operation and maintenance (O&M) activities associated with this alternative would include inspection of the impermeable cover and maintenance of the topsoil layer. Groundwater monitoring for the Acid Pond has been included as a component of the groundwater alternatives. Because the contaminated sediments, although treated, would remain on-site, this alternative would include a deed record to prevent potential exposure to site contaminants. The deed record would describe the location of the stabilized contaminants and provide notice to future potential buyers that excavating in that location may cause a release of hazardous substances.

3.9.1.5 Alternative AP4: Geomembrane Wall, Metals Precipitation Treatment System. The Acid Pond would be isolated from groundwater and the surrounding soils by a geomembrane technology as described in Alternative AP2. The liquid within the Acid Pond would be pumped out, treated on-site, and then discharged to the Wah Chang Ditch under the requirements of the NPDES limits. Alternative AP4 is identical to AP2 with the exception of no in situ stabilization being implemented. This alternative could coincide with the placement of other materials in the Acid Pond including drum and supersack contents, NORM slag, non-NORM slag and hazardous soils.** An impermeable cover consisting of 60-mil HDPE geomembrane liner and 12 inches of compacted clay would be placed over the former pond area and topped with a 6-inch topsoil layer. The O&M activities associated with this alternative would include inspection of the impermeable cover and maintenance of the vegetative layer. Monitoring of groundwater in the vicinity of the Acid Pond has been included as a component of the groundwater alternatives Because contaminated sediments would remain on-site, institutional controls would be required in the form of a deed record to further limit the potential for human exposure to contaminants.

3.9.1.6 Alternative AP5: Geomembrane Wall, Deep Well Injection of Liquid and Sediment. In this alternative, the Acid Pond would be isolated from the groundwater and surrounding soils by the geomembrane to prevent pond recharge during treatment. The liquid and sediment from the Acid Pond and the sediment from the Wah Chang Ditch would be slurried and then pumped to the on-site deep injection well for final disposal. The Acid Pond would be backfilled with materials from off-site sources or with site materials that do not exceed contaminant source leachate remedial action cleanup levels. To implement this alternative, the existing on-site deep injection well, which was completed in 1985 to a total depth of approximately

** The term "hazardous soil" is used to define soil which leaches contaminants greater than the contaminant source leachate concentrations shown on Table 3.11.3.1, "Remedial Action Cleanup Levels."

6,600 feet below ground surface, would be used. The injection zone for this well is the lower Miocene sands, which are found at depths ranging from 5,600 to 6,600 feet below ground surface. These sands extend laterally throughout Galveston County. Massive impermeable shale and clay beds are present both above and below the sands, making this formation an attractive unit for injection. According to the permit application for this well, dated October 23, 1984, the rate of injecfon was to average 50 gallons per minute (gpm); the maximum instantaneous rate of injection was 100 gpm; the surface injection pressure was not to exceed 800 pounds per square inch (psi); and the total monthly volume of waste injected was not to exceed 2.2 million gallons. At some point during the late 1980s or early 1990s, the on-site deep injection well was plugged. According to a TDWR interoffice memorandum, it is likely that the well was plugged using four 50-foot cement plugs, with the tops of the plugs being located at approximately 5,600 feet below ground surface, 5,000 feet below ground surface, and 1,700 feet below ground surface, and at the ground surface. To implement this alternative, the plugged well would need to be reentered, which would entail drilling through the four plugs. Before injection of the sediments, these materials would be mixed with existing liquid located in the Acid Pond, and potentially with water from other sources, to form a slurry for pumping purposes. After the completion of all waste injection, the deep well would again be plugged. The emptied Acid Pond would be backfilled with clean fill from off-site sources or with site materials that do not exceed contaminant source leachate remedial action cleanup levels. The O&M activities associated with this alternative would include the installation of two monitoring wells to monitor the injection system. These wells would monitor the first potable water aquifer present above the lower Miocene sands to detect the upward migration of waste. Institutional controls in the form of a deed record would be needed to prevent disturbance, reentry, or reuse of the plugged deep injection well.

3.9.1.7 Drummed Materials (DR) Historical documentation and investigations disclosed numerous drums and supersacks present in Areas B, E, J, and L. The drums and supersacks contain a variety of materials including spent catalysts, corrosives, trash, water treatment chemicals, and lubricants and in many cases these are a primary contaminant source. As of June 1996, it was estimated that approximately 6,500 deteriorated drums and supersacks were present at the site. Many of the drums are believed to contain principal threat wastes; consequently treatment is the preferred remedial alternative. The fundamental components and cost of each alternative are shown in Box 3.9.1.7, "Components of Each DR Remedial Alternative;" the key ARARs for each alternative are shown in Table 3.9.1.7 - 1, "Key ARARs For DR Remedial Alternatives;" and a comparison of each alternative to the nine evaluation criteria specfied in the NCP is shown in Table 3.9.1.7 - 2, "DR Remedial Alternative Comparison."

Box 3.9.1.7 Components of Each DR Remedial Alternative

Alternative DR2: Off-Site Disposal

- Treatment Components - None
- Containment Components
  - Off-Site disposal.
- Cost

Capital	$3,760,000		
Present Worth O&M	$,000	Annual O&M	$000
Total Present Worth	$3,760,000		

Alternative DR3: Stabilization of Drum Contents On-site

- Treatment Components
  - Stabilize drum contents.
- Containment Components
  - Bury the stabilized drum materials with the stabilized acid pond sediments beneath a topsoil cover.
- Institutional Control Components - None.
- Cost

Capital	$450,000	Annual O&M	$000	No additional cost to acid pond O&M.
Present Worth O&M	$000			
Total Present Worth	$450,000			

Alternative DR4: Placement of Drum Contents On-site

- Treatment Components - None
- Containment Components
  - Cover drum contents in the acid pond with a clay cover.
- Institutional Control Components - None.
- Cost

Capital	$350,000			
Present Worth O&M	$.000	Annual O&M	000	No additional cost to acid pond O&M.
Total Present Worth	$350,000			

Alternative DR5: Deep Well Injection of Drum Contents

- Treatment Components - None.
- Containment Components
  - Deep well injection of drum contents
- Institutional Control Components - None.
- Cost

Capital	$610,000			
Present Worth O&M	$.000	Annual O&M	000	Included with the AP5 cost
Total Present Worth	$610,000			

Table 3.9.1.7 - 1
Key ARARs For DR Remedial Alternatives

Requirement	DR1	DR2	DR3	DR4	DR5
Underground Injection Control (UIC) Program 40 C.F.R. Part 144, 42 USC 300(f)	N/A	N/A	N/A	N/A	YES
40 C.F.R. Part 268, Land Disposal Restrictions	YES	YES	YES	YES	YES
40 C.F.R. Part 264 Standards for Owners and Operators of Hazardous Waste Treatment, Storage, and Disposal Facilities	YES	YES	YES	YES	YES

Table 3.9.1.7 - 1 Key ARARs For DR Remedial Alternatives					
Requirement	**DR1**	**DR2**	**DR3**	**DR4**	**DR5**
30 TAC. Environmental Quality, Part I, Texas Natural Resource Conservation Commission, Chapter 335, Industrial Solid Waste and Municipal Hazardous Waste, Subchapter S, Risk Reduction Standards.	YES	YES	YES	YES	YES

Abandoned drums in Area E.

Table 3.9.1.7 - 2
DR Remedial Alternative Comparison

Criterion	DR1	DR2	DR3	DR4	DR5
Overall protection of human health and the environment	Provides no protection of human health or the environment.	Protection of human health and environment achieved by removing waste material and drums from site.	Protection is achieved by stabilizing selected drum contents and removing the rest off site.	Protection is achieved by isolating selected drum wastes from the environment, taking the rest off site.	Protection is achieved by deep well injecting drum wastes below any usable aquifers
Compliance with ARARs	Does not meet ARARs.	Drum removal and waste disposal would be conducted in accordance with RCRA and other Federal, state, and local requirements.	Stabilization of waste materials could pass the RCRA toxicity characteristic requirements	Must provide adequate protection of shallow groundwater by preventing water infiltration through impermeable cover	Must comply with numerous state and Federal ARARs, but possible
Long-term effectiveness and permanence	Not effective or permanent.	Provides long term effectiveness and permanence by eliminating future exposure and migration through the removal of wastes from the site.	Stabilized materials do not readily leach contaminants, providing a long-term effective and permanent solution.	Impermeable cover and geomembrane wall must be maintained to prevent infiltration of stormwater and shallow groundwater	If injection well is properly abandoned, this method should provide for long term effectiveness and permanence
Reduction of toxicity, mobility, or volume through treatment	None through treatment.	None through treatment.	Stabilization provides a reduction in toxicity and mobility of site contaminants, but does not reduce volume.	Placement on site provides no reduction of waste toxicity, mobility, or volume, but isolates waste from the environment	Provides no reduction in waste toxicity, mobility, or volume, but isolates waste from the environment
Short-term effectiveness	No associated risk to workers and residents.	Potential risks associated with spills/leaks on public roads and worker exposure during loading affect the short-term effectiveness.	Workers would be required to wear appropriate PPE and adhere to safe construction practices to minimize short-term effects.	Workers would be required to wear appropriate PPE and adhere to safe construction practices to minimize short-term effects.	Workers would be required to wear appropriate PPE and adhere to safe construction practices to minimize short-term risks.
Implementability					
Implementability Technical	No action required, therefore, technically feasible.	Equipment, labor, and disposal facilities are available, making alternative technically feasible.	Stabilization of drum wastes is now routinely performed. Alternative is technically feasible.	Equipment and contractors are readily available.	Limited vendors can supply the technology to prepare the waste for slurry injection.
Implementability Administrative	No action required, therefore, administratively feasible.	Manifesting would be required. Alternative is administratively feasible.	No specialized limits would be required for stabilization.	Must show that groundwater would be adequately protected	Would require compliance with state and Federal ARARs, must meet TNRCC approval
Implementability Availability of services and materials	Services and materials are not required.	No specialized labor or equipment would be required. Scrap yards and disposal facilities have the necessary capacity.	EPA-qualified vendors are available.	No specialized labor or equipment would be required.	Limited vendors can supply technology to create the waste slurry necessary for deep well injection.
State Acceptance	Other than rejecting DR1 and DR5, the State did not express a preference for any of the other alternatives.				
Community Acceptance	While there was no specific preference for alternatives DR1 through DR4, two comments were received favoring deep well injection, DR5.				

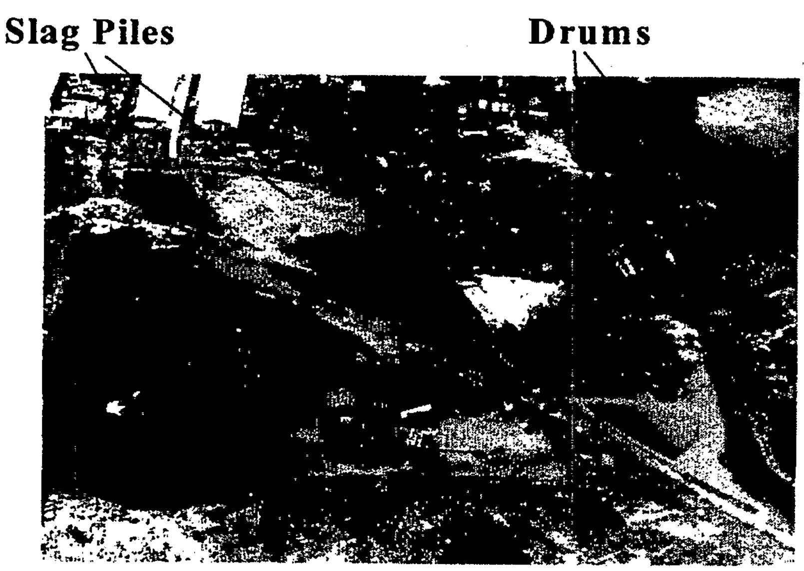
3.9.1.8 Alternative DR1: No Action. Under this alternative, no action would be taken to remove, treat, or contain the drums and supersacks and their contents. Because the drum contents would remain in place, the potential for spills and leaks of these materials would not be mitigated.

3.9.1.9 Alternative DR2: Off-Site Disposal. Under this alternative, the drummed materials and supersack contents would be characterized and shipped off site for disposal at an EPA-approved disposal facility. Facilities in Texas, Louisiana, and Kentucky have been identified for the disposal of these wastes. Because all drummed materials would be taken off site for disposal, there would be no operation and maintenance activities associated with this alternative, nor would institutional controls be required.

3.9.1.10 Alternative DR3: Stabilizing Inorganic Drummed Materials and Supersack Contents, Disposing of Drummed Organic Material Off site. Under this alternative, all drums and supersacks would be emptied, decontaminated and hauled off site for scrap metal recycling or disposal, or would be landfilled on site. The inorganic drummed materials and supersack contents would be stabilized and used to fill the Acid Pond. The organic contents would be disposed of off site at an EPA approved treatment and disposal facility. Drum decontamination water would be treated with the Acid Pond liquids. Because the drummed materials would be treated along with the Acid Pond sediments, there are no O&M activities for this alternative. Likewise, institutional controls are not included with this alternative but are part of the Acid Pond alternatives.

3.9.1.11 Alternative DR4: Placement of Drum Contents On-site. This alternative is identical to Alternative DR3, except that no stabilization would be implemented for the drum contents. All drums and supersacks would be emptied, decontaminated, and hauled off site for scrap metal recycling or disposal. For purposes of cost estimation, the assumption has been made that drum inorganic contents would be deposited in the Acid Pond. Organic wastes removed from approximately 220 drums in the former Morchem facility would be disposed of off site with the AST wastes. O&M activities and institutional controls associated with this alternative have been included as a component in the Acid Pond alternatives, not as a part of this alternative.

3.9.1.12 Alternative DR5: Deep Well Injection of Drum Contents. Under this alternative, all drums and supersacks would be emptied of their contents, decontaminated, and hauled off site for scrap metal recycling or off-site disposal, or landfilled on site. The inorganic waste contents of the drums and supersacks would be crushed (as needed), and then mixed with the organic wastes and water to form a slurry of approximately 30 percent solids. This slurry would then be injected through the existing on-site deep injection well into the subsurface. Monitoring of the deep well injection system has been included as an O&M activity under the injection of the Acid Pond Alternative.



Southern portion of the Site

3.9.1.13 NORM SLAG (NSL). The following alternatives were developed to address NORM slag piles 12, 13, 30, and 31. During the Phase II RI slag emitting radiation above regulatory standards and containing inorganic concentrations above the proposed slag remedial action cleanup levels was identified as a primary contaminant source. The elevated radioactive levels are believed to be from naturally occurring radiation sources concentrated in the slag during the smelting operations. The estimated NORM slag piles volume is 14,100 cubic yards. All of the following NORM slag remedial alternatives, with the exception of NSL1, "No Action," involve either placing the material under an impermeable cap, disposing at a Department of Energy disposal facility, or deep well injection. These alternatives remediate the external and internal carcinogenic human health risk associated with the radioactive material by preventing external radiation exposure and preventing direct contact, ingestion, and inhalation of any contaminant sources containing radium-226 exceeding the criteria in 40 C.F.R. Part 192. Covering the radioactive material on site is consistent with remedies previously employed at two other Superfund sites: the Denver Radium site in Colorado and the Monticello Mill Tailings site in Utah. At Denver Radium[56] radiation in building and Process Areas was detected to a depth of 40 inches with an average concentration of 90 pCi/g, and in open areas to an average depth of 39 inches at an average concentration of 69 pCi/g. Like the Denver Radium site, the Tex-Tin site was found to contain radium, thorium, and uranium. However, in contrast to Denver Radium, the Tex-Tin slag piles were found to have radium-226 or radium-228 concentrations generally less than 20 pCi/g with a maximum recorded concentration of 107 pCi/g. Soils and sediments at Tex-Tin averaged less than 5 pCi/g. For the Monticello[57] site, primary contaminants of concern affecting the soil and debris are metals including arsenic, chromium, and lead; and radioactive materials including thorium-230, radium-266, and radon-222. Uranium mill tailings, which were left on the site or taken away to be used as fill at construction sites in the nearby town, are to be consolidated in a repository near the mill site. The repository will then be capped to protect groundwater, isolate the waste from the environment, and control the escape of radon gas. Average waste concentrations at Monticello ranged from 590 to 879 pCi/g of radium-226 in various tailings piles. In contrast, Tex-Tin radium-226 concentrations peaked at 107 pCi/g and most of them were less than 20 pCi/g. The fundamental components and cost of each alternative are shown in Box 3.9.1.13, "Components of Each NSL Remedial Alternative," the key ARARs for each alternative are shown in Table 3.9.1.13 - 1, "Key ARARs For NSL Remedial Alternatives," and a comparison of each alternative to the nine evaluation criteria specfied in the NCP is shown in Table 3.9.1.1 - 2, "NSL Remedial Alternative Comparison."

Table 3.9.1.13 - 1
Key ARARs For NSL Remedial Alternatives

Requirement	NSL1	NSL2	NSL3	NSL4	NSL5
Underground Injection Control (UIC) Program 40 C.F.R. Part 144, 42 USC 300(f)	N/A	N/A	N/A	N/A	YES
40 C.F.R. Part 268, Land Disposal Restrictions	YES	YES	YES	YES	YES
40 C.F.R. Part 264 Standards for Owners and Operators of Hazardous Waste Treatment, Storage, and Disposal Facilities	YES	YES	YES	YES	YES
40 C.F.R. Part 192, Subpart B, Health and Environmental Standards for Thorium Mill Tailings	YES	YES	YES	YES	YES
30 TAC. Environmental Quality, Part I, Texas Natural Resource Conservation Commission, Chapter 335, Industrial Solid Waste and Municipal Hazardous Waste, Subchapter S, Risk Reduction Standards.	YES	YES	YES	YES	YES

Box 3.9.1.13 Components of Each NSL Remedial Alternative

Alternative NSL2: Off Site Disposal of NORM Slag.

- Treatment Component - None
- Containment Component
  - Off site disposal
- Institutional Control Components - None
- Cost

Capital	$16,730,000			
Present Worth O&M	$000	Annual O&M	$000	
Total Present Worth	$15,730,000			

Alternative NSL3: Stabilization of NORM Slag

- Treatment Components
  - Stabilize NORM slag.
- Containment Components
  - Landfill and Cover stabilized slag with impermeable cover so radioactive exposure levels are not exceeded
- Institutional Control Components
  - Deed recordation to protect the integrity of the cap.
- Cost

Capital	$970,000			
Present Worth O&M	$000	Annual O&M	$000	No additional cost, included with groundwater O & M activities.
Total Present Worth	$970,000			

Alternative NSL4: Placement of NORM Slag On-site

- Treatment Components - None
- Containment Components
  - Dispose of slag with the acid pond sediments in the acid pond beneath an impermeable cap.
- Institutional Control Components - None.
- Cost

Capital	$130,000			
Present Worth O&M	$,000	Annual O&M	$000	No additional cost included with acid pond O&M.
Total Present Worth	$130,000			

Alternative NSL5: Deep Well Injection of NORM Slag

- Treatment Components - None
- Containment Components
  - Deep well injection for NORM slag.
- Institutional Control Components - None
- Cost

Capital	$2,810,000			
Present Worth O&M	$000	Annual O&M	$000	No additional cost included with

Table 3.9.1.13 - 2
NSL Remedial Alternative Comparison

Criterion	NSL1	NSL2	NSL3	NSL4	NSL5
Overall protection of human health and the environment	Provides no protection of human health or the environment.	NORM slag would be removed from the site, which would provide protection of human health and the environment.	Stabilizing NORM slag is protective of human health and the environment.	Provides protection of human health and the environment by isolating waste, but may not sufficiently protect shallow groundwater	Protects human health and the environment by isolating waste from the surrounding environment
Compliance with ARARs	Does not meet ARARs.	Contaminated material would be removed to levels that would meet the applicable ARARs. Off-Site disposal would need to comply with applicable regulations.	Compliance with ARARs can be achieved by stabilizing and covering to meet radioactive exposure levels	Shallow groundwater must be monitored to verify compliance	Numerous state and Federal ARARs must be closely monitored for groundwater protection
Long-term effectiveness and permanence	Not effective or permanent.	Removal of waste and off-site disposal at an appropriate licensed landfill would provide long-term effectiveness and permanence.	Stabilized material would not readily leach contaminants, providing a long-term effective and permanent solution.	Dependent on the effectiveness of the impermeable cover and the geomembrane wall to prevent the infiltration of stormwater and shallow groundwater	If injection well is properly abandoned, this should provide adequate long-term protection of the environment
Reduction of toxicity, mobility, or volume through treatment	None through treatment.	None through treatment.	Stabilization would provide a reduction in mobility of site contaminants, but would increase volume.	No reduction of toxicity, mobility, or volume. Dependent on the effectiveness of the impermeable cover and the geomembrane wall.	No reduction of toxicity, mobility, or volume, but should provide adequate protection of the environment.
Short-term effectiveness	No associated risk to workers and residents.	On-site workers and nearby residents could be exposed to waste materials or dust in the short term.	Workers would be required to wear appropriate PPE and adhere to safe construction practices to minimize short-term effects.	Workers would be required to wear appropriate PPE and adhere to safe construction practices to minimize short-term effects.	Workers would be required to wear appropriate PPE and adhere to safe construction practices to minimize short-term effects
Implementability					
Implementability Technical	No action required, therefore, technically feasible.	Equipment, labor, and the necessary disposal facilities are available, making alternative technically feasible.	Stabilization technology is routinely applied for radioactive materials.	Can be Implemented using standard construction technology	Limited vendors can supply the technology required to crush the slag and create the slurry required for deep well injection.
Implementability Administrative	No action required, therefore, administratively feasible.	Radioactive waste would be shipped a minimum distance of 1,400 miles. Logistical problems associated with rail shipping and disposal facility may arise.	No specialized limits would be required for stabilization.	No specific requirements for this alternative	Would require compliance with numerous ARARs and the permission of the TNRCC
Implementability Availability of services and materials	Services and materials are not required.	All materials and services needed for this alternative are routinely used in construction activities. Special consideration to handling of NORM material and decontamination of equipment may be required.	EPA-qualified stabilization vendors are available.	Equipment and EPA-approved contractors readily available.	Limited vendors are available that can provide the technology necessary to crush the slag and create an injectable slurry.
State Acceptance	Other than rejecting NSL1 and NSL5, the State did not express a preference for any of the other alternatives.				
Community Acceptance	While there was no specific preference for alternatives NSL1 through NSL4, two comments were received favoring deep well injection, NSL5.				

3.9.1.14 Alternative NSL1: No Action. Under this alternative, no action would be taken to remove, treat, or contain NORM slag piles 12, 13, 30, and 31. Because the NORM slag would be left in place, the potential for this material to migrate would not be mitigated.

3.9.1.15 Alternative NSL2: Off-Site Disposal of NORM Slag. Under this alternative, the NORM slag piles would be loaded onto railcars and/or vehicles permitted to transport NORM waste, and transported to an off-site NORM disposal facility. A facility in the Western United States has been identified as a potential disposal site for the NORM slag. Because all NORM slag would be disposed of off site, there would be no O&M associated with this alternative. There are no institutional controls associated with this alternative.

3.9.1.16 Alternative NSL3: Stabilizing NORM Slag. Under this alternative, the NORM slag would be stabilized on site, buried below grade and sealed beneath an impermeable cover in a landfill within Area C. The NORM slag will be buried in a manner to ensure that allowable radioactive dosage levels are not exceeded at the surface. O&M activities would include groundwater monitoring, cover inspection and maintenance, and institutional controls, which are included under SS2 and GW2 alternatives; consequently there are no additional O&M activities associated with this alternative. Because stabilized contaminated slag would be buried on site, this alternative would also include a deed record as an institutional control to limit the potential for future human exposure to contaminants. The deed record would describe the location of the slag and provide notice to potential buyers that excavations in that location may cause a release of hazardous substances.

3.9.1.17 Alternative NSL4: Placement of NORM Slag On-site. Under this alternative, the NORM slag would be transported to an on-site location and deposited under an impermeable cover. For purposes of estimating the assumption has been made that the NORM slag would be deposited in the Acid Pond. No stabilization would be performed. Because maintenance of the Acid Pond is included as an O&M activity under the Acid Pond alternatives, and because groundwater monitoring is included under the groundwater alternatives, there are no O&M activities associated with this alternative. There are no institutional controls associated with this alternative.

3.9.1.18 Alternative NSL5: Deep Well Injection of NORM Slag. Under this alternative, the NORM slag would be crushed, mixed with water, and disposed of via deep well injection. The crushed NORM slag would be mixed with water from the Acid Pond, wastewater ponds, or other sources, to achieve a 30-percent solids slurry. The slurry would then be pumped into the existing on-site deep injection well. At the completion of deep well injection activities, the well would be plugged. Monitoring of the deep injection system has been included as an O&M activity under Acid Pond Alternative AP5. Therefore, there are no O&M activities associated with this alternative.

3.9.1.19 NON-NORM SLAG (SL) The following alternatives were developed to address the 58 non-NORM slag piles (piles 1 through 11, 14 through 29, and 32 through 62). The Phase II RI noted that the majority of the slag piles consist of metallic ore and slag but that some piles contain construction debris and scrubber sludge. As described in the site conceptual model, EPA identified these piles as primary contaminant sources. The metallic ore and slag were generated during the smelting operations. Phase II RI analytical results indicated that composite samples collected from non-NORM slag piles 1, 11, 19, 27, 28, 29, 52, 56, 57, 58, and 62 exhibit hazardous waste toxic characteristics because they leach lead and/or mercury concentrations exceeding the maximum concentrations listed in 40 C.F.R. §261.24 "Toxicity Characteristic" (see also section 3.5.26, "Types of Contamination and the Affected Media"). Consequently, if disposed of off site, this slag would be classified as a RCRA hazardous waste The total volume of the hazardous non-NORM slag piles is approximately 20,000 cubic yards. The remaining 47 non-NORM slag piles did not fail TCLP (Toxicity Characteristic Leaching Procedure) testing and would not be classified as RCRA hazardous waste. However, these piles contain CERCLA hazardous substances (heavy metals) in concentrations that pose an unacceptable carcinogenic risk or non-carcinogenic hazard to human health and the environment. The estimated non-NORM non-hazardous*** slag piles volume is 32,000 cubic yards.

*** Non-Hazardous is used to identify slag or soil which is not a RCRA hazardous waste but was determined to pose a carcinogenic risk or non-carcinogenic hazard through the BHHRA.

3.10.4 Reduction of Toxicity, Mobility, or Volume Through Treatment. Reduction of toxicity, mobility, or volume through treatment refers to the anticipated performance of the treatment technologies that may be included as part of a remedy. There is no reduction of toxicity, mobility, or volume through treatment under Alternative SW1. Under SW3 and SW4, acid pond sediments, Wah Chang Ditch sediments, drum contents, NORM slag and hazardous non-NORM slag are stabilized thereby reducing the toxicity and mobility. In Alternative SW5, where all of the aboveground storage tank contents, drum wastes, and NORM and hazardous non-NORM slag are disposed of off site, there is no reduction in toxicity, mobility, and volume of contaminants on site. In SW2, there is a reduction of mobility by minimizing infiltration with the geomembrane and impermeable cap. In SW5, there is also a reduction of mobility, toxicity, and volume of contaminants in groundwater but no reduction through treatment. Alternative SW6 doesnot reduce toxicity or mobility but isolates the waste from the environment.

3.10.5 Short-Term Effectiveness. Short-term effectiveness addresses the period of time needed to implement the remedy and any adverse impacts that may be posed to workers and the community during construction and operation of the remedy until the cleanup levels in Table 3.11.3.1, "Soil Sediment, Slag and Sludge Remedial Action Cleanup Levels," are met. For the short-term effectiveness criteria, the no action alternative (SW1) has no associated carcinogenic risk to workers. Alternatives SW2, SW3, SW4, SW5, and SW6 all have short-term effects to workers which could be minimized by the use of personal protective equipment and dust control measures, and other engineering techniques.

3.10.6 Implementability. Implementability addresses the technical and administrative feasibility of a remedy from design through construction and operation. Factors such as availability of services and materials, administrative feasibility, and coordination with other governmental entities are also considered. All of the alternatives can be implemented. The technology, in situ stabilization, treatment, removal, and disposal are all well-documented technologies. Deep well injection of slurried materials is a proven oil field technology, but reentry of the existing on-site injection well will require caution and significant well integrity testing. Alternatives SW2, SW3, SW4, SW5, and SW6, all would require institutional controls in the form of a deed record to prohibit groundwater use and assure the integrity of the soil covers. Alternatives SW4, SW5, and SW6 would optimize future land uses at the site.

3.10.7 State Acceptance. TNRCC reviewed the Remedial Investigation, BHHRA, and Feasibility Study and provided comments to EPA. TNRCC also reviewed the proposed plan and submitted comments to EPA on November 4, 1998. Lastly, TNRCC accepted the remedy, SW3, on May 3, 1999.

3.10.8 Community Acceptance. Community acceptance is an important consideration in the final decision for the Site, and accordingly a public meeting was held on October 6, 1998, at the Texas City, City Hall. At this meeting EPA received oral and written public comments. EPA also accepted written comments by mail from September 9, 1998 through November 9, 1998, the end of the public comment period. EPA carefully considered all public comments received during the comment period before making a final decision on the remedy for OU1. A summary of the comments EPA received is included in this ROD as Section 4.

3.10.9 Qualitative Comparison. Table 3.10..9 provides a qualitative comparison between the site wide alternatives. A "–" indicates the alternative does not meet the criteria, an "O" indicates the criteria are met, and a "✚" indicates a best fix.

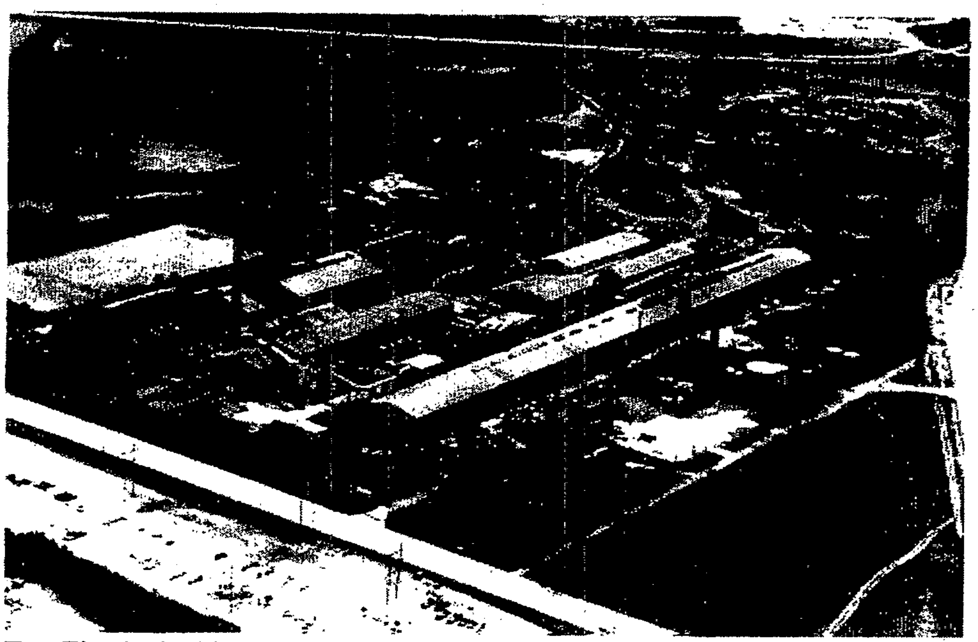
Discarded Drums in Area E.

Table 3.10.9 Qualitative Comparison						
Evaluation Criteria	**SW1**	**SW2**	**SW3**	**SW4**	**SW5**	**SW6**
Protection of human health	–	✚	✚	✚	✚	○
Compliance with ARARs	–	○	✚	✚	✚	–
Long-term effectiveness and performance	–	–	✚	✚	✚	✚
Reduction of toxicity, mobility and volume	–	–	○	○	○	○
Short-term effectiveness	✚	○	○	○	○	○
Implementability	✚	✚	✚	✚	✚	○
Cost (Present Worth)	$0	$15,580,000	$28,610,000	$88,280,000	$112,060,000	$36,930,000

Legend:
- – Unacceptable
- ○ Acceptable
- ✚ Best Fix

3.11 Selected Remedy. This section expands upon the details of the Selected Remedy from that which was provided in the "Description of Alternatives" section. This section also provides the general engineering details and estimated costs for the selected remedy so the design engineer can initiate the remedial design. The remedy is discussed in three sections: "Description of the Selected Remedy," "Summary of Estimated Remedy Costs," and "Expected Outcomes of the Selected Remedy."

3.11.1 Description of the Selected Remedy - SW3: On-site Stabilization, Compacted Clay Cover, Groundwater Monitoring, and Asbestos Removal, and Buildings Demolition. EPA's selected remedy is SW3, (see Figure 3.11.1). The component remedial alternatives are summarized in the following sections. A summary of the Site Wide Alternative SW3 is shown in Box 3.11.1. Under this alternative, a geomembrane wall would be placed around the Acid Pond. The Acid Pond liquids would be treated and discharged into the Wah Chang Ditch. Stabilization will be used for treatment of the Acid Pond and Wah Chang Ditch sediments. Drummed materials, hazardous non-NORM slag, and soils exceeding the leachate concentrations shown on Table 3.11.3.1, "Soil Sediment, Slag and Sludge Remedial Action Cleanup Levels" would be stabilized and used to fill the Acid Pond. The total volume of materials for on-site stabilization would be approximately 94,000 cubic yards. The wastewater pond liquids would be discharged into the Wah Chang Ditch. Soil exceeding any remedial action cleanup level in Table 3.11.3.1 but not exceeding leachate concentrations would be covered with a 24-inch clay soil cover. The above ground storage tank contents would be shipped off site for disposal at an EPA approved treatment and disposal facility. A perimeter monitoring program would be implemented to ensure no further groundwater degradation. Each building would be evaluated during Remedial Design using the criteria described in Section 3.11.3.5. If demolition is appropriate dust and asbestos would be removed from the buildings, the buildings demolished, and the debris landfilled on site. Buildings which are not demolished will be decontaminated. A detailed description of this remedial alternative is discussed in the following sections. The first section describes the distinguishing and unique features of the remedial alternatives for each contaminant source, while the second section describes the features common to each remedial alternative. A cost estimate for each alternative is also included in the first section.



Tex-Tin site looking towards the waste-water ponds and acid pond.

BOX 3.11.1 Site Wide Alternative 3

Alternative AP3: Geomembrane Wall, Filter Press - GAC Treatment System, Sediment Stabilization.

- Treatment Components
  - Granulated activated carbon (GAC) treatment to remove metals from acid pond water
  - Stabilization for sediments and sludge
- Containment Components
  - Geomembrane wall to prevent groundwater from recharging the acid pond.
  - Impermeable cover over stabilized sediments
- Institutional Control Components
  - Deed Record to notify potential buyers that excavation on site may cause a release of hazardous substances.
- Total Present Worth $6,575,000

Alternative WP2: NPDES Discharge of Water, 24-Inch Clay Cover

- Treatment Components
  - None
- Containment Components
  - Clay and topsoil cover over the pond sediments
- Institutional Control Components - None.
- Total Present Worth $2,695,000

Alternative GW2: Long-Term Monitoring

- Treatment Components - None
- Containment Components - None
- Groundwater Monitoring
  - Installing monitoring wells to provide perimeter monitoring to ensure groundwater does not exceed alternate concentration limits
- Institutional Control Components
  - Deed records to prevent on-site use of the Shallow, Medium and Deep Transmissive Zone groundwater.
- Total Present Worth $331,000

Alternative DR3: Stabilization of Drum Contents On-site

- Treatment Components
  - Stabilize drum contents.
- Containment Components
  - Stabilize drummed materials and use them to fill the acid pond.
- Institutional Control Components - None.
- Total Present Worth $450,000

Alternative AST2: Off-Site Disposal of AST Contents

- Treatment Components - None
- Containment Components
  - Off-Site disposal.
- Total Present Worth $450,000

Box 3.11.1 (cont.) Site Wide Alternative 3

Alternative SS2: Cover Soils Exceeding Soil Remedial Action Cleanup Levels - Stabilize and Cover Soils That Exceed Contaminant Source Leachate Remedial Action Cleanup Levels.

- Treatment Component
  - Stabilize soils exceeding contaminant source leachate remedial action cleanup levels and use them to fill the acid pond.
- Containment Component
  - Cover contaminated soils which do not leach contaminants with concentrations exceeding contaminant source leachate level but exceed human health risk levels.
- Institutional Control Components
  - Deed record to protect the integrity of the clay cover.
- Total Present Worth $3,967,000

Alternative NSL3: Stabilization of NORM Slag

- Treatment Components
  - Stabilize NORM slag.
- Containment Components
  - Landfill and cover stabilized slag with impermeable cap.
- Institutional Control Components
  - Deed record to protect the integrity of the cap.
- Total Present Worth $970,000

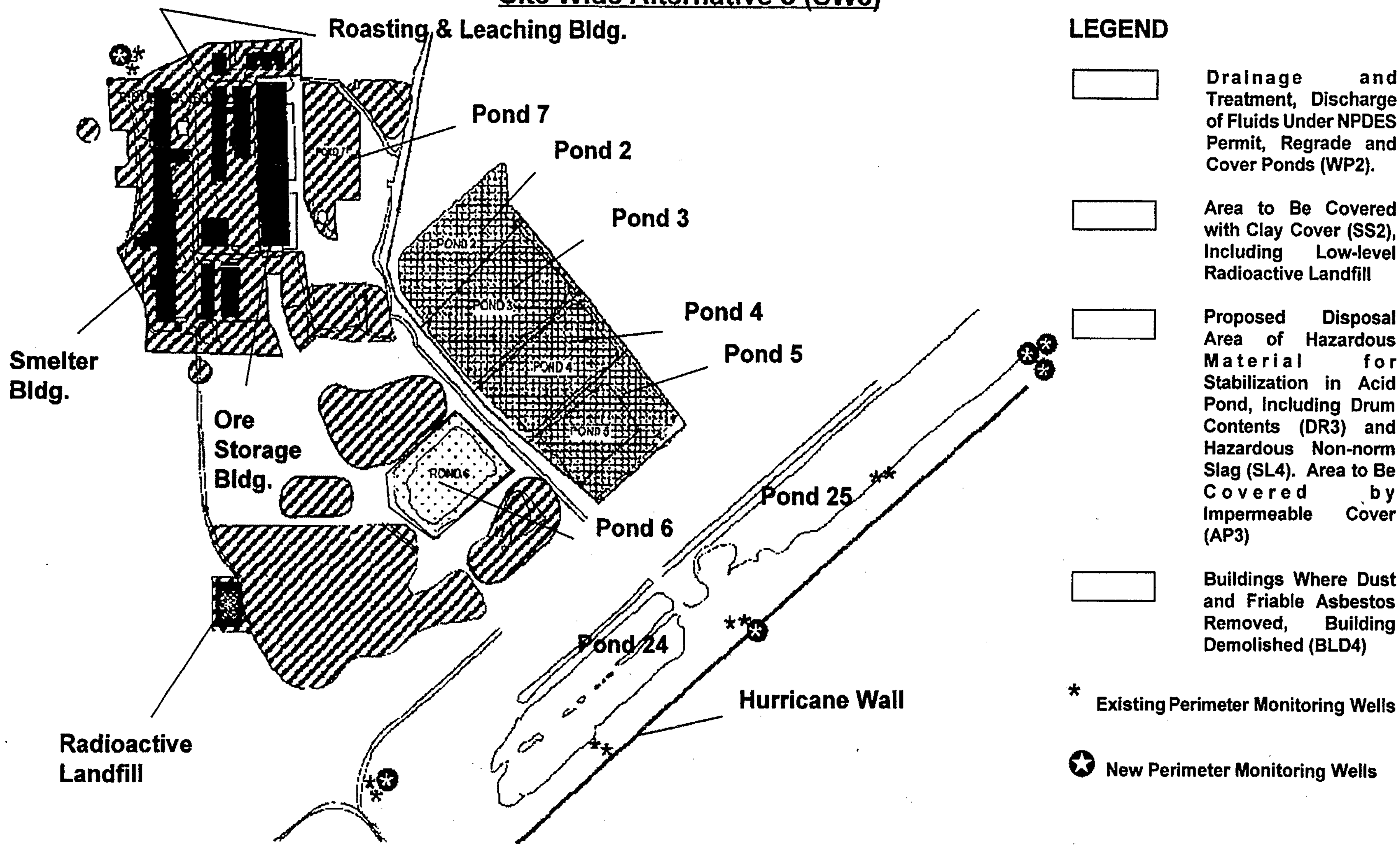
Alternative SL4: Stabilization and Covering of Hazardous non-NORM slag, Backfilling and Covering of Non-NORM slag.

- Treatment Components
  - Stabilize hazardous non-NORM slag and use it to fill the acid pond.
- Containment Components
  - Cover hazardous non-NORM slag exceeding with an impermeable cover.
  - Cover non-NORM non-hazardous slag with a compacted clay and topsoil.
- Institutional Control Components
  - Deed record to protect the integrity of the clay and topsoil cover.
- Total Present Worth $1,300,000

Alternative BLD4: Asbestos Removal and Building Demolition with On-site Disposal

- Treatment Components - None
- Containment Components
  - Asbestos and building debris disposed of in an on site landfill.
- Institutional Control Components - None
- Total Present Worth $11,950,000

Figure 3.11.1
Site Wide Alternative 3 (SW3)



Distinguishing and Unique Features of Each Remedial Alternative Comprising SW3.

3.11.1.1 AP3 On-site Stabilization of Acid Pond Sediments and Wah Chang Ditch Sediments. The principal threat from Wah Chang Ditch and the Acid Pond sediments would be treated on site through stabilization. The liquid within the pond would be treated using the filter press - GAC treatment. Treated water would be discharged to the Wah Chang Ditch under the NPDES limits. The filter cake from the press would be stabilized. The stabilized mixtures would be placed, graded and compacted as backfill in the Acid Pond.

3.11.1.1.1 Liquid Treatment. The pH of the liquid in the Acid Pond would be raised to eliminate theacidity and precipitate metals contaminating the water in the pond, thus eliminating the principal threat. A filter press would remove suspended solids and the filter press effluent would be passed through a granulated activated carbon filter to remove other dissolved and suspended contaminants. To comply with ARARs, effluent from the carbon filter would be required to meet NPDES discharge permit requirements before it is discharged to the Wah Chang Ditch. Precipitated metal species would be stabilized along with pond and ditch sediments and disposed of on-site.

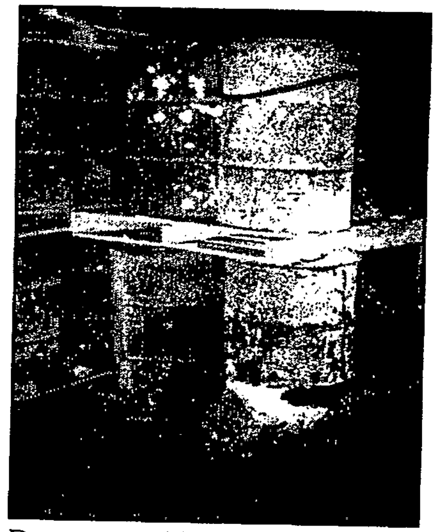
3.11.1.1.2 Geomembrane Vertical Barrier Wall. Prior to stabilization the Acid Pond would be isolated from groundwater and the surrounding soils by a geomembrane vertical barrier to prevent pond recharge during treatment. Care will be taken to ensure that the geomembrane wall is properly keyed into theunderlying clay layer.

Table 3.11.1.1.
Cost Estimate, Remedial Alternative AP3
Geomembrane Wall, Filter Press-GAC Treatment System, In-Situ Sediment Stabilization, Impermeable Cover

Item Description	Quantity	Unit	Cost/Unit	Cost**
Capital Costs				
Field Overhead and Oversight	6	month	$8,967.00	$53,802
Health and Safety	6	month	$6,247.00	$37,482
Geomembrane Wall Installation	48,600	square ft.	$16.50	$801,900
Excavation and Transportation of Wah Chang Ditch Sediment	1	lump sum	$408,708.00	$408,708
Filtration Treatment System	8,500,000	gallon	$0.004	$34,000
Metal Precipitate Recycling	10,000	cubic yard	($3.00)	($30,000)
In-Situ Stabilization Mobilization and Demobilization	1	lump sum	$60,000.00	$60,000
In-Situ Stabilization	63,000	cubic yard	$35.00	$2,205,000
Impermeable Acid Pond Cover	196,020	square ft.	$1.00	$196,020
General Equipment Mobilization and Demobilization (6%)	1	lump sum	$226,015.00	$226,015
			Subtotal Direct Capital Costs	**$3,992,927**
			Overhead and Profit (25%)	$998,232
			Total Direct Capital Costs (Rounded to Nearest $10,000)	**$4,990,000**
Indirect Capital Costs				
			Engineering and Design (7%)	$349,300
			Legal Fees and License/Permit Costs (5%)	$249,500
			Total Indirect Capital Costs	**$598,800**
			Subtotal Capital Costs	$5,588,800
			Contingency Allowance (15%)	$838,320
			Total Capital Costs (rounded to the nearest $10,000)	**$6,430,000**
O&M Costs				
Cover Inspection and Maintenance	1	lump sum	5,862.00	$5,862
			Subtotal	**$5,862**
			Overhead and Profit (25%)	$1,466
			Subtotal (Rounded to nearest $10,000)	**$10,000**
			Administration (5%)	$500
			Insurance, Taxes, Licenses (2.5%)	$250
			Contingency Allowance (15%)	$1,500
			Total O&M Costs (rounded to the nearest $1,000)	**$12,000**
			30 year cost projection. Assumed discount rate per year: 8.0%	$135,093
			Present Worth of O&M (rounded to nearest $1,000)	$135,000
			Total Alternative Cost (Capital Cost plus O&M) to nearest $10,000	**$6,570,000**

Notes:
*The factors represent adjustments for difficulty, size, and other intangibles that will affect the work.
**Due to rounding, the amount in the Cost column may be slightly different than the product of the values in the Quantity, Cost/Unit, and Factor columns.

3.11.1.2 DR3: Stabilizing Inorganic Drummed Materials and Supersack Contents, Disposing of Drummed Organic Materials Off Site. Under this alternative, all drums and supersacks would be emptied of their contents, decontaminated, andhauled off site for scrap metal recycling, off-site disposal, or disposal in an on-site landfill. Spent catalyst and other materials classified as principal threat wastes from drummed materials and supersacks would be stabilized and used to fill the Acid Pond. The organic contents would be disposed of off site at an EPA approved treatment and disposal facility.



Drums stored inside the ore storage building.

Table 3.11.1.2
Cost Estimate, Remedial Alternative DR3
Stabilization of Drums and Drum Contents
Tex Tin Corporation Superfund Site
Texas City, Texas

Item Description	Quantity	Unit	Cost/Unit	Cost**
Capital Costs				
Field Overhead and Oversight	1	month	$8,967.00	$8,967
Health and Safety	1	month	$6,247.00	$6,247
Loading and Crushing of Drums	6,500	drum	$26.98	$175,370
Sample and Analysis of Drum Contents	10	sample	$1,507.70	$15,077
In-Situ Stabilization	1,600	cubic yards	$35.00	$56,000
General Equipment Mobilization and Demobilization (6%)	1	lump sum	$15,700.00	$15,700
			Subtotal Direct Capital Costs	**$277,361**
			Overhead and Profit (25%)	$69,340
			Total Direct Capital Costs (Rounded to Nearest $10,000)	**$350,000**
Indirect Capital Costs				
			Engineering and Design (7%)	$24,500
			Legal Fees and License/Permit Costs (5%)	$17,500
			Total Indirect Capital Costs	**$42,000**
			Subtotal Capital Costs	$392,000
			Contingency Allowance (15%)	$58,800
			Total Alternative Cost (rounded to the nearest $10,000)	**$450,000**

Notes:
** Due to rounding, the amount in the Cost column may be slightly different than the product of the values in the Quantity, Cost/Unit, and Factor columns.

3.11.1.3 NSL3: Norm Slag Stabilization. Under this alternative, the NORM slag would be stabilized on the site, buried below grade and sealed with an impermeable cover within Area C. Stabilization isa treatment which will reduce this principal threat waste's toxicity and mobility. The slag will be buried deep enough below grade so that the cover reduces the radionuclide dosage concentration at the surface to an acceptable level.

Table 3.11.1.3.
Cost Estimate, Remedial Alternative NSL3
Stabilization of NORM Slag

Item Description	Quantity	Unit	Cost/Unit	Cost*
Capital Costs				
Field Overhead and Oversight	3	month	$8,967.00	$26,901
Health and Safety	3	month	$6,247.00	$18,741
Loading of NORM Slag	14,100	cubic yard	$1.69	$23,829
Sample and Analysis of Soil below NORM Pile	10	sample	$607.60	$6,076
In-Situ Stabilization	14,100	cubic yard	$35.00	$493,500
General Equipment Mobilization and Demobilization (6%)	1	lump sum	$34,143.00	$34,143
			Subtotal Direct Capital Costs	**$603,190**
			Overhead and Profit (25%)	$150,797
			Total Direct Capital Costs (Rounded to Nearest $10,000)	**$750,000**
Indirect Capital Costs				
			Engineering and Design (7%)	$52,500
			Legal Fees and License/Permit Costs (5%)	$37,500
			Total Indirect Capital Costs	**$90,000**
			Subtotal Capital Costs	$840,000
			Contingency Allowance (15%)	$126,000
			Total Alternative Cost (rounded to the nearest $10,000)	**$970,000**

Notes:
* Due to rounding, the amount in the Cost column may be slightly different than the product of the values in the Quantity, Cost/Unit, and Factor columns.

3.11.1.4 SL4: Covering non-Hazardous non-NORM Slag and Stabilizing Hazardous non-NORM Slag. This alternative would cover non-hazardous non-NORM slag with clay as described in soil alternative SS2. The remaining hazardous non-NORM slag would be stabilized on site to eliminate the principal threat and used to fill the Acid Pond as described in remedial alternative AP3.

Table 3.11.1.4.
Cost Estimate, Remedial Alternative SL4
Stabilization and Covering of Hazardous non-NORM Slag
Backfilling and Covering Remaining Slag

Item Description	Quantity	Unit	Cost/Unit	Cost*
Capital Costs				
Field Overhead and Oversight	3	month	$8,967.00	$26,901
Health and Safety	3	month	$6,247.00	$18,741
General Equipment Mobilization and Demobilization	1	lump sum	$9,914.00	$9,914
Stabilization of Hazardous non-NORM slag piles	20,000	cubic yard	$35.00	$700,000
Loading of Non-NORM slag	52,000	cubic yard	$0.96	$49,972
Subtotal Direct Capital Costs				**$805,528**
Overhead and Profit (25%)				$201,382
Total Direct Capital Costs (Rounded to Nearest $10,000)				**$1,010,000**
Indirect Capital Costs				
Engineering and Design (7%)				$70,700
Legal Fees and License/Permit Costs (5%)				$50,500
Total Indirect Capital Costs				**$121,200**
Subtotal Capital Costs				$1,131,200
Contingency Allowance (15%)				$169,680
Total Alternative Cost (rounded to the nearest $10,000)				**$1,300,000**

Notes:
* Due to rounding, the amount in the Cost column may be slightly different than the product of the values in the Quantity, Cost/Unit, and Factor columns.

3.11.1.5 SS2: Cover Contaminated Soils, Stabilize and Cover Hazardous Soils. This alternative would cover contaminated soils which do not leach contaminants in concentrations greaterthan those shown in Table 3.11.3.1, "Soil Sediment, Slag and Sludge Remedial Action Cleanup Levels," stabilize soils which leach contaminants in concentrations greater than those shown in Table 3.11.3.1 and use these soils to fill the Acid Pond. Additional soil cover will be added to the low-level radioactive landfill to improve drainage and prevent water from ponding in the low areas on the existing cover. The additional cover would consist of a 24-inch clay and a six-inch topsoil layer.

Table 3.11.1.5
Cost Estimate, Remedial Alternative SS2
24 Inch Clay Cover

Item Description	Quantity	Unit	Cost/Unit	Cost*
Capital Costs				
Field Overhead and Oversight	3	month	$8,967	$26,901
Health and Safety	3	month	$6,247	$18,741
Clay Cover	42	acre	$41,200	$1,730,400
Clay Cover Radioactive Landfill	2	acre	$41,200	$82,400
In-Situ Stabilization	1855	cubic yard	$35	$64,925
General Equipment Mobilization and Demobilization (6%)	1	lump sum	$115,402	$115,402
Subtotal Direct Capital Costs				**$2,038,769**
Overhead and Profit (25%)				$509,692
Total Direct Capital Costs (Rounded to Nearest $10,000)				**$2,550,000**
Indirect Capital Costs				
Engineering and Design (7%)				$178,500
Legal Fees and License/Permit Costs (5%)				$127,500
Total Indirect Capital Costs				$306,000
Subtotal Capital Costs				$2,856,000
Contingency Allowance (15%)				$428,400
Total Capital Costs (rounded to the nearest $10,000)				$3,280,000
O&M Costs				
Vegetative Cover Inspection and Maintenance	1	lump sum	$38,716	$38,716
Subtotal				**$38,716**
Overhead and Profit (25%)				$9,679
Subtotal (Rounded to nearest $10,000)				**$50,000**
Administration (5%)				$2,500
Insurance, Taxes, Licenses (2.5%)				$1,250
Contingency Allowance (15%)				$7,500
Total O&M Costs (rounded to the nearest $1,000)				**$61,000**
30 year cost projection. Assumed discount rate per year: 8.0%				$686,725
Present Worth of O&M (rounded to nearest $1,000)				$687,000
Total Alternative Cost (Capital Cost plus O&M) to nearest $10,000				**$3,970,000**

* Due to rounding, the amount in the Cost column may be slightly different than the product of the values in the Quantity, Cost/Unit, and Factor columns.

3.11.1.6 WP2: Wastewater Pond Liquids Discharged to Wah Chang Ditch, and Fill Ponds. Under this alternative, the water within the ponds would be directly discharged without treatment to the Wah Chang Ditch under the requirements of the NPDES limits. The ponds would then be filled with clean soil, if necessary, and covered with a 24-inch compacted clay cover. This alternative requires only 24 inches of compacted clay to cover the pond sediments plus any additional fill needed to raise the total cover to grade.

Table 3.11.6.
Cost Estimate, Remedial Alternative WP2
NPDES Discharge of Water, 24-inch Clay Cover

Item Description	Quantity	Unit	Cost/Unit	Cost*
Capital Costs				
Field Overhead and Oversight	3	month	$8,967.00	$26,901
Health and Safety	3	month	$6,247.00	$18,741
Surface Water Removal System	1	lump sum	$28,670.00	$28,670
Backfill for Wastewater Ponds (Non-Haz slag or soils)	167,464	cubic yard	$6.56	$1,098,564
Vegetative Wastewater Pond Cover	1	lump sum	$345,330.00	$345,330
General Equipment Mobilization and Demobilization (6%)	1	lump sum	$70,373.00	$70,373
			Subtotal Direct Capital Costs	$1,588,578
			Overhead and Profit (25%)	$397,145
			Total Direct Capital Costs (Rounded to Nearest $10,000)	$1,990,000
Indirect Capital Costs				
			Engineering and Design (7%)	$139,300
			Legal Fees and License/Permit Costs (5%)	$99,500
			Total Indirect Capital Costs	$238,800
			Subtotal Capital Costs	$2,228,800
			Contingency Allowance (15%)	$334,320
			Total Capital Costs (rounded to the nearest $10,000)	$2,560,000
O&M Costs				
Vegetative Cover Inspection and Maintenance	1	Year	$7,072.00	$7,072
			Subtotal	$7,072
			Overhead and Profit (25%)	$1,768
			Subtotal (Rounded to nearest $10,000)	**$10,000**
			Administration (5%)	$500
			Insurance, Taxes, Licenses (2.5%)	$250
			Contingency Allowance (15%)	$1,500
			Total O&M Costs (rounded to the nearest $1,000)	**$12,000**
			30 year cost projection. Assumed discount rate per year: 8.0%	$135,093
			Present Worth of O&M (rounded to nearest $1,000)	$135,000
			Total Alternative Cost (Capital Cost plus O&M) to nearest $10,000	**$2,700,000**

* Due to rounding, the amount in the Cost column may be slightly different than the product of the values in the Quantity, Cost/Unit, and Factor columns.

3.11.1.7 GW2: Long-term Groundwater Monitoring. Under this alternative a deed record prohibiting groundwater use in the Shallow, Medium, and Deep Transmissive Zones wouldbe implemented. In addition, a perimeter monitoring program would be implemented to monitor the Shallow, Medium, and Deep Transmissive Zones. Action levels for triggering re-evaluation of the site groundwater and subsequent response actions would be based on the perimeter ACLs (Alternate Concentration Limits) calculated for the Shallow and Medium Zones, and MCLs in the Deep Zone.* ACLs and MCLs are listed in Table 3.11.3.4, "Groundwater Remedial Action Levels." The site specific ACL calculations are discussed in the *Feasibility Study Report, Tex Tin Site, Operable Unit No. 1*, Appendix D.

3.11.1.7.1 Groundwater Monitoring. The monitoring program would consist of four nestedwell sets along the perimeter. Therewill be three wells in each nest, one to monitor each transmissive zone. For cost estimating purposes, it is assumed thatfour three-well nests and four singular wells would be monitored on an annual basis for the contaminants listed in Table 3.7.1.1, "Site Wide Summary of Chemical of Concern." Ten existing monitoring wells would be used for the perimeter monitoring program, and six new wells would be installed. The proper well location to monitor the down gradient extent of groundwater contaminants will be determined during the remedial design. In the event groundwater monitoring indicates groundwater contaminant concentrations are greater than "Groundwater Remedial Actions Levels," EPA will initiate further investigations to determine why those concentrations have increased and then propose an appropriate remedial response.

3.11.1.7.2 Operations and Maintenance. O&M activities associated withthis alternative include annual groundwater sampling to determine if a trend in the contaminant concentrations indicates the groundwater concentrations are exceeding the remedial action levels listed in Table 3.11.3.4 The action levels for triggering an additional groundwater response action for the Shallow and Medium Transmissive Zones are based on ACLs for industrial use. The two principal ecological contaminant sources are the Acid Pond and the Wah Chang Ditch sediments. The Acid Pond will be isolated and the Wah Chang Ditch Sediments will be stabilized. Action levels for the Deep Transmissive Zone would be set at MCLs. The basis for these concentrations is explained in Section 3.10.3.4 "Groundwater."

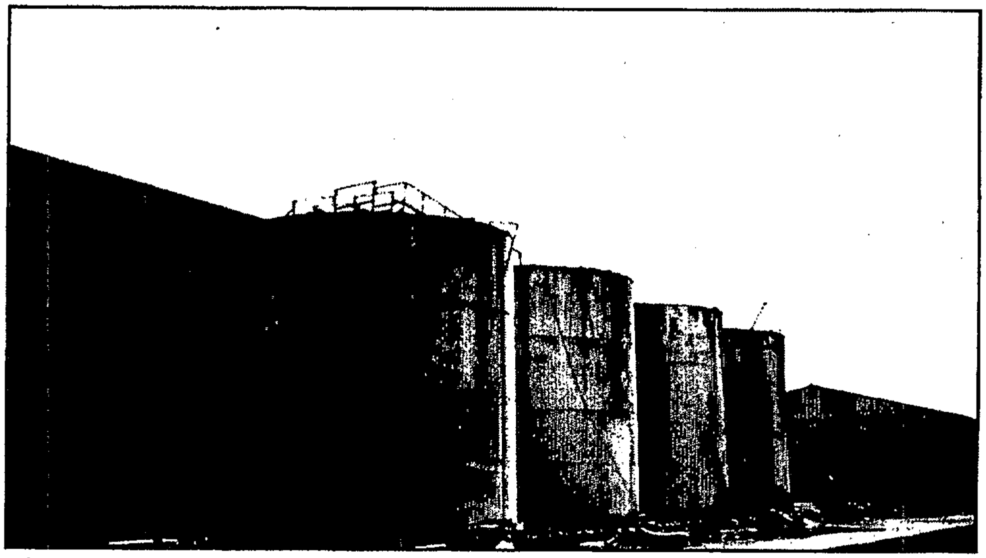
* In accordance with the NCP §300.430.(e)(1)(B). "An Alternate Concentration Limit (ACL) may be established in accordance with CERCLA section 121(d)(2)(B)(ii)." In this case, the use of ACLs is allowable because based upon information contained in the RI and SRI reports, the point of human exposure lies at or within the boundary of the facility.

Table 3.11.1.7 Cost Estimate, Remedial Alternative GW2 No Action with Long-Term Monitoring				
Item Description	**Quantity**	**Unit**	**Cost/Unit**	**Cost***
Capital Costs				
Health and Safety	0.25	month	$6,247	$1,562
Field Overhead and Oversight	0.25	month	$8,967	$2,242
Installation of Six New Monitoring Wells	1	lump sum	$27,517	$27,517
Subtotal Direct Capital Costs				**$31,321**
Overhead and Profit (25%)				$7,830
Total Direct Capital Costs (Rounded to Nearest $1,000)				**$39,000**
Indirect Capital Costs				
Engineering and Design (7%)				$2,730
Legal Fees and License/Permit Costs (5%)				$1,950
Total Indirect Capital Costs				**$4,680**
Subtotal Capital Costs				**$43,680**
Contingency Allowance (15%)				$6,552
Total Capital Costs (rounded to the nearest $10,000)				**$50,000**
O&M Costs				
Groundwater Monitoring	16	sample	$837.23	$13,396
Subtotal				**$13,396**
Overhead and Profit (25%)				$3,349
Subtotal (Rounded to nearest $10,000)				**$20,000**
Administration (5%)				$1,000
Insurance, Taxes, Licenses (2.5%)				$500
Contingency Allowance (15%)				$3,000
Total O&M Costs (rounded to the nearest $1,000)				**$25,000**
30 year cost projection. Assumed discount rate per year: 8.0%				$281,445
Present Worth of O&M (rounded to nearest $1,000)				$281,000
Total Alternative Cost (Capital Cost plus O&M) to nearest $10,000				**$330,000**

Notes:

* Due to rounding, the amount in the Cost column may be slightly different than the product of the values in the Quantity, Cost/Unit, and Factor columns.

3.11.1.8 AST2: Off-Site Disposal of Above Ground Storage Tank Contents. Under this alternative all liquid and solid wastes would be removed from the ASTs, characterized, properly manifested, then transported offsite for treatment and disposal. The tanks would then be dismantled, decontaminated, and properly disposed of or recycled. This alternative would protect human health and the environment by removing all AST contents from the site and eliminating the potential for the wastes to leak from the tanks and migrate. Removal of the AST contents would achieve long-term effectiveness and permanence by eliminating potential future exposure and migration of site- related contaminants. Reduction in toxicity, mobility, and volume would be achieved by removing the AST contents from the site and disposing of these materials in a secure disposal facility. During removal of the AST contents, onsite removal workers could be exposed to contaminants through direct contact with waste materials. Such exposure could be minimized through the use of protective clothing and equipment. Transportation of the AST contents over public roads to the disposal facility is a concern due to the risk of accidents with the potential for spills and leaks of wastes. Alternative AST2 is technically feasible, with equipment, labor, and disposal facilities readily available. Demolition firms are available for the dismantling and decontamination of the ASTs once emptied. Scrap yards in the site vicinity should be readily available for scrapping of the dismantled ASTs. Since all AST contents would be disposed of offsite, long-term O&M measures would not be required. Institutional controls would not be required.



Above ground storage tanks.

Table 3.11.1.8
Cost Estimate , Remedial Alternative AST2
Off-Site Disposal of Above-Ground Storage Tank Contents

Item Description	Quantity	Unit	Cost/Unit	Factor*	Cost**
Capital Costs					
Field Overhead and Oversight	3	month	$8,967.00	1	$26,901
Health and Safety	3	month	$6,247.00	1	$18,741
Loading of Above-Ground Storage Tank Contents for Disposal	289,850	gallon	$0.35	1	$101,448
Decontamination and Disassembly of ASTs	73	tank	$951.07	1	$69,428
Salvage Value of ASTs	872	ton	$-45.00	1	($39,240)
Transportation to Carlyss, LA disposal facility***	2	trip	$600.00	1	$1,200
Transportation to Port Arthur, TX disposal facility****	19	trip	$550.00	1	$10,450
Transportation to Atascocita, Humble, TX disposal facility***	57	trip	$350.00	1	$19,950
Disposal of Base Liquid and Sludge to Carlyss, LA	7,000	gallon	$1.60	1	$11,200
Disposal of Acid Oxidizer, Flammable, and Mixed Liquid to Port Arthur	55,800	gallon	$0.25	1	$13,950
General Equipment Mobilization and Demobilization (6%)	1	lump sum	$14,042.00	1	$14,042
Subtotal Direct Capital Costs					$248,069
Overhead and Profit (25%)					$62,017
Total Direct Capital Costs (Rounded to Nearest $10,000)					$310,000
Indirect Capital Costs					
Engineering and Design (7%)					$21,700
Legal Fees and License/Permit Costs (5%)					$15,500
Total Indirect Capital Costs					$37,200
Subtotal Capital Costs					$347,200
Contingency Allowance (15%)					$52,080
Total Alternative Cost (rounded to the nearest $10,000)					$400,000

Notes:

*The factors represent adjustments for difficulty, size, and other intangibles that will affect the work.

**Due to rounding, the amount in the Cost column may be slightly different that the product of the values in the Quantity, Cost/Unit, and Factor columns.

***4000 gallons of inorganic waste are transported in one trip load to Carlyss and Atascocita disposal facilities.

****3000 gallons of organic waste are transported in one trip load to Port Arthur facility.

3.11.1.9 BLD4: Removal of Dust and All Asbestos from Buildings and Structures, Demolition of Buildings and Structures and On-site Disposal of Debris. Prior to building demolition grossly contaminated surfaces would be cleaned and all known asbestos-containing material (ACM) would be removed. Known ACM includes pipe insulation, roof shingles and transite wall panels. Building demolition would remove all remaining contamination from the environment to preclude a contaminant release from the collapse or demolition during a storm. The demolition debris would be decontaminated and salvaged or buried with ACM in a hazardous waste landfill on site. The landfill siting will be coordinated with local officials to provide for the best beneficial site reuse. Contaminated soil from beneath the buildings would be handled in accordance with soil remedial alternative SS2. To estimate the cost of this alternative EPA assumed 30 percent of the soil or 4,830 cubic yards would be stabilized in the Acid Pond and buried in the pond as backfill. BLD4 includes demolition of the following facilities when appropriate:

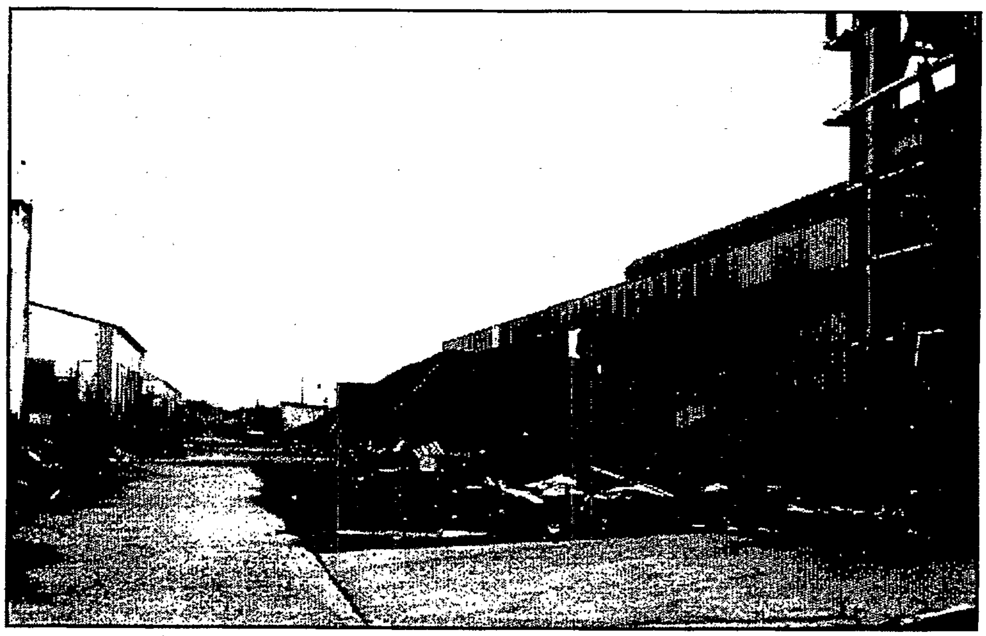
- Roasting and Leaching Building
- Maintenance Building
- Change Room
- Laboratory and Office Building
- Smelter Building
- Ore Storage Building
- General (Engineering) Office
- Warehouses No. 1, No. 2, and No. 3
- Smelter Stack
- Water Tower

The fundamental components and cost of each alternative are shown in Box 3.9.1.19, "Components of Each SL Remedial Alternative," the key ARARs for each alternative are shown in Table 3.9.1.19 - 1, "Key ARARs For SL Remedial Alternatives," and a comparison of each alternative to the nine evaluation criteria specified in the NCP is shown in Table 3.9.1.19 - 2 "SL Remedial Alternative Comparison."

3.9.1.20 Alternative SL1: No Action. Under this alternative, no action would be taken to remove, treat, or contain the non-NORM slag piles. Because the non-NORM slag would be left in place, the potential for this material to migrate would not be mitigated.

3.9.1.21 Alternative SL2: Off-Site Disposal of Non-NORM slag. Under this alternative, the non-NORM slag piles would be loaded into vehicles permitted to carry hazardous wastes, and transported off site, to EPA-approved waste disposal facilities. Several potential disposal facilities located in Texas, Louisiana, and Kentucky have been identified for the disposal of the non-NORM slag. Because all non-NORM slag would be disposed off site, there would be no O&M activities associated with this alternative. There are no institutional controls associated with this alternative.

3.9.1.22 Alternative SL3: Recycling of Selected Slag Piles, Stabilization, or Backfilling of Remaining Slag. Under this alternative, selected piles of the non-NORM slag would be loaded and transported to a metals-recycling facility for processing. The slag piles being considered for recycling include slag piles 2, 3, 53, and 55 (non-hazardous). After the slag is processed and the recovered metals are sold, EPA would receive a metals recovery fee or processing credit depending on the mass of metals recovered. Hazardous non-NORM slag piles (piles 1, 11, 19, 27 through 29, 52, 56 through 58, and 62) would be placed on site under an impermeable cap. For purposes of estimating, the assumption has been made that the NORM slag would be placed in the Acid Pond and stabilized insitu along with the Acid Pond sediments or stabilized on-site and disposed of in the Acid Pond. The remaining non-NORM slag would be either placed into the wastewater ponds as backfill or graded over the site and capped with the 24-inch clay cover if the non-NORM slag. Because the non-NORM slag would be taken off site for recycling, treated in the Acid Pond, or used as backfill in the wastewater ponds, no O&M activities are included with this alternative.



Slag pile on the east side of the Smelter Building.

Box 3.9.1.19 Components of Each SL Remedial Alternative

Alternative SL2: Off-Site Disposal of Non-NORM slag

- Treatment Component - None
- Containment Component
  - Off site disposal
- Institutional Control Components - None
- Cost

Capital	$19,000,000			
Present Worth O&M	$000	Annual O&M	$000	
Total Present Worth	$19,000,000			

Alternative SL3: Recycling of Selected Slag Pile, Stabilization or Backfilling of Remaining Slag.

- Treatment Components
  - Recycle metal from slag with recoverable metals.
- Containment Components
  - Seal hazardous non-NORM slag with an impermeable cover.
  - Cover non-NORM slag with topsoil and compacted clay.
- Institutional Control Components
  - Deed record to protect the integrity of the cap.
- Cost

Capital	$970,000			
Present Worth O&M	$000	Annual O&M	$000	No additional O&M cost. O & M activities would be included in the Acid Pond alternative.
Total Present Worth	$970,000			

Alternative SL4: Stabilization and Covering of Hazardous non-NORM slag, Backfilling and Covering of Non-NORM slag.

- Treatment Components
  - Stabilize hazardous non-NORM slag
- Containment Components
  - Cover hazardous non-NORM slag exceeding with an impermeable cover.
  - Cover non-NORM non-hazardous slag with a compacted clay and topsoil.
- Institutional Control Components
  - Deed recond to protect the integrity of the clay and topsoil cover.
- Cost

Capital	$1,300,000			
Present Worth O&M	$000	Annual O&M	$000	No additional O&M cost. O&M activities would be included in the Acid Pond or Surface and Subsurface soil alternatives.
Total Present Worth	$1,300,000			

Alternative SL5: Deep Well Injection of hazardous non-NORM slag

- Treatment Components - None
- Containment Components
  - Deep well injection for hazardous non-NORM slag
  - Cover contaminated non-NORM slag with compacted clay and topsoil.
- Institutional Control Components - None
- Cost

Capital	$2,920,000			
Present Worth O&M	$000	Annual O&M	$000	No additional O&M cost. O&M activities would be encompassed with the O&M for alternative AP5.
Total Present Worth	$2,920,000			

Table 3.9.1.19 - 1 Key ARARs For SL Remedial Alternatives					
Requirement	**SL1**	**SL2**	**SL3**	**SL4**	**SL5**
Underground Injection Control (UIC) Program 40 C.F.R. Part 144, 42 USC 300(f)	N/A	N/A	N/A	N/A	YES
40 C.F.R. Part 268, Land Disposal Restrictions	YES	YES	YES	YES	YES
40 C.F.R. Part 264 Standards for Owners and Operators of Hazardous Waste Treatment, Storage, and Disposal Facilities	YES	YES	YES	YES	YES
30 TAC. Environmental Quality, Part I, Texas Natural Resource Conservation Commission, Chapter 335, Industrial Solid Waste and Municipal Hazardous Waste, Subchapter S, Risk Reduction Standards.	YES	YES	YES	YES	YES

3.9.1.23 Alternative SL4: Stabilize and Cover Hazardous Non-NORM slag, Cover Non-Hazardous Slag That Exceeds Slag Remedial Action Cleanup Levels. Hazardous non-NORM slag piles that exceed contaminant source leachate remedial action cleanup levels (i.e. piles 1, 11, 19, 27 through 29, 52, 56 through 58, and 62) would be stabilized on site. The stabilized hazardous non-NORM slag would be used to fill the Acid Pond. The remaining non-hazardous non-NORM slag would be covered with clay in accordance with soil remedial alternative SS2. Because contaminated slag would be buried on site above health based levels, this alternative would also include a deed record as an institutional control to limit the potential for future human exposure to contaminants. The deed record would describe the location of the stabilized and covered slag and provide notice to potential buyers that excavations in those locations may cause a release of hazardous substances. Because the non-hazardous non-NORM slag would be placed in the Acid Pond no additional O&M activities are included with this remedial alternative.

3.9.1.24 Alternative SL5: Deep Well Injection of Hazardous non-NORM slag, Placement of Non-NORM slag. Under this alternative, the hazardous non-NORM slag would be crushed, mixed with water, and disposed of via deep well injection. The crushed slag would be mixed with water from the Acid Pond, wastewater ponds, or other sources, to achieve a 30-percent solids slurry. The slurry would then be pumped into the existing on-site deep injection well. At the completion of deep well injection activities, the well would be plugged to avoid future disturbance of the injected wastes materials. The non-NORM slag may be placed in the wastewater ponds as backfill, in the Acid Pond, or graded across the site and covered with a 24 inches of compacted clay. Monitoring of the deep injection system has been included as an O&M activity under Acid Pond Alternative AP5.

Slag pile south of smelter building.

Table 3.9.1.19 - 2
SL Remedial Alternative Comparison

Criterion	SL1	SL2	SL3	SL4	SL5
Overall protection of human health and the environment	Provides no protection of human health or the environment.	Protection of human health and the environment would be achieved by removing slag from the site.	Protection should be achieved by stabilization and recycling of the slag, or by isolating it.	Provides for protection of the environment by stabilization and isolation of the slag.	Provides for protection of the environment by isolation of the slag
Compliance with ARARs	Does not meet ARARs.	Off-Site disposal would need to comply with applicable regulations.	Compliance with ARARs can be achieved by stabilization.	Compliance with ARARs can be achieved through isolation from humans and the environment.	Meets ARARs for deep well injection.
Long-term effectiveness and permanence	Not effective or permanent.	Removal activities and off-site disposal at an appropriate licensed landfill would provide long-term effectiveness and permanence.	Stabilized materials would not readily leach contaminants, providing a long-term effective and permanent solution.	Should be effective if clay cover prevents direct contact by humans and the environ-ment.	Effective and permanent if injection well is properly abandoned
Reduction of toxicity, mobility, or volume through treatment	None provided through treatment	None provided through treatment.	Stabilization would provide a reduction in mobility of site contaminants, but would increase volume.	Stabilization would provide a reduction in mobility of site contaminants, but would increase volume.	No reduction of toxicity, mobility, or volume, but the waste is isolated from humans and the environment
Short term effectiveness	No associated risk to workers and residents.	On-site workers could be exposed to waste materials or dust in the short term.	Workers would be required to wear appropriate PPE and adhere to safe construction practices to minimize short term effects.	Workers would be required to wear appropriate PPE and adhere to safe construction practices to minimize short-term effects.	Workers would be required to wear appropriate PPE and adhere to safe construction practices to minimize short-term effects.
Implementability					
Implementability Technical	No action required, therefore, technically feasible.	Equipment, labor, and the necessary disposal facilities are available, making alternative technically feasible.	Alternative is technically feasible. Stabilization is a proven technology.	Alternative is technically feasible with standard construction technology	Alternative is technically feasible using oil field technology
Implementability Administrative feasibility	No action required, therefore, administratively feasible.	Slag would pose no special limiting issues associated with off-site disposal. Manifesting would be required.	No specialized limits would be required for stabilization.	No special limits or requirements are needed for this alternative	Requires coordination with TNRCC for issuance of limits
Implementability Availability of services and materials	Services and materials are not required.	All materials and services needed for this alternative are routinely used in construction activities.	EPA-qualified stabilization vendors are available.	Materials and EPA-approved contractors are readily available.	Limited number of vendors can supply the technology necessary
State Acceptance	Other than rejecting SL1 and SL5, the State did not express a preference for any of the other alternatives.				
Community Acceptance	While there was no specific preference for alternatives SL1 through SL4, two comments were received favoring deep well injection, SL5.				

3.9.1.25 SURFACE AND SUBSURFACE SOILS (SS). The following alternatives were developed to address surface and subsurface secondary and tertiary contaminants sources soils that have concentrations of inorganic contaminants above the remedial action cleanup levels. The term "contaminated soil" is used in this Record of Decision to define soil with contaminant concentrations greater than those concentrations listed in Table 3.11.3.1, "Soil, Sediment, Slag and Sludge Remedial Action Cleanup Levels." The fundamental components and cost of each alternative are shown in Box 3.9.1.25, "Components of Each SS Remedial Alternative" and the key ARARs for each alternative are shown in Table 3.9.1.25 - 1, "Key ARARs For SS Remedial Alternatives" and a comparison of each alternative to the nine evaluation criteria specified in the NCP is shown in Table 3.9.1.25 - 2

.3.9.1.26 Low-Level Radioactive Landfill. The existing Low-Level Radioactive Landfill will be included in all soil alternatives considered for OU1. A 24-inch compacted clay cover topped with 6 inches of topsoil will be placed over the landfill to improve drainage and reduce surface water infiltration, thus adding groundwater protection. O&M would include inspection of the clay cover and groundwater monitoring. Because the radioactive material would be buried on site, this alternative would also include a deed record as an institutional control to limit the potential for future human exposure to contaminants. The deed record would describe the location of the landfill and provide notice to potential buyers that excavations in that location may cause a release of hazardous substances. Groundwater monitoring would be required as part of the O&M for the Low-Level Radioactive Landfill.

3.9.1.27 Alternative SS1: No Action. Under this alternative, no action would be taken to remove, treat, or contain hazardous or contaminated surface and subsurface soils. Because no action would be taken for these soils, the potential for contaminants migrating off site or leaching to the groundwater would not be mitigated.

3.9.1.28 Alternative SS2: Cover Soils Exceeding Soil Remedial Action Cleanup Levels - Stabilize and Cover Soils That Exceed Contaminant Source Leachate Remedial Action Cleanup Levels. Under this alternative, soils exceeding the soil remedial action cleanup levels in Table 3.11.3.1, "Remedial Action Cleanup Levels," but not exceeding leachate concentrations in Table 3.11.3.1 would be covered with a 24-inch compacted clay cover and topped with six inches of topsoil. This alternative would also include the Low-Level Radioactive Landfill area. The topsoil would be seeded with native grass chosen for long-term erosion control. Approximately 44 acres would be covered with the clay cover. Soils exceeding contaminant source leachate remedial action cleanup levels in Table 3.11.3.1, "Soil Sediment, Slag and Sludge Remedial Action Cleanup Levels," would be stabilized and used to fill the Acid Pond. Because contaminated soils would be buried on site above health based levels, this alternative would also include a deed record as an institutional control to limit the potential for future human exposure to contaminants. This remedial alternative also applies to any contaminated soils found beneath buildings demolished as part of remedial alternative BLD4. The deed record would describe the location of the contaminated soils and provide notice to potential buyers that excavations in that location may cause a release of hazardous substances. Consequently, future site development would require EPA's evaluation to ensure construction activities are conducted safely and that the cover remains protective. O&M activities associated with this alternative would include clay cover inspection and maintenance.

Table 3.9.1.25 - 1
Key ARARs For SS Remedial Alternatives

Requirement	SS1	SS2	SS3	SS4	SS5
Underground Injection Control (UIC) Program 40 C.F.R. Part 144, 42 USC 300(f)	N/A	N/A	N/A	N/A	YES
40 C.F.R. Part 268. Land Disposal Restrictions	YES	YES	YES	YES	YES
40 C.F.R. Part 264 Standards for Owners and Operators of Hazardous Waste Treatment, Storage, and Disposal Facilities	YES	YES	YES	YES	YES
30 TAC. Environmental Quality, Part I, Texas Natural Resource Conservation Commission, Chapter 335, Industrial Solid Waste and Municipal Hazardous Waste, Subchapter S, Risk Reduction Standards.	YES	YES	YES	YES	YES

Box 3.9.1.25 Components of Each SS Remedial Alternative

Alternative SS2: Cover Soils Exceeding Soil Remedial Action Cleanup Levels - Stabilize and Cover Soils That Exceed Contaminant Source Leachate Remedial Action Cleanup Levels.

- Treatment Component
  - Stabilize soils exceeding contaminant source leachate remedial action cleanup levels and dispose of them with the stabilized acid pond soils
- Containment Component
  - Cover contaminated soils which do not leach contaminants with concentrations exceeding contaminant source leachate levels but exceed human health risk levels.
- Institutional Control Components
  - Deed recordation to protect the integrity of the clay cover.
- Cost

Capital	$3,280,000		
Present Worth O&M	$ 687,000	Annual O&M	$61,000
Total Present Worth	$3,967,000		

Alternative SS3: On-site Stabilization of Hazardous and Contaminated Soils

- Treatment Components
  - Stabilize hazardous soils
- Containment Components
  - Cover stabilized soils with topsoil cover.
- Institutional Control Components
  - Deed recordation to protect the integrity of the topsoil cover.
- Cost

Capital	$34,720,000	Annual O&M	$61,000
Present Worth O&M	$687,000		
Total Present Worth	$35,407,000		

Alternative SS4: Excavation and Consolidation of Hazardous or Contaminated Soils On Site.

- Treatment Components - None
- Containment Components
  - Excavate hazardous soils and use them to backfill acid pond then cover the pond with compacted clay.
  - Cover contaminated soils with topsoil and compacted a clay.
- Institutional Control Components - None.
- Cost

Capital	$6,710,000			
Present Worth O&M	$.000	Annual O&M	$000	No additional cost to acid pond O&M.
Total Present Worth	$6,710,000			

Alternative SS5: Deep Well Injection of Hazardous Soil, Cover Contaminated Soils With Compacted Clay.

- Treatment Components - None
- Containment Components
  - Deep well injection for hazardous soils
  - Cover contaminated soils with topsoil and compacted clay.
- Institutional Control Components
  - Deed recordation to protect the integrity of the clay / topsoil cover.
- Cost

Capital	$3,210,000		
Present Worth O&M	$687,000	Annual O&M	$61,000
Total Present Worth	$3,897,000		

Table 3.9.1.25 - 2
SS Remedial Alternative Comparison

Criterion	SS1	SS2	SS3	SS4	SS5
Overall protection of human health and the environment	Provides no protection of human health or the environment.	Protection provided by preventing direct contact through stabilizing and covering hazardous soils. However, contamination would remain in place.	Protection is achieved by stabilizing contaminated site soils. Cover would prevent direct contact with stabilized material.	Protection provided by preventing direct contact through covering hazardous and contaminated soils. However, contamination would remain in place.	Protection provided by isolating the hazardous soil from humans and the environment
Compliance with ARARs	Does not meet ARARs.	In compliance with ARARs	Stabilization of hazardous soils could meet the ARARs	Compliance with ARARs achievable with institutional controls	Waste meets ARARs compliance criteria
Long-term effectiveness and permanence	Not effective or permanent.	Stabilized materials would not readily leach contaminants, providing a long-term effective and permanent solution.	Stabilized materials would not readily leach contaminants, providing a long-term effective and permanent solution.	Provides long-term effectiveness when combined with institutional controls.	Provides long tem effectiveness with proper deep well injection abandonment
Reduction of toxicity, mobility, or volume through treatment	Provides no reduction of waste toxicity, mobility, or volume.	Reduction in surface mobility is achieved and volume would be increased.	Stabilization would provide a reduction in mobility of site contaminants, but would increase the volume.	Reduction in surface mobility is achieved. Toxicity and volume unchanged, but hazardous soils are isolated from the environment	Reduction in surface mobility is achieved. Toxicity unchanged, but hazardous soils are isolated from the environment.
Short-term effectiveness	No associated risk to workers. Nearby residents could be affected by continued off-site migration of wastes.	Grading and cover placement could cause exposure in the short term. Dust control measures would be required.	Workers would be required to wear appropriate PPE and adhere to safe construction practices to minimize short-term effects.	Excavation, grading and cover placements could cause short-term exposure. Dust control measures would be required.	Excavation, grading, slurry mixing, and cover placements could cause short-term exposure. Dust control measures would be required
Implementability					
Implementability Technical	No action required, therefore, technically feasible.	Covering is an established construction procedure.	Stabilization of soil to fix metal contamination is well documented and technically feasible.	Excavation and consolidation is an established construction procedure.	Technically feasible using oil field technology
Implementability Administrative	No action required, therefore, administratively feasible.	Future site development may require special limiting. Deed recordations would be required.	No specialized limits would be required for stabilization. Deed recordation would be required.	Deed recordations would be required.	Coordination with TNRCC would be required
Implementability Availability of services and materials	Services and materials are not required.	All materials and services needed for this alternative are routinely used in construction activities.	EPA-qualified vendors are available.	All materials and services needed for this alternative are routinely used in construction activities.	Limited vendors can supply this technology
State Acceptance	Along with rejecting SS1and SS5, the State expressed a preference to include a cover over the radioactive landfill with each of the alternatives. However the State did not express a preference for any of the remaining alternatives.				
Community Acceptance	While there was no specific preference for alternatives SS1 through SS4, two comments were received favoring deep well injection, SS5. In addition one comment was received rejecting all soil stabilization.				

3.9.1.29 Alternative SS3: On-site Stabilization of Soils. Under this alternative, all surface and subsurface soils exceeding remedial action cleanup levels would be treated on site by an in situ stabilization process. The stabilized soil would immobilize the metal contaminants and reduce the leachability of the waste. For cost estimation purposes, it has been assumed that in situ stabilization would be performed. The volume of soil requiring treatment is estimated at 549,800 cubic yards. Upon the completion of in situ stabilization, the area would be covered with a 6-inch topsoil layer that would be seeded with native grass chosen for long-term erosion control capabilities. The topsoil cover would be designed for stormwater management. Also included with this alternative, would be placement of a 24-inch clay cover and 6-inch topsoil layer over the Low-Level Radioactive Landfill. Institutional controls in the form of deed recordations would be required to prevent disturbance of the vegetative cover, treated soils, and Low-Level Radioactive Landfill. Future redevelopment of the site would require a reevaluation of the protectiveness of the vegetative layer, based on projected land use. O&M activities included with this alternative include inspection and maintenance of the vegetative layer and clay cover for the Low-Level Radioactive Landfill. Groundwater monitoring would also be included for the Low-Level Radioactive Landfill.

3.9.1.30 Alternative SS4: Excavation and Consolidation of Soils Exceeding Remedial Action Cleanup Levels On Site. Under this alternative, soils exceeding remedial action cleanup levels would be excavated and consolidated on site in either the Acid Pond or Area C. While soils may be consolidated elsewhere on-site, these areas have been chosen for estimating purposes. Soils that exceed contaminant source leachate remedial action cleanup levels would be disposed in the Acid Pond; soils exceeding remedial action cleanup levels but not the contaminant source leachate remedial action cleanup levels would be consolidated in Area C. The volume of soil excavated would be 285,900 cubic yards. Soils exceeding remedial action cleanup levels would be excavated, placed in trucks, and transported to Area C. The excavated areas would be backfilled with clean compacted fill materials from off-site sources or on-site materials that do not exceed remedial action cleanup level concentrations. Area C, where soils exceeding remedial action cleanup levels would be consolidated, would be graded and covered with 24 inches of compacted clay common fill and topped with a 6-inch topsoil layer. The compacted clay cover would also be placed over the Low-Level Radioactive Landfill area. The portion of Area C to be covered under this alternative will be approximately 18 acres. The costs associated with sealing the Acid Pond with an impermeable cover are included in the Acid Pond alternatives. The O&M activities associated with this alternative would include clay cover inspection and maintenance. Groundwater monitoring would be included for the Low-Level Radioactive Landfill. Deed recordations would be required to prevent potential exposure to site contaminants.

3.9.1.31 Alternative SS5: 24-Inch Clay Cover on Non-hazardous Soils Exceeding Remedial Action Cleanup Levels; Deep Well Injection of Hazardous Soils. Under this alternative, soils that exceed contaminant source leachate remedial action cleanup levels would be excavated and deep well injected Other soils exceeding remedial action cleanup levels but not contaminant source leachate remedial action cleanup levels would be covered with 24 inches of compacted clay. For estimation purposes, it has been assumed that the non-hazardous soils exceeding remedial action cleanup levels would be consolidated in Area C. Excavated areas would be backfilled with clean soil and graded. Soils exceeding remedial action cleanup levels would be consolidated in Area C, covered with 24 inches of compacted clay fill and topped with a 6-inch topsoil layer. The Low-Level Radioactive Landfill would also be covered with 24 inches of compacted clay fill and topped with a 6-inch topsoil layer. Approximately 18 acres in Area C would be covered. Deed records would be required for covered areas exceeding remedial action cleanup levels and the Low-Level Radioactive Landfill. Remediation of OU1 would be suitable for industrial redevelopment. Deed records would be required for the deep injection well following closure. O&M activities associated with this alternative would include cover inspection and maintenance. Monitoring of the deep well injection zone would be included under the deep well injection alternative. Groundwater monitoring of the Shallow, Medium, and Deep transmissive zones would be required for the Low-Level Radioactive Landfill.

3.9.1.32 WASTEWATER PONDS (WP). The following alternatives were developed to address on-site water and sediments in Wastewater Ponds 1 through 5 which are identified in the site conceptual model as primary and tertiary contaminant sources. The analytical results of sediment samples collected during the Phase II RI indicate that the wastewater pond sediments contain heavy metals at concentrations exceeding the remedial action cleanup levels. Since EPA does not consider pond water or sediments to be principal threats, there is no preference for treatment. Heavy metal concentrations in the pond water appear to be below the NPDES discharge limits, which would allow direct discharge to the Wah Chang Ditch as long as the maximum allowable flowrate was not exceeded. The following alternatives focus on discharging the pond water to the Wah Chang Ditch and treating or containing the pond sediments. The fundamental components and cost of each alternative are shown in Box 3.9.1.32, and the key ARARs for each alternative are shown in Table 3.9.1.32 - 1. A comparison of each alternative to the nine evaluation criteria specified in the NCP is shown in Table 3.9.1.32 - 2.


Slag pile in Area B.

Box 3.9.1.32 Components of Each WP Remedial Alternative

Alternative WP2: NPDES Discharge of Water, 24-Inch Clay Cover

- Treatment Components
  - None
- Containment Components
  - Clay and topsoil cover over the pond sediments
- Institutional Control Components - None.
- Cost

Capital	$2,560,000		
Present Worth O&M	$135,000	Annual O&M	$12,000
Total Present Worth	$2,695,000		

Alternative WP3: NPDES Discharge of Water, Sediment Stabilization

- Treatment Components
  - Stabilize pond sediments. Stabilization treatment mixes treatment agents into the contaminated sediments to reduce the contaminant solubility.
- Containment Components
  - Topsoil cover over the stabilized sediments
- Institutional Control Components - None.
- Cost

Capital	$11,940,000		
Present Worth O&M	$135,000	Annual O&M	$12,000
Total Present Worth	$12,075,000		

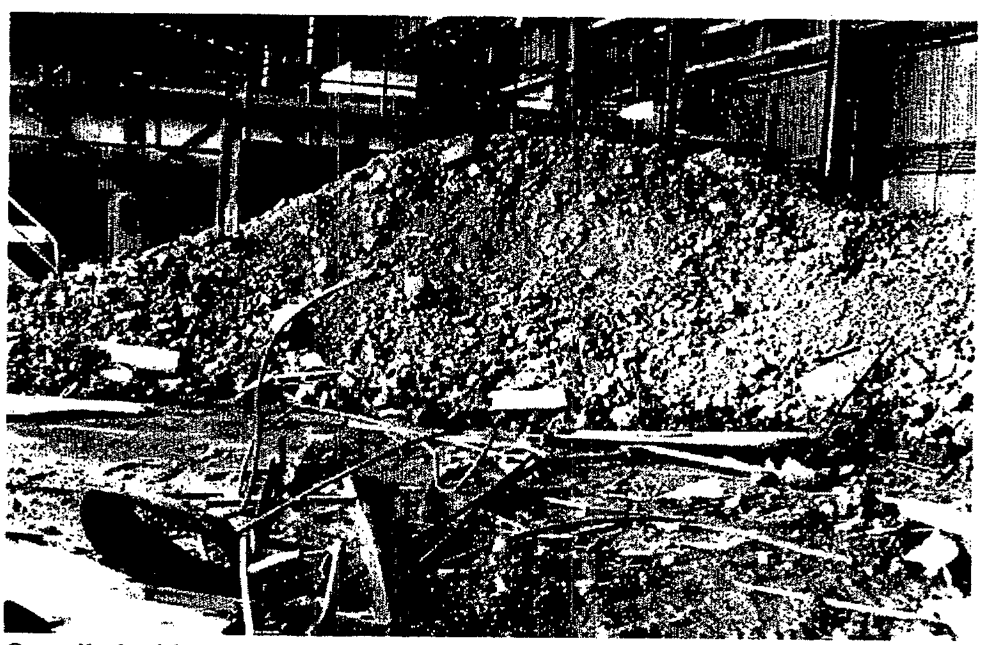
Table 3.9.1.32 - 1 Key ARARs For Wastewater Pond (WP) Remedial Alternatives		
Requirement	**WP1**	**WP2**
40 C.F.R. Parts 122 to 125, National Pollutant Discharge Elimination System (NPDES)	YES	YES
40 C.F.R. Part 268, Land Disposal Restrictions	YES	YES
40 C.F.R. Part 264 Standards for Owners and Operators of Hazardous Waste Treatment, Storage, and Disposal Facilities	YES	YES
30 TAC. Environmental Quality, Part I, Texas Natural Resource Conservation Commission, Chapter 335, Industrial Solid Waste and Municipal Hazardous Waste, Subchapter S, Risk Reduction Standards.	YES	YES

Table 3.9.1.32 - 2 WP Remedial Alternative Comparison			
Criterion	**WP1**	**WP2**	**WP3**
Overall protection of human health and the environment	Provides no protection of human health or the environment.	Protection provided by preventing direct contact through covering pond sediments. However, contamination is left on site untreated.	Alternative is protective of human health and the environment since contaminants are solidified.
Compliance with ARARs	Does not meet ARARs.	Discharge to ditch must comply with NPDES permit limits.	Contaminated media is stabilized.
Long-term effectiveness and permanence	Not effective or permanent.	Provides long-term effectiveness.	Cover and stabilization provide for long term effectiveness and permanence.
Reduction of toxicity, mobility, or volume through treatment	Provides no reduction of waste toxicity, mobility, or volume.	Does not alter toxicity or volume of waste. Surface mobility of waste reduced.	Provides a reduction in waste mobility, but volume is increased.
Short-term effectiveness	No associated risk to workers. Nearby residents may be affected by continued off-site migration of waste.	Short-term effects may include worker exposure to pond sediments during cover placement.	Short-term effects include potential worker exposure to stabilization reagents and dust during site work.
Implementability			
Implementability Technical	No action required, therefore, technically feasible.	Pumping of water and cover construction are established construction practices.	Treatability studies may be required for stabilization process. Pumping of water and cover construction are established construction practices
Implementability Administrative	No action required, therefore, administratively feasible.	No anticipated problems achieving NPDES limits.	No anticipated problems achieving NPDES limits.
Implementability Availability of services and materials	Services and materials are not required.	Cover materials, construction equipment are readily available.	EPA-qualified vendor for stabilization process is available. Cover construction and water discharge can be performed by most contractors.
State Acceptance	Along with rejecting WP1, the State did not express a preference for either WP2 or WP3.		
Community Acceptance	While there was no specific preference for alternatives WP1 through WP3.		

3.9.1.33 Alternative WP1: No Action. Under this alternative, no action would be taken to remove, treat, or contain the water and sediments contained in Wastewater Ponds 1 through 5. Because contaminated media would be left in place, the potential for off-site contaminant migration would not be mitigated.

3.9.1.34 Alternative WP2: NPDES Discharge of Water, 24-Inch Clay Cover. Under this alternative, the pond water would be analyzed to confirm that it could be directly discharged without treatment to the Wah Chang Ditch in accordance with the requirements of the NPDES permit. Once empty, the pond berms would be leveled to the grade of the surrounding site. Once an even grade was achieved, a clay cover consisting of 24 inches of compacted common clay fill would be constructed over the former pond area and topped with a 6-inch topsoil layer. The topsoil layer would be seeded with grass to provide for erosion control. If more than 24 inches of compacted clean clay fill is needed to bring the pond level to grade, then only the 6-inch topsoil layer would be needed. The intent is to provide 24 inches of clean compacted clay fill over contaminated materials that exceed the site remedial action cleanup levels. If this is achieved in part by adding clean fill to bring the ponds to grade, the additional 24-inch clay cover is not required. The O&M activities associated with this alternative would include the inspection of the compacted clay cover and maintenance of the vegetative layer. Because contaminated sediments would be buried on site above health based levels, this alternative would include a deed record as an institutional control to limit the potential for future human exposure to contaminants. The deed record would describe the location of the covered contaminants and provide notice to potential buyers that excavations in that location may cause a release of hazardous substances.

3.9.1.35 Alternative WP3: NPDES Discharge of Water, Sediment Stabilization. Under this alternative, the water within the ponds would be directly discharged without treatment to the Wah Chang Ditch under the requirements of the NPDES limits. Treatment of the wastewater pond sediment would consist of stabilization Stabilization treatment mixes treatment agents into the contaminated sediments to reduce the contaminant solubility. After all stabilization was completed, the berms would be graded and common fill would be added, if necessary, to fill in voids and to bring the former ponds to an even grade with the rest of the site. Upon the completion of stabilization, the former wastewater ponds would be covered with a 6-inch topsoil layer, which would be seeded with grass chosen for long-term erosion control capabilities. The O&M activities associated with this alternative would include inspection and maintenance of the vegetative layer. Because contaminated sediments, although treated, would remain on-site, this alternative would also include institutional controls in the form of deed records to prevent disturbance of stabilized sediments or unsafe site development that could expose future site workers to contaminants.



Ore pile inside smelter building.

3.9.1.36 GROUND WATER (GW). The results of the Phase II RI and the SRI show that groundwater isa secondary contaminant source and a low level threat. Since the most likely potential future use of the Shallow and Medium Transmissive Zones would be for industrial use the site groundwater RAOs include preventing further degradation of the Shallow and Medium Transmissive Zones off site and preventing migration of contaminated groundwater to the Deep Transmissive Zone off site. This includes preventing discharge of groundwater contaminants to off-site ponds at concentrations that would impact ecological receptors. The fundamental components and cost of each alternative are shown in Box 3.9.1.36, "Components of Each GW Remedial Alternative" and the key ARARs for each alternative are shown in Table 3.9.1.36 - 1, "Key ARARs For GW Remedial Alternatives" and a comparison of each alternative to the nine evaluation criteria specified in the NCP is shown in Table 3.9.1.36 - 2, "GW Remedial Alternative Comparison."

Box 3.9.1.36 Components of Each GW Remedial Alternative

Alternative GW2: Long-Term Monitoring

- Treatment Components - None
- Containment Components - None
- Groundwater Monitoring
  - Installing monitoring wells to provide perimeter monitoring to ensure groundwater does not exceed alternate concentration limits
- Institutional Control Components
  - Deed records to prevent on-site use of the Shallow, Medium and Deep Transmissive Zone groundwater.
- Cost

Capital	$50,000		
Present Worth O&M	$281,000	Annual O&M	$25,000
Total Present Worth	$331,000		

Alternative GW3: Extraction Well System, Filter Press-GAC Treatment System

- Treatment Components
  - Granulated activated carbon (GAC) treatment to remove contaminants from the groundwater.
  - Stabilization for sediments and sludge
- Containment Components
  - Geomembrane wall to prevent groundwater from recharging the acid pond.
- Institutional Control Components - None.
- Cost

Capital	$430,000		
Present Worth O&M	$1,238,000	Annual O&M	$110,000
Total Present Worth	$1,668,000		

Table 3.9.1.36 - 1 Key ARARs For GW Remedial Alternatives			
Requirement	**GW1**	**GW2**	**GW3**
40 C.F.R. Parts 122 to 125, National Pollutant Discharge Elimination System (NPDES)	YES	YES	YES
40 C.F.R. Part 300, §430(e)(4)F, National Contingency Plan, Alternate Concentration Limits	YES	YES	YES
30 TAC. Environmental Quality, Part I, Texas Natural Resource Conservation Commission, Chapter 335, Industrial Solid Waste and Municipal Hazardous Waste, Subchapter S, Risk Reduction Standards.	YES	YES	YES

3.9.1.36 - 2 GW Remedial Alternative Comparison			
Criterion	**GW1**	**GW2**	**GW3**
Overall protection of human health and the environment	Provides no protection of human health or the environment	Provides protection of human health and environment by restricting groundwater use.	Achieves protection by extracting and treating contaminated groundwater.
Compliance with ARARs	Does not meet ARARs in the three transmissive zones.	The monitoring well network will be designed to demonstrate compliance with ARARs at the perimeter in the Deep Transmissive Zone and with ACLs in the shallow and medium zones at the perimeter.	Compliance with ARARs would be achieved both on and off site.
Long-term effectiveness and permanence	Not effective or permanent.	Deed records are effective in preventing groundwater use.	Extraction and treatment of groundwater is a long-term effective and permanent solution. Extraction wells preferred.
Reduction of toxicity, mobility, or volume through treatment	Provides no reduction in groundwater toxicity or mobility. Does not reduce volume of contaminants in groundwater.	Provides no reduction in groundwater toxicity or mobility. Does not reduce volume of contaminants in groundwater.	Achieves a reduction in toxicity, mobility, and volume of groundwater contaminants through treatment.
Short-term effectiveness	No associated risk to workers and residents.	Short-term potential exposure during groundwater monitoring sampling.	Short-term potential exposure associated with extraction well installation and operation of treatment facility.
Implementability			
Implementability Technical	No action required, therefore, technically feasible.	Groundwater monitoring and deed records are feasible. Monitoring well installation is feasible.	Groundwater extraction and filter press - GAC systems appear suitable to remove metals and VOCs from extracted groundwater.
Implementability Administrative	No action required, therefore, administratively feasible.	Deed record would require administration, but feasible.	No anticipated problems achieving NPDES limits with filter press - GAC treatment system.
Implementability Availability of services and materials	Services and materials are not required.	Groundwater monitoring services readily available. Monitoring well materials, equipment and contractors are readily available.	Limited vendors would install and operate treatment system.
State Acceptance	Other than rejecting GW1, the State indicated a preference for GW3 over GW2.		
Community Acceptance	While there was no specific preference for any of the alternatives, there was one comment received critical of EPA's groundwater investigation.		

3.9.1.37 Alternative GW1: No Action. Under this alternative, no action would be taken to remove, treat, or contain site groundwater. Because contaminated groundwater would not be treated, the potential for off-site contaminant plume migration would not be mitigated.

3.9.1.38 Alternative GW2: Long-Term Monitoring. Under this alternative, a long-term perimeter groundwater monitoring program in the Shallow, Middle, and Deep Transmissive Zones would be implemented. This would ensure no further off-site migration of contamination after the source control remedy is implemented. A deed record would provide notice to landowners that groundwater remains contaminated and would notify landowners that contact with untreated groundwater may pose an unacceptable risk or hazard to site workers. The record would also prevent the use of the shallow, medium, and deep groundwater. The monitoring progam would consist of four nested wells sets along the perimeter. There will be three wells in each nest,one to monitor each transmissive zone. For cost estimating purposes, it is assumed that four three well nests and four singular wells would be monitored on an annual basis for the contaminants listed in Table 3.11.3.4. Ten existing monitoring wells would be used for the perimeter monitoring program, and six new wells would be installed. During the remedial design EPA will determine the best locations to monitor the down gradient contamination. O&M activities associated with this alternative include annual groundwater sampling and assessing the condtion of the monitoring wells. The action levels triggering additional groundwater response actions for the Shallow, Medium and Deep Transmissive Zones are shown in Table 3.11.3.4, "Groundwater Remedial Action Cleanup Levels."

3.9.1.39 Alternative GW3: Extraction Well System, Filter Press-GAC Treatment System. Under this alternative, groundwater would be pumped to the surface using an extraction well system, treated on-site, and discharged to the Wah Chang Ditch under the NPDES limits. The number, locations, and depths of extraction wells would be determined during the remedial design phase based upon the results of groundwater modeling. This alternative would prevent further migration of contaminants in the Shallow and Medium Transmissive Zones off site or vertically downward. For this alternative, it was assumed that the treatment system used for treating the Acid Pond would be modified for use in treating contaminated groundwater. The main modification would consist of downsizing the system to treat a lower flow rate. It is anticipated that the Acid Pond liquid treatment system would operate at a flow rate in the range of 100 to 300 gpm, whereas the groundwater treatment system would operate at approximately 10 gpm. O&M activities would include operation of the extraction well and treatment system, as well as a perimeter groundwater sampling and monitoring program similar to what is described in Alternative GW2, plus an on-site sampling program to monitor the progress of the cleanup. Institutional controls in the form of deed records would be required to prevent the installation or use of on-site water wells in the Shallow, Medium, and Deep Transmissive Zones.

3.9.1.40 ABOVEGROUND STORAGE TANKS (ASTs). Above ground storage tanks contain approximately 289,850 gallons of hazardous waste (see Section 3.5.26, "Types of Contamination and the Affected Media") considered to be a principal threat waste. The fundamental components and cost of each alternative are shown in Box 3.9.1.40, "Components of Each AST Remedial Alternative" and the key ARARs for each alternative are shown in Table 3.9.1.40-1, "Key ARARs for AP Remedial Alternatives," and a comparison of each alternative to the nine evaluation criteria specified in the NCP is shown in Table 3.9.1.40 - 2, "AST Remedial Alternative Comparison."

3.9.1.41 Alternative AST1: No Action. Under this alternative, no action would be taken to remove, treat, or contain the AST contents. The potential for spills and leaks of the AST contents would not be mitigated.

3.9.1.42 Alternative AST2: Off-Site Disposal of AST Contents. Facilities in Texas, Louisiana, and Kentucky have been identified as potential locations for AST wastes disposal. Individual waste streams would be manifested, and then transported off-site for treatment and disposal. Empty ASTs would be dismantled, decontaminated, and recycled at an offsite scrap yard or disposed of off site. Because all AST contents would be disposed of off site, there wouldbe no O&M activities or institutional controls associated with this alternative.

Box 3.9.1.40 Components of Each AST Remedial Alternative

Alternative AST2: Off-Site Disposal of AST Contents

- Treatment Components - None
- Containment Components
  - Off-Site disposal.
- Cost

Capital	$400,000		
Present Worth O&M	$ 000	Annual O&M	$000
Total Present Worth	$400,000		

Alternative AST3: Off-Site Disposal of Organic Wastes, Treatment of Inorganic Wastes.

- Treatment Components
  - Stabilizing inorganic waste
- Containment Components
  - Off-Site disposal
  - Bury the stabilized inorganic wastes on-site with the stabilized acid pond sediments beneath a clay cover.
- Institutional Control Components
  - Deed Record.
- Cost

Capital	$370,000	Annual O&M	$000	No additional cost to acid pond O&M.
Present Worth O&M	$000			
Total Present Worth	$370,000			

Alternative AST4 Deep Well Injection of AST Contents.

- Treatment Components - None
- Containment Components
  - Cover drum contents in the acid pond with a clay cover.
- Institutional Control Components - None.
- Cost

Capital	$390,000			
Present Worth O&M	$,000	Annual O&M	000	No additional cost to acid pond O&M.
Total Present Worth	$390,000			

Table 3.9.1.40 - 1
Key ARARs For AST Remedial Alternatives

Requirement	AST1	AST2	AST3	AST4
Underground Injection Control (UIC) Program 40 C.F.R. Part 144, 42 USC 300(f)	N/A	N/A	N/A	YES
40 C.F.R. Part 268, Land Disposal Restrictions	YES	YES	YES	YES
40 C.F.R. Part 264 Standards for Owners and Operators of Hazardous Waste Treatment, Storage, and Disposal Facilities	YES	YES	YES	YES
30 TAC. Environmental Quality, Part I, Texas Natural Resource Conservation Commission, Chapter 335, Industrial Solid Waste and Municipal Hazardous Waste, Subchapter S, Risk Reduction Standards.	YES	YES	YES	YES

Table 3.9.1.40 - 2
AST Remedial Alternative Comparison

Criterion	AST1	AST2	AST3	AST4
Overall protection of human health and the environment	Provides no protection of human health or the environment.	All AST contents would be removed from site, providing protection of human health and the environment.	Off-Site disposal accompanied with waste treatment would provide protection of human health and the environment.	Deep well injection would provide protection of human health and the environment
Compliance with ARARs	Does not meet ARARs.	Disposal of AST contents would be conducted in accordance with RCRA and other Federal, state, and local requirements.	Disposal of organic AST contents would have to comply with applicable regulations. Stabilization of inorganic wastes meets ARAR criteria.	Deep well injection is in compliance with ARARs
Long-term effectiveness and permanence	Not effective or permanent.	Removal action provides long-term effectiveness and permanence.	Long-term effectiveness and permanence would be provided	Long-term effectiveness and permanence would be provided by isolating the waste from the environment
Reduction of toxicity, mobility, or volume through treatment	None through treatment	None through treatment	None through off site disposal, however on-site stabilization of inorganic waste would reduce waste toxicity and mobility, but not volume.	No reduction in toxicity, mobility, or volume and mobility of inorganic wastes.
Short-term effectiveness	No associated risk to workers.	Worker exposure to AST contents could pose potential short-term risks.	On-site workers could be exposed to waste materials in the short term.	On-site workers could be exposed to waste materials in the short term. Potential spills and leaks of organic AST waste during transport. Slurry mixing operations could expose workers.
Implementability				
Implementability Technical	No action required, therefore, technically feasible.	AST demolition, waste hauling, and disposal are common industrial practices.	Activities associated with AST demolition, off-site disposal, and waste treatment are established industrial practices.	Technically feasible using oil field technology.
Implementability Administrative	No action required, therefore, administratively feasible.	Manifesting would be required. Alternative is administratively feasible.	Manifesting would be required for off-site disposal. Alternative would be administratively feasible.	Coordination with TNRCC would be required.
Implementability Availability of services and materials	Services and materials would not be required.	No specialized equipment, labor, or materials would be required. Scrap yards and disposal facilities have the necessary capacity.	Labor and equipment associated with both off-site disposal and treatment of wastes is available.	Limited vendors can supply this technology.
State Acceptance	Other than rejecting AST1 and AST4, the State did not expressed a preference to any of the other alternatives.			
Community Acceptance	While there was no specific preference for alternatives AST1 through AST3, two comments were received favoring deep well injection, AST4.			

3.9.1.43 Alternative AST3: Off-Site Disposal of Organic Wastes, Treatment of Inorganic Wastes. Under this alternative, ASTs containing organic liquid and sludge would be emptied and the contents properly disposed of off site. Those ASTs with inorganic liquid and sludge concentrations exceeding the soil, sediment and sludge contaminant leachate remedial action clanup levels would be emptied and their contents treated and disposed of on-site. Liquids requiring treatment would be treated along with the Acid Pond liquid. Sludge from these ASTs would be stabilized and used to fill the Acid Pond. Empty ASTs would be dismantled, decontaminated, and recycled at an offsite scrap yard or landfilled on site. Because the AST organic contents would be disposed of off site and the inorganic materials treated along with the Acid Pond sediments, O&M activities and institutional controls are not required for this alternative.

3.9.1.44 Alternative AST4: Deep Well Injection of AST Contents. Under this alternative, ASTs would be emptied, and their contents mixed with water to create a 30 percent solids slurry (if necessary) for deep well injection. Empty ASTs would be dismantled, decontaminated, and recycled at an off-site scrap yard. Because monitoring of the deep well injectionzone has been included under Alternative AP5, O&M activities have not been included in this alternative. There are no institutional controls associated with this alternative.

3.9.1.45 BUILDINGS AND STRUCTURES ALTERNATIVES. Site buildings are contaminated with spills and dust from the smelting process creating a principal threat. Eleven buildings remain in the Process Area, many of which contain or are covered with asbestos-containing materials (ACM). The fundamental components and cost of each alternative are shown in Box 3.9.1.45, "Components of Each BLD Remedial Alternative" and the key ARARs for each alternative are shown in Table 3.9.1.45 - 1, "Key ARARs For BLD Remedial Alternatives," and a comparison of each alternative to the nine evaluation criteria specified in the NCP is shown in Table 3.9.1.45 - 2, "BLD Remedial Alternative Comparison."

Inside the Smelter Building.

Table 3.9.1.45 - 1
Key ARARs For BLD Remedial Alternatives

Requirement	BLD1	BLD2	BLD3	BLD4
40 C.F.R. Part 264 Standards for Owners and Operators of Hazardous Waste Treatment, Storage, and Disposal Facilities	YES	YES	YES	YES
40 C.F.R. Part 268, Land Disposal Restrictions	YES	YES	YES	YES
40 C.F.R. Part 40 Part 61.145, Asbestos Standards for Demolition and Renovation	YES	YES	YES	YES
30 TAC. Environmental Quality, Part I, Texas Natural Resource Conservation Commission, Chapter 335, Industrial Solid Waste and Municipal Hazardous Waste, Subchapter S, Risk Reduction Standards.	YES	YES	YES	YES

Box 3.9.1.45 Components of Each BLD Remedial Alternative

Alternative BLD2: Asbestos Removal

- Treatment Component - None
- Containment Component
  - Asbestos disposal in off site landfill.
- Institutional Control Components - None
- Cost

Capital	$3,170,000		
Present Worth O&M	$000	Annual O&M	None, all asbestos removed off site.
Total Present Worth	$3,170,000		

Alternative BLD3: Asbestos Removal and Building Demolition, Off-Site Disposal Alternative

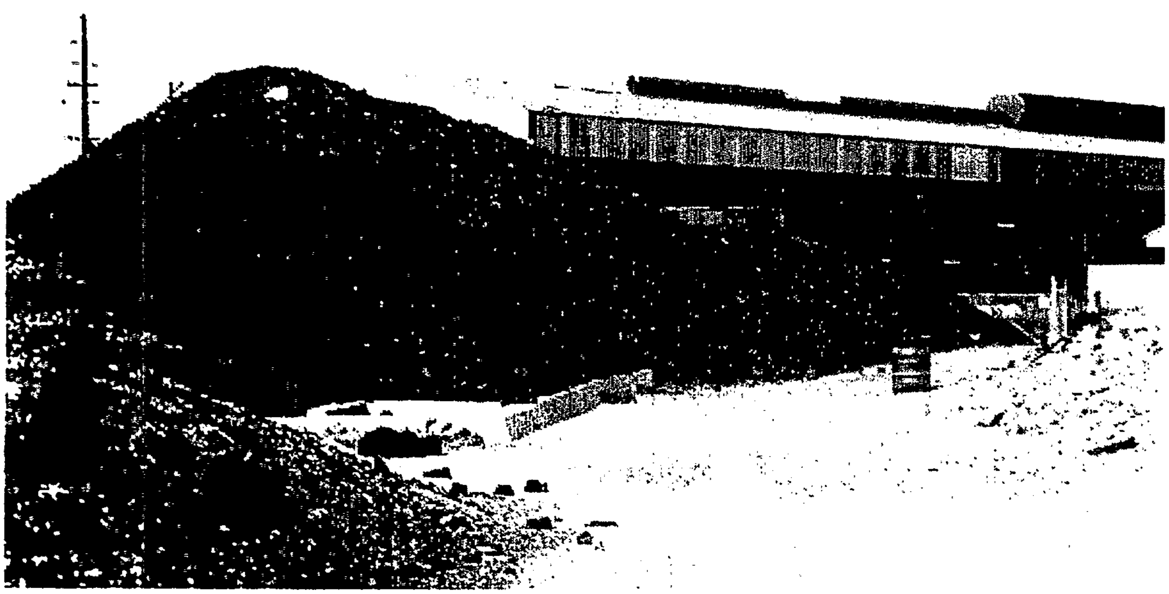
- Treatment Components - None
- Containment Components
  - Asbestos and building debris disposal in off site landfill.
- Institutional Control Components - None
- Cost

Capital	$19,750,000		
Present Worth O&M	$000	Annual O&M	None all asbestos and debris removed off site.
Total Present Worth	$19,750,000		

Alternative BLD4: Asbestos Removal and Building Demolition with On-site Disposal

- Treatment Components - None
- Containment Components
  - Asbestos and building debris disposed of in an on-site landfill.
- Institutional Control Components - None
- Cost

Capital	$11,940,000		
Present Worth O&M	$11,000	Annual O&M	$1,000
Total Present Worth	$11,951,000		

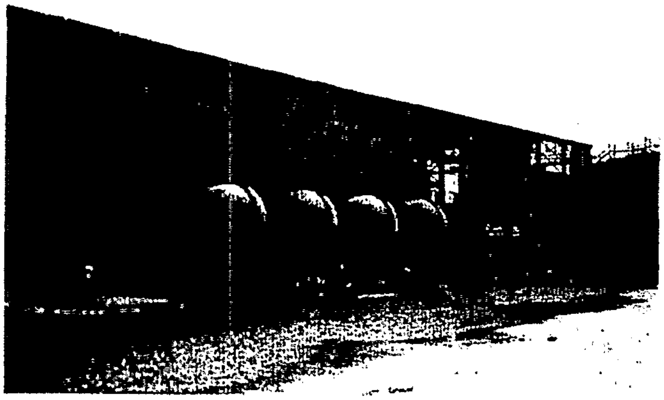


Slag pile. Smelter building in the background.

Table 3.9.1.45 - 2 BLD Remedial Alternative Comparison				
Criterion	**BLD1**	**BLD2**	**BLD3**	**BLD4**
Overall protection of human health and the environment	Provides no protection of human health or the environment.	Protection of human health and environment would be achieved by removing dust and friable asbestos.	Protection of human health and environment would be achieved by removing all dust and ACM and demolishing buildings.	Protection of human health and the environment would be achieved by removing all dust and ACM and demolishing buildings.
Compliance with ARARs	Does not meet ARARs.	Off-Site disposal would comply with ARARs.	Off-Site disposal would comply with ARARs.	Packaging and landfilling requirements would meet ARARs.
Long-term effectiveness and permanence	Not effective or permanent.	The long-term effective-ness is met but is not a permanent solution since non-friable asbestos remains on-site.	Removal of all ACM achieves long term effectiveness and permanence.	Isolation of ACM achieves long term effectiveness and permanence.
Reduction of toxicity, mobility, or volume through treatment	Would provide no reduction of toxicity, mobility, or volume.	There is a reduction of mobility and volume of the ACM by removal and disposal.	There is a reduction of mobility and volume of the ACM by removal and disposal.	There is a reduction of mobility due to landfilling. No reduction in volume.
Short term effectiveness	No associated risk to workers and residents.	On-site workers could be exposed during removal but measures could be taken to minimize this risk.	On-site workers could be exposed during removal but measures could be taken to minimize this risk.	On-site workers could be exposed during removal but measures could be taken to minimize this risk.
Implementability				
Implementability Technical	No action required, therefore, technically feasible.	Removal of asbestos is technically feasible.	Removal of asbestos and building demolition is technically feasible.	Removal of asbestos and building demolition is technically feasible.
Implementability Administrative	No action required, therefore, administratively feasible.	Measures to prevent remaining non-friable asbestos from future exposure would be required.	Feasible, no asbestos left on-site.	Would require compliance with ARARs.
Implementability Availability of services and materials	Services and materials are not required.	All materials available.	All materials available.	All materials available.
State Acceptance	Other than rejecting BLD1, the State did not expressed a preference to any of the other alternatives.			
Community Acceptance	The mayor of Texas City supported the proposed alternative BLD4 while EPA received one comment opposing this alternative. EPA also received two comments proposing to leave the buildings standing.			

3.9.1.46 Alternative BLD1: No Action. Under this alternative, no action would be taken to remove any of the ACM from the buildings and structures.

3.9.1.47 Alternative BLD2: Asbestos Removal. This alternative would first require bracing unstable buildings to allow for safe entry; removing contamimated dust from building surfaces; and removing friable asbestos. Friable asbestos includes 4,100 linear feet of pipe insulation and 6,200 cubic feet and 17,800 square feet of other ACM. For purposes of estimating the volume of ACM, it is assumed that all building asbestos is friable except for the shingles and the transite panels on the walls and roofs. Non friable asbestos (shingles and transite panels) would not be removed from buildings. A structural survey conducted in 1996 indicated that several buildings are not safe and would require bracing before the asbestos-containing materials could be removed from them. These buildings are the Roasting and Leaching Building, Maintenance Building, Smelter Building, and Ore Storage Building. Additionally, chemicals are still sbred in the Laboratory and Office Building. These chemicals would be collected and removed before conducting the asbestos abatement. Contaminated dust would also be removed from interior surfaces of all buildings.



Southwest side of the Roasting and Leaching Bldg.

3.9.1.48 Alternative BLD3: Asbestos Removal and Building Demolition, Off-Site Disposal. Friable asbestos and dust would be removed, as described in Alternative BLD2. In addition, all other evident asbestos such as transite siding and roofing as well as pipe insulation would be removed from the buildings and structures. Several structures would no longer have exterior walls or roofs and would be demolished. All building materials would be disposed off site. Buildings on this site are clad with an estimated 356,000 square feet of asbestos-containing siding and roofing materials, over 90 percent of it being transite panels. Removal of all asbestos-containing siding and roofing materials would eliminate the need to catalog them and inform future building occupants, would eliminate the need for special care should any inadvertent damage occur during future occupancy, and would eliminate the asbestos hazard to any future workers. Removing this material would expose building columns and beams to the elements, and they would rapidly deteriorate, quickly becoming unsafe. Site buildings would therefore be slated for demolition immediately following asbestos abatement when appropriate. The demolished building materials would be disposed of at an off-site landfill. Site buildings include:

- Maintenance Building
- Warehouses No.1, No.2, and No.3
- Smelter Building and Stack
- Laboratory and Office Building
- General (Engineering) Office
- Change Room
- Kaldo Furnace and Kaldo Works
- Water Tower

Soil beneath some of the building foundations would be excavated following demolition of the foundations. The contaminated soil volume is estimated at 16,100 cubic yards. It is assumed that 30 percent of that volume (4,830 cubic yards) would exceed contaminant source leachate remedial action cleanup levels and would be combined with other materials in the Acid Pond. O&M costs and institutional controls would be included under other alternatives.

3.9.1.49 Alternative BLD4: Asbestos Removal and Building Demolition with On-site Disposal

Alternative BLD4: Under Alternative BLD4, all asbestos would be removed as described in BLD3, but it would be buried below grade in an on-site landfill. All building demolition debris would be decontaminated to be sold for salvage or disposed of in a landfill on-site. Contaminated soil beneath the building foundations may require remediation in accordance with Section 3.9.1.24 "Surface and Subsurface Soils," Remedial Alternative SS2. Because building debris would remain on site above health based levels, this alternative would also include a deed record as an institutional control to limit the potential for future human exposure to contaminants. The deed record would describe the location of the covered or stabilized landfill debris and buried soils. The record would also provide notice to potential buyers that excavations in those locations may cause a release of hazardous substances. O&M costs and institutional controls would be included under other alternatives.

Kiln inside the Roasting and Leaching building.

3.9.2 Site Wide Alternatives. The similar individual alternatives, i.e. stabilization, water treatment or off site disposal, previously discussed were combind into site wide (SW) alternatives that address each of the contaminant primary, secondary or tertiary contaminant sources (see Table 3.9.2, Site Wide Alternative Similarities”). As a result six (6) site wide alternatives were developed to address the OU1 contamination. The alternatives include the no action alternative (SW1) that is required by the NCP. The other alternatives covera range of technologies, cost, protection, containment or treatment to address OU1 contaminant sources. The design and construction for each site wide alternative should not last more than 36 months.

Table 3.9.2
Site Wide Alternative Similarities

	SW2	SW3	SW4	SW5	SW6
STABILIZATION ALTERNATIVES INCLUDED IN SITE WIDE ALTERNATIVES					
WP3 - Stabilization Sediments				X	
SL3 - Recycling, Stabilization or Backfilling			X		
SS3 - Stabilizing All Soils Exceeding Soil Remedial Action Cleanup Levels			X	X	
DR3 - Stabilization of Drummed Materials		X	X	X	
AP3 - Sediment Stabilization		X	X	X	
SL4 - Stabilizing non-NORM slag	X	X			
SS2 - Stabilizing Soil That Exceed Contaminant Source Leachate Levels	X	X			
NSL3 - Stabilizing and Landfilling NORM Slag		X			
WATER TREATMENT REMEDIAL ALTERNATIVES INCLUDED IN SITE WIDE ALTERNATIVES					
AP3 - Filter Press - GAC Treatment System,		X	X	X	
AP4 - Metals Precipitation Treatment System	X				
GW3 - Extraction and Treatment				X	
WP3 - Treatment				X	
ON SITE LAND DISPOSAL W/O TREATMENT					
BLD4 - Asbestos Removal and Building Demolition, On-Site Disposal of Building Debris		X	X		X
SS5 - Land Disposal w/o Treatment					X
NSL4 - Landfilling NORM Slag On Site w/o Treatment	X				
DR4 - Landfill Drummed Materials On Site w/o Treatment.	X				
OFF SITE DISPOSAL					
AST2 - Off Site Disposal of AST Contents	X			X	
NSL2 - Off Site Disposal of NORM Slag			X	X	
SL2 - Off Site Disposal of non-NORM Slag				X	
BLD3 - Building Demolition, Off Site Disposal of Building Debris				X	
AST3 - Off Site Disposal of Organic Wastes		X	X		
DEEP WELL INJECTION					
AP5 - Wall, Deep Well Injection of Liquid and Sediment					X
SL5 - Deep Well Injection of non-NORM slag					X
AST4 - Deep Well Injection of AST Contents					X
DR5 - Deep Well Injection of Drummed Materials					X
NSL5 - Deep Well Injection of NORM Slag					X
MISCELLANEOUS REMEDIAL ALTERNATIVES					
GW2 - Long Term Monitoring	X	X	X		X
WP2 - Discharge w/o Treatment	X	X	X		X
BLD2 - Asbestos Removal	X				

3.9.3 **SW1: No Action Alternative.** Under this alternative, no action would be taken to remove, treat, or contain any of the contamination found on OU1. No action would be taken at the acid pond and sediments in the Wah Chang Ditch, the wastewater ponds, groundwater, drums, aboveground storage tanks, surface and subsurface soils, NORM and non-NORM slag, or buildings and structures. Because contaminated media would remain in place, the potential for off-site migration of contaminants would not be mitigated. The no action alternative is required by the NCP and provides a basis of comparison for the remaining alternatives. No costs are associated with this alternative.

3.9.4 **SW2: Consolidation of Hazardous Materials and Covering with Impermeable Cap, Groundwater Monitoring, and Asbestos and Dust Removal from Buildings.** Components of this alternative include the following elements:

- A vertical geomembrane barrier would be installed around the Acid Pond, the liquids in the pond would be removed and treated on site to remove the metals by precipitation, the Wah Chang Ditch and Acid Pond sediments would be placed in the Acid Pond, and an impermeable cover would be placed over the Acid Pond (AP-4). Non-NORM slag leaching contaminants greater than the contaminant source leachate remedial action level would also be consolidated (SL-4)
- The drum contents, NORM slag, and soils exceeding a contaminant source remedial action cleanup level would be placed under an impermeable cover (DR-4, NSL-4)
- Soils exceeding a remedial action cleanup levels but not exceeding the contaminant source remedial action cleanup level would be covered in place with a clay compacted cover (SS-2)
- The aboveground storage tank contents would be disposed off-site (AST-2)
- The wastewater pond liquids would be discharged into the Wah Chang Ditch and the wastewater ponds backfilled (WP-2)
- A perimeter groundwater monitoring program would be initiated (GW2)
- The dust and friable asbestos would be removed from the buildings on site (BLD-2)

3.9.5 **SW3: On-site Stabilization, Compacted Clay Cover, Groundwater Monitoring, Asbestos Removal, and Building Demolition.** This is the selected alternative and includes the following elements:

- On-site stabilization of Acid Pond sediments and Wah Chang Ditch sediments (AP3), stabilization of drum and supersack inorganic contents, off-site disposal of organic contents (DR3), stabilization of NORM and hazardous non-NORM slag (NSL3 and SL4);
- Soils exceeding remedial action cleanup levels but not soils exceeding the contaminant source remedial action cleanup level would be covered with compacted clay cover including the low-level radioactive landfill; soils exceeding the contaminant source remedial action cleanup levels would be stabilized and capped (SS2)
- Wastewater pond liquids would be discharged to Wah Chang Ditch, and ponds backfilled (WP2)
- Long-term groundwater monitoring (GW2)
- Off-Site disposal of organic Aboveground Storage Tank contents (AST2) at a facility approved for K0052 waste disposal.
- Removal of dust and all asbestos from buildings, demolition of buildings and on-site disposal of debris (BLD4)

Under this alternative, a geomembrane wall would be placed around the Acid Pond. The Acid Pond liquids would be treated and discharged into the Wah Chang Ditch. Stabilization will be used to treat the Acid Pond and Wah Chang Ditch sediments, drummed materials, hazardous non-NORM slag. Soils exceeding the leachate concentrations shown on Table 3.11.3.1, "Soil Sediment, Slag and Sludge Remedial Action Cleanup Levels" would be stabilized and used to fill the Acid Pond. The estimated volume of materials for on-site stabilization is 94,000 cubic yards. The wastewater pond liquids would be discharged into the Wah Chang Ditch while soil exceeding any remedial action cleanup level in Table 3.11.3.1, "Soil Sediment, Slag and Sludge Remedial

Action Cleanup Levels," would be covered with a 24-inch clay soil cover. The above ground storage tank contents would be disposed of off site at an EPA approved treatment and disposal facility and a perimeter groundwater monitoring program would be implemented to ensure no further degradation of groundwater. Lastly the dust and asbestos from the buildings would be removed, the buildings would be demolished, and the building debris would be landfilled on-site.

3.9.6 SW4: On-site Stabilization, Consolidation, and Covering of Soils, Groundwater Monitoring, and Asbestos Removal. The components of SW4 include the following:

- On-site stabilization of Acid Pond sediments and Wah Chang Ditch sediments (AP3), drum contents stabilization (DR3), non-NORM slag stabilization and recycling (SL3) and off-site landfill NORM disposal (NSL2).
- On-site stabilization of soils that exceed remedial action cleanup levels (SS3)
- Wastewater pond liquids discharged to Wah Chang Ditch and ponds backfilled (WP2)
- Long-term groundwater monitoring (GW2)
- Off-Site disposal of Aboveground Storage Tank contents (AST2)
- Removal of dust and all asbestos from buildings, building demolition, and on-site disposal of debris (BLD4)

The alternative is similar to SW-3 except that soils exceeding remedial action cleanup levels would be stabilized on-site, NORM slag would be disposed of off site, and selected non-NORM, non-hazardous slag would be recycled.

3.9.7 SW5: On-site Stabilization of the Acid Pond, Off-Site Disposal of Hazardous Wastes, Groundwater Extraction, and Building Demolition

This alternative consists of the following components:

- On-site stabilization of Acid Pond sediments and Wah Chang Ditch sediments (AP-3), and waste pond sediment stabilization (WP3)
- On-site stabilization of soils exceeding remedial action cleanup levels (SS-3)
- Stabilization of drum contents on site (DR3), off-site disposal of NORM and hazardous non-NORM slag (NSL2 and SL2), off-site disposal of aboveground storage tank contents (AST2)
- Groundwater extraction and treatment (GW3)
- Removal of dust and all asbestos from buildings, building demolition, and building materials disposed of off site (BLD3)

Under this alternative wastes would be removed from the site for disposal, or else treated or stabilized at the site.

3.9.8 SW6: Deep Well Injection of Drum Contents, Sediment, and Slag; and Building Demolition.

This alternative consists of the following components:

- Waste pond drainage/NPDES discharge and placement of 24-inch clay cover (WP2)
- Excavate and consolidate soils that exceed remedial action cleanup levels and cover with a clay cap, inject TCLP hazardous soils (SS5)
- Deep well injection of drum contents (DR5), deep well injection of NORM and hazardous non-NORM slag (NSL5 and SL5), deep well injection of Acid Pond liquid and sediments as well as Wah Chang Ditch sediments (AP5), and deep well injection of AST contents (AST4)
- Long-term groundwater monitoring (GW2)
- Removal of dust and all asbestos from buildings, building demolition, and on-site disposal of building materials (BLD4)

This alternative would involve reentering the existing deep injection well on-site, and installing two new deep monitoring wells to monitor the injection well waste perimeter radius.

The soils exceeding remedial action cleanup levels but not TCLP-hazardous would be excavated and consolidated on-site. Soils exceeding TCLP limits would be deep well injected as would the NORM slag and most other contaminated materials from the site.

3.10 Summary of Comparative Analysis of Site Wide Alternatives. The alternatives for OU1 were evaluated in accordance with the nine criteria specified in the NCP, 40 C.F.R. 300.430(e)(9) and (f)(1). These criteria are:

1. Overall Protection of Human Health and the Environment
2. Compliance with Applicable or Relevant and Appropriate Requirements (ARARs)
3. Long-term Effectiveness and Permanence
4. Reduction of Toxicity, Mobility or Volume Through Treatment
5. Short-Term Effectiveness
6. Implementability
7. Cost
8. State Acceptance
9. Community Acceptance.

3.10.1 Overall Protection of Human Health and the Environment. Overall protection of human health and the environment addresses whether each alternative adequately protects human health and the environment and describes how carcinogenic risks and non-carcinogenic hazards posed through each exposure pathway are eliminated, reduced or controlled, through treatment, engineering controls, and/or institutional controls. The only OU1 alternative that does not meet the threshold criteria (protecting human health and the environment and complying with ARARs) is SW1, the no action alternative. Alternatives SW2, SW3, SW4, SW5, and SW6 all are protective of human health and the environment.

3.10.2 Compliance with Applicable or Relevant and Appropriate Requirements. Section 121(d) of CERCLA requires that remedial actions at CERCLA sites at least attain legally applicable or relevant and appropriate Federal and State requirements, standards, criteria and limitations which are collectively referred to as ARARs. Alternatives SW2, SW3, SW4, and SW5 are in compliance with ARARs. Remedial Alternative SW6 will require a waiver of 30 Texas Administrative Code Chapter 331. "Underground Injection Control, Subchapter D. Standards For Class I Wells Other Than Salt Cavern Solid Waste Disposal Wells, § 331.63 Operating Requirements." This ARAR requires regulating injection pressure at the wellhead so as to assure that the pressure in the injection zone during injection does not initiate new fractures or propagate existing fractures in the injection zone, initiate new fractures or propagate existing fractures in the confining zone, or cause movement of fluid out of the injection zone that may pollute drinking water or surface water.

3.10.3 Long-Term Effectiveness and Permanence. Long-term effectiveness and permanence refers to expected residual carcinogenic risk and the ability of a remedy to maintain reliable protection of human health and the environment over time, once clean-up levels have been met. This criterion includes the consideration of residual carcinogenic risk and the adequacy and reliability of controls. All alternatives, except the no action alternative, meet the long-term effectiveness and permanence criteria Alternatives SW3 and SW4 permanently stabilize the most mobile contaminants. Under Alternative SW5, the drums, aboveground storage tank contents, and NORM and non-NORM slag are removed and disposed of off site to a permanently monitored treatment and disposal facility. Off-site disposal provides the greatest long-term effectiveness and permanence at the site. In Alternative SW2, hazardous materials are consolidated on site and permanently covered with an impermeable cap. BLD3 and 4 provide the most effective long-term and permanent remedies since there is no specific use identified for the site and many structures on site are contaminated, so the collapse or destruction of these building during high winds could release the contaminants contained in the buildings into the environment. Consequently, EPA considers there can be little if any current use of the buildings without significant decontamination, demolition, renovation or construction. In addition since the current building owner is in bankruptcy and there is no long-term maintenance plan, the buildings will most likely continue to deteriorate. As the buildings deteriorate friable asbestos fibers from siding and roofing could be released Therefore, EPA believes building demolition provides the most effective long-term permanent remedy to ensure there is no release of friable asbestos or other hazardous substances into the environment.

Table 3.11.1.9.
Cost Estimate, Remedial Alternative BLD4
Dust Removed, Friable and Non-friable Asbestos Remediated and Landfilled On-site, Structures* Demolished

Item Description	Quantity	Unit	Cost/Unit	Cost*
Capital Costs**				
Structural Inspection - Roasting & Leaching Bldg	48	HRS	$100.00	$4,800
Structural Inspection - Maintenance Bldg	48	HRS	$100.00	$4,800
Structural Inspection - Smelter Bldg	48	HRS	$100.00	$4,800
Structural Inspection - Ore Storage Bldg	48	HRS	$100.00	$4,800
Structural Inspection - Ore Storage Bldg	48	HRS	$100.00	$4,800
Asbestos Abatement: Pipe Insulation	4,100	LF	$10.00	$41,000
Asbestos Abatement: Asbestos Containing Materials	6,200	CF	$7.00	$43,400
Asbestos Abatement: Asbestos Containing Materials	17,800	SF	$6.80	$121,040
Asbestos Abatement: Building Siding & Roofing	356,000	SF	$6.80	$2,420,800
Vacuum Dust in Interiors of Buildings	1	LS	$74,555.00	$74,555
Pressure Wash Interior Walls of Buildings	1	LS	$154,008.00	$154,008
Packaging & Handling	4,421	CY	$50.00	$221,046
Demolish Roasting & Leaching Bldg.	1,176,000	CF	$0.25	$294,000
Demolish Maintenance Bldg	318,780	CF	$0.25	$79,695
Demolish Warehouse No. 1	491,400	CF	$0.25	$122,850
Demolish Warehouse No. 2	249,600	CF	$0.25	$62,400
Demolish Warehouse No. 3	220,000	CF	$0.25	$55,000
Demolish Smelter	3,021,525	CF	$0.25	$755,381
Demolish Smelter Stack	250	LF	$1,000.00	$250,000
Demolish Lab & Office Building	123,904	CF	$0.25	$30,976
Demolish General Engineering Office	58,080	CF	$0.25	$14,520
Demolish Change Room	66,429	CF	$0.25	$16,607
Demolish Ore Storage Bldg.	1,848,000	CF	$0.25	$462,000
Demolish Kaldo Furnace	168,480	CF	$0.25	$42,120
Demolish Kaldo Works	78,00	CF	$0.25	$19,500
Demolish Water Tower	1	LS	$65,920.00	$65,920
Excavation and Transportation of Soil Under Structures	16,133	CY	$6.00	$96,798
In-Situ Stabilization	4,840	CY	$35.00	$169,397
Backfill Using Non-Hazardous Soil from the Site	16,133	CY	$5.00	$80,665
Load debris in trucks, transport across site	102	day	$3,666.95	$374,029
Construct and close RCRA landfill	113,000	SF	$8.00	$904,000
General Equipment Mobilization and Demobilization (6%)	.06	%	$6,995,707.0 0	$419,742
			Subtotal Direct Capital Costs	**$7,415,450**
			Overhead and Profit (25%)	$1,853,862
			Total Direct Capital Costs (Rounded to Nearest $10,000)	**$9,270,000**

Table 3.11.1.9. Cost Estimate, Remedial Alternative BLD4 Dust Removed, Friable and Non-friable Asbestos Remediated and Landfilled On-site, Structures* Demolished				
Item Description	**Quantity**	**Unit**	**Cost/Unit**	**Cost***
Indirect Capital Costs				
			Engineering and Design (7%)	$648,900
			Legal Fees and License/Permit Costs (5%)	$463,500
			Total Indirect Capital Costs	**$1,112,400**
			Subtotal Capital Costs	**$10,382,400**
			Contingency Allowance (15%)	$1,557,360
			Total Capital Costs (rounded to the nearest $10,000)	**$11,940,000**
O&M Costs				
Annual Maintenance, present value	1	LS	$678	$678
			Subtotal Direct Annual O&M Costs	**$678**
			Overhead and Profit (25%)	$170
			Total O&M Costs (Rounded to Nearest $1,000)	**$1,000**
			Administration (5%)	50
			Insurance, Taxes, Licenses (2.5%)	$25
			Subtotal Capital Costs	**$1,075**
			Contingency Allowance (15%)	$161
			Total O&M Costs (rounded to the nearest $1,000)	**$1,000**
			30 year cost projection at an assumed 8% discount rate.	$11,158
			Present Worth of O&M (rounded to nearest $1,000)	$11,000
			Total Alternative Cost (Capital Cost plus O&M) to nearest $10,000	**$11,950,000**

* Due to rounding, the amount in the Cost column may be slightly different than the product.

** Capital Costs may be reduced if during the remedial design EPA determines some buildings do not meet the demolition criteria stated in section 3.11.3.5.

3.11.1.10 Operation and Maintenance. The NORM Slag and Building Debris landfills, covered soils, and filled ponds will require long term inspection and maintenance as an O&M measure. Annual O&M inspections would look for breaches in the landfill cover. Additional inspections would occur after severe weather events (i.e., hurricanes) to ensure there is no erosion damage to the cover. O&M measures would also include groundwater monitoring to ensure contaminants do not continue leaching into the groundwater.

3.11.1.11 Stabilization. Remedial Alternatives AP3, DR3, SS2, NSL3 and SL4 will require stabilizing contaminant sources to eliminate a principal threat. Detailed design studies would be required to design the optimum stabilizing reagents mixture. The optimal mix design would produce the most cost effective homogeneous stable mixture that would alter the chemical or physical composition of the contaminants to prevent them from leaching contaminants in concentrations exceeding the leachate concentrations shown in Table 3.11.3.1.

3.11.1.12 Impermeable Cover. An impermeable cover is required to cover stabilized contaminants for AP3 and NSL3. Once the stabilization is complete the mix would be covered with an impermeable clay or HDPE cover designed to prevent direct contact by humans or wildlife. The cover would also be designed to ensure sediment toxicity and mobility is permanently reduced and rainfall infiltration is minimized. In the case of a cover for NORM slag, the cover would be designed to comply with radiation ARARs at the surface. Therefore, radiation modeling will be necessary to determine the cover design necessary to reduce the expected radiation dosage at the fence line. Should site development be considered in the future, the thickness and composition of the cover would need to be reevaluated based upon the proposed development.

3.11.1.13 Institutional Controls. Because contaminants and debris would remain buried on site, the Site Wide Alternative SW3 would also include a deed record as an institutional control to limit the potential for future human exposure to contaminants. The deed record would describe the locations of the buried contaminants, low-level radionuclide landfill and debris and provide notice to potential buyers that excavations in those locations may cause a release of hazardous substances.

3.11.1.14 Clay Cover. Remedial Alternatives WP2, SS2 and SL4 require a clay cover to contain low level threat waste. The intent is to cover the areas that exceed the remedial action cleanup levels with a minimum of 24 inches of clean compacted clay. If a minimum of two feet of clean fill is used to backfill the ponds to grade, then an additional 24-inch clay cover will not be required. If this can be accomplished in backfilling the ponds to grade, then the addition of a clay cover is not needed. The clay cover would be topped with six inches of topsoil seeded with native grass chosen for long-term erosion control. Should site development be considered in the future, the thickness and composition of the cover would need to be reevaluated based upon the proposed development.

3.11.2 Summary of the Estimated Remedy Costs. The estimated remedy costs are summarized in the following table. As previously discussed, EPA believes Site Wide Alternative SW3 can be designed and constructed in less than 36 months.

Table 3.11.2
Summary of the Estimated Remedy Costs

Site Alternatives		
AP3	Geomembrane wall, filter press/GAC treatment system, sediment stabilization	$6,570,000
WP2	NPDES discharge pond water, 24-inch clay cover	$2,700,000
GW2	Long-term monitoring of groundwater	$330,000
DR3	Stabilization of drum contents on site	$450,000
AST2	Off-Site disposal of organic AST contents	$400,000
SS2	24-inch clay cover on non-hazardous soils, stabilize and cover hazardous soil	$3,970,000
NSL3	Stabilization of NORM slag	$970,000
SL4	Stabilization and covering hazardous non-NORM slag, backfill and cover remaining non-NORM slag	$1,300,000
BLD4	Asbestos removal, building demolition, on-site disposal	$11,950,000
	TOTAL	$ 28,640,000

3.11.3 Expected Outcomes of the Selected Remedy. The purpose of this response action is to control carcinogenic risks and non-carcinogenic hazards posed to current construction workers and future construction and industrial workers through: accidental ingestion of contaminated soil, drummed catalyst and groundwater; inhalation of radon gas or asbestos fibers; external radiation from NORM slag piles; and direct contact with acid pond water or above ground storage tank sludge. Upon completion of the remedy the site is expected to be available for any industrial uses that would not disturb any of the buried contaminants or use any untreated groundwater. The results of the baseline risk assessment indicate that existing conditions at the site pose an excess lifetime carcinogenic risk greater than 1 in 10,000 (1.0E-04) or a non-carcinogenic hazard with a Hazard Index greater than 1, as shown on Table 3.7.1.4.7, "Carcinogenic Risk or Chronic Hazards Justifying Remedial Action." Therefore, EPA will take remedial action in those areas of the site where the contaminant concentrations exceed the remedial action cleanup levels in Tables, 3.11.3.1 and 3.11.3.4.

3.11.3.1 Soil, Sediment, Slag or Sludge. Since no Federal or State ARARs define specific soil, sediment, slag or sludge cleanup levels, EPA developed the cleanup levels shown in Table 3.11.3.1, "Remedial Action Cleanup Levels," through a site specific risk analysis as explained in Section 3.7, "Site Carcinogenic Risk and Non-Carcinogenic Hazard." EPA and TNRCC determined the appropriate cleanup standard for arsenic to be 200 ppm.[58] The "Identification and Listing of Hazardous Waste, Subpart B - Criteria for Identifying the Characteristics of Hazardous Waste and for Listing Hazardous Waste, Toxicity Characteristic," 40 C.F.R. §261.22 defines the action level for the AST sludge.

3.11.3.2 Leachate. To protect human health and the environment from the primary, secondary and tertiary contaminant sources leaching contaminants, EPA established the leachate levels in Table 3.11.3.1, "Remedial Action Cleanup Levels," based upon the Safe Drinking Water Act Maximum Contaminant Levels (MCLs) to ensure that the leachate will not add unacceptable amounts of contamination to the groundwater. EPA will use EPA SW-846 Method 1312, "Synthetic Precipitation Leaching Procedure" (SPLP) to determine the contaminant concentrations in leachate.

Table 3.11.3.1
Remedial Action Cleanup Levels

Chemical / Waste	Basis Cleanup Level	Cleanup Levels	
		Soil, Sediment, Slag and Sludge (mg / kg)	Leachate* (mg/L)
Antimony	Risk Assessment		0.006
Arsenic	Risk Assessment	194	0.05
Barium	MCL**		2.0
Beryllium	MCL		0.004
Cadmium	Risk Assessment	2,044	0.005
Chromium (total)	Risk Assessment	1,577	0.1
Copper	Risk Assessment	75,628	1.3
Lead	Risk Assessment	2,000	0.015*
Mercury	Risk Assessment	613	0.02
Nickel	Risk Assessment	40,880	
Selenium	MCL		0.05
Zinc	Risk Assessment	613,200	
1,1,2-Trichloroethane	MCL		0.005
1,2-Dichloroethane	MCL		0.005
Benzene	MCL		0.005
Chloroform	MCL		0.1
Acid Pond Water and Above Ground Storage Tanks	Treatment is required when the pH is less than 2. Reference "Identification and Listing of Hazardous Waste, Subpart B - Criteria for Identifying the Characteristics of Hazardous Waste and for Listing Hazardous Waste, Toxicity Characteristic," 40 C.F.R. §261.22.		

*Leachate concentrations determined by EPA SW-846 Method 1312, "Synthetic Precipitation Leaching Procedure." Soil, sediment, slag and sludge materials exceeding leachate concentrations shown would require stabilization.
**See Section 3.10.4.2, "Leachate."

3.11.3.3 Surface Water. Remedial alternatives AP3 and WP2 require discharging surface water which meets the discharge requirements of the NPDES permit for the facility. Those requirements are listed in table 3.11.3.3, "NPDES Pollutant Discharge Limits, NPDES Permit Number TX0004855 9.11.2."

Table 3.11.3.3 NPDES Pollutant Discharge Limits NPDES Permit Number TX0004855			
Parameter	**Sample Type**	**Concentration**	
Chemical Oxygen Demand	Grab	125.0	mg / L
Total Suspended Solids	Grab	120.0	mg / L
Biological Oxygen Demand, Five Day	Grab	40.0	mg / L
pH Minimum	Grab	6.0	
pH Maximum	Grab	9.0	
Oil and Grease	Grab	15.0	mg / L
Arsenic, Total	Grab	0.20	mg / L
Copper, Total	Grab	0.133	mg / L
Manganese, Total	Grab	3.0	mg / L
Nickel, Total	Grab	2.0	mg / L
Tin, Total	Grab	1.0	mg / L
Zinc, Total	Grab	1.051	mg / L

3.11.3.4 Groundwater. The groundwater action levels in Table 3.11.3.4, "Groundwater Remedial Action Levels" were based upon Safe Drinking Water Act MCLs for the Deep Transmissive Zone and alternate concentration limits (ACLs) for the Shallow and Medium Transmissive Zones. EPA determined that since on-site groundwater will most likely not be used as a drinking water source and that the likelihood of a down gradient receptor is minimal (see Section 3.6 "Current and Potential Site and Resource Uses"), site specific ACLs for industrial use would be an appropriate action level since background wells up gradient from the site indicate the groundwater up gradient exceeds secondary MCL concentrations.[59] The site specific ACL calculations are discussed in the *Feasibility Study Report, Tex Tin Site, Operable Unit No. 1*, Appendix D.

3.11.3.5 Building Demolition. During the remedial design EPA will further evaluate the buildings on site. EPA will require building demolition when :

- There are no long term building maintenance plans to prevent building deterioration, which may present a release or threat of release of a hazardous substance to the environment;

- The building presents a safety hazard to response workers;

- The building components are so contaminated that decontamination is impracticable;

- The building components are so corroded or otherwise compromised that decontamination is inpracticable; or

- Building demolition is necessary to facilitate implementing other components of the remedial action.

Table 3.11.3.4 Groundwater Remedial Action Levels		
Contaminant of Concern	**Deep Zone MCLs (mg/L)**	**Shallow and Medium Zones ACLs (mg/L)**
Antimony	0.006	7.05
Arsenic	0.05	0.05
Barium	2.0	1,230.00
Beryllium	0.004	0.011
Cadmium	0.005	8.81
Chromium	0.1	17,600.00
Copper	1.3	652.00
Mercury	0.02	5.29
Nickel	0.1	352.00
Selenium	0.05	88.10
Benzene	0.005	0.081
Chloroform	0.1	0.909
1,2-Dichloroethane	0.005	0.102
Radium 226 and Radium 228, combined	5 pC/L	5 pC/L
Gross alpha particle radioactivity (excluding radon and uranium)	15 pC/L	15 pC/L

3.12 Statutory Determinations. This section provides a brief, site-specific description of how the selected remedy satisfies the statutory requirements of CERCLA Section 121 and explains the five-year review requirements for the selected remedy. Table 3.12 below provides a comparison of the selected remedy to the others considered.

3.12.1 Protection of Human Health and the Environment. The selected remedy will provide adequate protection to human health andthe environment through treatment, engineering controls, and / or institutional controls. Box 3.12.1, "Protection ofHuman Health and the Environment,"explains how the remedy will reduce the carcinogenic risks to less than 1 in 10,000 and reduce the non-carcinogenic hazards to a Hazard Index less than one by eliminating the pathways to the receptors from each contaminant source.

3.12.2 Compliance with Applicable or Relevant and AppropriateRequirements(ARARS). Applicable or relevant and appropriate requirements include substantive provisions of any promulgated Federal or more stringent State environmental standards, requirements, criteria or limitations that are determined to be legally applicable or relevant and appropriate requirements for CERCLA site or action. Applicable requirements are those requirements promulgated under Federal or State law that specifically address a hazardous substance, pollutant, contaminant, remedial action, location or other circumstance found at a CERCLA site. Relevant and appropriate requirements are those requirements that although not legally applicable, address problems or situation sufficiently similar to those encountered at the CERCLA site so that their use is well suited to the circumstances found at the site. The ARARs EPA selected for this site are listed in Table 3.12.2. - 1, "Action Specific ARARs," Table 3.12.2 - 2, "Chemical Specific ARARs," and Table 3.12.2 - 3, "Location Specific ARARs."

3.12.3 Cost Effectiveness. It is EPA's judgement that the selected remedy SW3 is cost-effective and represents a reasonable value for the money to be spent. In making this determination, the following definition was used: "A remedy shall be cost-effective if its costs are proportional to its overall effectiveness." (40 C.F.R. 300.430(f)(1)(ii)(D). This was accomplished by evaluating the "overall effectiveness" of those alternatives that satisfied the theshold criteria (i.e., were both protective of human health andthe environment and ARAR-compliant). Overall effectiveness was evaluated by assessing the relationship between long-term effectiveness and permanence as well as reduction in toxicity, mobility, and volume through treatment and short term effectiveness. Overall effectiveness was then compared to costs to determine cost-effectiveness. EPA determined the relationship of the overall effectiveness of Site Wide Alternative SW3 to be proportional to its cost and hence represents a reasonable value for the money to be spent. SW1 and SW6 were not taken into consideration as cost effective remedies since they did not comply with ARARs. SW2 was not considered cost effective because it did not offer acceptable long-term effectiveness and permanence nor did it reduce toxicity, mobility or volume through treatment. While alternatives SW3, SW4 and SW5 offered acceptable or better long-term effectiveness and permanence, reduction of toxicity, mobility and volume as well as short-term effectiveness, the cost to achieve those standards through alternatives SW4 and SW5 is almost triple and therefore less cost effective than remedial alternative SW3.

Table 3.12 - Qualitative Comparison						
Evaluation Criteria	**SW1**	**SW2**	**SW3**	**SW4**	**SW5**	**SW6**
Protection of human health	–	✚	✚	✚	✚	○
Compliance with ARARs	–	○	✚	✚	✚	–
Long-term effectiveness and permanence	–	–	✚	✚	✚	✚
Reduction of toxicity, mobility and volume	–	–	○	○	○	○
Short-term effectiveness	✚	○	○	○	○	○
Implementability	✚	✚	✚	✚	✚	○
Cost (Present Worth)	$0	$15,580,000	$28,610,000	$88,280,000	$112,060,000	$36,930,000

Legend:
– Unacceptable
○ Acceptable
✚ Best Fix

Box 3.12.1 Protection of Human Health and the Environment

Drummed Materials (spent catalyst) in Areas B, E, J, and L are identified in the site conceptual model as primary contaminant sources. Exposed drum materials (spent catalyst) provide a pathway to industrial and construction workers through exposure routes such as accidental ingestion or dermal contact during work activities. Stabilization will provide treatment to reduce toxicity and mobility and using stabilized material fill the Acid Pond is an engineering control that will also reduce mobility.

Soil in Areas A through F, J, and L through N are identified on the site conceptual model as secondary as well as tertiary contaminant sources. Exposure to soils provide a pathway to industrial and construction workers through exposure routes such as accidental ingestion, inhalation of radon gas released from the soil* or dermal contact. In addition, workers in these areas may come into contact with surface soil or subsurface soil (which may be brought to the surface via soil excavation activities) through maintenance or construction activities. Stabilizing soils that leach contaminants in leachate concentrations greater than the cleanup levels in Table 3.11.3.1, "Remedial Action Cleanup Levels," will provide treatment to reduce toxicity and mobility of the principal threat. Using this soil to fill the Acid Pond is an engineering control that will also reduce mobility.

Waste piles in Areas A through F, and J, are identified in the site conceptual model as primary contaminant sources. Exposure to these piles provides a pathway to industrial and construction workers through exposure routes such as accidental ingestion, inhalation of radon gas released from the soil or dermal contact during work activities. Stabilization will provide treatment to reduce toxicity and mobility and using stabilized material fill the Acid Pond is an engineering control that will also reduce mobility.

Sediments in Areas G and K, are identified in the site conceptual model as secondary as well as tertiary contaminant sources. Exposure to sediments provides a pathway to industrial and construction workers through exposure routes such as accidental ingestion and dermal contact. Workers in these areas may come into contact with sediments through maintenance or construction activities. Stabilization will provide treatment to reduce toxicity and mobility and using stabilized material fill the Acid Pond is an engineering control that will also reduce mobility.

Surface water in Areas G & K. Exposure to contaminants in surface water associated with on-site drainage ditches and on-site ponds was evaluated through dermal contact with surface water. The Acid Pond in Area K is a primary contaminant source. Area G becomes a secondary or tertiary source dependent upon the release mechanism shown on Figure 2.4.7(b). Workers may be exposed to surface waters during work activities. Water treatment to neutralize the pH will reduce the toxicity. GAC treatment will also reduce toxicity by removing heavy metals from the waste stream. The NPDES discharge limits provide action levels to reduce toxicity.

Groundwater, Areas Shallow, Medium and Deep Transmissive Zones were each evaluated through ingestion and noningestion exposure routes (i.e., dermal contact while showering, and inhalation of volatiles through showering). These exposure routes were selected because future on-site industrial workers may use on-site groundwater for showering and / or drinking. A deed record as an institutional control will prevent the use of untreated groundwater thus eliminating the exposure route.

* As the NORM slag piles erode, fine slag particles become mixed with the soil on site. These particles then decay to form radon gas.

Table 3.12.2 - 1
Action Specific ARARs

Remedial Alternative	Synopsis of Citation	Action to be Taken to Attain Requirement	Status
BLD4, SL4, NSL3	Clean Air Act (CAA) § 112, 40 C.F.R. § 61	Remediation in compliance with regulation	Applicable
BLD4	National Emission Standards for Hazardous Air Pollutants (NESHAPs)--Asbestos Standards for Demolition and Renovation, 40 C.F.R. § 61.145	Asbestos remediation	Applicable
BLD4, AP3	Prevention of Significant Deterioration of Air Quality, 40 C.F.R. § 52.21	Building demolition and water treatment systems will comply with these regulations, and will not constitute a major stationary source of air pollution	Relevant and Appropriate
BLD4, AP3	Non-Attainment Areas-LAER, 42 USC § 172(b)(6) and § 173	Building demolition and water treatment systems will comply with these regulations, and will not constitute a major stationary source of air pollution	Relevant and Appropriate
All alternatives	Stormwater Regulations, 40 C.F.R. § 122, 125	All selected alternatives must comply with stormwater issues during implementation through a pollution prevention plan.	Applicable.
AP3, WP2	Concentration limits for liquid effluents from facilities that extract and process uranium, radium, and vanadium ores, 40 C.F.R. § 440 Subpart C	Water treatment via carbon filtration, direct NPDES discharge from wastewater ponds	Applicable
AP3	Water Quality Criteria: Report of the National Technical Advisory Committee to the Secretary of the Interior; April 1, 1968	Water treatment via carbon filtration, direct NPDES discharge from wastewater ponds	To Be Considered*
SL4, NSL3	Characteristics of Nonhazardous Slag, 40 C.F.R. § 261.3(c)(2)(ii)(C)(1)	Determines classification of hazardous vs. non-hazardous slag for disposal classification	Applicable
All alternatives	Standards for Owners and Operators of Hazardous Waste Treatment, Storage, and Disposal Facilities 40 C.F.R. § 264 Subparts B, C, D and G	Off-Site disposal or on-site placement under an impermeable cap	Applicable***
AST2, AP3, GW2, DR3	Standards for Container and Tank Storage of Hazardous Waste, 40 C.F.R. § 264 Subparts I and J	Off-Site disposal or capped on-site placement of hazardous wastes	Applicable****
DR3, SS2, NSL3, SL4	Standards for Waste Piles and Landfills, 40 C.F.R. § 264 Subparts L and N	On-site placement must comply with these standards.	Relevant and Appropriate
WP2, DR3, SS2, SL4	Corrective Action Management Units (CAMU), 40 C.F.R. § 264 Subpart S	If temporary storage units are implemented during remedial action, they should comply with this subpart.	Relevant and Appropriate
WP2, DR3, SS2, SL4	Corrective Action Management Units (CAMU) (Miscellaneous Units), 40 C.F.R. § 264 Subpart X	If temporary storage units are implemented during remedial action, they should comply with this subpart.	Relevant and Appropriate

** Based on discharge to off-site ponds from Wah Chang ditch 40 C.F.R. 300.430(d)

*** Applicable for off-site disposal, Relevant and Appropriate for on-site placement

**** Applicable for off-site disposal, Relevant and Appropriate for on-site placement

Table 3.12.2 - 1 Action Specific ARARs			
Remedial Alternative	**Synopsis of Citation**	**Action to be Taken to Attain Requirement**	**Status**
SS2, AST2	PCB Disposal, 40 C.F.R. § 761.60	Off-Site disposal and on-site disposal should comply with these regulations for PCB contaminated wastes.	Applicable*****
AP3, DR3, SS2, NSL3, SL4, BLD4	Land Disposal Restrictions, 40 C.F.R. § 268.1(c)(4)(iv), "Purpose, Scope and Applicability"	Wastes deemed hazardous only by the toxicity characteristics are exempt from this restriction once they no longer exhibit prohibitive characteristic at the point of land disposal.	Applicable
BLD4, SS2	Specific Air Emission Requirements for Hazardous or Solid Waste Management Facilities, 30 TAC Subchapter L §335.367	Excavation and asbestos removal	Relevant and Appropriate
BLD4	Asbestos Notification Fees, 30 TAC § 101.28	Asbestos removal and disposal on-site	Relevant and Appropriate
AP3	Emissions Specifications, 30 TAC § 115.131	On-site treatment or off-site disposal of organic AST and Acid Pond wastes (if exists).	Relevant and Appropriate
AST2, AP3	Industrial Wastewater Emissions, 30 TAC § 115.140-115.149	On-site treatment or off-site disposal of organic AST and Acid Pond wastes (if exists).	Relevant and Appropriate
AP3, DR3, NSL3, SL4, BLD4, SS2	Control of Air Pollution by Permits for New Construction or Modification, 30 TAC §116	On-site waste consolidation and capping	Relevant and Appropriate
BLD4	Requirements for Specified Sources, 30 TAC § 111.111	Building Demolition	Applicable
BLD4	Control Requirements for Surfaces with Coatings Containing Lead, 30 TAC § 111.135	Building Demolition, asbestos abatement	Relevant and Appropriate
AP3, WP2	Consolidated Permits Subchapter O, Additional Conditions and Procedures for Wastewater Discharge Permits and Sewage Sludge Permits	NPDES discharge through the Wah Chang Ditch	Applicable.
AP3, WP2	Pollution Prohibition, Texas Water Code § 26.121	NPDES discharge through the Wah Chang Ditch.	Applicable
AP3, WP2	Surface Water Quality Standards - Determination of Attainment, 30 TAC § 307.9	NPDES discharge through Wah Chang Ditch	Applicable
AP3, WP2, GW2	Acute Toxicity, 30 TAC § 307.6(b)(1)	NPDES discharge through Wah Chang Ditch to off-site water bodies	Applicable
AP3, WP2	Chronic Toxicity, 30 TAC § 307.6(b)(2)	NPDES discharge through Wah Chang Ditch to off-site water bodies	Applicable
AP3, WP2	Human Toxicity, 30 TAC § 307.6(b)(3)	NPDES discharge through Wah Chang Ditch to off-site water bodies	Applicable
AP2, AP3, AP4, WP2, WP3, GW3	Water Quality Certification, 30 TAC § 279	NPDES discharge through Wah Chang Ditch to off-site water bodies	Relevant and Appropriate
AP3, WP2	Site-Specific Uses and Criteria, 30 TAC § 307.7(b)(5)	NPDES discharge through Wah Chang Ditch to off-site water bodies	Applicable
AP3, WP2	Oyster Waters 30 TAC § 307.7(b)(3)(B)(iii)	NPDES discharge through Wah Chang Ditch to off-site water bodies	Applicable
All remedial alternatives	Texas Water Quality Act, TCA, Water Code, Title 2-State Water Commission	Spill or discharge during remedial activities to off-site waters	Applicable
BLD4	Disposal of Special Wastes, 30 TAC § 330.136	Asbestos remediation	Applicable

***** Applicable for off-site disposal, Relevant and Appropriate for on-site disposal

Table 3.12.2 - 1
Action Specific ARARs

Remedial Alternative	Synopsis of Citation	Action to be Taken to Attain Requirement	Status
NSL3	Exemptions, General Licenses, and General License Agreements, 25 TAC §289.251	NORM waste remediation	Relevant and Appropriate
NSL3	Radiation Rules for Licensing of Radioactive Waste Disposal 30 TAC §336.	Substantive requirements for licensing of the radionuclide landfill (if required)	Relevant and Appropriate
AST2	Above-Ground Storage Tanks (AST), 30 TAC § 334 Subpart F	Removal of AST contents and off-site disposal	Applicable
All alternatives	Exposure to Toxic and Hazardous Substances, 25 TAC §295.102	Health and Safety Plan composed and requirements implemented during remediation	Applicable
AST2	Permanent Removal from Service, 30 TAC § 334.55 (pertains to USTs)	If USTs are located, the wastes will be disposed off site or deep well injected in a similar fashion to ASTs	Applicable
AST2	Free Product Removal, 30 TAC § 334.79	Free product removed and disposed off site	Applicable
AP3, WP2, GW2	Closure and Remediation, 30 TAC Subchapter A § 335.8	Carbon Filtration, Extraction and treatment, direct NPDES discharge	Applicable
AST2	Shipping and Reporting Procedures Applicable to Generators of Hazardous Waste or Class I Waste and Primary Exporters of Hazardous Waste, 30 TAC Subchapter A § 335.10	Off-Site waste disposal for hazardous slag, storage tank wastes, drum wastes, and building demolition materials	Applicable
AST2	Requirements for Recyclable Materials and Nonhazardous Recyclable Materials, 30 TAC Subchapter A § 335.24	Off-Site waste disposal for hazardous slag, storage tank wastes, drum wastes, and building demolition materials	Applicable
AP3, WP2, GW2, SL4, NSL3, AST2, DR3, BLD4.	Adoption of Appendices by Reference, 30 TAC Subchapter A § 335.29	Sampling and Analysis Plan should comply with the requirements of these regulations	Applicable
AST2	Hazardous Waste Management General Provisions, 30 TAC Subchapter B § 335.41	Transportation and disposal for storage tank wastes	Applicable
AST2	Standards Applicable to Generators of Hazardous Wastes, 30 TAC Subchapter C § 335.61, §§ 335.65-335.70	Storage, transportation and disposal for storage tank wastes	Applicable
GW2	Applicability of Groundwater Monitoring and Response, 30 TAC Subchapter F § 335.156	Perimeter well sampling and monitoring	Relevant and Appropriate
GW2	Required Programs, 30 TAC Subchapter F § 335.157	Perimeter well sampling and monitoring	Relevant and Appropriate
AP3, AST2, SS2, SL4, NSL3, BLD4	Interim Standards for Owners and Operators of Hazardous Waste Storage, Processing, or Disposal Facilities, 30 TAC Subchapter E § 335.111	Storage, transportation and disposal for hazardous slag, storage tank wastes, drum wastes, and building demolition materials	Relevant and Appropriate
AP3, AST2, SS2, SL4, NSL3, DR3, BLD4	Interim Standards for Owners and Operators of Hazardous Waste Storage, Processing, or Disposal Facilities-Standards, 30 TAC Subchapter E § 335.112	Storage, transportation and disposal for hazardous slag, storage tank wastes, drum wastes, and building demolition materials	Relevant and Appropriate
AP3, WP2, SS2, NSL3, SL4	Containment for Waste Piles, 30 TAC Subchapter E § 335.120	Impermeable cover over waste materials, geomembrane wall in Acid Pond	Applicable
AP3, AST2, SS2, SL4, NSL3, DR3, BLD4	Permitting Standards for Owners and Operators of Hazardous Waste Storage Processing or Disposal Facilities, 30 TAC Subchapter F § 335.151	Storage, transportation and disposal for hazardous slag, storage tank wastes, drum wastes, and building demolition materials	Relevant and Appropriate

Table 3.12.2 - 1
Action Specific ARARs

Remedial Alternative	Synopsis of Citation	Action to be Taken to Attain Requirement	Status
AP3, AST2, SS2, SL4, NSL3, DR3, BLD4	Standards, 30 TAC Subchapter F § 335.152	Storage, transportation and disposal for hazardous slag, storage tank wastes, drum wastes, and building demolition materials	Relevant and Appropriate
AP3, WP2, SS2, NSL3, SL4	Design and Operating Requirements (Waste Piles) 30 TAC Subchapter F § 335.170	Impermeable cover over waste materials, geomembrane wall in Acid Pond	Relevant and Appropriate
SL4, NSL3	Prohibition on Open Dumps, 30 TAC Subchapter I § 335.302	On-site placement of NORM and non-NORM slag currently piled on-site.	Relevant and Appropriate
All alternatives	Hazardous Substance Facilities Assessment and Rededication, 30 TAC Subchapter K, § 335.341 (b)(4)	Compliance with Federal CERCLA standards	Relevant and Appropriate
AP3, WP2, SS2,NSL3, SL4	Warning Signs for Contaminated Areas, 30 TAC Subchapter P § 335.441	Warning signs to be placed in areas of waste consolidation such as the Acid Pond and Area C	Applicable
AP3, WP2, SS2, NSL3, SL4, DR3, AST2	Waste Classification and Waste Coding Required, 30 TAC Subchapter R § 335.503	Waste will be classified in accordance with these regulations	Applicable
AP3, WP2, SS2, NSL3, SL3, DR3, AST2,	Hazardous Waste Determination, 30 TAC Subchapter R § 335.504	Wastes will be classified in accordance with these regulations	Applicable
AP3, WP2, SS2, NSL3, SL4, DR3,, AST2	Class 1 Waste Determination, 30 TAC Subchapter R § 335.505	Wastes will be classified in accordance with these regulations	Applicable
AP3, WP2, SS2, NSL3, SL4, DR3,, AST2	Class 2 Waste Determination, 30 TAC Subchapter R § 335.506	Wastes will be classified in accordance with these regulations	Applicable
AP3, WP2, SS2, NSL3, SL4, DR3,, AST2	Class 3 Waste Determination, 30 TAC Subchapter R § 335.507	Wastes will be classified in accordance with these regulations	Applicable
AP3, WP2, SS2, NSL3, SL4, DR3,, AST2	Classification of Specific Industrial Solid Wastes, 30 TAC Subchapter R § 335.508(l)	Wastes will be classified in accordance with these regulations	Applicable
NSL3	Radiation Rules, 30 TAC §336 25 TAC §289.259	On site disposal of NORM slag	Applicable
AP3, BLD4	Clean Air Act (CAA)	Treatment systems and building demolition/asbestos removal	Applicable
AP3, BLD4	National Primary and Secondary Air Quality Standards (NAAQS) 40 CFR, § 50	Treatment systems and building demolition/asbestos removal will comply to these regulations	Applicable
AP3, WP2, SS2, NSL3, SL4, DR3, AST2,	TNRCC Historically Contaminated Sites: Industrial Versus Municipal Solid Waste, July 12, 1994	These procedures would be considered prior to waste disposal.	To Be Considered

Key:
CFR = Code of Federal Regulations
LAER = Lowest Achievable Emission
RCRA = Resource Conservation and Recovery Act
USC = United States Code
TAC = Texas Administrative Code
TRCR = Texas Regulations for Control of Radiation
TNRCC = Texas Natural Resource Conservation Commission

Table 3.12.2 - 2
Chemical Specific ARARs

Remedial Alternative	Synopsis of Citation	Action to be Taken to Attain Requirement	Status
GW2	Safe Drinking Water Act Primary Drinking Water Standards (Maximum Contaminants Level [MCL]), 40 CFR, § 141	Perimeter monitoring	Applicable
AP3, WP2	Toxic Pollutant Effluent Standards, 40 CFR, § 129	Effluent flows to the Wah Chang Ditch	Relevant and Appropriate
GW2	Secondary Drinking Water Standards, 40 CFR, § 143	Groundwater should be evaluated for these criteria based on the Sampling and Analysis Plan	TBC
GW2	Maximum Contaminant Level Goals (MCLG), 40 C.F.R. § 141.50	Will be considered in the Sampling and Analysis Plan, but no specific requirements will be made for compliance.	TBC
AP3, WP2	Federal Clean Water Act Water Quality Criteria, 40 CFR, § 131	Off-Site receptors (such as Swan Lake or Galveston Bay) will not receive NPDES waste materials that would cause deterioration of these water bodies	TBC
AP3, WP2	Hazardous substances, 40 C.F.R. § 116.3 and 116.4	Treatment and analysis would be sufficient to prevent discharge of hazardous materials to the Wah Chang Ditch	Relevant and Appropriate
AP3, DR3, AST2, NSL3, SL4, BLD4	Solid Waste Disposal Act Subtitle C Requirement, 40 CFR, § 264, Subpart F	On-site placement of waste materials under an impermeable cap	Relevant and Appropriate
NSL3	Health and Environmental Standards for Uranium and Thorium Mill Tailings, 40 CFR, § 192 Subpart B	On-site placement under an impermeable cap.	Relevant and Appropriate
All alternatives	Pollutant or Contaminant Definition, CERCLA § 101.33	Evaluation of substances based on this criteria via the Sampling and Analysis Plan, Human Health Risk Assessment, and Ecological Risk Assessment	Relevant and Appropriate
All alternatives	Designation of Hazardous Substances, 40 CFR, § 302.4	Substances will be evaluated for hazardous characteristics prior to disposal, either on site or off site.	Applicable
NSL3	Listed Radionuclides, 40 CFR, § 302.4, Appendix B	Slag containing listed radionuclides have been identified and will be disposed off site or under an impermeable cover site	Applicable
SS2	EPA Strategy for Reducing Lead Exposures, October 3, 1990	Lead exposure from soil will be reduced through stabilization or consolidation under an impermeable cover	Relevant and Appropriate
SS2, BLD4	Particulates-Net Ground Level, 30 TAC § 111.155	Building demolition, soil excavation	Relevant and Appropriate
BLD4, SS2, SS3	Sulfur Dioxide (SO_2) Ground-Level Concentration, 30 TAC § 112.7	Building demolition, soil excavation, water treatment	Relevant and Appropriate
BLD4, SS2, AP3	Hydrogen Sulfide, 30 TAC § 112.31 & § 112.32	Building demolition, soil excavation, water treatment	Relevant and Appropriate
BLD4, SS2, AP3	Sulfuric Acid, 30 TAC § 112.41	Building demolition, soil excavation, water treatment	Relevant and Appropriate
AP3, WP2	Texas Surface Water Quality Standards, 30 TAC § 307.4	NPDES discharge to Wah Chang ditch	Relevant and Appropriate

Table 3.12.2 - 2
Chemical Specific ARARs

Remedial Alternative	Synopsis of Citation	Action to be Taken to Attain Requirement	Status
AP3, WP2	Antidegradation, 30 TAC § 307.5	NPDES discharge to Wah Chang ditch	Relevant and Appropriate
AP3, WP2	Application of Surface Water Standards, 30 TAC § 307.8	NPDES discharge to Wah Chang ditch, storm water runoff	Applicable
AP3, WP2	Numerical Criteria for Toxics, 30 TAC § 307.6(c)	NPDES discharge to Wah Chang ditch	Applicable
NSL3	Regulation of NORM Slag, 25 TAC §289.127 46 TRCR §46.4(a)(1)(a)	On-site placement under an impermeable cap	Applicable
NSL3	Standards for Radiation Control, 25 TAC §289.202	On-site placement under an impermeable cap	Applicable
AP3, WP2, GW2, DR3, AST2, SS2	Class 1 Waste Determination Subchapter R, 30 TAC § 335.554	Excavation, drum and storage tank waste disposal, soil disposal, Acid Pond and Wah Chang ditch sediment disposal	Applicable

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Table 3.12.2 - 3
Location Specific ARARs

Remedial Alternative	Synopsis of Citation	Action to be Taken to Attain Requirement	Status
AP3, WP2	Executive Order on Flood plain Management, Order No. 11988	NPDES discharges to Flood plain areas.	To Be Considered.
AP3, WP2	Fish and Wildlife Coordination Act, 16 USC § 661 et seq. 16 USC § 742 a 16 USC § 2901	Modification of off-site drainages for NPDES discharges not likely to occur.	To Be Considered
AP3, WP2, SS2	Protection of Wetlands Executive Order No. 11990, 40 C.F.R. § 6.302(a) and Appendix A	Excavation, on-site placement	Relevant and Appropriate
SS2, SL4, AST2, DR3, AP3, WP2	General Application; Proximity of New Construction to Schools, 30 TAC § 116.111	On-site placement, Acid Pond construction, deep well construction	Relevant and Appropriate
AP3, WP2, SS2, NSL3, SL4, DR3, AST2.	TNRCC Historically Contaminated Sites: Industrial Versus Municipal Solid Waste, July 12, 1994	These procedures would be considered prior to waste disposal.	To Be Considered

Key:
CFR = Code of Federal Regulations
RCRA = Resource Conservation and Recovery Act
USC = United States Code
TNRCC = Texas Natural Resource Conservation Commission
LAER = Lowest Achievable Emission
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3.12.4 Utilization of Permanent Solutions to the Maximum Extent Possible. EPA has determined that remedial alternative SW3 represents the maximum extent to which permanent solutions and treatment technologies can be utilized in a practicable manner at the site. Of those remedial alternatives thatare protective of human health and the environment and comply with ARARs, EPA selected remedial alternative SW3 because it provided the best balance of trade-offs amongthe other remedial alternatives with respect to the five balancing criteria explained in Section 3.9.9, "Summary of Comparative Analysis of Site Wide Alternatives." Site Wide Alternative SW3 represents the maximumextent to which permanence and treatment can be practically utilized at this site with consideration to State and community acceptance. Remedial Alternative SW3 utilizes stabilization and water treatment to providea long-term effective and permanent reduction of toxicity and mobility for principal threats. Short-term effectiveness and implementability were not considered factors in selecting the remedy since the construction methods and duration for each site wide remedy is essentially the same for each alternative. Consequently, cost effectiveness became the decisive factor. While SW3 did not provide treatment for all contaminated materials as did SW4 and SW5, SW3 recognizes that some of the contaminants in the soil and slag are not mobile and would not require stabilization to reduce mobility. Consequently, additional stabilization would be ineffective.

3.12.5 Preference for Treatment as a Principal Element. In accordance with CERCLA, EPA's preference for treatment of principal threats is the principle element of the remedial alternative. The principal threats on site were identified in Section 3.5.29, "Contaminant Sources" and the preferred treatment for each principal threat is identified in Section 3.10.4, "Protection of Human Health and the Environment." EPA believes that through the use of stabilization,* neutralization and granulated activated carbon filtration, treatment has been used to the maximum extent practicable as discussed in Section 3.10.7, "Utilization of Permanent Solutions to the Maximum Extent Possible," above. Consequently this remedial alternative provides a preference for treatment as a principal element.

3.12.6 Five Year Review Requirements. Since hazardous substances, pollutants or contaminants remain at the site above levels that would allow for unlimited use and unrestricted exposure, EPA will review the remedial action no less than once every five years after remedial action was initiated. This review is to assure the community that the remedial alternative continues to protect human health and the environment.

3.12.7 No significant changes. There were no significant changes made to the proposed plan in this ROD. However, there was a minor change to SW3. EPA substituted alternative AST2 for alternative AST3. This substitution assures proper management of RCRA K0052 listed waste.

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* In so far as stabilization alters the composition of the hazardous substance through a chemical or physical means, it is considered treatment technology as defined in the NCP §300.5, "Definitions."

4 RESPONSIVENESS SUMMARY. The United States Environmental Protection Agency (EPA) has prepared this Responsiveness Summary for the Tex Tin Corporation Superfund Site (Tex Tin Site), as part of the process for making final remedial action decisions for Operable Unit No. 1 (OU No. 1). This Responsiveness Summary documents, for the Administrative Record, public comments and issues raised during the public comment period on EPA's recommendations presented in the Proposed Plan for the contaminated areas of the Tex Tin Site, OU No. 1, and provides EPA's responses to those comments. EPA's actual decisions for OU No. 1 are detailed in the Record of Decision (ROD) for OU No. 1. Pursuant to Section 117 of the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), 42 U.S.C. § 9617, EPA has considered all comments received during the public comment period in making the final decision contained in the ROD for OU No. 1.

4.1 Overview of Public Comment Period. EPA issued its Proposed Plan detailing remedial action recommendations for OU No. 1 for public review and comment on September 9, 1998. Documents and information EPA relied on in making its recommendations in the Proposed Plan were made available to the public on or before September 9, 1998 in three Administrative Record File locations, including the Moore Public Library located in Texas City. EPA provided thirty days for public comment. At the request of the public, EPA extended the comment period an additional thirty days and it closed on November 9, 1998.

EPA held a public meeting to receive comments and answer questions on October 6, 1998, at City Hall in Texas City, Texas. All written comments as well as the transcript of oral comments received during the public comment period are included in the Administrative Record for OU No. 1 and are available at the three Administrative Record repositories.

4.2 Comments and Issues Raised During the Comment Period

Public Meeting, October 6, 1998, Texas City, City Hall - Comments received at the Public Meeting.

COMMENT: *Mayor Doyle: Good evening, ladies and gentlemen, and welcome to this most important hearing that's before us here this evening in our community of Texas City and our neighboring community of La Marque. I think it's very important that we put this project in proper perspective. First, I'm sorry to hear that we had a written request for a 30-day delay. If someone hasn't found out all they need to know about this project by now, they must have been living on Mars. We have had this project before us twice. Most of these kind of funds, when you're talking about placing a site on a Superfund location, happens once. In our case it started -- the first listing occurred after extensive studies and announcements and plans result back in August of 1990. I had just been elected Mayor in May of 1990, and the NPL listing was remanded in June of 1991 after legal and other hearings, administrative hearings. And it was ordered deleted from the NPL in May of 1993. Frustrated by that, the City filed suit against Tex-Tin because since the Federal government couldn't do it and the State couldn't do it, we thought, well, at least we have the power of -- of legislation in the home rule city, we as a city will try to do something about this. And you might ask, well, why was the City so frustrated over something like this? Well, to find out that frustration, you have to go back to 1939, the beginning of World War II. Of course you know we were not involved in it in 1939. It was not until 1941 that we became engaged in the war. But I want to tell you about a little story about this community. And I think it's very important the Federal government learn this story. And I went to Washington to tell them about it. So I'm going to kind of diverge from the routine of a hearing like this proposed plan that we're going to be discussing tonight. The Defense Plant Corporation, called DPC, was operated by the Federal Loan Agency and established on February the 24th, 1942. The DPC was dissolved and the function transferred to the Reconstruction Finance Corporation after the war was over on July the 1st, 1945. Well, during that period of time when the war broke out, we had no tin manufactured in -- on this northern hemisphere. It was a critical material that we needed for the war. And the construction of the tin smelter was not at the request of this community. It was as a part of a* *national plan. The Federal government brought it here, United States Government. And consequently after 1945 the R -- RFC was abolished on June 30th, 1957. And those functions were transferred to the Housing and Home Finance Agency, which later, in September of 1965, became the Department of Housing and Urban Development. In addition, other agencies assumed responsibility for this site: The General Services Agency, the Small Business Administration, and the Department of the Treasury. Now those are all PRP's of this site. There's 130 of them. My contention and our contention has been the United States Government brought this plant here. They allowed this plant to stay here, and they have a responsibility to clean it up as soon as possible. Now that is a -- the underlying program for this hearing tonight and for what actions are taken in the future. On September the 8th of this year I went to Washington. I met with the Department of Justice at 1425 New York Avenue Northwest in Washington D.C. I met with Joel Gross, chief environmental enforcement of the Department of Justice. And John Gregory. Lettie Grisham, chief environmental defense; and Eric Hostetler from the Department of Justice. And only in the United States Government can we do that sort of thing where you have on the one hand the defense attorneys lined up working for the government and on the right hand the prosecuting attorneys lined up. It was a very interesting meeting to come there and to talk to our Federal government, who are going to represent part of the United States Government that enforces and the other part of the United States Government that is going to try to defend those agencies. Now, the purpose of my meeting was to address a GAO report, general accounting office report of the United States Government on the time required for the completion and assessment clean-up of hazardous waste sites in this country. Non-Federal sites listed on the NPL in 1966 took EPA 9.4 years from the time of discovery of the site. The clean-up at the sites -- that's for the listing. The clean-up after the listing of the sites averaged 10.6 years by 1996, compared to 3.9 years during 1986 to 1989. You'd ask: Why did it increase from 3.9 in '89, in that period to 1996? The number. That's why. There's a lot of them. Now, my mission before that group and tonight, as an opening statement, is that we need a fast-track performance here. In the past one of the methods used by the EPA for the clean-up of the site has been to bring all 130 principal responsible parties, the PRP's, and bring lawsuits if they cannot reach agreement -- to put the money on the table to start the job. My contention is United States Government is the deep pocket that needs to start the job. And then after they finish with that, they can sue whomever they wish to recover the funds necessary to clean up this site. In my statement to Mr. Gross in a letter dated May 28th, 1999, I stated the following -- following: We understand that these and other agencies -- I've identified the agencies for you -- may not follow that approach based on the general belief that they may not have specific statutory authority to allocate funds -- I'm talking about the Treasury Department and all the list of other agencies -- for clean-ups like this and that the money for the clean-up must come from a certain, quote, "judgment fund," closed quote, that can only be assessed after a lawsuit is filed and a consent decree with the other PRP's is negotiated. This runs counter to the view that Congress articulated of Federal agencies' responsibilities under the Comprehensive Environmental Response Compensation and Liability Act, called CERCLA, and EPA's policies relating to enforcement against Federal agencies that have incurred CERCLA liability, which clearly they've incurred the liability. It's documented in the halls of the Congress, Library of Congress. All of this is there. The EPA holds Federal facilities accountable for environmental clean-up and will proceed with enforcement actions at Federal facilities in the same way that it would proceed against private facilities. Now, today I faxed to our senators and our congressmen a request that they ensure that these agencies are budgeting funds so that they will clean up and meet their responsibilities on this site just as other private corporations are being asked to do. One of the things that brings all of this importance to home in Texas City is the fact this is not our first dealing with the United States Federal Government due to the war. Every community was impacted by the war. Every family was impacted by the loss of a loved one or someone injured. But no community in the United States was impacted by the war like Texas City, Texas because in April 1947, on April 24 the 16th and on April the 17th, two liberty ships blew up in our harbor and they killed over 380 some-odd people. They injured almost 4,000 people, and this community has suffered from that ever since. Lawsuits were filed. On June the 8th, 1953, the United States Supreme Court held that the United States Government was not liable. But I think it's interesting to read from the book that was written on this disaster where it says, "The Coast Guard's failure to enforce dangerous cargo regulations came to light in the Dalehite and -- versus United States, consolidated 273 suits for damages relating to the explosion filed under the Federal Tort Claims Act of 1946 on behalf of 8,487 persons. The* *claim by Elizabeth Dalehite and her son for the wrongful death of her husband and his father went on trial in 1949 before Judge T. M. Kennerly in the U.S. District Court, Southern Division of Texas. Millions of dollars were at issue, including substantial claims insurance companies, blaming almost every one else, including the municipality -- that's Texas City -- stevedore firms, longshoremen unions, and shipping. The United States Government denied having any responsibility for the deaths and injuries. Approximately 20,000 pages of testimony and exhibits have been generated by the time Judge Kennerly rendered his verdict just prior to the third anniversary of these explosions. He found for the plaintiffs, holding the United States at faulton some 80 specific points. The appeal of this decision was overturned by the Fifth Circuit court and confirmed on a four-to-three vote by the United States Supreme Court in 1953. Both the Court of Appeals and the Supreme Court reached their decisions on the basis of the meaning of culpability in Federal Tort Claims Act of 1946; that is, the Supreme Court majority thought that the plaintiffs were not entitled to sue because the act confined liability to specific acts of negligence and not to tortious conduct. So, as you can tell, those of you who represent the government in this case, there is a feeling in this communitythat we shared our part of the battle in the war that we won in World War II. But we also paid a big price for it that most communities did not have to pay. I submit to you that Tex-Tin is an additional price that we have had to pay. We have lived with that. We live with it day in and day out, and when we were frustrated by it being removed in May of 1993, we took them to our municipal court for failure to maintain their building in a safe and sanitary condition. The reason was the boiler was falling down and you could literally see, drifting from it, all sorts of materials that could be dangerous to those who passed by. On August 2nd in 1993 a plea bargain agreement was reachedwherein the defendants agreed to demolish certain structures and provide some certain for landscaping -- some funds for that. The demolition was completed on January 1994. On September the 17th, 1996, without permission, some parts of the plant were being removed. The -- our fire department responded, not knowing what they were also engaged in entering that site, to the Tex-Tin site, fora fire. The security company in charge of the property was cited for failure to provide fire watch. I guess you can say we've had it. And so we went to the Governor. I have letters here from the Governor, from both of our senators, and from our congressmen to get this back on track. And I do appreciate the EPA and the TNRCC, and particularly Ralph Marques, who, at the time I was elected in 1990, was appointed as the head of our environmental committee, the first this city has ever had. And he has since been appointed by the Governor as one of the commissioners -- three commissioners of TNRCC. EPA, Myron Knudson. I couldn't ask for more help than we have had out of Region VI. We cannot allow bureaucracy to stand in the way of this clean-up. We cannot do things in the old, usual, customary way in this clean-up. The Federal Government's hands are not clean in this clean-up, and we want that message to be loud and clear in Washington D.C. and the office of the EPA and also with the attorney -- our -- general of the United States and the justice department. Our objectives are to promote the commencement of the actual clean-up as soon as possible, and we support this plan. There will be -- should be no delay in the clean-up based on the source of funds. United States Government stands behind this, and they should be -- they weretalking about how -- what we're going to do with the surplus in Washington now. I submit to you there is no lack of funds. If Superfund money is not really available, Federal PRP should stand and find for -- and fund the clean-up. Federal PRP's are held accountable by law. I read that part of the law. Federal PRP's should budget funds as appropriate for their Superfund site exposure. And I have asked our Congress to do that. Department of Justice should treat Federal PRP's at least like private PRP's. Federal PRP's should lead the clean-up effort at appropriate sites where funds are not otherwise available. And if that happens to be the case here, then we expect them to lead. Thank you.*

EPA RESPONSE: We at EPA Region 6 also want to expedite activities for the Tex Tin site. While EPA cannot make up for harm that private corporations or Federal may have caused to the communities of Texas City and LaMarque EPA is working to ensure that the public and the environment is protected from the contaminants on site. As you stated, we too have been working to list the site on the NPL since the early 1990's to begin cleanup activities. But as you are aware, listing this site has been challenged many times by the companies that owned, operated or had dealings with the Tex Tin facility. Some of these companies continue opposing remedial activities suchas building demolition and stabilizing contaminated waste materials. So the delay to list the site has not been caused by EPAor other Federal agencies. With respectto Federal agencies that are liable for contamination at the Tex Tin site,EPA will pursue their involvement in funding the remediation. However, EPA cannot use its funding to pay for a cleanup that may have been caused by another Federal Agency, just as one city department cannot pay costs incurred by another department. With respect to viable potentially responsible parties (PRPs) for a site, EPA is required to follow an enforcement process to commit the PRPs to conduct the cleanup. We continue to pursue the enforcement process to obtain commitments from those responsible parties.

COMMENT: *I've been real concerned about the situation we have at -- at the tin smelter. Having experienced some of the things that we encountered on the Motco clean-up, I'd like to pass these points on to this group and for your consideration. First, those of us that have dealt with the contractors in the past -- which I've dealt with many of them down through the years -- when you get contractors, they will bid jobs and sometimes bid them low in order to get the job. Now, there's several reasons for doing that, and our first encounter with a contractor at the Motco Trust site was that IT was given the contract, being the low bidder. We finaly found out that their reason for getting the job was to use it as a stepping stone -- they're an international company -- to get other jobs throughout the world for neutralizing hazardous waste sites. So I would caution any contractors that are bidding this job, be sure that you get a good bid on the thing, that they can make money on it. Make money, but we want a good job. And come in ready to do the work. We ran in to quite a few difficulties, holdups on the job, in that we were dealing with a Government Agency and we didn't have cooperation in several instances where we were hung up to get clearance of some -- one of the major things was approval of the cap that we put on the thing. And EPA did not give us a final answer on that. It cost us a lot of money and a lot of time to work around that thing until we got it finished. But now we've got it cleaned up. It is a beautiful site. We had to put a retaining wall around it to keep it from migrating contaminants to the surrounding area. We don't have that problem here. But it is a possibility, needs to be explored. We hope we will be able to streamline EPA's outdated laws where we can get to work on the thing and get it cleaned up properly. So those of us that have dealt with it from a practical standpoint can -- going along with the Mayor's comment, we feel like the time is here, that we need to get the thing done and get on with the work.*

EPA RESPONSE: If EPA conducts the cleanup, we will evaluate all companies that submit bids and hire the most capable and responsive company at the lowest bid. Consequently, the work may not necessarily be awarded to the lowest bidder. We understand that companies in business to make a profit should be afforded the opportunity to make a profit by producing a good product at a reasonable cost. Regarding the placement of a retaining wall (slurry wall) at the Tex Tin site, we investigated the contaminated ground water at the site and concluded that a slurry wall or retaining wall was not warranted. The Motco site has different contaminants than those found at the Tex Tin site and therefore a direct comparison cannot be made between the Motco and Tex-Tin sites.

COMMENT: *I'm a lawyer practicing here in Texas City. I'm also the chairman of the Environmental Protection Emergency Response Advisory Board for the city of Texas City. I'm the chairman of the EPER board for the city of Texas City. Our committee is comprised of about 20 members. Our board is assigned the responsibility to -- to monitor and be aware of the environmental circumstances within our city, whether it's a matter of a Superfund site or -- or a matter of any other environmental matter that -- that might affect our citizens. I want the EPA to know that we, as a committee of citizens will be available to act as a -- as a conduit between the official operation of the city of Texas City. I encourage EPA and TNRCC to take every action to move this project forward. And if there's anything that we can do within the city and through our EPER board to facilitate the -- the quick response at the site, and then we invite you to contact any one of us, either with me directly or through Mayor Doyle.*

EPA RESPONSE: We appreciate your offer to help and welcome the opportunity to work with the EPER board and find the pro-active initiatives the Mayor and the community have taken to expedite the cleanup process encouraging. EPA will be happy to work with the City and the community to move the cleanup activities forward. We appreciate the City's and community's support and will work to address your concerns. We know that the City has waited a long time for cleanup activities to get started and understand its frustration, so we ask the city and community to bear with us a little longer as we proceed with the enforcement process which we are required, by law, to follow. So while construction site activities may not be going on, we are completing lots of legal, engineering and administrative activities to get the field work started.

COMMENT: *My concern -- or two or three concerns with the site, one of them being that both 519 and highway -- State Highway 146, which border the plants on the -- 519 on the north side and 146 on the west side, are both hurricane evacuation routes. And during high winds there's a history of material blowing from there and making it a hazard. Also in the past two years we've had ten calls to the site for where public safety officers or police officers or firemen had to respond and had four fires and different other types of calls, such as suspicious vehicles and stuff like that. So it's a danger. And plus any child that might wander into that place.*

EPA RESPONSE: EPA has placed a high priority in addressing the contaminated site buildings to prevent them from obstructing these roadways in case of an emergency situation and causing a release of hazardous substances. We are aware that some buildings are seriously deteriorated and we believe that deterioration of the site buildings will continue. Therefore, we are exploring the possibility of addressing the buildings first in a phased approach to the site remedy. We have had some initial discussion with individual potential responsible parties and may be able to use their contribution to site cleanup to address the site buildings first.

COMMENT: *My question is, what are you going to be doing with materials that are dismantled, the -- the infrastructure, the materials on the outside of the buildings? Are you intending to sell those pieces? Are they salvaged? What are you going to do with those?*

EPA RESPONSE: EPA has decided to evaluate the need to demolish buildings and structures onsite and will landfill the resulting debris onsite. However, contractors will have the option of salvaging materials that can be properly decontaminated. Only dismantled building materials that can be adequately decontaminated will be allowed to leave the site, the rest of the materials will be landfilled on site.

COMMENT: *The underground water, are you going to put a slurry wall around this complex to stop the migration of the underground water, which here six or seven years ago I think Woodward Clyde did an analytical study of that site. And they found contamination down to 38, 40 feet, 42 feet, et cetera. Are you going to use any type of slurry walls to keep the subsurface water contaminants from migrating to and from the bay? Or are you going to do anything to retain anything after you -- after you do your landfill? Are you going to have any retainage for underground -- on underground movement of water?*

EPA RESPONSE: Studies conducted by Woodward Clyde and recent studies conducted by EPA do not indicate the need for a slurry wall around the site. Once the remedial action has been completed to address the sources of contamination at the site, no further contamination of the site groundwater from site sources is expected. Because of the specific contaminants on site, we believe that the site soil's natural adsorptive characteristics will contain the contaminants on site. These metal contaminants tend to easily adsorb to soil materials. So, as contaminated groundwater moves through the soil, it acts as a filter. Consequently, we intend to monitor groundwater at the perimeter to ensure that there is no added release of site contaminants. In regards to the concern with a landfill, it will be constructed to EPA standards to ensure contamination cannot leach into the groundwater.

COMMENT: *Are you going to put any recovery wells in, any water treating facilities in there? If not, then are you going to monitor the groundwater on the exterior perimeter of the facility. Are you going to have someone out there checking the pH level out of these wells periodically? Or how are you going to -- how are you going to monitor that from time to time to time to time?*

EPA RESPONSE: Neither recovery wells nor a groundwater treatment facility are included in the site remedy. However, if it appears that off site groundwater contamination worsens, recovery wells and a treatment facility would be considered. As previously discussed, groundwater monitoring along the site perimeter will be conducted to ensure the groundwater quality is not worsening. At this time EPA believes this plan is sound because once site cleanup is completed, site contaminants should not be able to leach into the groundwater. Therefore, we expect groundwater quality to improve with time. The shallow, medium and deep transmissive ground water zones will be monitored under the preferred alterative for the site.

COMMENT: *Okay. And I would presume the -- that the City and the Mayor's office, they would get reportsof this monitoring system. I would presume the Mayor's office in Texas City, City Council, every year or two years would get a copy of the reports, because I -- it's just hard for me -- it's hard for me not tounderstand how come there hasn't been some migration there, possibly the chemical makeup or whatever, because I knowon the hazardous waste site at the Motco site, which he had mentioned also up at Crosby, there was -- there was migration of chemicals that were way over the Old Central Freight Yard at that time when they put the slurry wall in. I just -- I just wondered-- hopefully this is not a quick fix for a long-range set of circumstances.*

EPA RESPONSE: EPA will continue to place site reports and site information at the Moore Public Library to make information available to the public. If Texas City officials would like to receive certain types of reports, that can be arranged through our Community Involvement Coordinator. Perimeter wells indicate that site contaminants may have migrated beyond the operable unit boundary in the Shallow and Medium transmissive zones. However, these zones are not used for drinking water sources in the down gradient direction of the site. In the surrounding area, the shallow and medium transmissive zones are used for industrial purposes. Current perimeter wells do not exceed industrial use concentrations for site contaminants and therefore do not currently warrant a responseaction. The contaminants at the Motco site are different than those present at the Tex Tin site and a direct comparison of the two site cannot be made.

COMMENT: *If the remedy was not working, then would funds be available for you to remedy a situation immediately or in a -- in a timely manner?*

EPA RESPONSE: We believe that funds can be procured in a timely manner to address the areas that pose a risk to human health and the environment. The cleanup that we are proposing for the site will not bea quick fix remedy but a long term remedy that will remain protective of human health and the environment for a long time. That, in part, is why the cleanup will be expensive; we want it to be as permanent as possible. We will re-evaluate the effectiveness of the remedy every five years. If for some reason the remedy is not performing as designed, corrective measures will be taken so that the remedy remains protective.

COMMENT: *You're the project manager. From the EPA are you going to be the general contractor on the site, or are you going to contract everything out?*

EPA RESPONSE: The majority of the work at this site will contracted to EPA or the responsible parties' contractors. The current EPA site contractor is CH2M Hill, an environmental firm known worldwide. If EPA conducts the cleanup, CH2M Hill, through competitive bidding, would hire the appropriate contractors or subcontractors with the proper specialties to complete the work. The EPA project manager who will be overseeing that phase of the work is Carlos Sanchez.

COMMENT: *Then I would presume that you would also strongly recommend that when they come into our city, that we do have local area people around here that are very good subcontractors. And there are two or three in the area that have 40-hour trained people. And they have participated in the clean-up of sites in this area. And I would hope that you would certainly recommend that -- that they solicit subcontract work from the local area and from the Texas City and La Marque area and not bring in from Dallas or Houston or Oregon if we have qualified people in the area to take care of their needs. I would hope that -- I would ask tha if -- if you would do that. I'm glad we're going to get it cleaned up.*

EPA RESPONSE: EPA always encourages its contractors to hire local workers and subcontractors and we will do likewise for this site, and contractors generally do so to keep their bids lower. Many of them also understand the need to hire local workers and subcontractors. It has been our experience at other Superfund sites is that contractors do hire local workers and subcontractors. So we would expect a similar situation for the work at the Tex Tin site.

COMMENT: *Well, I would hope that you would possibly leave the project manager's name and so forth, if nothing else, with Commissioner Carl Sulivan here or the Mayor, and there might be some people that would like -- would possibly like to send themresumes or also* *send them qualifications to do the type of work that may be necessary out there, because if there's no contractors in Texas City that's on their bid list at the present time and they already have contractors, then they will bring contractors from -- from Dallas, from Houston. And there's people here that are qualified to do that work. So, like I said, I would certainly lke for somebody in the Texas City, City Council to have the contractor's name and address and whoever their project manager or -- and/or contract administrator would be.*

EPA RESPONSE: Carlos Sanchez (214) 665-8507 and Glenn Celerier (214) 665-8523 are the two principal project managers on the site. Please feel free to contact them to ask questions. However neither project manager has the authority to directly hire contractors. EPA is required to follow Federal acquisition processes to hire its contractors. With regard to subcontractors EPA cannot require the general contractor to hire specific subcontractors. However, once a contractor is selected, we would be glad to pass on that information to the city council or whomever asks for it, so resumes or qualifications could then be sent directly to the contractor.

COMMENT: *I had some concerns about what the definition of -- of fast track is. And so Ialso am not sure which remediation was chosen. Was it SW3 or SW6? I'm not sure what the difference is between SW3 and 6, other than injection of materials with SW6. Could you explain a little bit more the differencesbetween those two remediations and exactly what the definition of fast tack -- the Mayor made a good case for the Federal Government to pursue immediate clean-up. And certainly hope that's what happens. But I would like to have a forum understanding about the difference between those two.*

EPA RESPONSE: Fast track is used by different people in different ways. But what we mean, is that we we continually look for innovative ways to move the remedial process along faster. In addressing SW3 and SW6, essentially the only difference is the underground injection component. In the proposed plan we specifically asked for comments regarding underground injection because we thought that disposing of the contaminants deep underground would allow for more surface area to become available for development. Conversely landfilling and covering contaminants on site, would restrict future development in thoseareas to uses that would not require extensive excavation that could disturb the contaminants beneath the cover. However, there is a drawback, underground injection is expensive. So we solicited comments from the general public to learn if the publicbelieves deep-well injection, is worth the added cost. In this case publiccomment did not present any convincing arguments or supply additional information to support deep well injection; therefore, we determined that SW3 remained the preferred alternative.

COMMENT: *So the reason is just to free up more area; it's not for any concern about leaching of that material or that material being airborne? It's -- it's all -- all industrial development? I mean that -- that seems to be -- there's no concern about restoration of -- of the natural quality. It's all industrial level clean-up.*

EPA RESPONSE: The deep well injection alternative is a more permanent remedy that removes hazardous materials from the surface environment and results in more surface area being available for redevelopment. Under the deep-well injection alternative, hazardous materials would be injected into a deep zone that would never be used for drinking water. The deep well injection zone is about 5,000 feet below ground surface. On the other hand, while stabilizing and covering contaminantsis a safe remedy, it does have a limitation. That limitation is there can not be any excavation through the cover, and we believe that may limit redevelopment of this site. Consequently, any excavation would require additional specific requirements to prevent the release of contaminants. If the material was completely removed from the surface through deep-well injection, then more surface area could be redeveloped.

COMMENT: *But you do realize there's other drilling going on and from the past and future that there could be dry holes that have not been plugged that could cause the site clean-up to back up, too. A lot of deep injection well on it.*

EPA RESPONSE: If EPA were to have chosen deep-well injection as a remedy it would ensure there were no other holes and perforations in the confining formations above and below the injection zone. The injection process would also be carefully monitored to ensure that the confining formations are not fractured in such a manner that material could not migrate out of the injection zone.

COMMENT: *S. J. Manuel, La Marque Mayor Pro Tem. And in speaking for the citizens of La Marque, I would like to thank Mayor Doyle for his time and effort to return Tex-Tin to the Superfund list. I think this is something that we've needed for a long time. Shouldn't have been taken off of the list. I've got several questions. What happens to the material removed and how is it handled in the final disposal? What happens to the material that you remove until its final disposal, and where does it go? Talking about the carbon and rock and whatever we have on the surface that's contaminated. We won't be moving it to another state or anything?*

EPA RESPONSE: The contaminated materials will be treated and covered as described in the record of decision. Once we begin the cleanup this material would most likely be moved only once to be placed in its permanent resting place. The site materials will be handled as little as possible to minimize cost. However, specific materials handling and field activities will be determined by the contractor. With regards to an out of state shipment, there are no plans to move site materials to another state. Under the preferred alternative, there are some liquid waste materials that require off site disposal, but there are permitted facilities within Texas able to handle those materials. However, the site contractor may elect to dispose of some material in another state. In that case, EPA has to approve the disposal facility and the state to which the material is being shipped has to be notified.

COMMENT: *What distance from the contaminated site does the EPA test, and what process does it use to correct the problem for the underground water and the underground soil? The underground water, what we're -- we're looking at is there's some wells over here. I'm not for certain as to what contaminant levels we've found in those wells, but they haven't shown us that there's any -- any problem right now. And what we're looking at is using this groundwater and potential this groundwater use would be for some industrial use, not for drinking water use. Will you drill any kind of test well across the highway to see if it has moved toward La Marque? My concern is we have some citizens in La Marque that have wells that they still use to water their grass, their gardens, and flower beds. What are the chances these wells could be affected? Could they contact the EPA to have those wells tested if they so desire? Well, there's some people in the Lee addition and some on Shady Lane -- are the closest ones that have wells that are still being used. And I was wondering if the underground water could contaminate those wells.*

EPA RESPONSE: The nature and extent of known contamination was determined by detailed field investigation of the site and surrounding areas. Typically, the scope of site investigation depends on the facility's operational history and information received from the community. As the site investigation proceeds, the site boundaries as determined by the presence of contamination may either increase or decrease. Areas requiring response actions will be based on areas with site related contaminants that exceed regulatory or health based levels. To date at this site we do not think drilling wells west of the site or across Highway 146 is necessary since numerous site studies and local hydrogeological information shows groundwater movement towards a south, south-easterly direction, away from the city of La Marque. Therefore, wells that could potentially be affected by site related contaminants would be located down gradient of the site, towards Swan Lake and away from La Marque. If any citizen has a concern with their well water, they can report it to the Texas Department of Health or the TNRCC.

COMMENT: *I have experience during the early 1940's at the tin smelter as a process operator. That is a mean bugger; I can tell you that. But thankfully I got away from that mess in the early years of my growing up. Became an employee of Amoco Corporation. I've got one question. I want to make a couple more comments, too. In looking around and see how the industry operates in all facets of chemical and oil refinery and such, I see that there's a lot of expense involved. But for the life of me and in the terms of all good judgment and honest assessment and good decision-making, why in Christ's world is it going to cost so much money to get that thing wiped out? We do that all the time at Amoco. We don't -- it doesn't cost that much money. I can't see the 86 million. We wipe units away. They -- they're poisonous, too, but we don't have that much money involved. And I just want to know why it costs so dogged much. We've torn down units much larger than that with a lot less money. I can tell you that. Like the Mayor* *said, the Government's money, and they're supposed to have deep pockets, too. Well, I'm very thankful to God and to all the members of Texas City hat seeing this has possibly righted along the time used before and after. I'm proud to see that you guys are in, taking good steps towards the fact of getting that dad gummedthing wiped clean. And I do mean clean in every respect.*

EPA RESPONSE: EPA's remedy involves more than tearing down the buildings. The Tex Tin site is a large site with different contaminated components. We have to address extensive site contamination and treat contaminated materials to ensure they no longer threaten human health or the environment. The estimated cost of EPA's preferred alternative is $28.6 million. It is expensive but unfortunately, many environmental cleanup costs are high. We evaluated numerous cleanup alternatives that provided different levels of protection at varying costs and determined Site Wide Alternative #3 to offer the best level of protection at a reasonable cost. Site cost are considered when selecting cleanup alternatives for the site. However, the main criteria is to protect human health and the environment. We believe the preferred alternative meets these goals and is cost effective. Comparisons of the work that Amoco conducts to the selected Tex Tin cleanup are not valid since the circumstances at this site are different than those at Amoco.

COMMENT: *I'm a physician in La Marque, and also, for a time, developer here in Texas City and the Santa Fe area. The -- I want to offer my sympathies to the Mayor about the delays. And I might state to you that in some of the sites that I have worked with, for example, the case site, it took me 14 years to get the thing stopped. Many times with EPA and solid waste people, TNRCC in Austin, everything is in order for a clean-up. I have met all the criteria of the RCRA and clean air and clean water. Yet nothing happens and I -- and so I can appreciate the frustration of our Mayor in looking at this Tex-Tin thing. The other thing that I'd like to briefly go over with you is the overall health pictures of parts of Texas City. This is a study that was done by the University of Texas and was authorized by EPA. And the date on this study was 1975. What it is looking at is it stated air samples in vacuum bottles that had normal saline in them. And those studies were done at several sites here in the industrial area of Texas City, Anahuac, across the bay, Corpus Christi, San Antonio, Odessa, and one other city. At any rate, the findings are -- are frightening, to say the least. The amount of cancer in this county alone is enough to spur on action by any of the agencies. How it's going to go, I don't know. But the national average on lung cancer -- is just one of the cancers -- is 37 per 100,000. State of Texas has 38.52. Galveston County has 55.2. The relevance to the Tex-Tin site is it's only one of the problems here. I certainly agree it needs to go. And some of the things, the other areas you might look at, is the industrial canal which is the main outlet today for the runoff from the Tex-Tin. And I have here a study that was ordered by the US Fish and Wildlife. And it's a frightening study. I mean there's 35 highly toxic agents there, hydrocarbons. Hydrocarbon, mercury, and selenium. The rest are in the benzene category. Now I hope that this study that all -- currently that's underway would involve the industrial canal because it is really the major outlet of the entire Texas City industrial system. Now whether these contaminants are coming in from water or air that's contaminating it, who knows. But the -- all the bad actors are here. And I would submit these copies to you.*

EPA RESPONSE: This proposed plan only addresses the Tex Tin site. If you have information related to other health problems, it can be provided to the Texas Department of Health or the Agency for Toxic Substances and Diseases Registry. TNRCC may want to look at some of the other areas that you mentioned if you provide whatever information you have. TNRCC can then take action or request EPA's involvement.

COMMENT: *I wish I could help the Mayor in urging -- in the urgency. If I knew how to help him, I'd help, myself. I've been involved certainly initially with the Motco site. I've had several that I did get closed down in the Corpus Christi area, south coast The advantage we have right now is that the Tex-Tin is the highly visible thing. And I felt that's the only reason I was ever to make any headway at Motco, whereby a Superfund -- get Superfund, if it's visible to thousands of people. And Tex-Tin, with its horrible looking buildings has that visibility. And I think with the heat on, I think we -- some way if we could speed up these agencies, I'm here to receive all the advice that I can get, including EPA and the State of Texas, the -- I've been with the State in arguments beginning with water quality board, then the department of water resources, and next is back to the Texas Water Commission. And finally, thanks to our woman in Austin, we've got a new one there and a very fine man -- sorry to the commission -- finally after 14* *years went along with me, went with me on stopping the beginning site. At this point all they did is the materials in the child. They just went down to Brazoria County about 40, 45 miles and did the same thing here. I hope that doesn't happen here. If we're going to remove all that stuff off site, we need to know where that site is. My recommendation is at least 100 miles from the Gulf of Mexico. I would like to see some of this material, if we have to, hauled out to some of the counties in West Texas, like Loving County. I think you cannot find a water table. Give them everything they need. They accept a lot of this stuff. I don't see how it could do any harm. And I will be giving a lot of this material to you. If there are any questions, I'd be glad to comment on them. I haven't done justice to this report on cancer. It's extensive, and it needs to be repeated and certainly Tex-Tin is contributing to it. There's no doubt about that. But you can't have the contaminants listed at Tex-Tin standing alone. They're going to have to be considered as a part of the entire picture.*

EPA RESPONSE: EPA will work with Mayor Doyle and the citizens of Texas City and La Marque to move the cleanup of the Tex Tin site forward as fast as possible. One of the main components of the selected alternative for the site requires on-site treatment of hazardous materials and on-site disposal. We believe that this remedy will provideprotection to human health and the environment and that it is cost effective. We do not believe that disposing of site materials from the Tex Tin site to another location will address EPA's goals of providing protection to all areas of the country. We don't think the communities in West Texas would be receptive to hazardous materials being disposed of in their community. As far as the Tex Tin site contributing to more cancers cases in thecommunity, we cannot make that determination. However, we do have information that site contaminants can pose a potential health risk to humans and that is the basis for the proposed remedial action for the site.

COMMENT: *I'm the president of Texas City and La Marque Chamber of Commerce. Along with some 1,000-plus members, I would like to urge that the EPA move forward with this project and fast-track it because it is something that we have lived with for many years. I've been here 57 years and at one time my wife worked a tin smelter. So I know a little bit about it. But one of the things, too, that we would like to urge and just show you, I think when you came into the city, Texas City -- and our citizens spend a lot of time and money and effort to have a beautiful city. We have done a lot of beautification, being one of the All American cities in the last two years. And one of the things that we'd like to say, too, is we -- we appreciate what the city has done and we need some help cleaning up something that's bigger than we can do. So we ask the Government to help us out.*

EPA RESPONSE: We appreciate your comments and welcome the interest from the citizens of Texas City and La Marque in voicing their support of the cleanup effort at the Tex Tin site. We can see that the citizens of these two cities are proud of their cities and have worked hard in the beautification campaign and we will do all we can to expedite the cleanup process at the Tex Tin site.

COMMENT: *It's been the policy of the EPA to go after the -- that's been involved in these sites,and usually they wind up going after the ones with deep pockets and so forth. And a lot of these companies declare bankruptcy and it's drug out, takes a long time, takes a long time to find them, and people claim that, I'm not responsible, this one is responsible, back and forth, and these things is drug out. And I think part of the frustration that the Mayor was pointing out, that he's tired of fooling with all this and he wants the Government to -- to assume responsibility. Now it's unclear in my mind as I leave here tonight whether the Government has accepted this responsibility or are they still on this old program, the same program that they have, looking up these companies that they've been looking for the last, you know, 20 years or so. And the second thought was that nobody has mentioned the eye sore. You know, we all criticize the Federal Government. And I'm -- I'm included. But there's a lot of things that theGovernment does that benefits us all and they do a lot of things around here in Texas City. The ship channel, interstate highways, flood controls, and so forth. And they're really taking a bad rap on this thing right here. I mean if there wasn't even any pollution, that's one of the gateways to this city. You go over that overpass, and it looks terrible. It's a disgrace. Union Carbide tried to plant some plants out there. Now there might notbe any contamination, but you look, there's no grass that grows in the back of that thing. There's a bunch of pine trees all dead. They won't grow. And it's a shame that as much good as the Federal Government does in this community that they take a beating. I mean everything -- every time that thing comes up in the local* *newspapers, the Federal Government gets -- gets mentioned. But I wish you would answer my -- the first part of that question, whether y'all have accepted this responsibilityand -- and ready to move on with it, or do we still continue this fight with the -- our Congressmen and everyone else?*

EPA RESPONSE: EPA has an "enforcement first" policy, which provides that if there areviable potentially responsibleparties (PRPs) connected with the site, EPA pursues those PRPs to conduct the cleanup activities before spending taxpayer money on a remedial action. While there are exceptions, this is the general policy applicableto all Superfund sites. We deal with PRPs in a fair manner and attempt to negotiate a settlement with each one. It is true that this process takes a long time, but we are required todo so. However, we attempt to try settle with cooperative PRPs as soon as possible. However, realize some PRPs do not want to enter into agreements with EPA and such recalcitrant action may lengthen the settlement process. So any delays starting cleanup cannot be placed solely on the Government. The Mayor and others are aware that just listing the site on the NPL took many years because companies were contesting the listing. The Federal Government is negotiating its fair share of cleanup reponsibility for the site, and EPA treats the Federal responsible parties the same as we would treat private companies that are responsible for the contamination. As previously stated, EPA can not assume the site liability for other Federal agencies.

COMMENT: *If we leave this meeting here tonight with enthusiasm, if you go through the same program you've been going through, we can expect some action somewhere several years down the road. Let me aska second question. Is there any way that it can be done in two stages, to at least remove the eye sore first? I mean that wouldn't be quite as bad. It would still have the contamination. But at least we wouldn't have an eye sore.*

EPA RESPONSE: EPA appreciates the effort from the citizens of TexasCity and La Marque to get the cleanup of the Tex Tin site started. All we can promise is that we will work hard to move this process forward. We will also explore ways of getting all or part of the cleanup activities started at the site as early as posible. We have had discussions with a group of PRPs and we think it may be possible to use their contribution to commence addressing the buildings.

COMMENT: *I have a couple of questions. First of all I'd like to say that I appreciate -- I've been waiting for one of these since -- well, actually '90. My question has to do with the pond across 146 that's not been mentioned yet. Is this part of the site or is it not? The pond west of 146. A few years ago there were signs saying "arsenic in the water," and that's why I was concerned. I didn't see anything mentioned about it here. Unless that part has been backfilled, I was wondering if you were also -- getting back on the plans, 135,* [sic] *when you take the water out, what will you do with the soil? Are you going to bury it or are you going to go through some of the process?*

EPA RESPONSE: The pond west of Highway 146 was sampled as part of the investigations conducted for the Tex Tin site. Areas outside the Tex Tin site boundary become part of the site if site related contamination is found in those areas. Based on the sampling data collected from this pond, risk assessments were conducted to determine the need for a response action relating to Pond 22. Based on the risk assessment result, we are proposing no response action for Pond 22. EPA is unaware of warning signs being placed around Pond 22. If there is a health issue related to fish consumption, the Texas Department of Health (TDH) will make the determination on the placement ofwarning signs around Pond 22 to prevent fishing. The ponds within the Tex Tin site will be drained and backfilled. A minimum of 24 inches of clean soil will be used to cover the site ponds.

COMMENT: *The ponds inside the plant where you're going to remove the water, you said you would take the water and treat it or whatever. What about the soil underneath that water? You won't remove the soil or anything?*

EPA RESPONSE: Except for the Acid Pond, sediment contamination in the other ponds does not exceed concentrations that would warrantstabilization or some type of treatment. However, contaminant levels in these ponds exceed health based levels that require a response action to prevent exposure to humans. Therefore, the preferred alternative recommends covering those ponds with 24 inches of clean soil materials to prevent exposure of those contaminants.

COMMENT: *What about the foundations? Will you remove those from the site when you take the structure down, or will they remain thereand cap over? There are pretty good size foundations in there. And then asecond question along those lines, would you remove the buildings -- is it your proposal to come in withsome sort of mechanical device and cut them down, or will you actually be removing them with acetylene torch, et cetera? Will you require that those individuals that are going to work out there on the asbestos have the required, trained as specified.*

EPA RESPONSE: The site foundations will be removed to the extent required to clean up the site contamination. In some cases, not all of the building foundations will be removed. Remaining foundations will be covered with clean soil. The buildingdemolition will be conducted in a controlled manner to prevent release of site contaminants to the environment. The demolition contractor, with EPA approval, will determine demolition methods. Site workers are reqiired to meet specific training standards for the work they do. Workers involved with the asbestos cleanup will be required to meet the asbestos abatement training requirements.

COMMENT: *I live in Houston, Texas, Harris County, the home of 17 state and Federal Superfund sites. My Ph.D. is in geology. I am a registered professional geologist in the state of Kentucky, No. 446. I'm a certified professional geologist, No. 4485, with the American Institute of Professional Geologist, No. 2445, with the Society of Independent Professional Earth Scientists. I'm a Certified Fraud Examiner, No. 2285, the Association of Certified Fraud Examiners. I am an independent geoscientist consultant that has applied geology and geophysical methods to oil, gas, and environmental problems for more than 20 years. My clients are risk averse. My opinion is that the best -- that the applied geology and geophysical methods used at Tex-Tin were in fact not the best available or state of the art, leaving the public at an unacceptable risk. You propose SW No. 3 alternative actions for 28.6 million dollars. I recommend that the EPA safely demolish the buildings at this site at its own expense and provide the 28.6 million dollars directly to Texas City for reparation and restitution for damages to Texas City'senvironment. That's the air, water, and land, its citizens and residents. It is unconscionable that both US EPA and the State of Texas have provided insufficient data to support that the location and that the monitor wells are placed appropriately to protect the public drinking water supply even if the pits and ponds were capped. I have three technical areas of concern: One, the first, did you accurately outline the area of contamination; secondly, did you accurately determine thedepth of contamination; thirdly, allowable levels of chemical exposure. First, the area for Operable Unit 1 appears to be inconsistent with historical best available or acceptable engineering waste disposal practices. Let me briefly explain. The area outlined for Operable Unit 1 is defined by surface political boundaries, such as roads, railroad tracks, and ditches. Historical engineering practices for waste disposal placed landfills in waste disposal pits at or near moving water. The solution to pollution was dilution. This was in films in the training sessions I had. Waste fluids could migrate vertically and laterally away from the landfill and independent of political boundaries. Professional engineers who I service and I want to know, do you have the authority to waive liability to third parties outside Operable Unit 1? Secondly, regarding depth of contamination, the depth of contamination is influenced by two things: The depth of the pits with buried tanks, drums, wastewater and radioactive waste with respect to the underground drinking water supply; and, secondly, the depth of the waste that was injected from the underground injection control well, which was about 1 mile below the public drinking water supply. The samples from core holes seem to be limited towithin Operable Unit 1's outline in less than 80 feet deep. Yet did heavy chemicals from the pits and ponds wide rank deeper than 80 feet as at Motco where the contamination was at 300 feet below ground level? Is waste from the underground injection control well moving upward along fracture zones and contaminating the drinking water supply? In my professional opinion, today's best available, state-of-the-art geophysicd technology that is critical to delineating the areaand depth of underground fluid pathways and barriers for Tex-Tin includes the three-dimensional, high-resolution seismic reflection survey. The surveyed area would include but not be restricted to the 2-and-a-half-mile area of review required for underground injection control wells. This is important if the 10,000 year non migration clause is to be enforceable and to protect the long-term drinking water supply, at least lower the risk of contamination from the bottom up. A well-designed, three-dimensional high-resolution seismic reflection survey delineates* *buried, inactive faults. Faults control the oil and gas production in this area, faults that couldbe reactivated by groundwaterwithdrawal. But doesn't Texas City still use groundwater for its public water supply? Appropriate, well-designed,3-D, high-resolutionseismic surveys document the continuity of underground barriers between wells more accuratdy than the well data alone, the continuity of underground conduits to flow more accurately than well data alone and provides more accurate geological and engineering groundwater models. You did not use available, appropriate nonintrusive geophysical methods to help delineate the area and depth of contamination prior to placing monitor wells. Lastly, allowable levels of chemical exposure out of Operable Unit 1 also appear to be politicallydefined. According to the sections of the work I read, either no background data was available for certain chemicals, no samples were collected, no historical environmental baseline wasset, and threshold values ignored. And where the state and Federal levels differ, the higher value to health was agreed to. I agree, do you have the authority to waive liability to third parties outside Operable Unit 1? You propose -- in summary, you propose -- that I repeat -- SW No. 3 alternative actions for 28.6 million dollars. I think it is unconscionable that both the state and Federal environmental regulatory agencies have failed to practice safety first in Superfund sites, leavingthe public exposed to hazardous chemicals. The Mitral Management Service, United States Geological Survey, the Department of Defense, and Department of Energy's national and regional research and development labs, and Amoco Corp., and the Texas geological survey have used high-resolution seismic reflection programs for decades. Therefore, EPA should safely demolish the buildings at this site at its own expense and provide the 28.6 million dollars directly to Texas City for reparation and restitution for damages to the city's environment, citizens, and residents. What you did is legal, probably, strictly speaking. What it is not appropriate or the best available technology, even when youhave in your agreed order resistivity, the resistivitymeantthat it may not have been appropriate for what you're doing. So I'm very disappointed, but -- and I know I'm an outsider, but that's my opinion.*

EPA RESPONSE: EPA cannot provide compensation or reparations to Texas City or the community for damages that may have been caused by other Federal Agencies or private companies. EPA can provide funding for the cleanup of contamination if viable potential responsible parties are not found for a site. As far as waiving third party liability determinations are handled that will be determined by EPA in consultation with the U. S. Department of Justice on a case by case basis, based on the facts of a party's involvement with the site and whether it contributed to the site contamination. EPA uses highly trained personnel to determine the appropriatesampling methods and samples that are collected at Superfund site. We rely on the expertise of professional engineers, toxicologists with Ph. D. degrees, geologists with advanced degrees and other highly skilled, practical andexperienced personnel to make the decisions at Superfund sites. We want to emphasize that the geotechnicalinvestigations conducted for the Tex Tin site are appropriate for the goals of identifying contaminated areas that may pose a risk to human health and the environment and feasible, effective response action under Superfund, particularly the National Contingency Plan. The goal of these studies is to generate site specific information which isappropriate for use in the administrative process of remedy selection. The studies on site were not to identify potential geological formations for oil or gas exploration or other purposes as would be used by oil companies. We used proven, EPA approved sampling and analytical techniques at the site to determine the nature and extent of the contaminants of concern. As a matter of fact, the most extensive investigations conducted at the site were conducted by a contractor hired by Amoco Corporation, an oil company. Although modeling isan excellent way of predicting what may be found in the field, only actual sampling and analysis can estimate the true nature and extent of contaminant distribution on site and this was done at the Tex Tin site. Samples were also analyzed for radiological content. We believe that the sampling techniques and analytical methods used at the Tex Tin are reliable and have accuratelyestimated the nature and extent of contamination necessary to select a remedy for the site. Therefore; we are confident that by using the results obtained from the site investigations, a cleanup of site contaminants can be conducted which will provide long term protection of human health and the environment. Risk assessment methods based on national criteria were conducted for the Tex Tin site using site specific data to determine the risk that site contaminants pose to human health and the environment These risk assessments are conservative estimates based on various exposure scenarios. We believe that the risk estimates identify areas that require response actions to address site contaminants.

COMMENT: *I have a genuine concern about the actual work that's going to be done. What's the methodology of the material removal for, like, ponds, the dirt, remediation stuff? Is there any method disclosed yet?*

EPA RESPONSE: Specific remedial action methods have not been determined at this time and will not be determined until the remedial design and work plan stage, after the site remedy has been selected. We have some ideas, but we want the cleanup contractors to propose methods that they would use to conduct the cleanup. If those methods achieve the cleanup goals for the site, we would have no objections. To some extent, we want to give contractors a choice on cleanup methods that are used; we want them to be innovative. Different contractors have different ways of conducting site work. Some of the work could be performance based, as long as cleanup goals are met. More specific details on construction activities, cleanup methods, and monitoring will be included in the remedial design document.

COMMENT: *My concern is with the removal of material. I've seen a lot of material used with backhoes and OSHA approved suits, and there's a lot of airborne contamination. There's a lot of people hurt on the job. There's a lot of new, modern techniques and technologies back there -- not only my company, there's a lot of other companies. I think that it should be addressed or looked at. It should be done in a new, state-of-the-art type of equipment so that it does not affect the residents around Texas City and also the workers who are going to be working there, from wherever they come from.*

EPA RESPONSE: Methods or plans and specifications regarding site cleanup activities will be developed as part of the remedial design for the site. The EPA requires that the contractors safely handle hazardous materials such that contaminants are not released to the surrounding community, and that site workers are protected and not put in an unsafe situation. We require contractors to comply with all OSHA regulations in conducting cleanup activities. Worker safety for chemical and physical hazards is one of the major priorities at Superfund sites. Materials are tested before determining the safest and best methods to handle and dispose of hazardous materials. All of these precautions are also taken with the surrounding community in mind. We do not want to cause an on-site release that may impact the surrounding community. We require extensive monitoring to ensure that site activities do not result in releases of hazardous materials to the community. Trigger levels will be specified for air monitoring which would stop site activities or signal the need for modified work practices before reaching hazardous levels which could potentially affect the surrounding community. The EPA is not opposed to contractors using new modern construction techniques and technologies. Again, construction activities will be further defined in the remedial design.

COMMENT: *When will the ROD be ready.*

EPA RESPONSE: After the Public Comment period has ended, EPA will evaluate all comments before selecting the remedial action for the site. Depending on the number of comments submitted and if additional analyses are needed to address comments, the process for signing the ROD usually takes three to four months. This includes preparing the ROD document which details the selected remedy for the site, responding to public comments, and involving the State and other agencies in reviewing the ROD before the final document is signed by EPA's Regional Administrator, hopefully in early 1999.

COMMENT: *I own the 10 acres on Highway 146 due west of the tin smelter and own a steel company that operates out of that location. Early Nineties I believe it was the Texas National Resource Conservation Commission was doing testing at these sites on my place, on -- on the lake that's west of -- of the tin smelter, and y'all keep referring to the fact they haven't been tested or you don't have reports on that? Are you aware of the tests that were done, the soil samples and the well samples and the testing in the lake? And in La Marque also. But no one is referring to those tests or the results. And you sound like you're going to retest again.*

EPA RESPONSE: We are aware of the investigations conducted at those areas. Sampling and testing have been conducted for Pond 22 located on the west side of Highway 146 and in some residential areas of La Marque. The EPA is not recommending additional testing for Pond 22. However, there are some concerns related to the consumption of fish from Pond 22. The Texas Department of Health may decide to test fish from Pond 22 to determine if there is a need to post a fishing advisory or ban. The residential areas of La Marque will be addressed as Operable Unit No. 3. The need for additional sampling or a response action for those areas is currently being evaluated.

COMMENT: *What was in that lake? The water, the sediments in the bayou that were sampled in '92. It's in the remedial investigation report.*

EPA RESPONSE: You can find the results of the pond sampling and other sampling conducted in 1992 are included in Remedial Investigation reports prepared for the site which are part of the Administrative Record for the site. This information is available at the Moore Public Library in Texas City. Results from the investigations conducted were used determine if the ponds pose a risk to human health and to prepare the Ecological Risk Assessment (ERA) for the site. The results of the risk assessment and ERA did not indicate a need for a response action. Fish samples were inconclusive. However, indications are that follow up testing of the fish edible parts are needed to determine if a fish consumption advisory is warranted.

COMMENT: *So you don't have to go back and do everything again. I'm just -- I'm more concerned because what my understanding was when the initial testing was done that there wasn't anything harmful except minor traces of arsenic -- is what I was told. Now since this time we had the collapse of the furnace that the Mayor was talking about. And I mean it was awful. We had a tremendous cloud, gas that came over us, or dust or whatever it was. In addition to Chief Purdon was saying about every time the wind blows, we get a tremendous amount of dust, debris. No telling what blows in on us. And this fast track that you keep talking about sounds like it's an unknown. And I wish that y'all could give us a little better time schedule as far as what the Government is going to do and how fast they're going to do it because every day I've got my employees out there. And we're at risk, and we need to move on it. And I just think it's awful that we keep getting caught up in the gridlock that goes on that we all hear about all the time. And I respectfully request that the EPA and the State of Texas resources go after it and get it done.*

EPA/TNRCC RESPONSE: Several investigations have already been conducted in and around the Tex-Tin Site, including these ponds. Therefore, we do not believe that additional soil, sediment, or water sampling is needed. The EPA and the TNRCC have discussed what is in the pond, what they are used for, i.e. fishing, and whether or not consumption of fish from the ponds poses a health risk. The Texas Department of Health (TDH) evaluates the risk of exposure to contaminants through fish consumption, and we defer to the TDH in this matter.

COMMENT: *I was wondering what the time line was on the proposed object 1 activity. Is number -- is it years or months, or just what kind of time line is that? The other is, is if you finish this proposal by the end of December, as you -- as you think you will, when would you expect to get started?*

EPA RESPONSE: The public comment period for the Proposed Plan ended on November 9, 1998. EPA will evaluate all comments before selecting the remedial action for the site. Depending on the number of comments submitted and if additional analyses are needed to address comments, the process for signing the ROD generally takes three to four months. This includes preparing the ROD document which details the selected remedy for the site, responding to public comments, and involving the State and other agencies in reviewing the ROD before EPA's Regional Administrator signs the final document. If we enter into an agreement with the PRPs soon after the ROD is signed, it will probably be about a year before the actual site cleanup will start. The first step will be to complete the remedial design and prepare the plans and specifications for the site. Second, contractors have to be selected. Consequently, as you can see, two substantial components of work must be completed before field activities start.

COMMENT: *I'm a little concerned that some of our citizens out here might go away from here thinking that the environment in this city is -- is extremely dangerous for them to be in and is liable to cause them to be ill in some way. And I want to emphasize to you, do a little bit of a commercial on the community advisory (CAP) thing I don't know how many of you know that our city has a community advisory panel that's made up of citizens that attend these meetings once a month. They are facilitated by a person that does an outstanding job. They're attended by industrial representatives that bring us information all the time about what's being done to improve the environment in our city. And so it's open to citizens. If you're not aware of it, you'd like to attend, visitors can come into that meeting. I don't doubt thatas* *this project gets underway, there willbe reports made to the CAP on a regular basis and so -- so that committee in all likelihood will be monitoring what goes on at this site just as will the Environmental Protection Emergeny Response Advisory Board for the city. One of the things that -- one example of the type of information that we are brought every month, we got -- only last monh we had a toxic release inventory data that is prepared by Global Industry and submitted to EPA. It won't come out in any of the EPA publications for probably a year, but we got this last month. And in all -- it looks better every year. That is, it shows every year a reduction in the -- in the emissions into the atmosphere from local industry. Another thing that we got just recently is the data that is produced by the Texas City-La Marque community air monitoring network. I don't know how many of you are aware we do have an air monitoring network that measures continuouslyabout 500 differentchemicals and substances that might be in our air. And I want to say to you, my interpretation of that data that we've received only last month is that the air in this city is better than many cities that you might go to on your vacations. So, I say to you, don't go away from here thinking that the air you're breathing here every day is going to give you a 55 percent better chance of having cancer than some other city that you might live in.*

EPA RESPONSE: The Toxic Release Inventory (TRI) information is available to the public through EPA's Region 6 Internet Website. Additional information regarding the City's air quality can be obtained by calling EPA's office in Dallas, and I believe the TNRCC also has air quality information available for the public.

COMMENT: *Can I make one brief comment along Charlie's line, I don't know ifyou was on that committee at that time or not, but several years ago, seemed like it was in the time of two or three years, the EPA officials come before this committee and they -- one of the reasons why they told us that this site was taken off the Superfund list was that there wasn't any significant contamination off site. Now, this is their words, not mine. But they assured us, they assured the officials of Texas City, that the contamination off site was -- was not of any danger to, you know, human beings. They said it was minimal. So only thing I'm trying to say is that they said at that time that the surrounding people wasn't in any great danger. Now I share this, gentlemen, I share the fact that it should be cleaned up and there is a potential for this -- and it's not my words. It's their words. But I'm just trying to echo the fact that it's not a great danger in the La Marque area from -- according to the EPA. But I hope that they check it again and get the thing cleaned up.*

EPA RESPONSE: There is contamination at the site that warrants action on site and in the surrounding areas. EPA has investigated the residential areas of La Marque that are closest to the smelter which could have been impacted by air deposition from the smelter operations. We have designated the potentially affected residential areas of La Marque as Operable Unit No. 3 for the Tex Tin site. By doing this, we are tying the arsenic contaminated areas of La Marque to the Tex Tin site. The residential areas of La Marque will soon be addressed as OU No. 3

COMMENT: *I would just like to know what we can do besides writing our Congressmen and our Senators to make sure that you all stay on this very fast track hat we think is so important and that there not be more 30-day extensions. I mean how do you stop 30-day extensions and keep this process rolling? What else do we need to do?*

EPA RESPONSE: The 30-day time extension to the comment period was requested by those involved with the site, and if requested, EPA is required by law to grant such an extension. At this point, there is nothing that can be done to stop the time extension. Beyond that, you can get involved by attending meetings such as this and participating in the Superfund process. There is a Technical Assistance Grant (TAG) available for his site. We believe TAG's are an excellent way for citizens to become involved in the Superfund decision making process. That will help. Forming a Community Advisory Group for the site can also help move the action along.

COMMENT: *I'm still concerned about your contractor. You say you have a contractor. Is he on a cost-plus basis just as an advisor to get this plan detailed, formulated? Or where do you stand as far as getting the work done?*

EPA RESPONSE: EPA has not selected a contractor to conduct the cleanup work for the Tex Tin site. We are now in the process of selecting a remedy for the site.

EPA's contractor prepared the feasibility study for the site and provided technical assistance; that contractor wil continue in that role until we begin the next phase of site work. At that time, EPA's contractor will either oversee the cleanup activitiesif these activities are conducted by the PRPs or the contractors that conduct theconstruction or manage the cleanup activities if EPA conducts the cleanup. EPA's contractor is paid on a level of effort basis. EPA controls the work assignment for the work that the contractor conducts for the site.

COMMENT: *We found in the Motco site that a public relations firm was concerned with the thing and kept our community well informed as to the activity of the site. Worked out real well until we wound the thing downand we had some upsets on the thing that kind of cdored our final clean-up on the thing. But would you mind having a group that will keep our general public advised to the detail as you go along and include local citizens' input to this thing?*

EPA RESPONSE: EPA's community involvement branch will handle the release of public information and conduct other public involvement activities. If you are interested in having information mailed directlyto you, you can ask Donn Walters to place your name on the site mailing list. Additionally, as activities proceed, we will be conducting open house meetings to keep the community informed regarding site activities. There are two other meetings that are typically planned for all sites after signing the ROD. When we complete the design, we have an open house in which the public can come and take a look at the design and we can again listen to concerns and comments. When we start the remedial action, before the contractor begins work on site,we will visit the community and explain tothe community what's going to happen. Additionally, EPA would encourage the community to form a Community Advisory Group so that there can be better interaction between the community and EPA.

COMMENT: *I want to see, for this lady here and Sheaffer, about what do we need to do. What do we have to do to get it done? That's what these people are trying to find from you. Now do we need to go and get some light petitions, or you guys goingto trust us like we trust you? It's like Brother Reagan said when he kissed against that wall with Kruschev. "Yes, we trust you, sir, but sign here," when he went to kick that wall down.*

EPA RESPONSE: Community participation is an important of part of the Superfund process. We do trust the communities of Texas City and La Marque and we hope that you will continue to trust us. We will be honest in the responses we give to you and in the information we provide to you. Sometimes youmay not like what we say, but we will try to give you the right information. We hope you do not lose your patience with us and continue to work with us in getting the site cleaned up.

COMMENT: *I'm probably the only member here save the tin smelter tonight. But in the process of tearing this thing down, can you maneuver this stuff around and put you a membrane in there before you cap it off? And the second thing is, you're talking about building a big shipyard down here along Snake Island. Can we use some of that fill there possibly or can this thing be converted for an area, assembly area, for this dock? In the process of chewing your problem in one place, you might be creating another one. But you're going to need a marsh land area for the material thatcomes in on these ships. Can this building possibly be salvaged to use for steel storage or whatever have you in the process of moving it off of ships and all? I know right now your big problem is you want to get rid of the thing. But to me there's a salvage value there and this thing could possibly be used for other thingsrather than just tear it down and putting it on the end of the property here.*

EPA RESPONSE: As far as using a membrane, the landfill design for the site materials will be based on the materials being disposed of inthe landfill. That will be addressed in the remedial design. One of the plans was to leave the buildings intact. However, many of the structural connections in the buildings are badly corroded and there would be a lot of work required to shore upthe buildings. In addition the buildings have to be completely decontaminated from the contaminated dust that's accumulated over the years. It's our opinion that for some buildings the best thing to do is to just take them down and landfill them on the site. However, if some parts of a building can be adequately decontaminated, they can be sold as salvage materials. The conservation assumption in the proposed plan was that all building materials and debriswould be landfilled on site. As far as using fill materials from other locations, that is acceptable as long as the fill materials meet the site requirements. Those requirements will be specified in the remedial design. Activities being conducted at Snake Island are not part of EPA's construction for the Tex Tin site. But, if the timing can be worked out and the materials meet the specifications, we would not object to the use of fill materials from that location.

COMMENT: *If you mentioned Swan Lake, this stuff has been running off for 40, 50 years, 60 years into Swan Lake. Do we have a total contamination down there, or are we going to have to tackle Swan Lake next after this? Possible it was their whole idea on this scene here is not to disturb more contamination, to spread contamination. If Swan Lake is okay like it is, I say leave it alone; don't disturb it.*

EPA RESPONSE: EPA has conducted an investigation in the Swan Lake salt marsh area. Preliminary indications are that some small areas of the Swan Lake marsh may require a response action. The contaminated areas tend to be limited where the historical Wah Chang ditch emptied into Swan Lake. The Swan Lake reports are being finalized to determine the full extent of contamination and what areas may need a response action. We have designated the Swan Lake Salt Marsh as Operable Unit No. 4 of the Tex Tin site so that we can look closely at that area and take action if it is warranted. If a cleanup is warranted for some areas of the Swan Lake marsh, the cleanup will be conducted such that the contamination is not spread and wildlife habitat is disturbed as little as possible. We do not want to spread the contamination and create a bigger problem in trying to clean up small contaminated areas. However, metals contamination cannot heal with time, so action is required to address the highly contaminated areas.

COMMENT: MAYOR DOYLE: *I want to thank you and the other panelists for conducting this hearing this evening here in Texas City. And most importantly I want to thank each of you for taking your time from your busy schedules to come out on -- and attend and provide input on what is probably the most important single event occurring in our city right now. I want to enter into the record a letter from Craig Eiland at Texas House of Representatives, leaving today in support of the project; also one from Senator Phil Gramm for the permanent record. I also want to pay tribute to Senator Kay Bailey Hutchison for sending a staff person here and for her support since nineteen -- since her election and since I have been working on this project. She has been very supportive, along with Congressman Nick Lampson. Patty Gray, state legislator, will also submit a letter, and Governor George Bush has been very helpful in attempting to give us support for a fast track. I was listening to Troy a moment ago and -- and I can remember when I went to work for Carbide in 1956, how everybody used to talk about Ford Bacon and Davis. And that's where most of those Carbiders came from. I want to make the point to you for the record that Ford Bacon and Davis spent 6.5 million, not 28.6. They built that plant in 18 months. Now we've proven in Texas City we can go downtown and tear down old buildings in a lot less time than it took to build them. So that plant went into production in 1942, April, and I think it's high time for it to go out of production. And you need to expedite it. I'd like to just recap a couple of things that were said here tonight. The lake, Carl, you had brought that lake up. We brought it up also at the hearing when this preliminary hearing was held in my offices on August 18th. We mentioned the barrels that were stored by the lake and all of a sudden zapped. We don't know where those barrels went. We don't know who those barrels belong to. The record shows that the lake has not been contaminated, but the record also will reflect no one has checked the bottom of the lake to see if the barrels happen to be there and if there's any contents in those barrels. And I specifically asked for that on August 18th. And I think it should be done as part of your request. I think this should be a comprehensive environmental fast track response. I don't know how we get there to do that. But it needs to be done. We had addressed the site of the mega port. I was in Houston only this last week before a panel proposing our site here in Texas City on Shoal Point as the future Texas mega port. We're trying to get Houston, the Port of Houston, Port of Galveston, and ourselves to work together on a comprehensive plan for that. So we want this site completely recycled. If it's not completely recycled and there is stores there, then what's left should become a wildlife habitat. It should not be left like the Motco site. I have not -- I haven't taken a policy, but I don't think there's a good way to leave a site by a major interstate highway. We have worked hard, as you've heard here tonight, on trying to make this a beautiful city. The first project included the enhancement of our gateways. The State spent a lot of money with the City to do that. This is not in keeping with an entry to our city. We want not only the aesthetics -- you know, I'm big on aesthetics -- but I'm also equally big on environment. We want to protect the wildlife, we want to protect the people. The* *bid conferences, prebid conferences: We do that real well here in Texas City because we've had over -- between 300 and 400 million dollars in new expansion in our industries since 1990. We have never had abatement used before I became Mayor. But we have had six projects now. We know how to bring in all of the local people, the suppliers, the contractors, and sit down with the general contractors and talk to the subcontractors and bring in our own subcontractors and get them talking. And we have good rules and also oversight techniques under our abatement project to make sure that our local people are put to work. I would strongly encourage you to allow us to participate in that with your general contractor. We will make sure they use local labor. We will not run your costs up and they will use local businesses and local materials that can be bought here. Training: We have a safety council on Sixth Street. They restored one of our old action -- that we didn't tear down and they can teach your people good safety techniques that are going to work on this job. We have a College of the Mainland that can teach people to properly handle these materials if you need to train them I'm glad to hear that December '98 will still be the ROD date that you're going to shoot for because I was really concerned that was going to be pushed back. I would like for somebody to tell us the day work will start in 1999. And until I hear that, I'm going to keep asking Senator Kay Bailey Hutchison and I'm going to keep asking Senator Gramm and your staffs, if you're here tonight, and Congressman Lampson, to find that out for us. I can assure you the citizens of Texas City won't let me duck a question like that, and I'm not going to let you duck it either. Funding made available to the Federal Government by those agencies who are the successors to the Defense Plant Corporation. Again I want to mention them because I don't think you were here when I mentioned them earlier. General Services Administration: well-known name in Washington, inside the beltway. Small Business Administration: another well-known name. Department of Housing and Urban Development, HUD. We also have the Department of Treasury. Now, if there's not funds there for this, you're just trying to put us on. And we are not going to accept "no funds available" as an answer. Department of Justice. I've met with them. They should enforce on the Federal agencies who are PRPs with the same rules, the same enthusiasm that they enforce on private PRP's. The US Supreme Court, in closing, in 1953 told our people no after six years of trying to get some money out of the explosion of the* Grand Camp. *It took Congressman Thompson to get the bureaucracy to move. And on August 12th, 1955 President Dwight Eisenhower signed the bill and about 17 million dollars were paid to 1,394 persons in Texas City. Nine years. That's too long. We need to have some action immediately here. Again, thank all of you for coming tonight. And I assume we're adjourned.*

Comments submitted by Terralog Technologies USA, Inc. by report dated November 2, 1998.

TERRALOG COMMENT: *The Proposed Plan of Action, dated September 9, 1998, describes six site wide remediation alternatives for the Tex Tin Corporation Superfund Site. The EPA has identified one of these alternatives, SW3, as a preferred option, but has noted advantages of and solicited public comment on a second alternative, SW6. Alternative SW3 involves on-site stabilization and cover of most wastes at the site, with some off-site transport and disposal of organic wastes. Alternative SW6 involves deep well injection of hazardous wastes at the site.*

The deep well injection alternative (SW6) is in fact superior to the on-site stabilization and cover, and off-site disposal alternative (SW3), and should be implemented at the Tex Tin Superfund site for the following reasons:

- Deep well injection provided greater protection to the environment (and ground waters in particular) than surface stabilization and cover, and off-site landfill disposal, and also preserves greater surface land for future site development;

- Costs for deep well injection have declined significantly in the past few years, so that this alternative can now be implemented at Tex Tin at similar or lower cost than the surface stabilization and cover alternative;

- Deep well injection with state-of-the-art monitoring technology has significant potential for remediation of other Superfund and hazardous wastes sites. Successful demonstration of this technology at the Tex Tin Site will provide valuable data and experience or application to other areas.

Deep well injection of hazardous and non-hazardous wastes from the Tex Tin site is the only remediation option which effectively removes the waste from the *biosphere; wastes are permanently removed from the surface and near surface environments. Fracture injection of wastes can be used to dispose of a wide variety of hazardous and non-hazardous wastes in an economic, time-efficient, and publicly acceptable manner. There is little surface impairment from injection operations, and future land use restrictions are significantly reduced once wastes are permanently entombed at depths well below groundwater.*

The costs for deep well injection have recently declined significantly, with technical advances in material processing, injection, and monitoring technology. Much of the waste material at the Tex Tin site can be safely injected at similar costs to the stabilization and cover alternatives. A cost summary for deep well injection is presented in this memorandum, detailing cost savings of about 35% compared to the original injection costs itemized in the Tex Tin Feasibility Study (FS) Report (Document Control NO. 98-756) prepared by CH2M Hill. Furthermore, significant errors in slag material volume calculations in the Feasibility Study inflated cost estimates for deep well injection by more than 100% relative to stabilization cover option for these materials.

Finally, deep well injection with state-of-the-art monitoring and analysis may potentially be applied to many other hazardous and non-hazardous wastes, providing superior environmental protection to on-site storage and cover or off-site transport and landfill disposal. In addition to industrial wastes, other applications include mining wastes, municipal wastewater treatment sludges (biosolids), and agriculture wastes can be effectively disposed of in this way. By applying this technology in a well documented and controlled manner at the Tex Tin site, the EPA will generate critical new data and experience for application to other Superfund sites and for other waste streams.

Because deep well injection is such an appealing option due to favorable environmental and long-term liability factors, the option should be included in any final remedial plan in the event that one or more of the potentially responsible parties prefers it.

EPA RESPONSE: Thank you for your comment and the effort you took to recalculate the site costs for comparisons of alternatives in light of the volume error. EPA agrees with the additional benefits that can be derived from the deep well injection option verses on-site stabilization and cover. Although your cost estimates do show a saving from the estimates presented in the FS report and even if your revised costs are all correct, the deep well injection alternative is still about $3 million higher than on-site stabilization and cover. While this may only represent about a 10% cost increase verses the preferred alternative, it is a higher cost that we cannot justify if Federal funding is used to implement the remedial action for the site. Also, the Deep Well Injection alternative does not meet ARARs for the site. In order to implement deep well injection at this site, EPA would have to conduct additional studies to support waiver of the UIC ARAR for the deep well injection of hazardous waste material and make that demonstration a part of the Administrative Record for the remedial action

4.2.0.1 Comments submitted by ARCO by letter dated November 6, 1998.

ARCO COMMENT: *Atlantic Richfield Corporation (ARCO) believes that Deep Well Injection is a viable alternative for the disposal of hazardous materials. We have had substantial experience in the development and use of this technology, and we recommend that the EPA continue to consider Deep Well Injection as a candidate technology for waste disposal for the following reasons:*

- The costs to implement this technology have declined as the technology improves and increases. This is a trend we expect will continue;

- This technology isolates the wastes and is therefore protective of human health and the environment; and

- It enhances property value because it makes the surface available for future site development.

This technology should be considered for solid waste disposal at sites with the appropriate geology and where costs are competitive. The Tex Tin Corporation Superfund Site is an ideal candidate for this technology because it has an existing well on site and because of the suitability of the geology. At the very least, Deep Well Injection should be considered further at Tex Tin if the PRPs express an interest in pursuing it as an option.

EPA RESPONSE: Thank you for your comments. EPA agrees with your assessment of the Deep Well Injection alternative and the added benefits thetechnology offers for the Tex Tin site. However, even with the current reduction in costs, the Deep Well Injection alternative is still several million dollars more expensive than the EPA selected alternative for the site. The other current obstacle for the Deep Well Injection alternative is that it does not meet ARARs for the site. A waiver petition for the deep well injection of hazardous materials ARAR can be pursued by EPA if the PRPs express a high interest in implementing this alternative.

Comments submitted by representatives for a group of companies by letter dated November 6, 1998.

COMPANIES COMMENT: *The U.S. Environmental Protection Agency ("EPA") has issued a Proposed Plan for the Tex Tin SuperfundSite (the "Site") Operable Unit No. 1 ("OU1") concerning the Tex Tin Property at Texas City, Texas. EPA requested comments on the Proposed Plan and information contained in the Administrative Record file. In response to EPA's public notice, the following companies herewith transmit and file comments in triplicate and request that this letter and these comments be included in and made a part of the Administrative Record: Chevron U.S.A. Inc.; E.I. du Pont de Nemours and Company; Elf Atochem North America, Inc., successor to M&T Chemicals, Inc.; General Electric Company: Rohm and Haas Texas, Inc; Southwire Company; Union Carbide Company; and Vulcan Materials Company (the "Companies")*

The Companies object to EPA's preferred alternative and object to implementation of the Proposed Plan for the reasons summarized below. The basis of these objections to EPA's preferred alternative are more fully set forth in the attached "Comments to EPA's Proposed Plan for Operable Unit No. 1 of the Tex Tin Superfund Site" prepared on behalf of the Companies by Environmental Resources Management ("ERM"). The Companies request that EPA revise its Proposed Plan to eliminate demolition of the buildings, stabilization of soils, and attendant remedial action and those other facts of the Proposed Plan noted in the enclosed technical comments. The Proposed Plan includes several actions that are inconsistent with the National Oil and Hazardous Substances Pollution Contingency Plan ("NCP") and that are not supported by information contained in the Administrative Record.

The Companies object to the proposed demolition of buildings because CERCLA expressly prohibits the proposed action, given that asbestos is a product in a building and there is no release. See 42 U.S.C. §9604(a)(3)(B). The NCP tracks the provisions of CERCLA; given that the proposed remedial action is prohibited by CERCLA, it also is inconsistent with the NCP. Additionally, OSWER guidance enlarges upon the NCP requirements, and EPA has failed to follow the requirements of its own guidance as set forth in OSWER Directive 9360.3-12 (August 12, 1993). Finally, judicial precedent, including that within the Fifth Circuit, confirms that EPA's proposed action is prohibited by CERCLA.

First, asbestos removal and building demolition should be completely eliminated from the Proposed Plan because these actions are inconsistent with the NCP. The NCP provides as follows:

Unless the lead agency determines that a release constitutes a public health or environmental emergency and no other with the authority and capability to respond will do so in a timely manner, a removal or remedial action under section 104 of CERCLA shall not be undertaken in response to a release: . . . [f]rom products that are part of the structure of, and result in exposure within, residential buildings or business or community structures . . . .

40 C.F.R. § 300.400(b)(2)(1997). The asbestos-containing materials ("ACM") designated for removal are clearly "part of the structure of" eleven buildngs on the Site. However, EPA has failed to demonstrate that there has been a release of ACM constituting a public health or environmental emergency.

Second, there is no evidence in the Proposed Plan, the Remedial Investigation, the Supplemental Remedial Investigation or the Feasibility Study or any release of ACM from the eleven buildings on the site. No friable ACM has been identified in these buildings, and EPA has not declared that the ACM in the buildings constitute a public health or environmental emergency. In fact, potential exposure to the ACM in these buildings was not even included within the Baseline Human Health Risk Assessment ("BHHRA") for the Site. See Proposed Plan at 24. EPA cannot declare an emergency without presenting any data to support it. The ACM in these *buildings has not created an emergency situation. The risk from the ACM identified by EPA is the risk that future workers may be exposed to ACM if the buildings deteriorate or are demolished. See Proposed Plan at 22. By its very definition, an emergency situation cannot currently exist if the risk is conditioned solely on the occurrence of future events (i.e., deterioration or demolition of buildings).*

Third, EPA inclusion of asbestos removal and building demolition in the Proposed Plan also contravenes several other NCP requirements. For instance, 40 C.F.R. § 300.430(d)(2) requires EPA to "characterize the nature of and threat posed by the hazardous substances and hazardous materials and gather data necessary to assess the extent to which the release poses threat to human health or the environment or to support the analysis and design of potential response actions. . . ." As noted above, EPA has collected no data to determine whether a release of ACM has occurred. In fact, EPA has not taken air samples from these buildings or soil samples from beneath these buildings for ACM. In addition, the NCP requires EPA to "conduct a site-specific baseline risk assessment to characterize the current and potential threats to human health and the environment that may be posed by" on-site contaminants. 40 C.F.R. § 300.430(d)(4). EPA conducted a BHHRA for the Site but, as noted above, chose to exclude exposure to asbestos from this risk assessment. Thus, EPA's proposed $12 million asbestos remedial action is not supported by any data and is inconsistent with the NCP.

Finally, the ACM removal and building demolition remedial action also is contrary to clear judicial authority establishing that CERCLA does not authorize the removal of asbestos form buildings. See, e.g., Kane v. United States, 15 F.3d 87, 89-90 (8th Cir. 1994); 3550 Stevens Creek Assoc. v. Barclays Bank, 915 F.2d 1355, 1364-65 (9th Cir. 1990), cert. denied, 500 U.S. 917 (1991); Dayton Indep. Sch. Dist. v. U.S. Mineral Prod. Co., 906 F.2d 1059, 1066 (5th Cir. 1990); First United Methodist Church v. U.S. Gypsum Co., 882 F.2d 862, 868 (4th Cir. 1989), cert. denied, 493 U.S. 1070 (1990). These courts all determined that Congress did not intend to extend CERCLA cleanup and cost recovery to cover ACM removal from buildings. The First United Methodist court summarized Congress' intent as follows:

> *[T]his interpretation of CERCLA fully comports with the most fundamental guide to statutory construction - common sense. To extend CERCLA's strict liability scheme to all past and present owners of buildings containing asbestos as well as to all persons who manufactured, transported, and installed asbestos products into buildings, would be to shift literally billions of dollars of removal costs liability based on nothing more than an improvident interpretation of a statute that Congress never intended to apply in this context. Certainly, if Congress had intended for CERCLA to address the monumental asbestos problem, it would have said so more directly when it passed SARA. . . . While CERCLA is unquestionably a far-reaching remedial statute that must be interpreted with an eye toward this nation's environmental problems, it cannot reasonably be interpreted to encompass the asbestos- removal problem.*

882 F.2d at 869. EPA is violating CERCLA and applicable judicial precedent by including ACM removal in the proposed remedial action for the Site.

Because EPA's Proposed Plan is prohibited by CERCLA, is inconsistent with the NCP, violates EPA's own guidance, and is barred by established judicial precedent, the Companies request that EPA withdraw asbestos removal and building demolition from the Proposed Plan.

EPA RESPONSE: As parties who are potentially responsible under CERCLA for contamination at the Tex Tin Site, the Companies' motivation to limit the scope and thus the cost of the remedial action as much as possible is understandable. However, EPA disagrees with the comment. Demolition buildings in appropriate cases and stabilization of contaminated soils are consistent with the National Contingency Plan's intent to provide for long term and permanent remedies protective of human health and the environment. In this case building demolition is not prevented by CERCLA's limitations on response provision, because EPA has jurisdiction to take a response action to abate a release or threat of release of hazardous substances, pollutants, or contaminants from a site, and provide for a long term permanent remedy.

The condition of the buildings at this site is well-documented. Investigations of this site have included three building surveys: one conducted to detect potential sources of hazardous materials inside the buildings (e.g., radiation, vapors/dust, asbestos, metals, or organics) in ten process area buildings, ("Building Survey Report," Appendix T, Remedial Investigation Report (Woodward-Clyde 1993)), an asbestos inspection, ("ACBM Survey Report," Ecology & Environment, 1996), Appendix R to Supplemental Remedial Investigation (Ecology & Environment, Inc. for EPA, 1997)(hereafter, "SRI"), and a third to ascertain the integrity of twelve of the process area structures themselves ("Building Integrity Inspection Report," (Ecology and Environment, Inc. 1996), Appendix S to SRI. Under the ROD (see Section 3.11.1) EPA plans to evaluate each building during remedial design and to demolish them when appropriate.

The "Building Integrity Inspection Report" indicates that some of the buildings are badly corroded. Consequently, EPA concludes that if these buildings are left exposed to the elements without corrosion control their condition will deteriorate to a point at which they will lose their structural integrity since there is no plan to control corrosion. For example, as the buildings deteriorate, the fasteners used to affix transite roofing and siding may corrode and these corroded fasteners could fail in a high wind. During such a failure roofing and siding may be ripped from the buildings and release asbestos fibers from the transite into the environment. Once roofing or siding is removed from the buildings any contamination contained in the buildings could also be released into the environment. Recent photographs of the site show that siding and roofing have already fallen off of some of the buildings. Therefore, EPA believes the best long term and permanent remedial action to prevent the release of hazardous substances, such as asbestos from the transite, into the environment is to demolish the corroded buildings. Other buildings present safety concerns for workers, or are so contaminated that decontamination is impracticable. Under CERCLA, EPA has jurisdiction to take all necessary response actions to abate a release or threat of release of hazardous substances, pollutants, or contaminants from a site.

The Companies do not specify how building removal at the Tex Tin Site departs from OSWER Directive 9360.3-12, "Response Actions at Sites with Contamination Inside Buildings." It should be noted that the guidance is specifically addressed to removal action; it cites to the predicate for response actions under CERCLA Section 104 and the limitations on response provision in 104(a)(3). It notes that a discharge of a hazardous substance, pollutant, or contaminant that remains entirely contained within a building is not a "release" under CERCLA unless it subsequently enters the environment. Given the condition that there is no maintenance plan to ensure the integrity of these buildings there is no certainty, that a long term plan, to ensure contaminants can be contained within a building. Therefore, EPA believes there is a threatened release for which CERCLA has response authority (50 FR 13462, April 4, 1985). The particular circumstances at the Tex Tin site fall within examples of actionable releases as described by the following guidance:

> *In general, authority to respond to a release or threat of release from a building exists if at least one person or the environment outside of the building may be exposed to the release. For example, if the hazardous substance, pollutant, or contaminant can migrate through a window or through the foundation or building structure into the soil, creating exposures to persons or hazardous to the environment, a sufficient basis may exist to show that there is a threat of release into the environment requiring the cleanup of the interior of the building.*

The Companies also argue that there is no evidence of any actual release of ACM from site buildings, or proof that the ACM is causing an emergency. Because EPA believes the threat of an asbestos release is not limited to an indoor release, in this case it is not necessary to establish the basis for an exception to the limitations on response provisions of CERCLA Section 104. Therefore, EPA is not required to prove that an actual ACM release has created an emergency. On the contrary, the current and future condition of the buildings present a threat of an asbestos release to the environment. Transite siding falling off the buildings can result in otherwise non-friable asbestos becoming friable. Moreover if the buildings go without maintenance and lose there structural integrity, friable pipe insulation found in seven of the buildings during the 1996 survey could be released to the environment.

To conclude, as noted above, the purpose for demolishing site buildings in this action is to provide a long term permanent remedy in cases where:

- There are no long term building maintenance plans to prevent building deterioration, which may present a release or threat of release of a hazardous substance to the environment;
- The building presents a safety hazard to response workers;
- The building components are so contaminated that decontamination is impracticable;
- The building components are so corroded or otherwise compromised that decontamination is inpracticable; or
- Building demolition is necessary to facilitate implementing other components of the remedial action.

The NCP allows for removal, demolition, excavation, etc., of other materials when necessary to address hazardous substances on site. Therefore, the proposed remedial action is authorized by CERCLA and consistent with the NCP.

COMPANIES COMMENT: *The Companies also object to the proposed soils stabilization because EPA failed to compare the Site-specific maximum allowable concentration of chemical in groundwater with Toxicity Characteristic Leachate Procedure (TCLP) data, which is the proper comparison to evaluate the need for a response action. A proper comparison demonstrates that TCLP leachate data do not exceed the maximum allowable on-site concentrations; thus, leachate from the soils, sediment, slag or drummed material will not impermissibly degrade the groundwater. Therefore, stabilization is not required to protect public health and the environment, and attendant remedial actions such as installation of a geomembrane wall also are unnecessary.*

Because EPA's own TCLP leachate data demonstrates no need to stabilize soils and other materials and conduct attendant actions to protect public health and the environment, the Companies request that EPA delete from the Proposed Plan the requirement to stabilize soils and other material and to conduct attendant actions because these proposals are inconsistent with the NCP.

EPA must select as its preferred alternative remedial actions that are not inconsistent with the NCP and that are not expressly prohibited by CERCLA. EPA has failed to do that for the Tex Tin Superfund Site. Accordingly, EPA must withdraw, revise and reissue its Proposed Plan so that it is not inconsistent with the NCP.

EPA RESPONSE: The proper use of TCLP data is not for the data to be compared to the maximum allowable concentration of chemicals in groundwater. The proper use of TCLP data is to determine whether a material is characteristically hazardous or not, which in turn determines whether it warrants a response action under CERCLA (since "hazardous wastes" are included in the definition of "hazardous substances") and also to determine the appropriate disposal facility. Under the Clean Water Act, Maximum Concentration Limits (MCLs) have been established for drinking water sources. The MCLs are the chemical concentrations to which allowable chemicals in ground water data are compared, not TCLP data. After evaluating site specific conditions and in agreement with TNRCC, EPA proposed to use the Synthetic Precipitation Leaching Procedure (SPLP) test to determine the potential of site contaminants leaching to the ground water. Therefore, materials that exceed the MCL concentration levels for the contaminants of concern when subjected to the SPLP will be stabilized to prevent future leaching of contaminants above MCL levels to the ground water. While the shallow and medium transmissive zones meet the criteria as potential future drinking water sources, EPA evaluated the current use of these ground water zones in the surrounding area and in particular the down gradient locations and concluded, with TNRCC's concurrence, that the ground water use for the shallow and medium transmissive zones would likely be for industrial use. Therefore EPA established a perimeter monitoring program based on alternate concentration levels (ACLs) for industrial use. In calculating the ACLs, further analyses were needed to determine if on-site ground water concentrations already existed which would exceed the perimeter ACLs. In that case, a ground water pump and treatment program would berequired to prevent exceedance of the perimeter ACLs. Calculating the maximum allowable levelson site was to determine the need for starting pump and treatment, not to establish or maintain continued on-site leaching concentrations at levels that would even exceed the limits for characteristically hazardous materials. Clearly maintaining the current leaching levels would cause further degradation of the shallow and medium transmissive zones and could in time impact the deep transmissive zone which is used as a drinking water source in the surrounding area. Additionally, maintaining the current leaching levels would not, in time, reduce the contaminant concentrations in the shallow and medium transmissivezones which is EPA's goal for these groundwater zones, a reduction in contaminant levels through natural forces.

The Companies' comment that "EPA's own TCLP leachate data demonstrates no need to stabilize soils and other materials..."is clearly wrong. TCLP leachate data in the remedial investigation reports show several waste materials that exceed TCLP levels for characteristic hazardous materials which would trigger treatment under the land disposal requirements. Materials exceeding TCLP levels would require treatment (stabilization) for on-site landfill disposal or off site disposal. Additionally, EPA, in consultation with the State, has determined that stabilization of materials exceeding SPLP concentrations is needed to protect the groundwater. Under CERCLA, EPA can take additional action to prevent migration of site contaminants to the ground water. This is EPA's goal in proposing stabilization for materials that exceed SPLP levels.

The Companies' comments ignored the risk posed by site contaminants to human health and the environment. Site risks are clearly presented and detailed in the Baseline Human Heath Risk Assessment report included in the Administrative Record. This report forms the basis for the response action proposed for the site. Stabilization is needed for protection of ground water and required for disposal of materials exceeding TCLP levels. The risk assessment for the site shows that a response action to address site contaminants that exceed human health levels is warranted. Response actions to address these site materials are warranted to address the present and future threat that site contaminants pose to human health. EPA believes that the best responseaction to address materials that are characteristically hazardous is through stabilization.

Installation of a geomembrane wall is necessary to isolate the acid pond, Pond 6, from the shallow ground water transmissive zone as part of the in situ treatment proposed for the Acid Pond. The geomembrane would prevent groundwater infiltration after dewatering the Acid Pond. The geomembrane would also help in preventing leaching of pond contaminants tothe shallow groundwater. Although stabilization of pond contaminants would be conducted as part of the preferred alternative for the site, the geomembrane would provide added protection.

EPA's preferred alternative for the Tex Tin site is consistent with the NCP in providing long term protection to human health and the environment and therefore is not prohibited by CERCLA. The Companies' comments regarding asbestos removal and stabilization of site materials are clearly inconsistent with EPA's long term goal of providing protection to human health and the environment at Superfund sites and therefore the Companies' comments areinconsistent with the NCP and CERCLA. The Companies' comments do not warrant reissuing the Proposed Plan for the Tex Tin Site, OU No. 1. EPA has evaluated comments received at the public meeting held at Texas City, City Hall on October 6, 1998, and written comments submitted. Based on the results of this evaluation, EPA has concluded that the preferred sitewide alternative, SW-3, presented in the Proposed Plan will be selected as the remedy for the site that will meet EPA's long term objectives for the site. As a result of comments received minor revisions made to the preferred alternative will be noted in the Record of Decision for the site.

5 END NOTES

1. The Administrative Record contains the documents that form the basis for the selection of a response action.

2. Woodward - Clyde, *Remedial Investigation Report, Volume 1 of VII,* June 1993, pp. 1-3 through 1-7.

3. King, E. B. and D. N. Gibson, "Tin Smelting at the Texas City Smelter," an unpublished general description of the Tex-Tin Site, updated.

4. The Dallas Morning News, 1990 - 91 Texas Almanac, 1989, p. 113. Average annual rainfall for Galveston County is 40.2 inches.

5. The Dallas Morning News, 1990 - 91 Texas Almanac, 1989, p. 71

6. Ecology and Environment, *Supplemental Remedial Investigation for the Tex Tin Corporation Site,* March 1997, page 1-6.

7. Environmental Systems Design and Management, Inc. (ESDM), *Building Integrety Inspection Report at Tex-Tin Corporation Site, Texas City, Galveston County, Texas,* November 1996.

8. Woodward Clyde, *Remedial Investigation Report,* June 1993.

9. Woodward-Clyde, *Remedial Investigation Report, Volume 1 of VII,* June 1993, Section 3.0, "Physical Characteristics."

10. Ecology and Environment, *Supplemental Remedial Investigation for the Tex Tin Corporation Site,* March 1997, Section 3, "Supplemental Remedial Investigation."

11. U. S. Department of Health and Human Services, Public Health Service, Agency for Toxic Substances and Disease Registry (ATSDR), *Toxicological Profile For 1,2-Dichloroethene*, August, 1996, p. 4.

12. U. S. Department of Health and Human Services, Public Health Service, Agency for Toxic Substances and Disease Registry (ATSDR), *Toxicological Profile For Antimony*, September, 1992, p. 4.

13. U. S. Department of Health and Human Services, Public Health Service, Agency for Toxic Substances and Disease Registry (ATSDR), Internet Web Page http://atsdr1.atsdr.cdc.gov:8080/ToxProfiles/phs8802.html

14. U. S. Department of Health and Human Services, Public Health Service, Agency for Toxic Substances and Disease Registry (ATSDR), *Toxicological Profile For Asbestos,*

August, 1995, p. 5.

15. U. S. Department of Health and Human Services, Public Health Service, Agency for Toxic Substances and Disease Registry (ATSDR), *Toxicological Profile For Barium*, July, 1992, p. 3.

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47. ATSDR (Agency for Toxic Substances and Disease Registry), *The Nature and Extent of Lead Poisoning in Children in the United States: A Report to Congress.* U.S. Department of Health and Human Services, Public Health Service. July 1988. ATSDR, *Toxicological Profile for Lead.* Final. NTIS PB 93-182475, April 1993. CDC (Centers for Disease Control), 1991. *Preventing Lead Poisoning in Young Children. A Statement by the Centers for Disease Control,* October 1991.

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50. Bowers, T.S., B.D. Beck, and H.S. Karam, *Assessing the Relationship between Environmental Lead Concentrations and Adult Blood Lead Levels.* Risk Analysis 14(2): 183-189, 1994.

51. EPA. *Risk Assessment Guidance for Superfund, Volume 1, Human Health Evaluation Manual* (Part A). Interim Final. Office of Solid Waste and Emergency Response, Washington, D.C. EPA/540/1-89/002, 1989.

52. EPA. *Human Health Evaluation Manual, Supplemental Guidance: "Standard Default Exposure Factors".* Office of Solid Waste and Emergency Response,

Washington, D.C. OSWER Directive 9285.6-03, 1991

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55. Stabilization is a treatment process that mixes or injects treatment agents into a material contaminated with heavy metals to accomplish one or more of the following objects:

- Improve the physical characteristics of the waste, without necessarily reducing aqueous mobility of the contaminant, by producing a solid form liquid or semi-liquid wastes
- Reduce the contaminant solubility
- Decrease the exposed surface area across which mass transfer loss of contaminants may occur
- Limit the contact of transport fluids and contaminants

EPA, *Contaminants and Remedial Options at Selected Metal-Contaminated Sites,* EPA/540/R-95/512, Office of Research and Development, July 1995. In so far as stabilization alters the composition of the hazardous substance through a chemical or physical means in accordance with the NCP §300.5, "Definitions," it is considered treatment.

56. EPA, Denver Radium Superfund Site, Record of Decision, 1992.

57. EPA, Motecillo Superfund Site, Record of Decision, 1990.

58. TNRCC, Jeffery A. Saitas, Executive Director, Memorandum to Program Areas Which Utilized the Risk Reduction Rules and Site-Specific Risk Analysis, September 11, 1998.

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Figure 3.1
Site Location

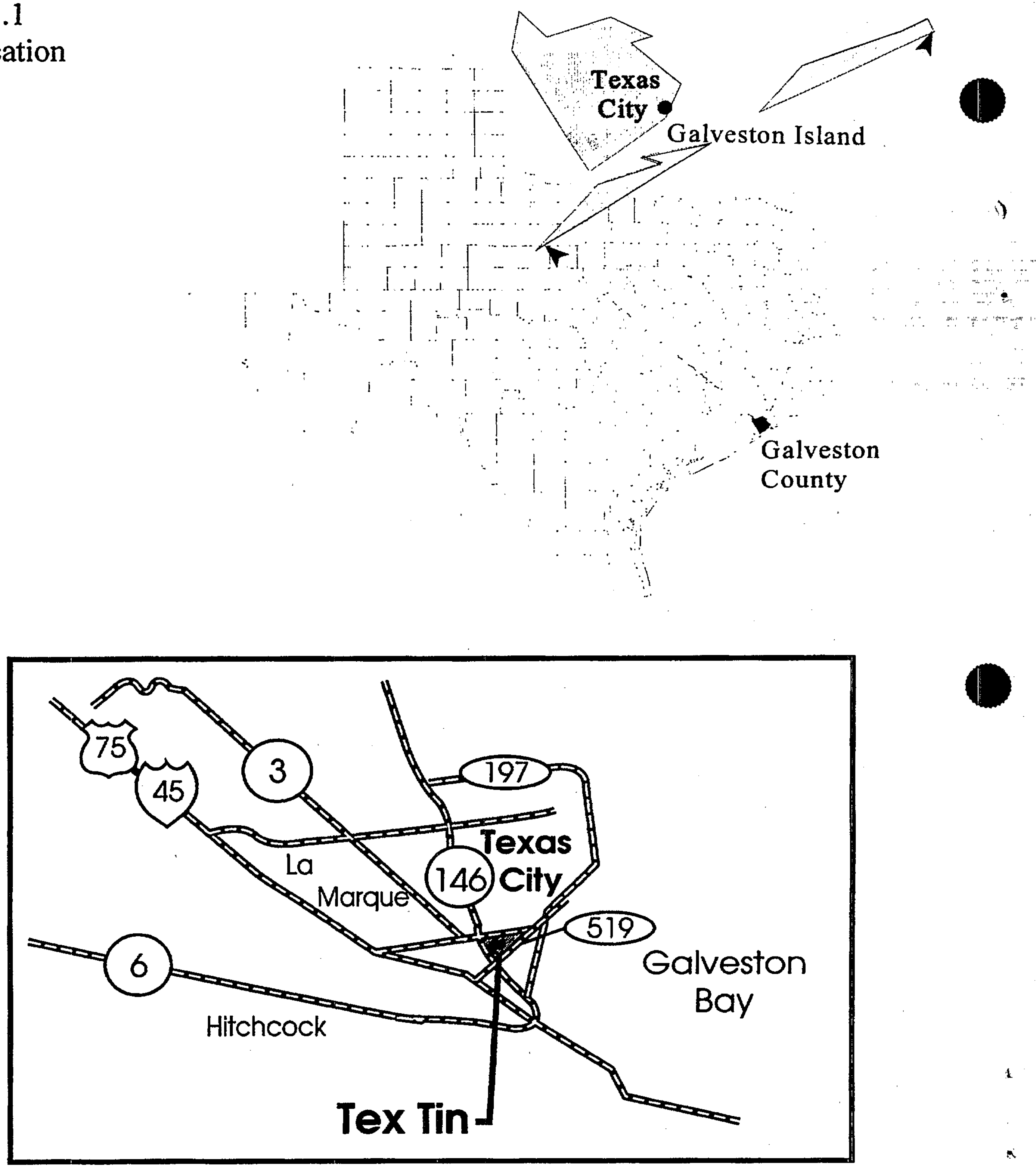
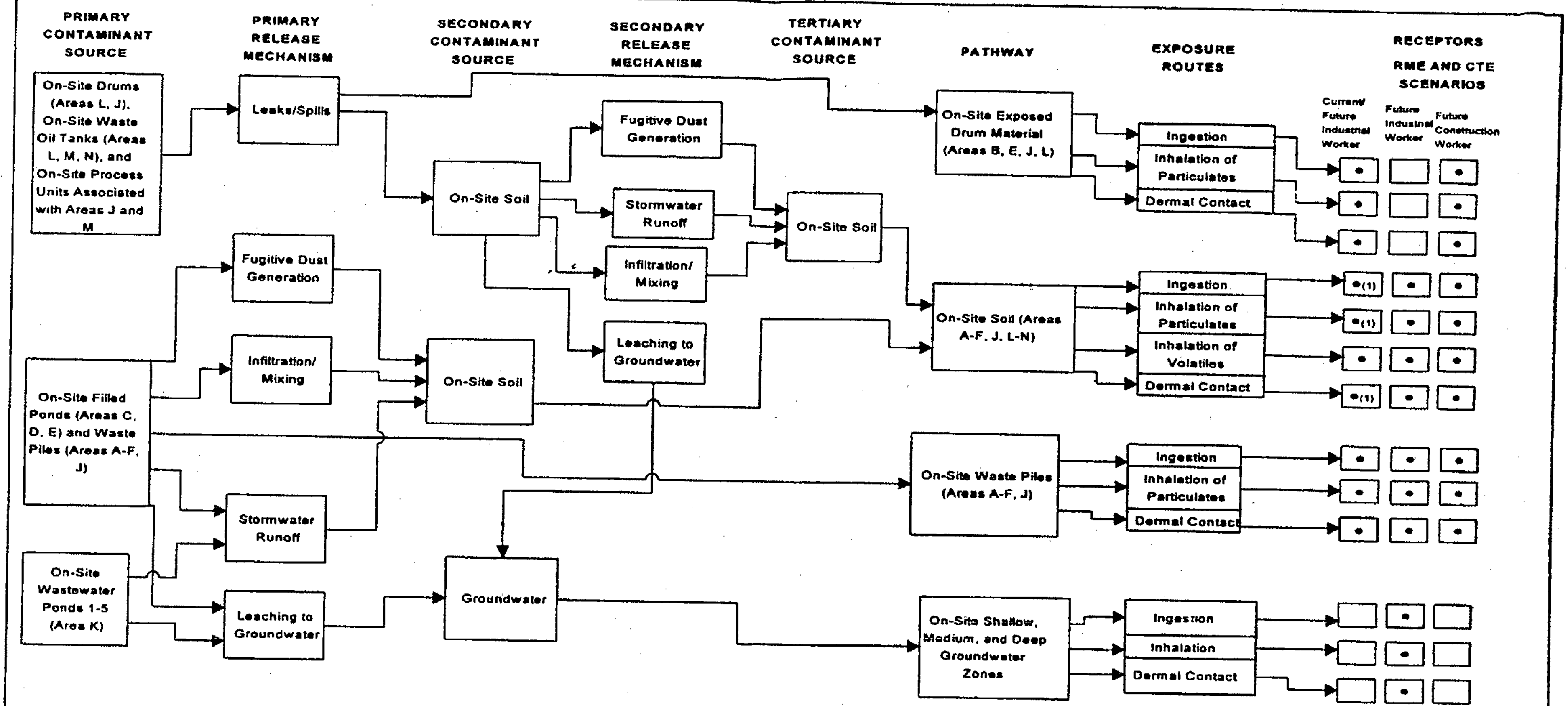
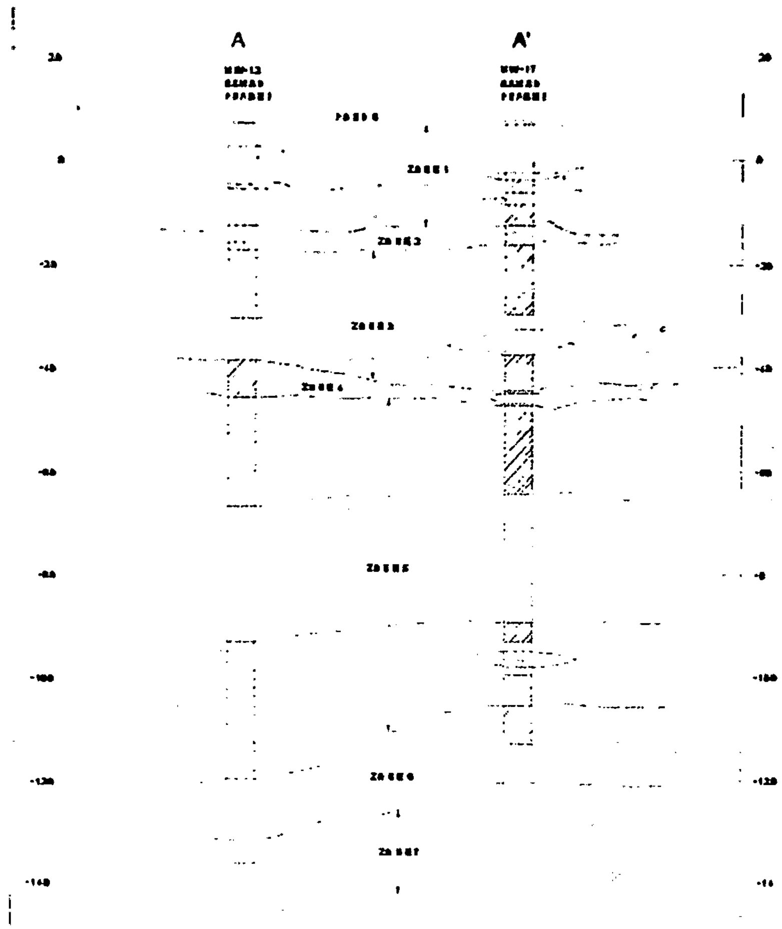


Figure 3.5.27 -1 Conceptual Site Model - Soil, Waste Piles and Groundwater

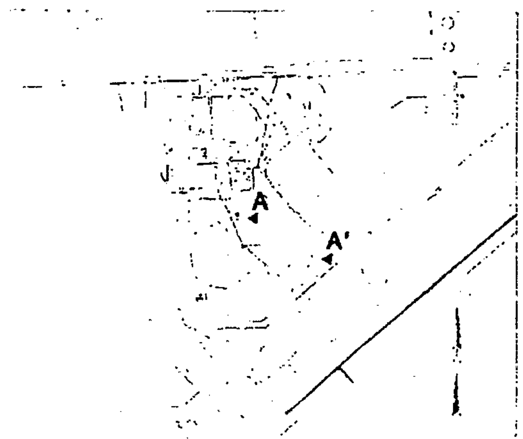


Note:

(1) Current/future industrial worker is assumed to only be exposed to contaminants insurface soil.



- FILL
- CLAY
- SILTY/SANDY CLAY
- SAND
- INTERLAYERED SAND AND CLAY
- CLAYEY SILT
- CLAYEY SAND
- SILTY SAND
- SANDY SILT
- POND SEDIMENT
- INDICATES A TRANSMISSIVE ZONE
- NO RECOVERY



CROSS-SECTION LOCATION MAP

Notes:

1. *Geological Information based on Phase II RI.*
2. *Zone 1 is the shallow confining zone*
3. *S&M&D indicates clustered wells representing*

REPRESENTATIVE GEOLOGICAL CROSS SECTION

Figure 3.5.21

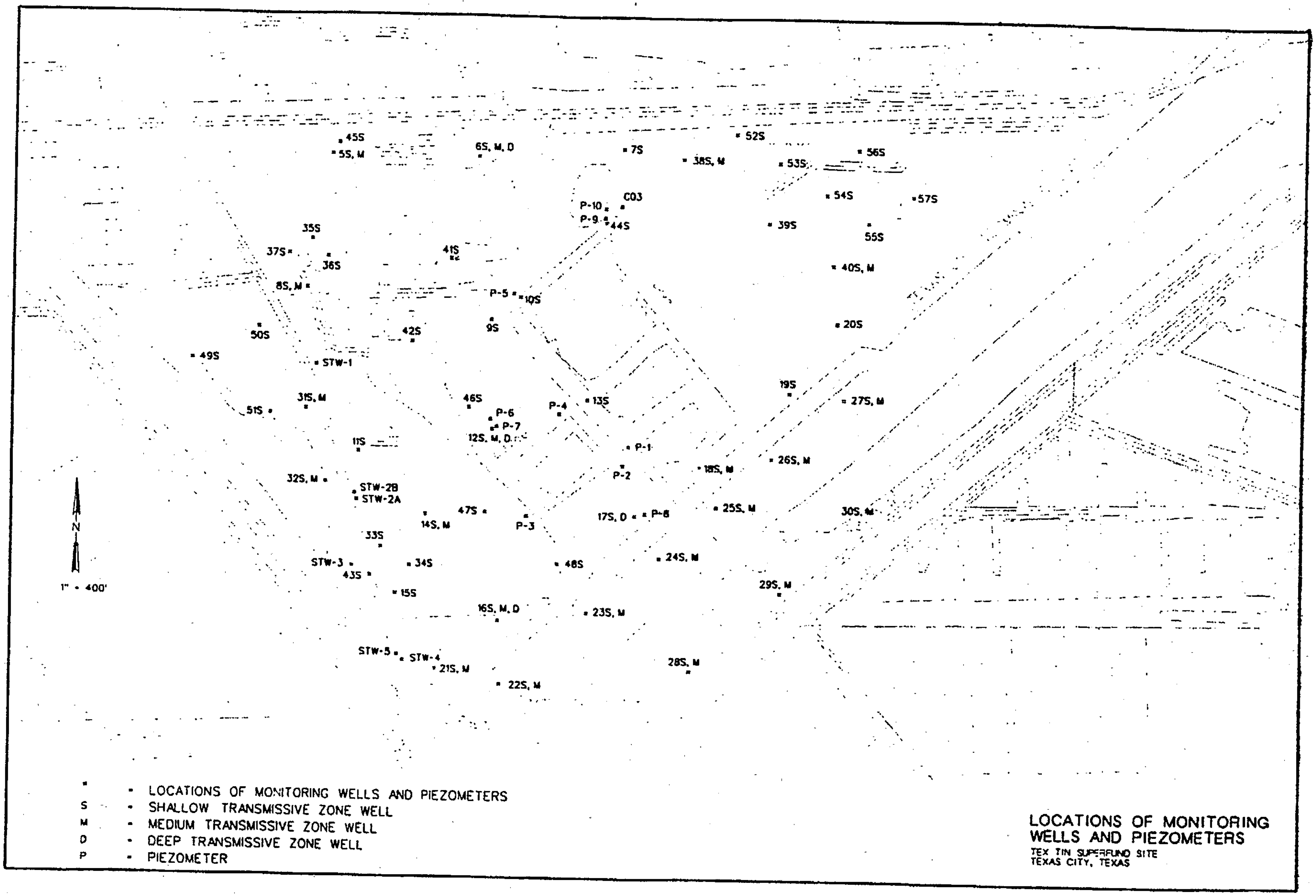
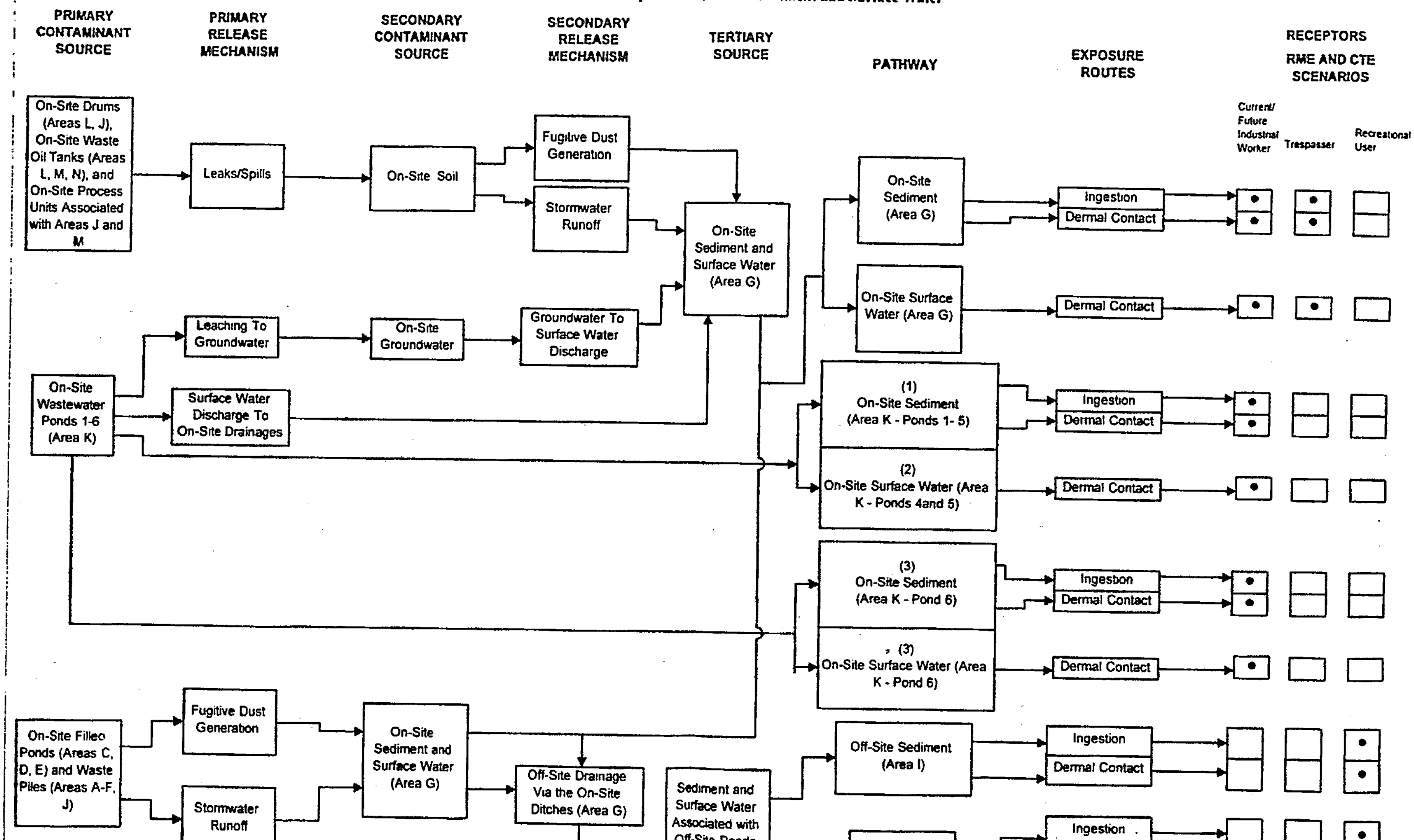


Figure 3.7.1.1.1

Figure 3.5.27 - 2 Conceptual Site Model - Sediment and Surface Water



Notes:
(1) Sediment exposure in Area K occurs in Ponds 1-5.
(2) Surface water exposure in Area K occurs in Ponds 4 and 5 (Ponds 1-2 are dry and Pond 3 is mostly dry)
(3) Pond 6 was evaluated separately from Ponds 1 through 5 because it is a waste acid pond and not a former wastewater treatment pond.

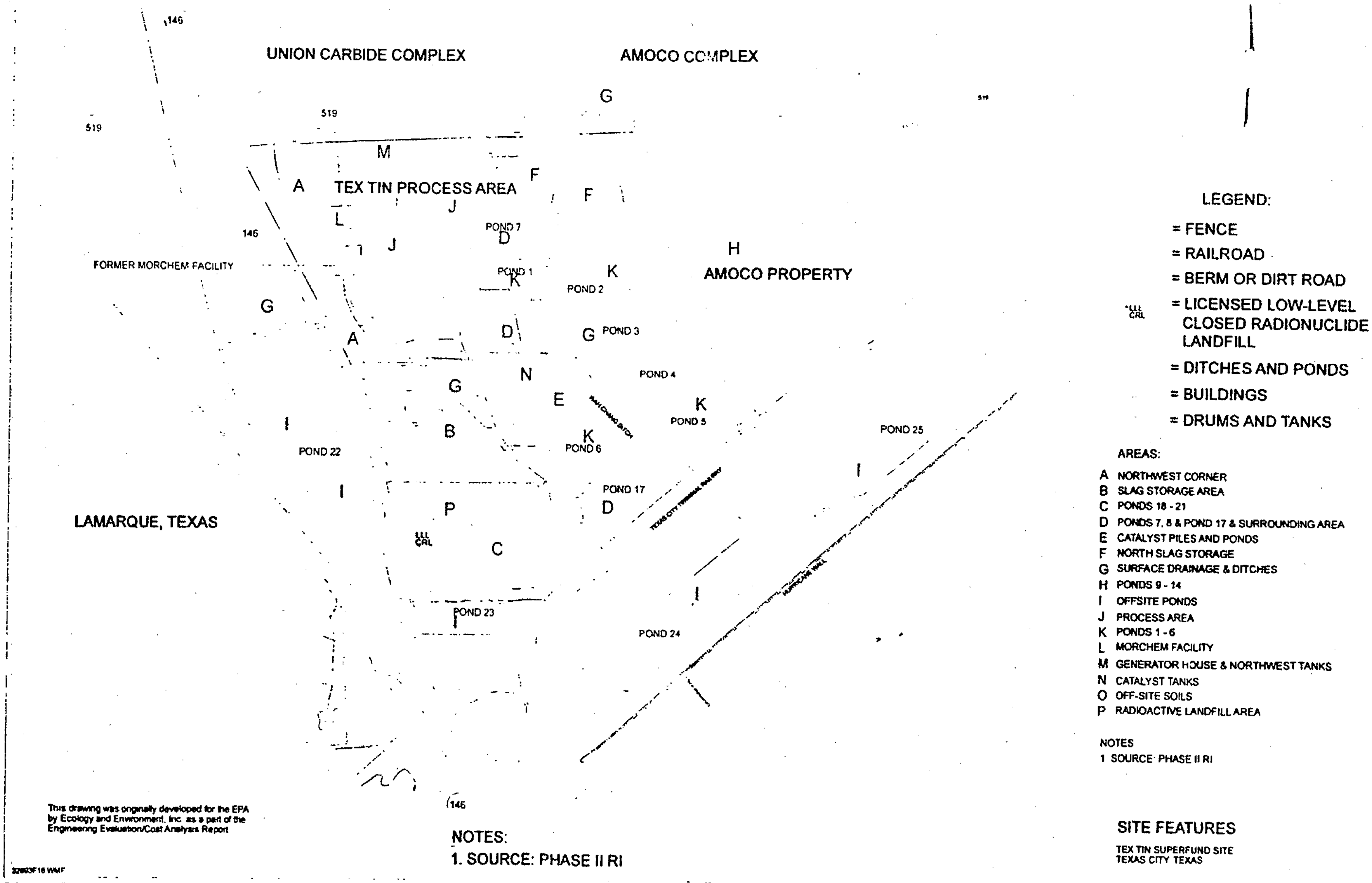

UNION CARBIDE COMPLEX
AMOCO COMPLEX
TEX TIN PROCESS AREA
FORMER MORCHEM FACILITY
AMOCO PROPERTY
LAMARQUE, TEXAS
POND 7
POND 1
POND 2
POND 3
POND 4
POND 5
POND 6
POND 17
POND 22
POND 23
POND 24
POND 25
519
146
LEGEND:
= FENCE
= RAILROAD
= BERM OR DIRT ROAD
= LICENSED LOW-LEVEL CLOSED RADIONUCLIDE LANDFILL
= DITCHES AND PONDS
= BUILDINGS
= DRUMS AND TANKS
AREAS:
A NORTHWEST CORNER
B SLAG STORAGE AREA
C PONDS 18 - 21
D PONDS 7, 8 & POND 17 & SURROUNDING AREA
E CATALYST PILES AND PONDS
F NORTH SLAG STORAGE
G SURFACE DRAINAGE & DITCHES
H PONDS 9 - 14
I OFFSITE PONDS
J PROCESS AREA
K PONDS 1 - 6
L MORCHEM FACILITY
M GENERATOR HOUSE & NORTHWEST TANKS
N CATALYST TANKS
O OFF-SITE SOILS
P RADIOACTIVE LANDFILL AREA
NOTES
1 SOURCE: PHASE II RI
This drawing was originally developed for the EPA by Ecology and Environment, Inc. as a part of the Engineering Evaluation/Cost Analysis Report
NOTES:
1. SOURCE: PHASE II RI
SITE FEATURES
TEX TIN SUPERFUND SITE
TEXAS CITY TEXAS

Figure 3.2.11