Record of Decision

Alcoa (Point Comfort)/Lavaca Bay Site
Point Comfort, Texas

CERCLIS # TXD 008123168

December 2001

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION 6
SUPERFUND DIVISION

Declaration for the Record of Decision

Site Name and Location

Alcoa (Point Comfort)/Lavaca Bay Superfund Site
Point Comfort, Calhoun County, Texas
TXD 008123168

Statement of Basis and Purpose

This decision document presents the selected remedial action for the Alcoa (Point Comfort)/Lavaca Bay Superfund Site (Site), in Point Comfort, Calhoun County, Texas, which was chosen in accordance with the Comprehensive Environmental Response, Compensation and Liability Act of 1980 (CERCLA), 42 USC §9601 et seq., as amended by the Superfund Amendments and Reauthorization Act of 1986 (SARA), and, to the extent practicable, the National Oil and Hazardous Substances Pollution Contingency Plan (NCP), 40 CFR Part 300 et seq., as amended. The Director of the Superfund Division, EPA Region 6 has been delegated the authority to approve this Record of Decision.

This decision was based on the Administrative Record, which has been developed in accordance with Section 113 (k) of CERCLA, and which is available for review at the Calhoun County Library in Port Lavaca, Texas, the U.S. Environmental Protection Agency (EPA) in Dallas, Texas, and the Texas Natural Resource Conservation Commission (TNRCC) in Austin, Texas. The Administrative Record Index (Appendix C to the ROD) identifies each of the items comprising the Administrative Record upon which the selection of the remedial action is based.

The State of Texas concurs with the Selected Remedy.

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.

Description of the Selected Remedy

This ROD sets forth the selected remedy for the Site, which involves actions to address mercury- and PAH-contaminated sediments in Lavaca Bay, ongoing unpermitted discharges of mercury and PAHs into Lavaca Bay, and soil contamination at the former Chlor-alkali Process

Area and soil contamination at the former Witco area. The selected remedy is a comprehensive approach for the Site and addresses all current and potential future risks caused by sediment and soil contamination.

The major components of this remedy are:

Bay System

- **Extraction and Treatment of Chlor-Alkali Process Area (CAPA) Ground Water** - CAPA ground water will be hydraulically controlled by a series of four extraction wells. Treatment of the extracted ground water will be performed by aeration using an air stripper, followed by carbon adsorption for mercury removal. The treated ground water will be discharged to Lavaca Bay.
- **Installation of a DNAPL Collection or Containment System at the Witco Area** -West of the former Witco Tank Farm Area, a collection trench or containment system will be installed for the purpose of intercepting DNAPL potentially migrating to Lavaca Bay. Recovered DNAPL will be collected and sent off site for treatment and disposal at a licensed disposal facility. The DNAPL will not be treated or stabilized on site prior to off site disposal. The specific areas of shoreline to be addressed by a remedy may be modified based on site conditions observed during remedy implementation. The use of either a DNAPL containment or collection technology will be refined during the remedial design.
- **Dredging of the Witco Channel** - approximately 200,000 cubic yards of mercury-contaminated sediment will be dredged and disposed of in an on site confined disposal facility located on Dredge Island. The dredged sediments will not be treated or stabilized before disposal. A final cover for the disposal areas will consist of dredged material taken from an area of Lavaca Bay that has mercury concentrations below human health and ecological risk-based values.
- **Remediation of the Witco Marsh by Dredging or Filling** - the Witco Marsh would be actively remediated to address the concern of biological uptake of mercury. The decision to dredge or fill the marsh will be made in the remedial design.
- **Enhanced Natural Recovery North of Dredge Island** - the areas north of Dredge Island would receive a thin cap over the entire area to accelerate the natural recovery process currently observed occurring in Lavaca Bay.
- **Natural Recovery of Sediments** - sediments that are not actively remediated will recover to acceptable levels through natural sedimentation It is estimated that surficial sediment mercury levels in all areas are expected to decline to levels in the current range of open areas of the Bay within a 5 to 10 year time frame.
- **Institutional Controls to Manage Exposure to Finfish/Shellfish** - the fish closure originally established by the Texas Department of Health in 1988 and updated in January 2000 will remain in place to control the consumption of finfish and shellfish for the "Closed Area".
- **Monitoring** - long term monitoring of sediments and fish will be required to confirm the natural recovery of sediment and fish tissue to acceptable levels. In addition, monitoring

of surface water will be conducted to evaluate the effectiveness of the CAPA hydraulic containment system. Full details of the monitoring program will be established during the design of the selected Bay System remedy.

Chlor-Alkali Process Area Soils

- **Building R-300 Removal** - the walls and roof of Building R-300 will be removed and hauled off-site.
- **Capping of Building R-300 Area** - The building slab and the area immediately west of Building R-300 will be capped with a clay sublayer covered by crushed rock.
- **Institutional Controls to Manage Exposure to Soil**- Excavation of any soils below or immediately west of Building R-300 would only be permitted after a worker safety program is developed for the specific excavation activity and repair of the cap would be required after excavation. The Building R-300 area would be deed recorded as containing soils with elevated mercury levels.

Former Witco Area Soils

- **Capping** - the Stormwater Sump and Separator Area and Former Tank Farm Area will be capped with soil caps
- **Institutional Controls to Manage Exposure to Soil** - future excavation of any soils in these areas would only be permitted after a worker safety program is developed for the specific excavation activity and repair of the cap would be required after excavation. These areas would be deed recorded as containing soils with elevated PAH concentrations.

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 (or resource recovery) technologies to the maximum extent practicable.

Because of the relatively high volume of sediments involved, and the low concentrations of mercury involved, treatment of sediments was not considered. The dredged material is being disposed of within the area of contamination and placement of dredged material in the confined disposal facility is appropriate. The toxicity, mobility and volume of mercury in CAPA ground water discharging to Lavaca Bay will be significantly reduced through treatment by carbon adsorption. Due to the toxicity, mobility, and volume of the contaminated waste, CAPA and Former Witco Area soils are considered to be low level threat waste, so capping is an appropriate remedy for these soils.

Because this remedy will result in hazardous substances remaining on-site above levels that allow for unlimited use and unrestricted exposure, a review will be conducted within five years after initiation of remedial action to ensure that the remedy continues to provide adequate protection of human health and the environment.

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 ground water use assumptions used in the baseline risk assessment and ROD
- ✔ Land and ground water 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 cost estimates are projected
- ✔ Decisive factor(s) that led to selecting the remedy

Authorizing Signatures

This ROD documents the selected remedy for sediments and soils at the Alcoa (Point Comfort)/Lavaca Bay Superfund Site. This remedy was selected by EPA with concurrence of the Texas Natural Resource Conservation Commission.

By: Myron O. Knudson Date: 12-20-01
Myron O. Knudson, P.E., Director
Superfund Division
EPA Region 6

CONCURRENCES

12/3/01
Gary A. Baumgarten
Project Manager
Date

12/3/01
Gustavo Chavarria, Chief
Arkansas/Texas Section
Date

12/6/01
William Honker, Chief
Arkansas/Texas Branch
Date

12/12/01
Pamela Travis
Office of Regional Counsel
Date

12/18/01
Mark Peycke
Office of Regional Counsel
Date

Bruce D. Jones
Office of Regional Counsel
Date

12/19/01
Lawrence E. Andrews
Acting Regional Counsel
Date

out
June Buzzell
Writer Editor, Superfund Division
Date

Pamela Phillips, Deputy Director
Superfund Division
Date

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ACRONYMS

ARARs	Applicable or Relevant and Appropriate Requirements
ATSDR	Agency for Toxic Substances and Disease Registry
BLRA	Baseline Risk Assessment
BMP	Best Management Practice
BSAF	Biota Sediment Accumulation Factor
CAPA	Chlor-Alkali Process Area
CAPA2	Citizens Advisory Panel to Alcoa
CCND	Calhoun County Navigation District
CERCLA	Comprehensive Environmental Response, Compensation and Liability Act
CFR	Code of Federal Regulations
CMP	Coastal Management Plan
COC	Chemical of Concern
COPC	Chemical of Potential Concern
CSM	Conceptual Site Model
CWA	Clean Water Act
CY	Cubic Yard
DMPA	Dredge Material Placement Area
DNAPL	Dense Non-Aqueous Phase Liquid
EE/CA	Engineering Evaluation/Cost Analysis
EPA	U.S. Environmental Protection Agency
ESD	Explanation of Significant Differences
FDA	Food and Drug Administration
FS	Feasibility Study
GPA	Gypsum Placement Area
H&S	Health and Safety
HI	Hazard Index
HPAH	High-molecular-weight PAH
HQ	Hazard Quotient
IGRI	Interior Ground Water Reconnaissance Investigation
LS	Lump Sum
MCL	Maximum Contaminant Level
MPRSA	Marine Protection, Research, and Sanctuaries
MSHA	Mine Safety and Health Administration
NAS	National Academy of Science
NCP	National Oil and Hazardous Substances Pollution Contingency Plan
ng/L	nanograms per liter
NOAA	National Oceanic and Atmospheric Administration
NOEC	No Observed Effect Concentration
O&M	Operation and Maintenance
OSHA	Occupational Safety and Health Administration

PAH	Polycyclic Aromatic Hydrocarbon
PCBs	Polychlorinated Biphenyls
PCO	Point Comfort Operations
PPE	Personal Protective Equipment
PSA	Potential Source Area
PSCR	Preliminary Site Characterization Report
RAA	Remedial Action Alternative
RAO	Remedial Action Objective
RBV	Risk Based Value
RfD	Reference Dose
RI	Remedial Investigation
RME	Reasonable Maximum Exposure
ROD	Record of Decision
SARA	Superfund Amendments and Reauthorization Act of 1986
SQT	Sediment Quality Triad
SSI	Surface Soil Investigation
TAC	Texas Administrative Code
TCCC	Texas Coastal Coordination Council
TDH	Texas Department of Health
TDS	Total Dissolved Solids
TNRCC	Texas Natural Resource Conservation Commission
TRV	Toxicity Reference Value
TWC	Texas Water Commission
TWQB	Texas Water Quality Board
USACE	U.S. Army Corps of Engineers

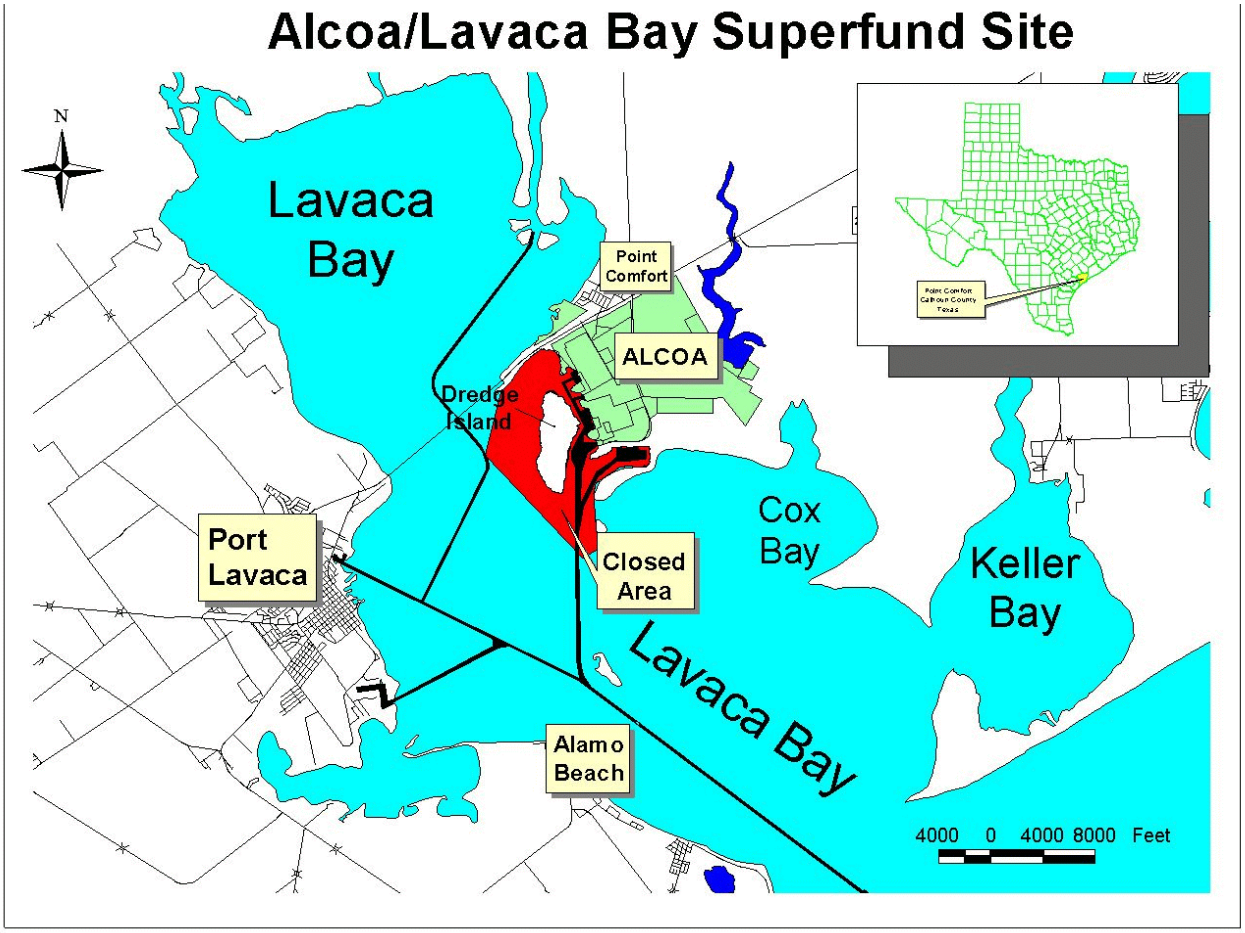
SECTION 1
Site Name, Location, and Description

The Alcoa/Lavaca Bay Superfund Site is located in Calhoun County, Texas and consists of the Alcoa Point Comfort Operations (PCO) Plant, Dredge Island, portions of Lavaca Bay, Cox Bay, Cox Creek, Cox Cove, Cox Lake and western Matagorda Bay.[1] The PCO Plant is located on the south side of State Highway 35 near the City of Point Comfort, Texas and is adjacent to Lavaca Bay on the west and Cox Creek/Cox Lake on the east (Figure 1).

The Environmental Protection Agency (EPA) is the lead agency for Site activities, with support from the Texas Natural Resource Conservation Commission (TNRCC). EPA in conjunction with the National Oceanic and Atmospheric Administration (NOAA) and the State of Texas signed a Cooperative Management Agreement to coordinate the interests of all federal and state agencies involved with the site. Agencies participating for the state of Texas include Texas Parks and Wildlife Department, TNRCC, and Texas General Land Office. NOAA is the lead administrative Natural Resource Trustee while the Department of Interior was represented by the U.S. Fish and Wildlife Service. The National Superfund electronic database identification number is TXD 008123168.

[1] This is also referred to as the "Study Area" in the Proposed Plan of Action

Figure 1-1


Alcoa/Lavaca Bay Superfund Site
N
Lavaca Bay
Point Comfort
ALCOA
Dredge Island
Port Lavaca
Closed Area
Cox Bay
Keller Bay
Lavaca Bay
Alamo Beach
4000 0 4000 8000 Feet

SECTION 2
Site History and Enforcement Activities

History of Site Activities

The Plant, which covers approximately 3,500 acres, was established as an aluminum smelter in 1948. Smelting operations were shut down in 1980. Bauxite refining, which utilizes bauxite ore to produce alumina, began in 1958 and is still active today. Past operations that have been dismantled and removed include the smelter, a cryolite plant, a chlor-alkali plant, and the Witco coal tar processing plant. The following paragraphs provide a background on areas of the site that were evaluated during the Remedial Investigation.

Chlor - Alkali Process Area (CAPA) From 1966 until 1979, Alcoa operated a chlor-alkali production plant to produce sodium hydroxide (caustic) and chlorine. Part of the chlor-alkali process involved the use of mercury cathodes. The main purpose of operating the chlor-alkali plant was to produce caustic that was necessary in the bauxite refining operations. Between 1966 and 1970, wastewater from the chlor-alkali plant that contained mercury, was transported to an offshore gypsum lagoon located on Dredge Island. After a settling period, the overflow from the gypsum lagoon was discharged to Lavaca Bay from two outfalls on Dredge Island.

Dredge Island Dredge Island, which is located in Lavaca Bay west of the plant site, began as a reef formation and was greatly increased in size and shape by the placement of dredge materials from the construction of Alcoa's Industrial Ship Channel and the periodic dredging between the mainland and the Island. The Island has been used for the management and disposal of dredge material since 1957 and has also been used for the disposal of gypsum, treated wastewater effluent from the CAPA and dredge materials from the Industrial Channel.

Mercury was placed on Dredge Island when wastewater from CAPA went to the Placement Areas and dredge spoil from Alcoa's Industrial Channel was deposited in the Placement Areas. The dredge materials may have contained mercury as a result of discharges from CAPA. Wastewater from CAPA went to the Placement Areas for a short period of time during 1969 and 1970. The overflow from the Placement Areas was discharged into Lavaca Bay from July 1965 to 1981.

Former Witco Processing Area Witco Chemical Corporation began operations in 1964 within the boundaries of the PCO Plant. Witco processed coal tar for the manufacture of electrode binder pitch and creosote. Operations at the Witco area included a coal tar tank farm, a creosote storage area, a binder pitch storage area, and a distillation area. Witco discontinued operations in December 1985.

After ceasing operations, Witco began the process of dismantling the plant. The plant was not subject to any regulatory closure requirements because there were no regulated units at the site.

However, under the oversight of the Texas Water Commission (TWC) [predecessor to the TNRCC], Witco began cleanup of the operating area. The first phase of the closure focused on the removal of all surface facilities, concrete foundations, and visually contaminated soils. When the first phase of the closure was nearing completion, Witco prepared a work plan to determine whether any residual contamination was present in the soil or ground water of the uppermost water-bearing zone. The work plan was approved by TWC in October 1988. Based on results from sampling of ground water monitoring wells, TWC requested that Witco prepare a Phase II work plan to determine the vertical extent of any remaining soil contamination at the plant site. Following completion of the Phase II sampling, Witco submitted the results to TWC in a data report. No comments on the data report were submitted to Witco. Witco continued semiannual monitoring of ground water until Alcoa advised Witco on March 17, 1995, that Alcoa intended to take over ground water monitoring at the site.

Lavaca Bay Lavaca Bay is an estuary of the Matagorda Bay system and has a surface area of approximately 60 square miles. The Bay has several uses ranging from commercial and industrial to a natural habitat for aquatic and avian species. Both commercial and recreational fishing for various finfish, blue crabs, and oysters take place in the bay. Lavaca Bay is also used for shipping and as a source of industrial cooling water. Sediments in a portion of Lavaca Bay have elevated levels of mercury and PAHs.

Texas Department of Health Fish Closure The Texas Department of Health (TDH) has sampled fish, crabs, and oysters since the 1970s. In the early 1970s, mercury levels in oysters and crabs were significantly elevated. Based on these findings TDH closed parts of Lavaca Bay to the harvesting of oysters. At that time, TDH did not have the authority to prohibit crabbing or fishing. The ban on oystering was lifted in October 1971 when the levels of mercury in oysters dropped below the 0.5 ppm Food and Drug Administration guideline. Periodic sampling and analysis by the TDH of finfish and shellfish in Lavaca Bay continued after 1970 and showed the problem of elevated mercury levels in finfish and shellfish to be persistent. On April 20, 1988, TDH issued an order closing an area of approximately 1 square mile of Lavaca Bay to the taking of finfish and crabs (Figure 1). On January 13, 2000, TDH reopened a portion of the closure area (Cox Bay). The closure for Cox Bay was removed because sampling showed that levels of mercury in finfish and crabs had decreased to a level acceptable for human consumption based on TDH's risk characterization.

History of Removal and Early Actions

During the Remedial Investigation, Alcoa conducted several early response actions under EPA oversight. In April 1998, an Action Memorandum was signed by EPA in which Alcoa was to conduct a non-time critical removal action at Dredge Island. The purpose of the removal action was to relocate and contain mercury-contaminated soils on the Island and fortify the Island to protect against possible damage during a severe storm event. The non-time critical removal action began in September 1998 and was completed during the summer of 2001.

Also, Alcoa installed a ground water extraction system in 1998 at CAPA as part of a treatability study. The extraction system was installed to evaluate the effectiveness of hydraulically controlling the discharge of mercury-contaminated ground water from CAPA into Lavaca Bay. Details about the CAPA ground water treatability study can be found in the October 1998, "*CAPA Groundwater Treatability Study*" data report. In addition, Alcoa conducted a dredging treatability study in two separate areas of Lavaca Bay. The first phase of the dredging treatability study took place in August 1998 while the second phase occurred in January 1999. Approximately 80,000 cubic yards of sediments were dredged and disposed of in Alcoa's disposal lakes and on Dredge Island during the treatability study. Details about the dredging treatability study can be found in the January 2000, "*Treatability Dredge Study*" data report.

History of Enforcement Activities

In 1970, the Texas Water Quality Board (TWQB) received information from the Texas Department of Health (TDH), and the Food and Drug Administration (FDA) concerning mercury in marine fauna around Lavaca Bay. As a result, TWQB initiated an investigation, and subsequently issued an emergency order to Alcoa to limit mercury amounts in wastewater discharges.

In May 1993 the Site was proposed for listing on the NPL, and was published as final on February 23, 1994. The effective date of the final NPL listing is April 23, 1994. During the months of January, February and the beginning of March 1994, technical and legal representatives from Alcoa, EPA, NOAA, and TNRCC (State Superfund and natural resource trustees representatives) successfully negotiated an Administrative Order on Consent and a Statement of Work for the RI/FS.

SECTION 3
Community Participation

Throughout the Site's history, a very active citizens advisory panel provided input to the regulatory agencies and Alcoa. Alcoa and EPA have kept the community and other interested parties informed of Site activities through informational meetings, fact sheets, press releases and public meetings. Below is a brief chronology of public outreach efforts.

EPA held open houses and workshops in August 1993, April 1994 and September 1994. During the August 1993 and April 1994 meetings EPA discussed the proposal and addition of the Alcoa site to the National Priorities List. The September 1994 meeting was held to obtain input from the community regarding their concerns and information needs in connection with the site.

A community advisory panel convened by Alcoa began to function in the spring of 1994. Following a presentation in July 1994 regarding advisory panels, the community advisory panel members enlisted the help of several others and retained an independent facilitator. This group began to act as a steering committee to draft a mission statement and ground rules, select a name, and select the members for a larger and more diverse panel. Alcoa, EPA Region 6, and the Texas Natural Resources Conservation Commission serve as liaisons to the panel. The steering committee completed its work in May 1995. The advisory panel, named the Citizens Advisory Panel to Alcoa (CAPA2) began meeting formally in June 1995. The CAPA2 generally met on a monthly basis unless there was no new information to provide to the group.

In August 1995, pursuant to the 1994 AOC, Alcoa released a community relations plan that outlined a program to address community concerns and keep citizens informed about and involved in remedial activities.

A Superfund Site Update summarizing the Dredge Island Engineering Evaluation/Cost Analysis was mailed to both EPA's and Alcoa's site mailing lists and a copy of the Administrative Record was placed in each of the three repositories. The repositories are located at the Calhoun County Library in Port Lavaca, Texas, at the TNRCC in Austin, Texas and at the EPA Region 6 office in Dallas, Texas. In addition, Alcoa made the Administrative Record available at the Alcoa Superfund Information Office located in Port Lavaca, Texas. An advertisement of the formal 30-day public comment period was placed in the Port Lavaca Wave on July 23, 26, and 29, 1997 and in the Victoria Advocate on July 26 and 28, 1997. A public information meeting was held July 29,1997 at the Bauer Exhibit Building in Port Lavaca, Texas. The formal public comment period, as advertised in the newspapers, ran from August 6, 1997, through September 5, 1997. Due to delays in getting the Administrative Record to the information repositories, the public comment period was extended until September 22, 1997. This notice was published in the Port Lavaca Wave and the Victoria Advocate.

The Proposed Plan of Action Fact Sheet summarizing the proposed remedial action for the Alcoa/Lavaca Bay site was mailed to the site mailing list and a copy of the Administrative Record was placed in each of the three repositories on June 21, 2001. The repositories are located at the Calhoun County Library in Port Lavaca, Texas, at the TNRCC in Austin, Texas and at the EPA Region 6 office in Dallas, Texas. An advertisement of the formal 30-day public comment period was placed in the Port Lavaca Wave on June 22 and 26, 2001 and in the Victoria Advocate on June 25, 2001.

On June 28, 2001, the Agency held a public meeting to discuss the Proposed Plan and to respond to oral comments. A transcript of this meeting and the comments along with the Agency's response to comments are included in the Administrative Record, which is part of this Record of Decision.

From June 21, 2001, the Agency held a 30-day public comment period to accept public comment on the alternatives presented in the Feasibility Study and the Proposed Plan and on any other documents previously released to the public. Two requests for an extension to the public comment period were submitted and the comment period was extended until August 29, 2001. During the public comment period for the Proposed Plan, only three entities submitted comments. In general, all comments supported the preferred alternative presented in the Proposed Plan, although there were comments regarding the risk assessment and monitoring. The responses to the comments are included in the Responsiveness Summary to this ROD.

SECTION 4
Scope and Role of Response Action

This is the only planned operable unit for the site and the selected remedial actions are intended to address all areas of concern at the Site. The scope of the remedial action for the Bay is to address all major ongoing sources of mercury and PAHs that result in the continued elevation of mercury and PAHs in surface sediments. The reduction of mercury in surface sediments will prevent further exposure of fish and shellfish to elevated mercury concentration from sediments. Once the ongoing sources of mercury are addressed, it is expected that mercury levels in fish and shellfish will decline over a period of time. Monitoring will be used to measure trends of mercury concentrations in fish and shellfish over time. For the CAPA and the Witco Area, the remedial actions will reduce the potential for direct exposure of human receptors to mercury and PAHs in soils.

A number of early response actions expected to help in the overall remediation strategy for the site were conducted during the RI/FS. A large-scale non-time critical removal action initiated in 1997 was completed at Dredge Island in the summer of 2001. The action has removed or immobilized mercury-contaminated materials that could enter the Bay System through surface water runoff. This action is expected to prevent an estimated 8 - 13 pounds of mercury per year from entering the Bay.

Several treatability studies that have addressed sources of mercury to the Bay have been conducted during the RI/FS. One treatability study removed mercury-contaminated sediments in the channel immediately adjacent to the CAPA which could be resuspended by ongoing barge and tug boat traffic. It is estimated that approximately 2,300 pounds of mercury were removed from the Lavaca Bay system during the treatability study. Another treatability study was conducted at CAPA to evaluate if the ongoing discharge of mercury-contaminated ground water can be prevented. The ground water system installed as an initial treatability study, which continues to operate, has been effective in reversing the gradient of mercury-contaminated ground water in the area of the CAPA. The CAPA ground water treatment system prevents an estimated 0.4 - 90 pounds of mercury per year from entering the Bay System.

SECTION 5
Site Characteristics

Physical Site Characteristics

The Alcoa PCO facility is situated adjacent to Lavaca Bay on the Texas Gulf Coast near the towns of Point Comfort (population 950) and Port Lavaca (population 10,900) as shown on Figure 1-1. Alcoa PCO, which includes the Plant and Dredge Island, is located adjacent to Lavaca Bay on the west and Cox Creek/Cox Lake on the east.

PCO currently comprises approximately 3,500 acres. The land areas not used for the process areas are for the most part used for the process lake system, which includes bauxite residue lakes, two dredge material placement lakes, and current and historic landfill areas. PCO also includes several docks, and Alcoa maintains a ship and barge channel from the Matagorda Ship Channel to the docks. The docks are used to deliver raw materials to PCO and to transport products to consumers. Dredge Island is an island in Lavaca Bay, west of the process area, that is approximately 420 acres. Dredge Island has historically been used to dispose of dredge material, gypsum, and chlor-alkali wastewater.

Lavaca Bay and Cox Bay are secondary bays of Matagorda Bay. Both are shallow bays, with average depths of four feet. Lavaca Bay has a surface area of approximately 64 square miles and Cox Bay has a surface area of approximately 8 square miles. Cox Cove includes an extensive marsh area located in the northwestern portion of Cox Bay. There are several oyster reefs and oyster beds throughout the area. Marshes and wetlands are found at several locations in the vicinity of the site.

Conceptual Site Model

The Conceptual Site Model (CSM) is a three-dimensional "picture" of site conditions that illustrates contaminant sources, release mechanisms, exposure pathways, migration routes, and potential human and ecological receptors. It documents current and potential future site conditions and shows what is known about human and environmental exposure through contaminant release and migration to potential receptors. The development of a CSM is an iterative task and is developed early in the site investigation process. As additional site data are collected, the model may be revised and refined to reflect the available data.

The preliminary CSMs for the human health risk assessment were developed using the findings from the Preliminary Site Characterization Report (PSCR). The objectives of the PSCR were to: (1) use existing site information and data to support identification, prioritization, and scoping of future Remedial Investigation (RI) activities; (2) identify areas of the site that may need to be addressed on an accelerated basis; and (3) preliminarily identify site- and technology-related data to support the evaluation of remedial alternatives in the Feasibility Study. The final conceptual site model used in the baseline human health risk assessment is presented in Figure 5-1.

For the ecological risk assessment, several conceptual site models were developed. Conceptual site models were developed for the Plant/Mainland area and for Lavaca Bay. The final conceptual site models used in the baseline ecological risk assessment are presented in Figures 5-2 through 5-6.

Investigative Approach

As described in the *Project Management Plan*, the investigations performed during the RI were risk-based (i.e., the technical approach was developed to investigate complete or potentially complete human health and ecological exposure pathways). The RI was based on the following concepts:

- The data quality objective process guided the data collection activities
- Nature and extent of contamination studies were conducted in the "Study Area"
- Existing chemical data collected from the site were combined with historical site information to develop initial lists of Chemicals of Potential Concern
- Risk Based Values (RBVs) were developed using conservative exposure assumptions, and were used for comparing site data to indicate potential risk to receptors;
- Data assessments where data were compared to RBVs or other risk-based criteria were used at various points during the RI to evaluate whether chemicals, effects, or other factors were indicative of potential risk to human health or ecological receptors in certain areas or pathways, and whether additional characterization was necessary.

Sampling Results

On March 16, 2000, the RI report for the site was approved by EPA. Numerous investigations of environmental media at the site, both in the Bay System and on the Plant/Mainland, were performed as part of the Superfund investigations. Primarily, these investigations included evaluations of Bay System water, biota, and sediment, and Plant/Mainland ground water and soil. The RI studies were conducted to evaluate: (1) the site environmental setting (i.e., physical characteristics of the site, such as meteorology, Bay hydrodynamics, geology, hydrogeology); (2) chemical characteristics of the site (i.e., nature and extent of contamination of environmental media, such as sediment, surface water, ground water, air, and biota) and the fate and transport of site chemicals within and across these media. The results of these studies have been presented in various separate submittals to EPA in the form of technical memoranda, data assessments, and data reports. While the sampling details and site-specific data are presented in those documents, the RI report summarizes their findings and incorporates them to present the causes and effects of chemical contamination in Lavaca Bay.

The RI was generally focused on three distinct but interrelated areas at the site: (1) the Bay System, which includes Lavaca Bay, Cox Bay, and parts of adjacent bays; (2) Dredge Island; and (3) the Plant/Mainland, which includes all process and other areas. Focused investigations were conducted at the former Witco Process Area and the CAPA. The primary findings from these investigations are discussed below.

BAY SYSTEM The Bay System portion of the RI consists of numerous studies that were conducted since mid-1995. These studies included the evaluation of physical, chemical and biological conditions in Lavaca Bay.

Biota Sampling

The RI evaluated the biological uptake processes occurring in Lavaca Bay in order to understand how and where methylmercury is produced. It is important to know where and how methylmercury is produced since the mercury measured in adult fish and shellfish tissue is mostly methylmercury.[2]

Results of the studies showed that the majority of methylmercury that enters the Lavaca Bay food chain is generated in the shallow (0-5 cm) sediments. Methylmercury can also be generated at depths below 5 cm. The investigation revealed that marshes typically had higher methylmercury concentrations than other habitats such as oyster reefs and open water areas. The data also indicated that total mercury concentrations in shallow sediments appear to be a significant factor controlling the production of methylmercury in the surface sediments. The higher methylmercury concentrations in sediment tended to correlate with higher total mercury concentrations in sediments.

Another study investigated the relationships between mercury levels in sediments and prey items. The prey items investigated were the ones that key upper trophic level species, such as red drum, prefer to feed on. Two key findings were identified from this study. First, prey items had the highest concentrations in areas with the highest total mercury surface sediment concentration. A second finding was that marsh habitats tended to have higher prey item concentrations than other habitats such as open water.

In addition to sampling prey items, information on mercury levels in adult fish and shellfish was obtained during the RI. The results from the fish and shellfish sampling followed the same trend as the prey item sampling. As fish and shellfish were captured in locations more distant from the plant, mercury concentrations in tissue tended to decrease. Table 5-1 presents the results of the finfish and shellfish sampling conducted during the RI.

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[2] Mercury is a naturally occurring element found in soils and bedrock. Mercury, principally inorganic mercury compounds, is released to environmental systems from the weathering and exposure of bedrock and from anthropogenic (man-made) sources. In aquatic systems, inorganic mercury compounds can become methylated by microorganisms to form organic complexes, such as methylmercury and dimethylmercury. Unlike the inorganic forms of mercury, methylmercury readily passes tissue membranes, is highly bioavailable through exposure and is very slowly eliminated from the body once ingested. In an aquatic environment, these properties may lead to the accumulation of high levels of methylmercury in the tissues of aquatic organisms, with significantly higher levels often found with increasing trophic levels in the aquatic food web.

Nature and Extent of Sediment Contamination

As part of the RI, extensive sediment sampling was conducted. Sediment samples were analyzed for a large number of contaminants. Based on the sampling results, only mercury and total PAHs were identified as COCs in Lavaca Bay.

Elevated surficial sediment (0-5 cm) mercury concentrations are restricted to the Industrial Channel vicinity, an area north of Dredge Island, and an area bordering the Open and Closed Area boundary southwest of Dredge Island. Figure 5-7 shows the surface mercury contours for Lavaca Bay. The extent of surficial mercury contamination is greatly reduced compared to mercury concentrations measured in 1973 and 1970. Areas with elevated total PAHs are found in the Alcoa Industrial Channel vicinity, and in the Witco Cut area. Figure 5-8 presents the surface sediment PAH concentrations in Lavaca Bay.

In addition to investigating surficial sediment mercury contamination, additional sampling was done to look at the depth profile of mercury contamination. In areas with low concentrations of mercury in surface sediments, the cores indicate that a cleaner layer of sediment has been deposited and that the Bay System is recovering through natural processes. It should be noted that the natural recovery process does not remove the mercury from the environment but rather reduces the concentrations within the biologically active zone. Elevated mercury levels could still exist at depth.

Three different studies were used to determine the vertical extent of mercury contamination in Lavaca Bay. Although the mercury concentrations vary greatly with depth and with distance from the plant, some trends were evident. The peak concentrations measured at depth are highest in the area immediately in front of the CAPA shoreline and decrease with distance away from the plant. Also, at sampling locations more distant from the plant, there tends to be a greater amount of clean sediment covering the elevated at-depth levels. The Radiochemistry study identified areas where surface mercury concentrations are higher than what could occur based on historical releases from CAPA. In these areas, it was concluded that an ongoing source or sources was responsible for the continued elevated mercury levels in surface sediments.

Role of Ongoing Sources

Findings of the RI indicated that ongoing sources play a significant role in maintaining elevated levels of mercury and PAHs in surficial sediments. The elevated levels of mercury occur in areas where the greatest impacts to biota were observed. Based on this finding, a number of studies were conducted to identify ongoing sources of mercury and PAHs to the Lavaca Bay system. Four primary ongoing sources were identified by the additional field investigations.

CAPA Ground Water: The CAPA was investigated separately as a focused investigation during the RI. A more in-depth discussion of the CAPA focused investigation is presented on page 5-12 of the Record of Decision. Potential mercury transport via ground water flux to the Bay System was conservatively estimated using several methods. The various methods produced an estimated range of flux values of 0.4 to 90 pounds per year. Based on the estimated potential loading of mercury to the Bay System, treatability testing was performed to develop alternatives that address the potential migration of mercury in ground water to the Bay System.

As discussed earlier, Alcoa installed a ground water extraction system at CAPA in 1998 as part of a treatability study. The extraction system was installed to evaluate the effectiveness of hydraulically controlling the discharge of mercury-contaminated ground water from CAPA into Lavaca Bay. Alcoa continues to operate the extraction system that has been successful in reversing the ground water gradient in the area of CAPA. These efforts appear to have resulted in significant decreases in terms of impacts to Lavaca Bay from dissolved-phase contaminants.

Dredge Island Run-off: Mercury was identified in materials that have historically been placed on Dredge Island. Soils and surface water runoff contained mercury at concentrations that contributed to the ongoing release of mercury to the Bay system. The primary source of the release occurred mainly on the north side of Dredge Island. An estimated 8 to 13 pounds of mercury per year entered Lavaca Bay as a result of runoff. As discussed earlier, a non-time critical removal action was completed at Dredge Island. As part of the removal action, the soils and sediments with elevated mercury levels were removed and relocated to fortified placement areas on the island.

Sediment Sources: There are areas of Lavaca Bay that have elevated concentrations of mercury in surface sediments. These areas with elevated levels can be resuspended by barge and ship traffic. Once the sediments are resuspended they can be transported by water currents to areas where mercury can become methylated and significant biota uptake occurs. The highest surface sediment mercury concentrations were along the CAPA shoreline. In general, the sediments in this area ranged from 10-50 ppm mercury, although there were individual samples that were higher than 100 ppm. The mercury-contaminated sediments in front of CAPA were dredged as part of a dredging treatability study in August 1998.

Another significant source contributing to the surface sediment concentration north of Dredge Island is the sediments in the Industrial Channel (including the Witco Harbor). These areas have been dredged infrequently since discharge of CAPA wastewater to Lavaca Bay stopped. These sediments can also be resuspended by tug and barge activities in the channel. Once resuspended, the sediments can be redeposited north of Dredge Island by prevailing water currents.

Witco Processing Area: A focused investigation was conducted at the Witco Processing Area during 1998 and 1999. It is believed that the primary mechanism for PAH discharge into Lavaca Bay is through the movement of a dense non-aqueous phase liquid (DNAPL)[3] along the fill layer based near the former Coal Tar Tank Farm and directly into the Bay sediments. A more in-depth discussion of the Witco focused investigation is presented on page 5-14 of the Record of Decision.

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[3] A DNAPL is a liquid that weighs more than water and does not dissolve easily in water. Therefore, a DNAPL forms a second layer below the ground water.

Nature and Extent of Water Column Contamination

Surface water investigations indicated that all chemicals of potential concern for surface water, with the exception of mercury, were below risk-based screening levels. The area along the CAPA shoreline and to the east and northeast of Dredge Island were identified as areas for locating potential ongoing sources of mercury to the surface water in Lavaca Bay. A sampling event was conducted in September 1997 in Alcoa's Industrial Channel to better understand the potential sources in the area. The highest concentrations of mercury in surface water (25 nanograms per liter) were observed in front of the CAPA shoreline. A focused CAPA shoreline surface water sampling program was initiated to examine this area in detail.

Several focused surface water sampling events were conducted by the CAPA shoreline. The first sampling event, which was conducted before the CAPA ground water extraction system was installed (January 8, 1998), clearly indicated that mercury enters Lavaca Bay from the CAPA subsurface. Unfiltered total mercury concentrations ranged from 11.9 nanograms per liter (ng/l) at the bottom of Lavaca Bay at the most distant station to 322 ng/l at the middle depth. In addition to elevated mercury concentrations, carbon tetrachloride was detected at nearly all stations and depths. The highest concentrations measured were 9.1 to 11.5 microgram per liter (ug/l). See Figure 5-9.

Following installation of the ground water extraction system at the CAPA, additional surface water samples were collected to determine if ground water containment had occurred. As detailed in the RI report, both mercury and carbon tetrachloride concentrations were significantly decreased by operation of the ground water extraction and treatment system. During the latest round of sampling (June 10, 1998) the maximum unfiltered mercury concentration reported was 53 ng/l (2.5 ng/l filtered) and most unfiltered mercury concentrations were less than 30 ng/l. Carbon tetrachloride was not detected in any samples above the analytical detection limit (see Figure 5-10). The ground water extraction and treatment system appears to be successful in reversing the ground water gradient in the area of CAPA. These efforts appear to have resulted in significant decreases in terms of impacts to Lavaca Bay from dissolved-phase contamination. As discussed in the remedial alternatives for the bay, additional monitoring of surface water will be conducted.

Future Scenarios / Modeling Studies

In addition to the RI studies that defined the nature and extent of contamination in the study area, other studies focused on understanding future conditions. One of these studies, the Radiochemistry Study, provided an understanding of sedimentation rates in Lavaca Bay and helped predict future trends in surface sediment concentrations. Also, a model was developed that evaluated the effect of hurricanes on sediment scour and redistribution in Lavaca Bay.

Sediment Radiochemistry: The rate of sediment burial in Lavaca Bay was evaluated at 18 locations during the RI. The burial rates were developed by measuring both naturally occurring and anthropogenic radioactivity levels and mercury concentrations in sediment cores. Based on the results of this study it was determined that the Bay is a depositional environment and that the rate of sedimentation ranges from 0.3 to 2.0 cm/yr. Although the data indicate that there is more sedimentation than erosion in the bay, the rates of deposition vary by area. The highest sedimentation rates occurred in the Cox Bay area and are influenced by the Corps of Engineers' discharge of maintenance material from the Matagorda ship channel in that area. The lowest rates were measured southwest of Dredge Island, and are most likely due to stronger currents and shallower water depths in this area. These sedimentation rates can be used to calculate half-life values (the amount of time it takes to reduce the concentration by 50 percent) for surface mercury concentrations. Those data can be used to predict the rate of sediment recovery that will occur in the future once ongoing sources have been controlled at the site. The estimated half lives for mercury in sediment ranges from 1 to 9 years.

Hurricane Scour Model: The RI collected data on sediment grain size, surface mercury concentrations, and at-depth mercury concentrations throughout Lavaca Bay. These data were used in a model to understand the effects of a major hurricane on the redistribution of mercury in Lavaca Bay. The model predicted currents and water level changes during a storm, the depth of sediment scour that would occur, and the redistribution of sediments that would happen as the storm passed. These predictions, along with the mercury concentration data, provide an assessment of how surface mercury concentrations should change as the result of a hurricane.

The storm scour model predicted an average net erosion of 3 cm (1.2 inches), and only 2 percent of the bay would have scour depths greater than 10 cm (4 inches). Erosion depths are predicted to be less than 5 cm (2 inches) in about 70 percent of the bay. This is much shallower than the peak concentration of mercury, which has been buried through sedimentation processes.

A sensitivity analysis of the major model inputs was conducted. The sensitivity analysis included evaluation of the impacts of different hurricane tracks, significant reductions in estimated sedimentation due to freshwater inflow, increasing the surficial sediment mix depth, and modifying the sediment resuspension potential parameter. In addition, the model was run with a 20 percent increase in wind speed. The results of the sensitivity analysis indicated negligible change in surface sediments, similar to the results for the design storm model.

The model provides a useful prediction of average scour conditions during a storm event. However, the nature of a hurricane force storm produces conditions that include large debris (i.e., telephone poles and pilings) traveling at high velocities in the water column and near the sediment surface. Such debris may scour localized areas to greater depths than the average conditions predicted by the model's simulation of wave and current generated scour. Although debris related scour is a potential in localized portions of the bay, natural recovery will serve to minimize the effect of any sediment re-suspension that might occur as a result of these storm induced conditions. Further details about the modeling can be found in the 1998 *"Sediment Transport Model - Hurricane Scour Report"*.

DREDGE ISLAND A focused investigation on Dredge Island was initiated in 1996 to evaluate the potential for a non-time critical removal action. The focused investigation evaluated: (1) the nature and extent of mercury levels in soil; (2) the potential for mercury and PAHs to migrate through ground water into Lavaca Bay; (3) the potential for surface runoff from the island to be a source of mercury in Lavaca Bay; and (4) the geotechnical properties of soil.

A total of 271 samples were collected from 79 borings. The mercury results for Dredge Island are presented on Figure 3.3-4 of the RI Report. A computer model of Dredge Island was developed based on the historic construction sequence of the Island. Mercury data was then imported into the electronic model for three-dimensional contouring. The results of the three-dimensional modeling are presented in the March 1997 "*Surface Runoff, Sediments and Groundwater Investigation*" Data Report.

Neither mercury nor PAHs were detected in ground water below Dredge Island above the detection limit. Based on these findings, no significant pathway for significant loading of ground water beneath Dredge Island to the Bay System exists.

The geotechnical evaluation showed that there were materials on the Island suitable for use in constructing dikes as part of the removal action. Also, as discussed earlier in the plan, surface run-off of mercury contaminated soil was identified as a source of mercury in Lavaca Bay sediments.

Based on these findings, an Action Memorandum was signed by EPA in April 1998, for Alcoa to conduct a non-time critical removal action. The primary objective of the removal action was to minimize the potential for the release of mercury-contaminated material located on the Island in the event that a severe storm (i.e., hurricane) strikes the area. Also, the completed removal action will minimize the erosion of mercury-contaminated soils, outside the containment dikes, into Lavaca Bay. During the removal action, contaminated soil and dredge spoil on the island were relocated and put in placement areas on the island. Also, the island was fortified to protect against potential damage during a severe storm event such as a hurricane.

PLANT/MAINLAND INVESTIGATIONS

The Plant/Mainland portion of the RI evaluated on-site soils, on-site air, off-site air, off-site discharge of ground water to surface water and off-site discharge of ground water to potentially potable ground water. Focused investigations were conducted at the Chlor-alkali Process Area (CAPA), Site I Landfill and the former Witco Area. Site-wide investigations conducted were the Surface Soils Investigation, Interior Ground Water Reconnaissance Investigation, and Plant/Mainland Ground Water Investigation.

SITEWIDE INVESTIGATIONS

Ground Water: Several ground water zones occur at various depths across the site and are referred to as Zones A, B, and C (from shallowest to deepest). Zone A is usually present about 0 to 5 feet above sea level and has Beaumont Clay above and below it. Zone B is separated from Zone A by Beaumont Clay. Zone B occurs around 20 to 30 feet below sea level and is between 1 foot and 20 feet in thickness. Zone C is separated from Zone B by Beaumont Clay and is the deepest ground water zone at the plant. The thickness of Zone C is unknown, but exceeds 50 feet at the CAPA. Numerous ground water studies were conducted during the RI to evaluate the transport of contaminants from the Alcoa plant into the Lavaca Bay system. The RI also evaluated current ground water discharge conditions and future conditions.

Plant/Mainland Perimeter Study:
The Plant/Mainland study evaluated ground water flow to perimeter areas of the site with the exception of the CAPA, Site I Landfill and Witco. These areas were evaluated separately in focused investigations and are discussed later in this ROD. During the Plant/Mainland investigation, 22 wells were sampled to evaluate ground water discharge to the Bay System. Six wells were sampled to evaluate ground water discharge to Cox Creek/Lake. The wells were sampled for the Bay System chemicals of potential concern (COPCs) which are mercury and PAHs. Some of the samples were also analyzed for chemicals present in Potential Source Areas (PSAs) upgradient of the monitoring wells.

In areas where the ground water flows into Lavaca Bay and is not considered a potential source of drinking water, the ground water samples were analyzed for mercury and PAHs. The sampling results were compared to screening criteria which were developed by multiplying the Federal Maximum Contaminant Level times a dilution factor of 100. If the ground water was considered a potential source of drinking water, the samples were analyzed for additional chemicals and compared directly to Federal Maximum Contaminant Levels under the Safe Drinking Water Act. Finally, if the ground water flows toward Cox Lake/Creek (fresh water conditions), the sampling results were compared to freshwater ambient water quality criteria.

For the areas where ground water discharges to the Bay System, mercury was detected at very low concentrations in Zone A and Zone B, while PAHs were detected at very low concentrations in Zone A. A model was used to determine whether ground water flow across the Plant/Mainland perimeter (other than from CAPA) is a significant source of mercury to the Bay System. The modeling results show that for all perimeter areas, except CAPA and Witco, the estimated mercury loading is 0.003 pounds per year. This estimate shows that perimeter loading is significantly less than the mercury loading from CAPA, which is predicted to range from 0.4-90 pounds per year. Therefore, it was determined that the 0.003 pounds per year perimeter ground water flow into the Bay System was not an area of concern because the amount of loading is insignificant when compared to other mercury sources. The perimeter ground water flow of mercury is not expected to impact the recovery of Lavaca Bay.

Ground water discharge to potentially potable ground water receptors is not a currently complete exposure pathway. A search of the state water well records indicated that there is currently no use of the shallow ground water from the zones investigated during the RI. A well survey indicates that there are no water wells in Point Comfort. Current ground water discharge to off-site potentially potable ground water receptors was evaluated by sampling wells along the Northern Perimeter. Results from the sampling showed that mercury and PAHs were not detected above the detection level. In one well, arsenic and fluoride exceeded the federal Maximum Contaminant Level (MCL). As discussed above, shallow ground water has not been used in the past, is not used now, nor will it likely be used in the future (due to land use restrictions and poor water quality). Therefore, this pathway was determined to be incomplete and did not require further investigation.

Although the potential potable ground water user pathway is incomplete, ground water flow for the northern perimeter eventually discharges to Lavaca Bay north of the causeway. Since the fluoride concentration was above the aquatic screening level, a ground water model was used to estimate its concentration when it enters Lavaca Bay. The estimated concentration of fluoride that enters Lavaca Bay (0.68 mg/L) was compared to ecological risk-based criteria in the BLRA. Results of the comparison are discussed in the "Summary of Site Risks" section of the ROD.

Eight ground water samples from wells along the eastern perimeter were analyzed for mercury, PAHs, and compounds associated with upgradient potential source areas (PSAs). The sampling results were compared to freshwater aquatic standards or other risk-based criteria. Mercury was not detected in any of the samples and PAH concentrations were not above the detection limits. One well (PEO6A) had concentrations of arsenic, cyanide, and fluoride above screening levels. A ground water model was used to evaluate the potential future discharge of these contaminants into Cox Creek/Lake. The estimated concentrations for arsenic (0.03 mg/L), cyanide (0.002 mg/L), and fluoride (2.15 mg/L) determined by the ground water model were compared to risk-based criteria in the Baseline Risk Assessment (BLRA). Results of the comparison are discussed in the "Summary of Site Risks" section of the ROD.

<u>Interior Ground Water Reconnaissance Investigation (IGRI):</u>
The IGRI was conducted to evaluate if contaminants, other than the Bay System COPCs (mercury and PAHs), could move from historic interior PSAs to the Bay System. For the IGRI, PSA-specific chemicals were measured in ground water samples collected upgradient and downgradient of 17 PSAs. Sampling results were used to determine the presence or absence of potential contamination in the ground water transport pathway at that PSA.

None of the 17 PSA areas had concentrations of mercury or PAHs that exceeded the risk based screening values. Eight of the areas had concentrations of one or more chemicals that exceeded their risk based concentrations. For those PSAs that exceeded screening levels, ground water modeling was performed to evaluate the potential for releases of ground water to pose an unacceptable risk to human health or the environment. The modeling results showed that only contaminants present at the Municipal Landfill and Cametco area could likely migrate into Lavaca Bay. The concentrations from the ground water model were evaluated in the baseline risk assessment.

<u>Surface Soils:</u> The Surface Soil Investigation (SSI) conducted in 1997 consisted of sampling at 19 PSAs and background areas. Sampling areas were chosen by focusing on areas with observed staining or areas that are known or suspected to have the highest potential for contamination. Results from the sampling were compared to screening values (Risk Based Values) that were determined to be protective of human health and the environment. If the sampling results for a PSA were above the screening value, that PSA would be evaluated further in the BLRA.

Surficial soil samples exceeded human health screening values at nine PSAs while ecological screening values were exceeded at three PSAs. The COPCs at the PSAs were PAHs, polychlorinated biphenyls (PCBs) and vinyl chloride. Table 5-2 presents a summary of surficial soil concentrations for the PSAs that were evaluated in the BLRA.

Air: Three studies were conducted to evaluate the off-site mercury concentrations. The first study was conducted in May 1995 and measured both vapor and particulate mercury concentrations at three locations. The three locations were in the city of Point Comfort, midway between Point Comfort and the PCO Plant, and south of the PCO plant. None of the daily ambient air samples collected over 15 days at any of the three sites showed a detectable level of mercury.

The CAPA focused investigation indicated the presence of detectable concentrations of airborne mercury above and downwind of CAPA. Measured mercury concentrations at the site exceed a risk-based value for residential exposures, but were below workplace exposures set by the Mine Safety and Health Administration. As discussed earlier, mercury was not detected in offsite locations. Another study was conducted to determine if the atmospheric deposition of mercury was a significant contributor of mercury to the Closed Area of Lavaca Bay. One year of data was collected at three sites in or near Lavaca Bay and at two background sites. The results indicate that mercury deposition from the ambient air into Lavaca Bay may be elevated above background levels. However, the amount of mercury possibly entering the Closed Area from atmospheric deposition is small relative to other historic sources of mercury to Lavaca Bay.

FOCUSED INVESTIGATIONS

Site I Landfill: A focused investigation was conducted at the Site I Landfill in 1996 and 1997 to evaluate if ground water from the landfill was impacting Cox Marsh or Cox Bay. Eleven monitoring wells were installed as part of the investigation and were analyzed for mercury and PAHs. The results of the ground water investigation showed that a completed exposure pathway for Bay System COPCs (mercury and PAHs) to receptors in Cox Marsh or Cox Bay did not exist. Therefore, the Site I Landfill was eliminated from further evaluation during the RI.

CAPA: A focused investigation was conducted at the chlor-alkali process area from December 1996 to June 1997 which included sampling and analysis of samples of air, surface and subsurface soils, and ground water. Additional field work has occurred at the CAPA between 1997 and 2000.

Ground Water Investigation: The ground water-bearing units at CAPA have been subdivided into three principal water-bearing zones: Zone A, Zone B, and Zone C. Zone A is the uppermost water-bearing unit and was typically about 2 to 3 feet thick at depths of approximately 14 to 17 feet below ground level (approximately 2 to -1 feet below sea level). Zone B which occurs about 26 to 40 feet below ground level (approximately -10 to -24 feet below sea level), is separated from Zone A by a clay layer and is in physical contact with the bottom of Lavaca Bay offshore of CAPA due to dredging of the navigation channel. Therefore, Zone B represents a zone of direct discharge from Zone B ground water to Lavaca Bay. In most areas at CAPA, Zone B has been subdivided into an upper member (Zone B_1) and a lower member (Zone B_2) separated by a fine-grained silt and clay unit. The combined thickness of Zone B_1 and B_2 ranges from less than 6 feet south of Building R-300 to more than 20 feet thick west of R-300. Zone C occurs 65 to 80 feet below ground level (approximately -49 to -66 feet below sea level) and is separated from Zone B by approximately 17 to 26 feet of clay. (See Figure 5-11) Ground water in the shallow zones in the area of CAPA is not considered suitable for drinking water due to high natural salinity.

Total dissolved mercury concentrations in Zone B ground water ranged from below the detection limit to 6.6 milligrams/liter (or parts per million). (See Figures 5-12 and 5-13) Observations of core samples showed that visible elemental mercury DNAPL occurs at the base of Zone B and in the uppermost portion of clay underlying Zone B at two locations immediately west of former Building R-300. An additional drilling program was conducted at the CAPA during May 2000. The purpose of the drilling program was to evaluate the potential presence of mercury DNAPL based on anomalies identified from surface geophysical surveys conducted during April 2000. Nine new borings were drilled during the program and were generally located to coincide with geophysical anomalies west of former Building R-300. Visible mercury was identified in four boreholes. The western limit of visible mercury DNAPL is in the vicinity of wells CAO47B, CAO45B and CAP9264. Results of the drilling program confirm that the mercury DNAPL has not migrated westward from the Building R-300 area. Also, a DNAPL which was mainly composed of carbon tetrachloride was detected in monitoring wells. Based on analyses of a carbon tetrachloride DNAPL sample, mercury concentrations in the DNAPL ranged from 3.1 mg/kg to 7.4 mg/kg.

As discussed earlier, a ground water extraction and treatment system was installed at CAPA to evaluate the effectiveness of Zone B ground water extraction as a means for hydraulic control. The system has been operating since 1998 and has been successful in reversing the ground water gradient in the area of CAPA. Based on the weight-of-evidence, neither mercury nor carbon tetrachloride DNAPL are believed to be in contact with Lavaca Bay. Carbon tetrachloride is a minimal risk to human and ecological receptors when compared to mercury. Although monitoring for carbon tetrachloride will continue, no specific remedial action objectives are being developed for carbon tetrachloride as it is anticipated that actions to address mercury in CAPA ground water and DNAPL will also address carbon tetrachloride. These efforts appear to have resulted in significant decreases in terms of impacts to Lavaca Bay from dissolved-phase contaminants. The ground water extraction system is expected to remove an estimated 0.4 to 90 pounds/year of mercury that otherwise would flow from CAPA ground water into Lavaca Bay. Also, approximately 1,100 pounds of mercury DNAPL were removed during the treatability study.

Soils Investigation: In this investigation shallow soils (less than 4 feet in depth), deeper soils (below 4 feet and to the top of the A Zone), and soils from the water-bearing zones were sampled and analyzed. Free elemental mercury and elevated mercury concentrations (greater than 1,000 ppm) were observed in soil samples within the footprint of Building R-300. Building R-300 is the location of the mercury cells that were used in the production of caustic and chlorine. Visible elemental mercury and/or elevated total mercury concentrations were encountered in soils within the Building R-300 footprint as deep as 18 feet below grade. Elemental mercury was also observed at the base of the Zone B unit, and in clay samples immediately below the base of Zone B in two borings drilled near a mercury collection trench just west of Building R-300. Concentrations of mercury outside the footprint of the R-300 building were generally less than the risk based screening value.

Air Investigation: Air sampling was conducted at five sites in and around the CAPA. The results from the sampling were compared to Occupational Safety & Health Administration (OSHA) permissible levels (50 $\mu g/m^3$), Mine Safety & Health Administration (MSHA) permissible levels (50 $\mu g/m^3$), and a residential RBV of 0.3 $\mu g/m^3$. Mercury concentrations from the interior of CAPA had concentrations ranging from 0.52 $\mu g/m^3$ to 3.34 $\mu g/m^3$. Mercury concentrations in upwind samples were very low, ranging from nondetectable levels to 0.023 $\mu g/m^3$. Concentrations of mercury downwind of CAPA ranged from 0.203 $\mu g/m^3$ to 0.786 $\mu g/m^3$. Measured mercury air concentrations exceeded the RBV for residential exposure, but were well below the OSHA and MSHA permissible air concentrations. Alcoa conducted a study in May 1995 to evaluate offsite ambient mercury concentrations. Both vapor and particulate mercury concentrations were measured at three locations. None of the daily air samples collected over 15 days at any of the three sites showed a detectable level of mercury. Because concentrations of mercury were below the OSHA and MSHA permissible levels, no further evaluation of the air inhalation pathway was conducted.

Witco - A focused investigation was conducted at the Witco Area during 1998 and 1999 to: (1) determine the potential discharge of PAHs and mercury in ground water to the Bay System: (2) identify and delineate the extent of DNAPL; and (3) define the potential for ground water and DNAPL migrating from the Witco Area to present an ongoing source of PAHs to Lavaca Bay sediments. The soils at Witco were investigated as part of the sitewide soils investigation. The Witco Area consists of two primary areas: (1) the Witco Processing Area; and (2) the former Witco Coal Tar Tank Farm Area.

Ground water - A two-phase investigation was conducted at the Witco Area. The Phase 1 investigation identified the presence of elevated PAH concentrations in ground water. One objective of the Phase 2 investigation was to further characterize the ground water pathway. Another objective was to determine the potential for ground water or DNAPLs migrating from the Witco Area to present an ongoing source of PAHs to the Bay System. The focused investigation included the drilling of 11 soil borings, installation of temporary and permanent monitoring wells in Zones A, B, and C, and a DNAPL observation well.

During Phase 2, ground water sampling showed that mercury concentrations were below detection levels with the exception of one sample that was just slightly above the detection level. Therefore, it was determined that the Witco area was not a source for release of mercury to the Bay System.

Total PAH concentrations in samples from Zone B wells ranged from below detection limits to 6.95 mg/l. In general, the highest concentrations of PAH detected in ground water were from wells near areas where PAH DNAPL was detected. PAH DNAPL was observed in several borings during the Phase 1 and Phase 2 investigations. The data indicate that PAH DNAPL is present at the former Coal Tar Tank Farm area and an area at the north end of the former Witco Process Area. No significant PAH DNAPL accumulations have been identified in the former Witco Process Areas.

Near the Coal Tar Tank Farm, PAH DNAPL was observed at the base of the fill layer where it contacts the original shoreline. PAH DNAPL was not observed in Zone B in the Coal Tar Tank Farm area. During inspection of the shoreline area to the southwest of the Coal Tar Tank Farm, an area of dark-stained, oily soil/sediment was observed. It is believed that the primary mechanism for PAH discharge to Lavaca Bay is through the movement of PAH DNAPL along the fill base to the west of the former Coal Tar Tank Farm and directly into the Bay sediments. Sediment sampling has shown that PAH concentrations in sediments near the Witco Area are elevated. In addition, PAH concentrations in surface sediments are elevated, indicating that an ongoing source of PAHs may be present.

Table 5-1
Summary of Methylmercury Concentrations in Fish and Shellfish

	Number of Samples	Minimum (mg/Kg)	Maximum (mg/Kg)	Arithmetic Mean (mg/Kg)
Closed Area				
Red Drum	290	0.08	4.45	1.22
Spotted Seatrout	51	0.18	1.49	0.53
Southern Flounder	9	0.16	1.21	0.41
Black Drum	274	0.02	3.76	0.71
Other Finfish [1]	61	0.07	1.72	0.42
Oysters	25	0.03	0.26	0.10
Blue Crabs	543	0.03	2.54	0.47
Shrimp	17	0.00	0.14	0.04
By-catch - Finfish [2]	149	0.03	3.76	0.45
By-catch - Shellfish [3]	543	0.03	2.54	0.47
Open Area				
Red Drum	87	0.06	1.30	0.40
Spotted Seatrout	29	0.09	0.88	0.31
Southern Flounder	12	0.03	0.32	0.14
Black Drum	104	0.02	1.10	0.28
Other Finfish [1]	93	0.01	1.35	0.18
Oysters	25	0.01	0.05	0.03
Blue Crabs	118	0.03	0.52	0.18
Shrimp	6	0.01	0.06	0.02
By-catch - Finfish [2]	113	0.01	0.60	0.14
By-catch - Shellfish [3]	118	0.03	0.52	0.18
Other Bays				
Red Drum	6	0.06	0.19	0.13
Spotted Seatrout	5	0.09	0.14	0.11
Southern Flounder	3	0.03	0.07	0.05
Black Drum	6	0.02	0.60	0.13
Other finfish [1]	40	0.01	0.32	0.06
Oysters	22	0.00	0.01	0.00
Blue Crabs	13	0.00	0.20	0.06
Shrimp	22	0.00	0.01	0.00
By-catch - Finfish [2]	113	0.01	0.60	0.05
By-catch - Shellfish [3]	13	0.00	0.20	0.06

1 Includes sand seatrout, gaftopsail catfish, Atlantic croaker, and sheepshead
2 Finfish average for bycatch based on: 3.3% black drum, 84.1% flounder, and 12.6% sheepshead
3 Shellfish is assumed to be 100% blue crab since relatively little shrimp and no oysters were reportedly consumed as by-catch by commercial shrimpers

Table 5-2
Summary Concentration Data
Surficial Soil Investigation

	Range of Concentration (minimum - maximum)				
Area	Total PAH (ppm)	Arsenic (ppm)	PCB-1248 (ppm)	PCB-1254 (ppm)	Vinyl Chloride (ppm)
Smelter Area	6.9 - 487.9	2.1 - 18.7	ND	ND - 3380	ND
Construction Debris Landfill	0.7 - 17.8	1.5 - 2.4	NA	NA	NA
Mainland Shoreline No. 3	196.9 - 301.2	NA	NA	NA	NA
Witco	25.0 - 8341.8	4.6 - 4.9	ND	ND	ND - 5.1
Waste Oil Management Area	ND - 0.2	2.25 - 2.27	96.2 - 3340	ND	ND
Enron Tanks	124 - 3423	2.6	ND	ND	ND
Fire Training Area	ND - 5.2	1.1 - 2.4	ND	ND	ND
Exxon Station	0.8 - 6.1	3.8 - 4.2	NA	NA	ND
CF Bean Property	2.3 - 27.7	3.1 - 19.3	ND	ND	ND

Figure 5-1
CONCEPTUAL SITE MODEL
PLANT/MAINLAND, DREDGE ISLAND, CHLOR ALKALI PROCESS AREA AND LAVACA BAY

SOURCE MATERIAL	RELEASE MECHANISM	ENVIRONMENTAL TRANSPORT & FATE	EXPOSURE ROUTE	CURRENT RECEPTOR		POTENTIAL FUTURE RECEPTOR	
				Maintenance Worker	Trespassing Youth	Industrial Worker	Construction Worker
Soil	Volatilization to Air	Air Dispersion	Inhalation of ambient air	U	U	U	U
Soil	Fugitive Dust Generation	Air Dispersion	Inhalation of ambient air	U	U	U	U
Soil			Direct Skin Contact or Incidental Ingestion	U	U	U	U

SOURCE MATERIAL	RELEASE MECHANISM	ENVIRONMENTAL TRANSPORT & FATE	EXPOSURE ROUTE	Recreational Angler	Commercial Shrimper
Sediments		Uptake by Fish	Ingestion of Fish	U	U
Sediments			Direct Skin Contact	U	

U - Indicates potential human receptor for complete migration pathway

Figure 5-2
Terrestrial Ecosystem Conceptual Site Model for Mercury

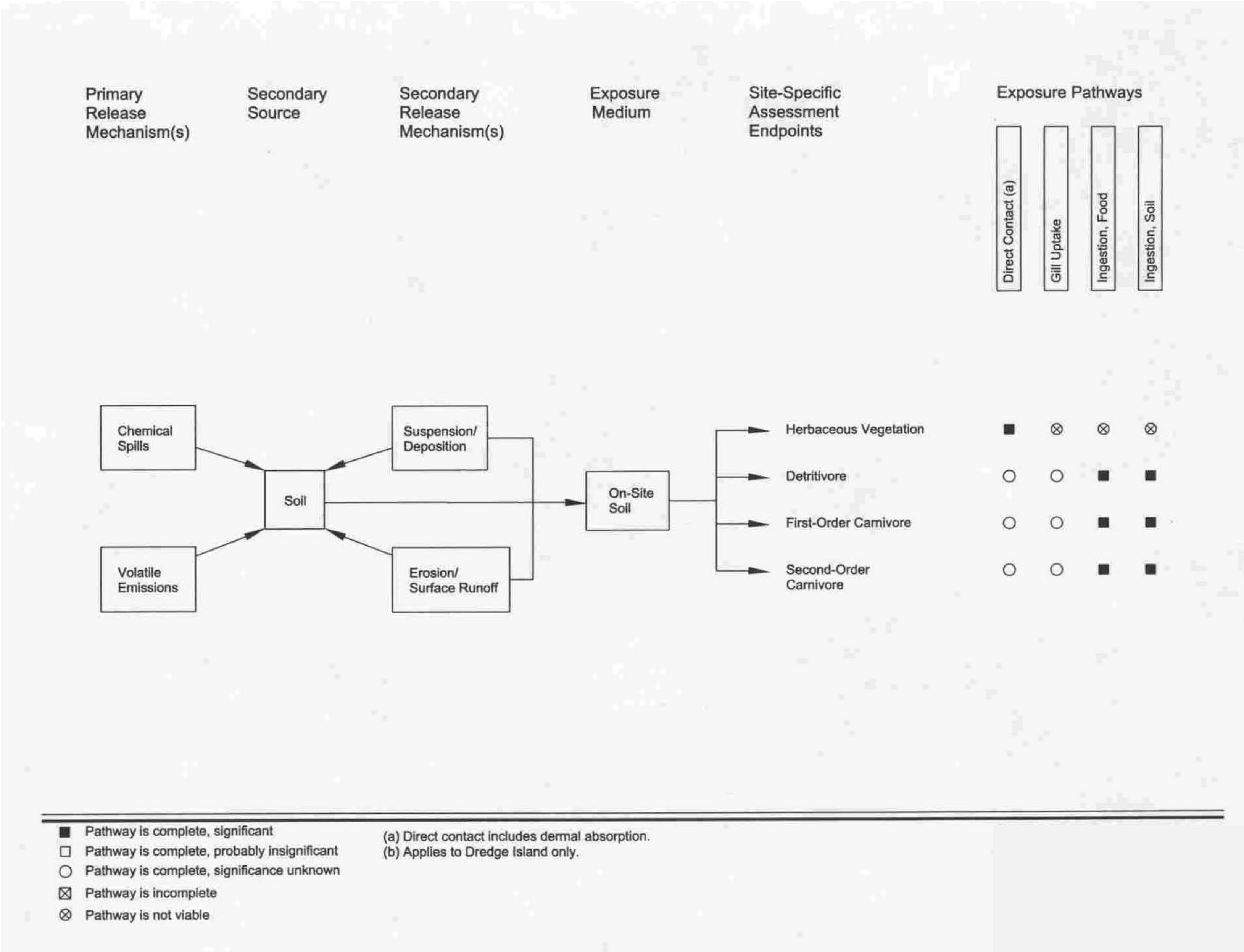


Figure 5-3
Terrestrial Ecosystem Conceptual Site Model for Other Metals

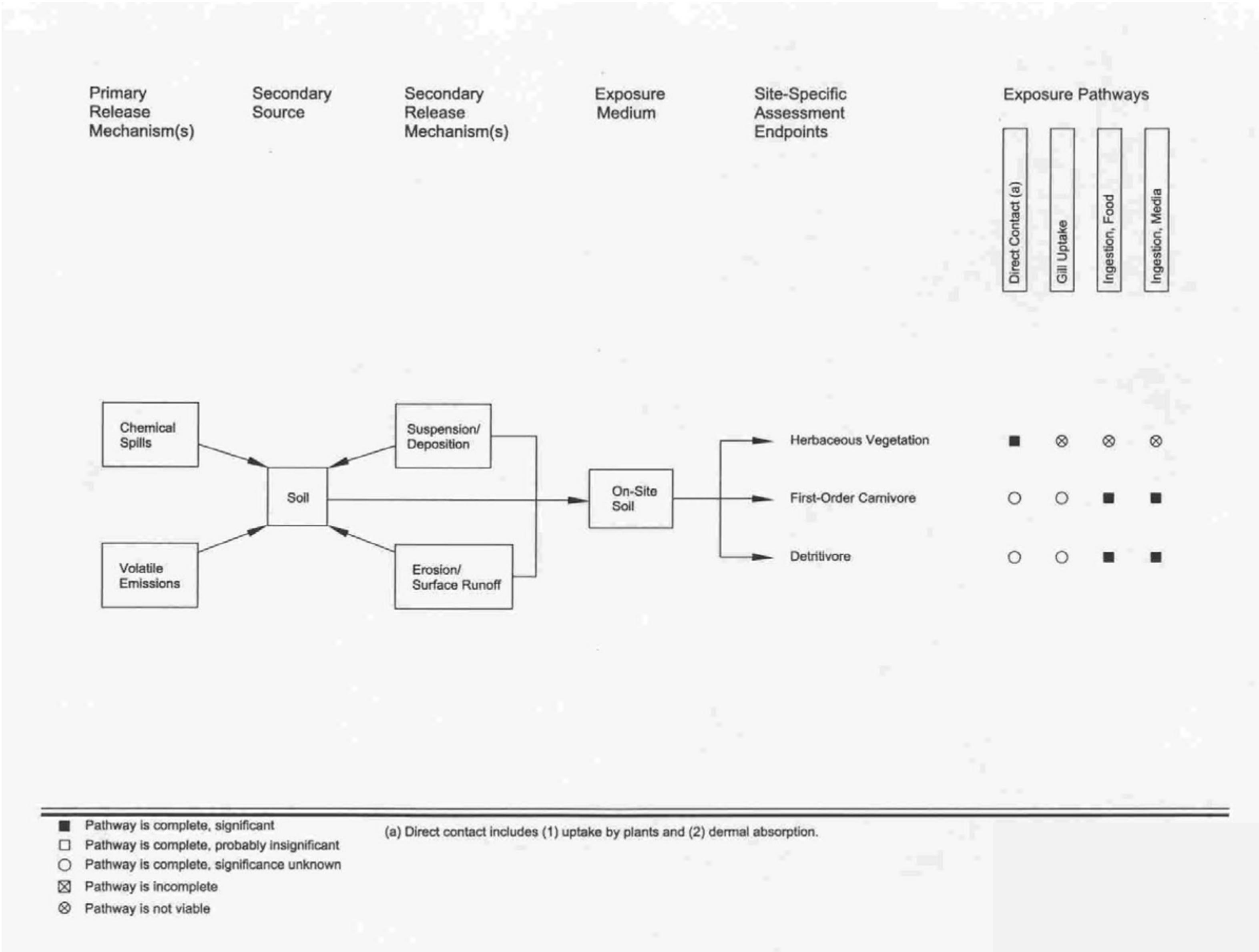


Figure 5-4
Terrestrial Ecosystem Conceptual Site Model for HPAH

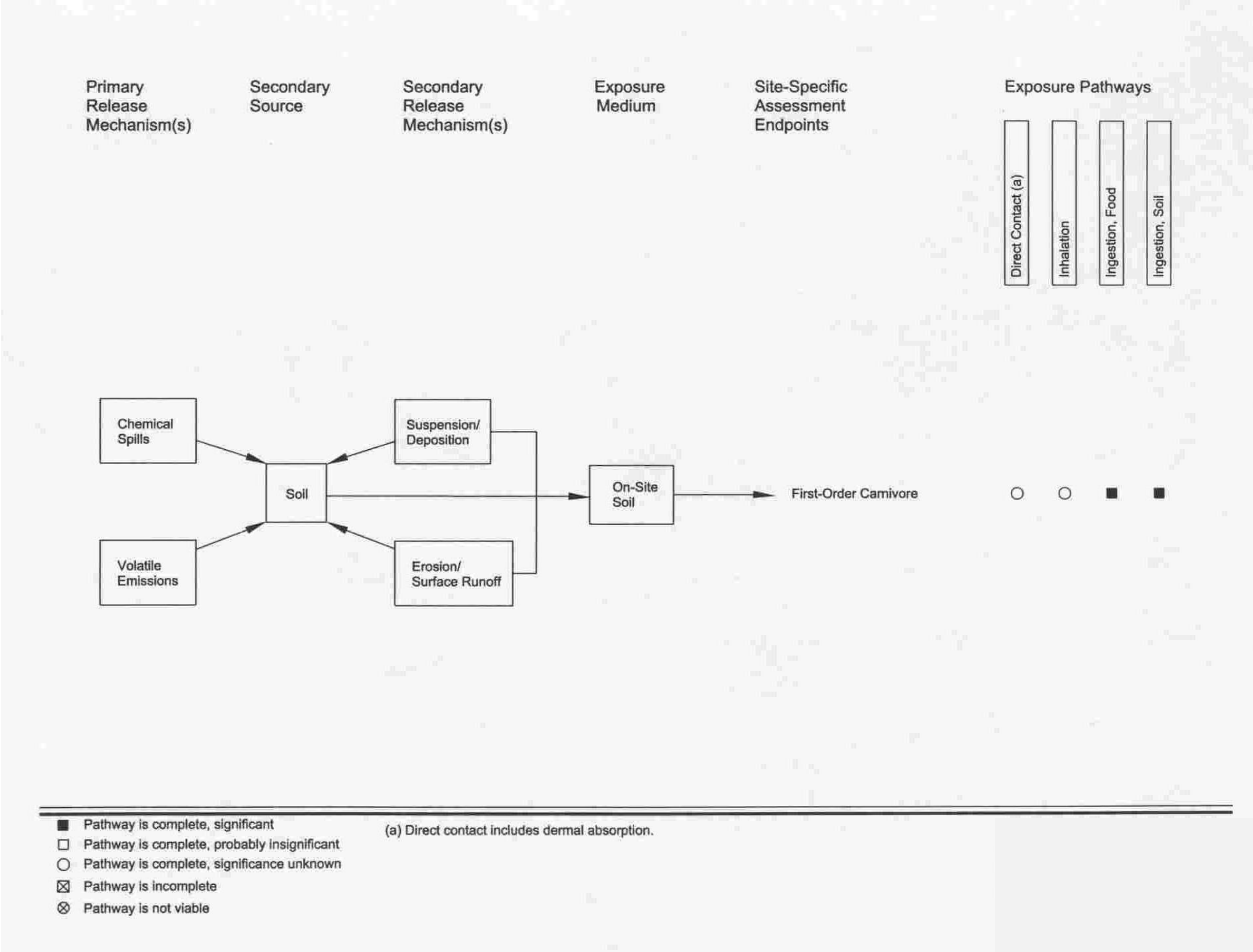


Figure 5-5
Estuarine Ecosystem Conceptual Site Model for Mercury

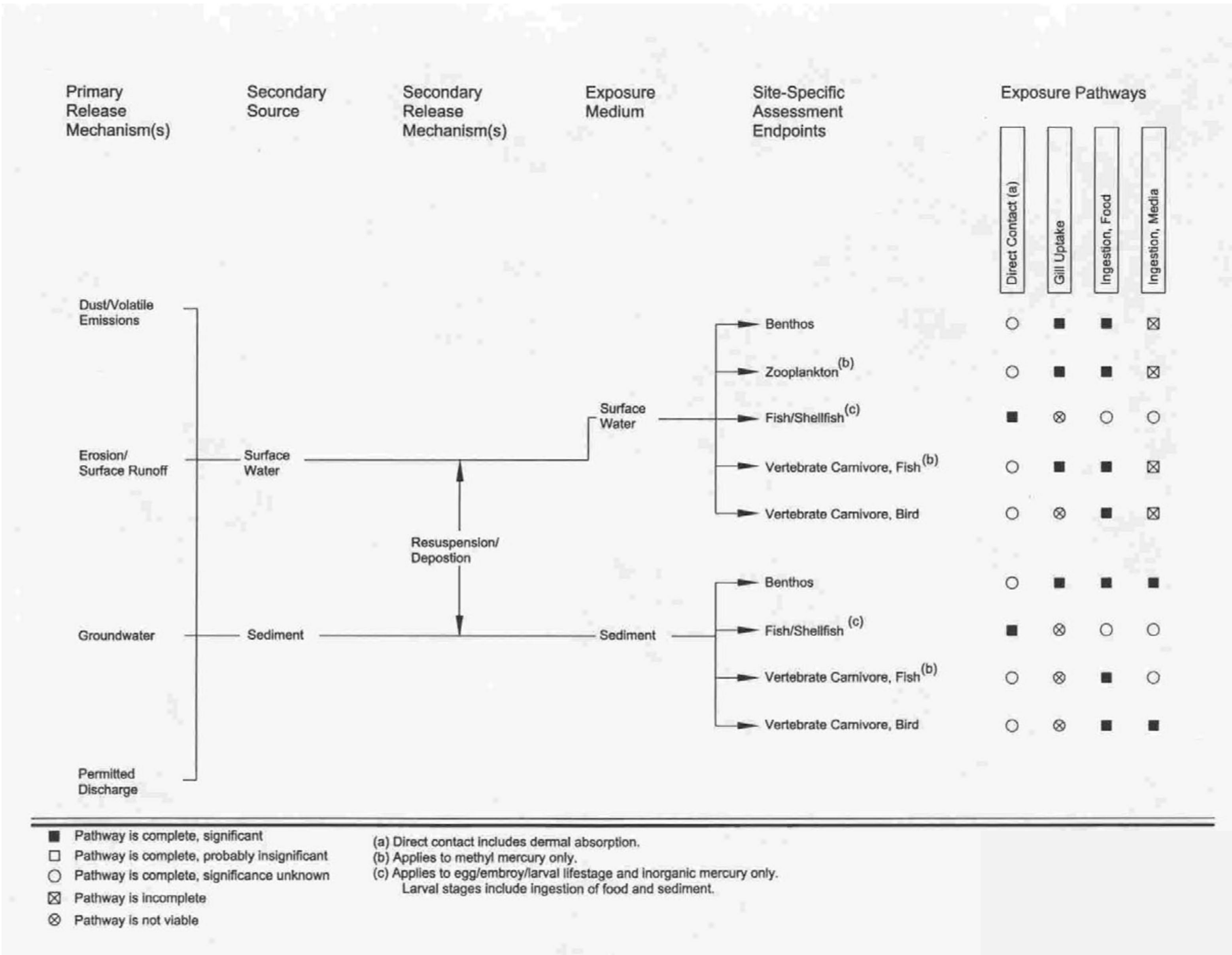


Figure 5-6
Estuarine Ecosystem Conceptual Site Model For LPAH and HPAH

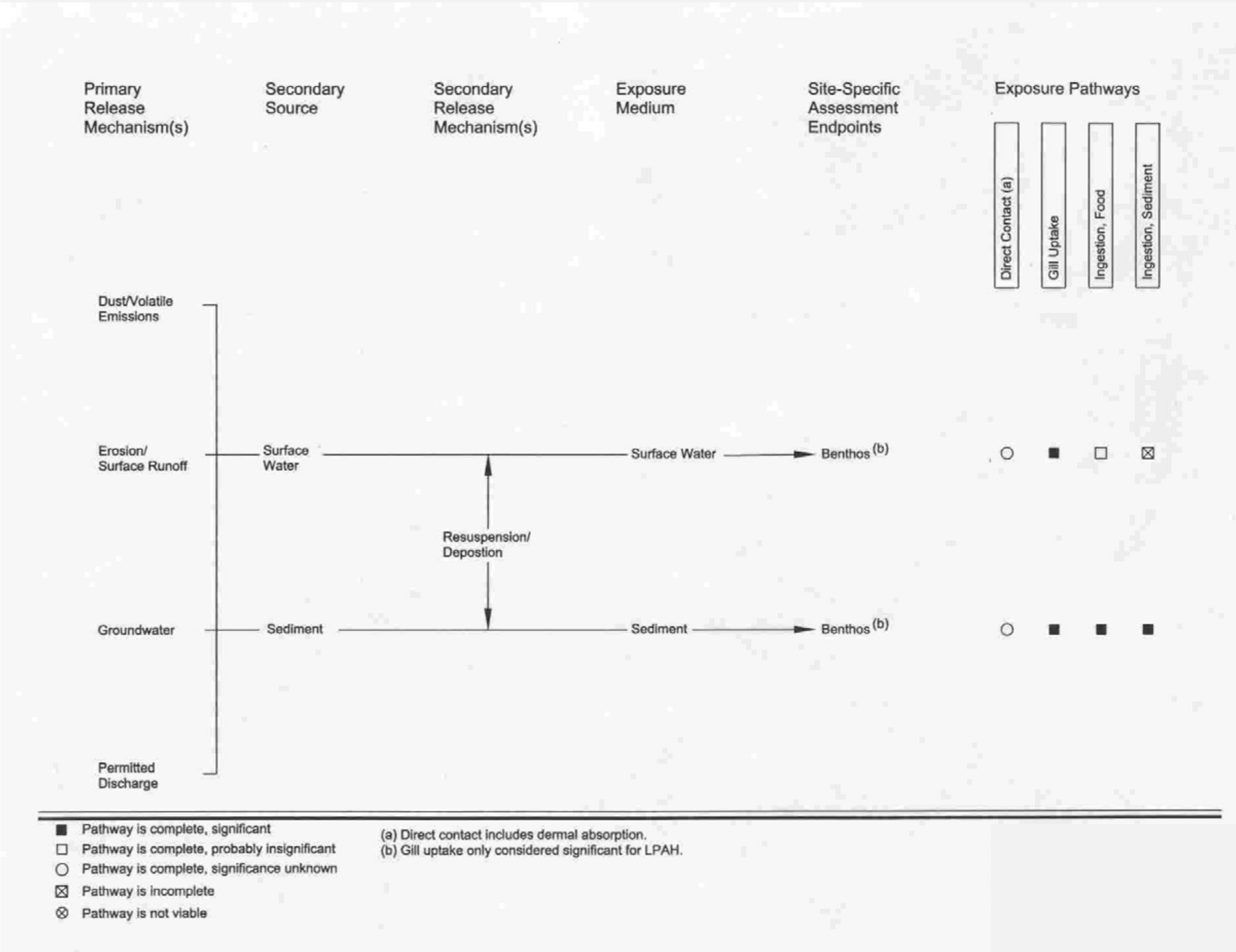


Figure 5-7

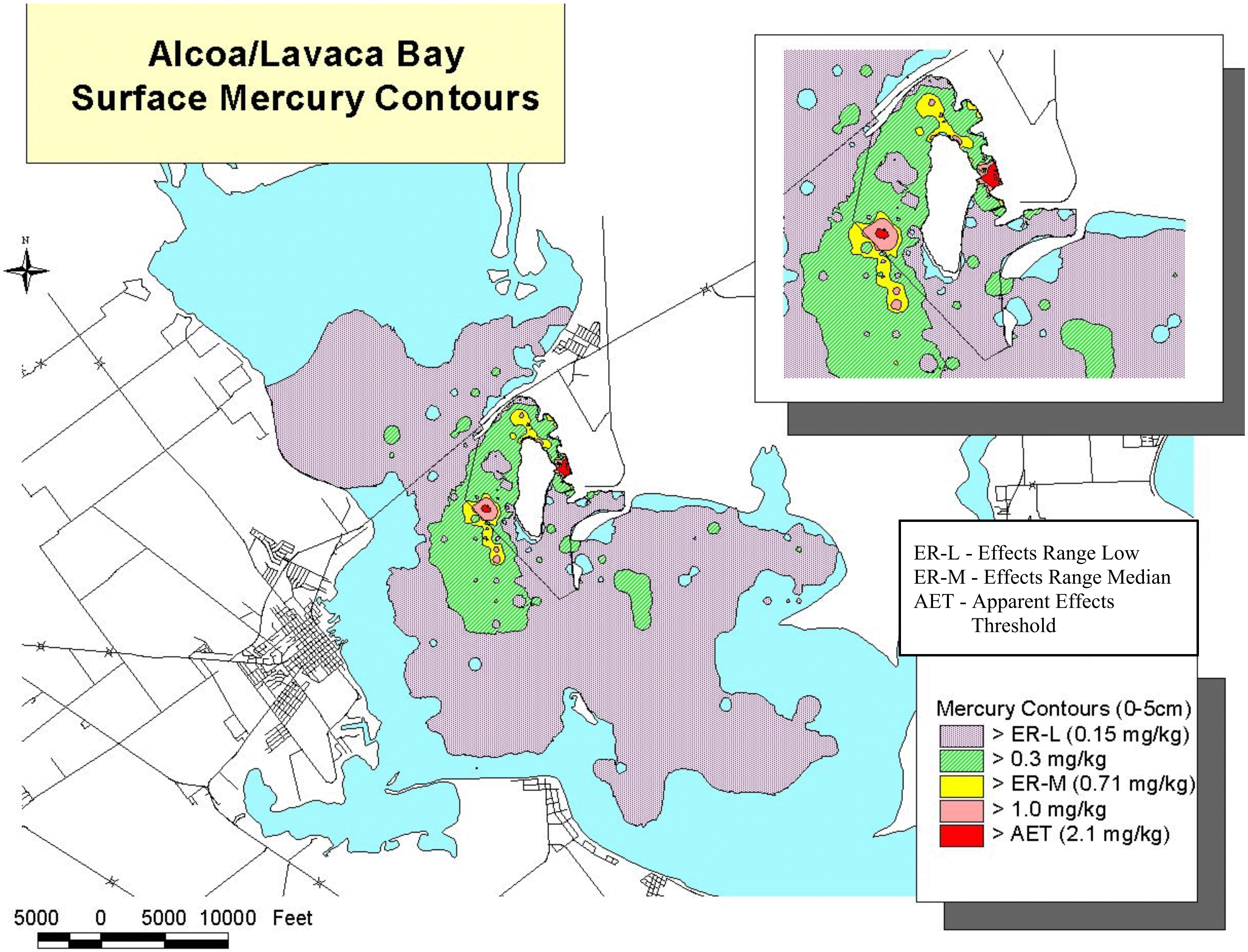

Alcoa/Lavaca Bay
Surface Mercury Contours
N
ER-L - Effects Range Low
ER-M - Effects Range Median
AET - Apparent Effects Threshold
Mercury Contours (0-5cm)
> ER-L (0.15 mg/kg)
> 0.3 mg/kg
> ER-M (0.71 mg/kg)
> 1.0 mg/kg
> AET (2.1 mg/kg)
5000 0 5000 10000 Feet

Figure 5-8

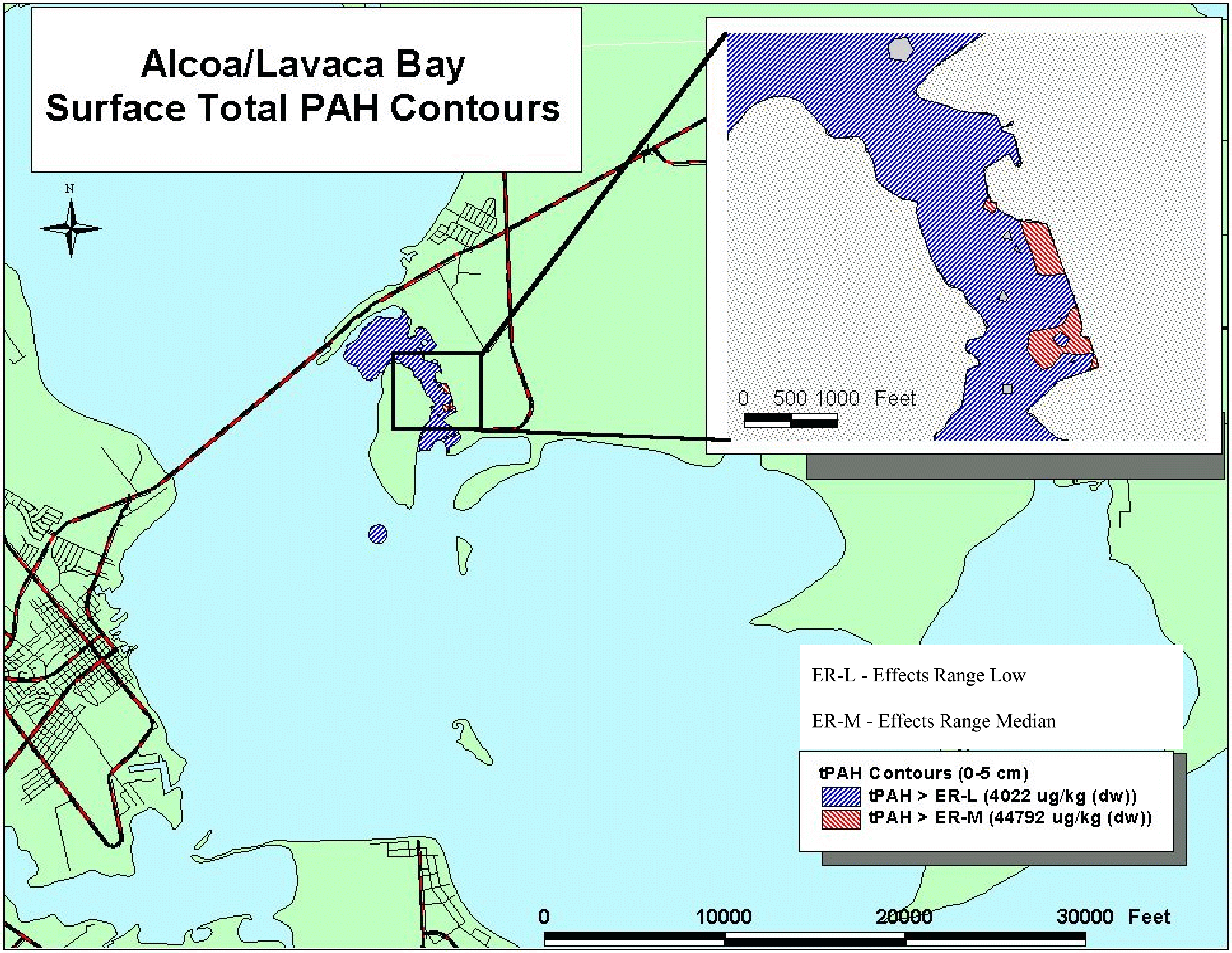

Alcoa/Lavaca Bay
Surface Total PAH Contours
N
0 500 1000 Feet
ER-L - Effects Range Low
ER-M - Effects Range Median
tPAH Contours (0-5 cm)
tPAH > ER-L (4022 ug/kg (dw))
tPAH > ER-M (44792 ug/kg (dw))
0 10000 20000 30000 Feet

Figure 5-9
Lavaca Bay Surface Water Sampling
Pre-CAPA Ground Water Extraction

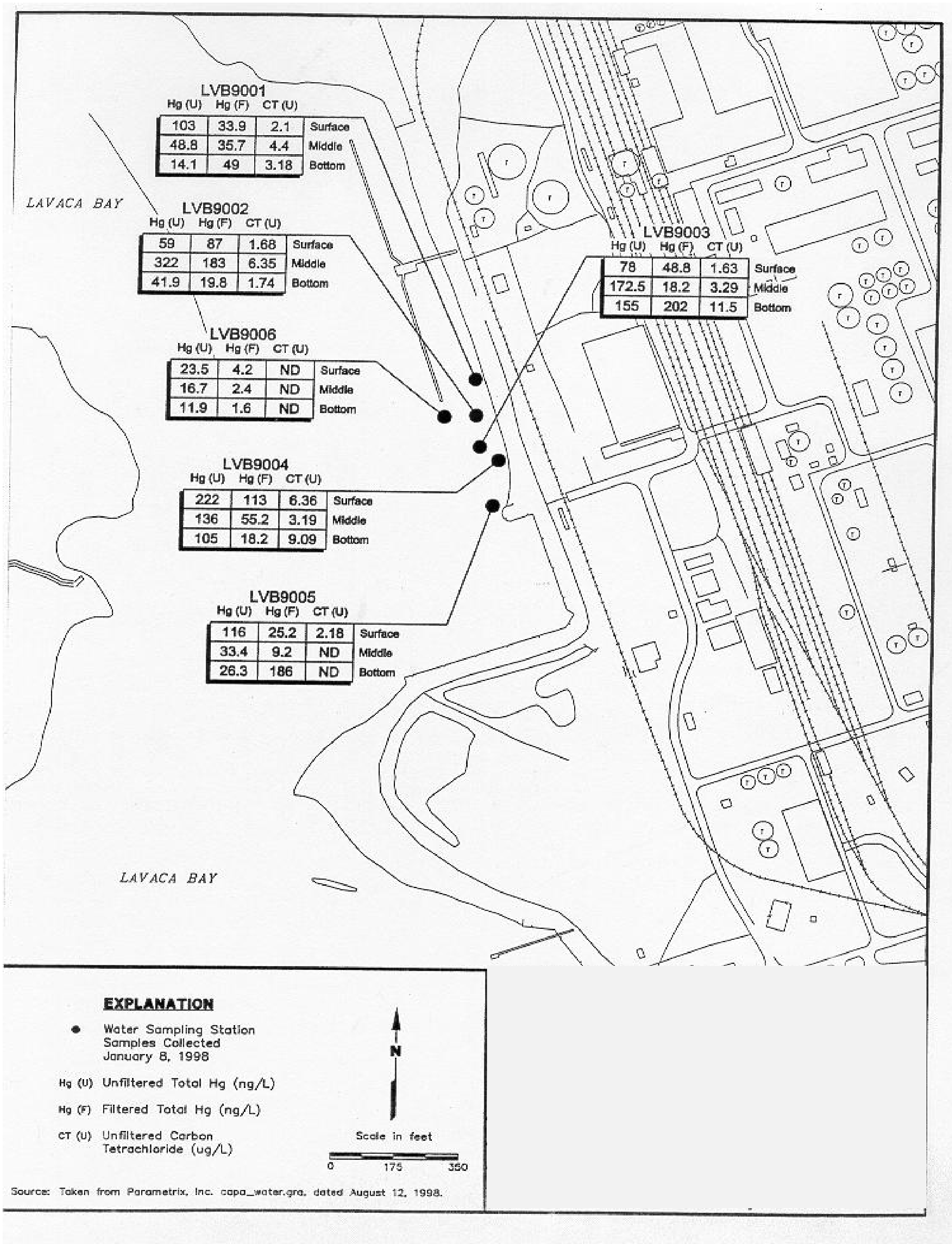


Figure 5-10
Lavaca Bay Surface Water Sampling
Post-CAPA Ground Water Extraction

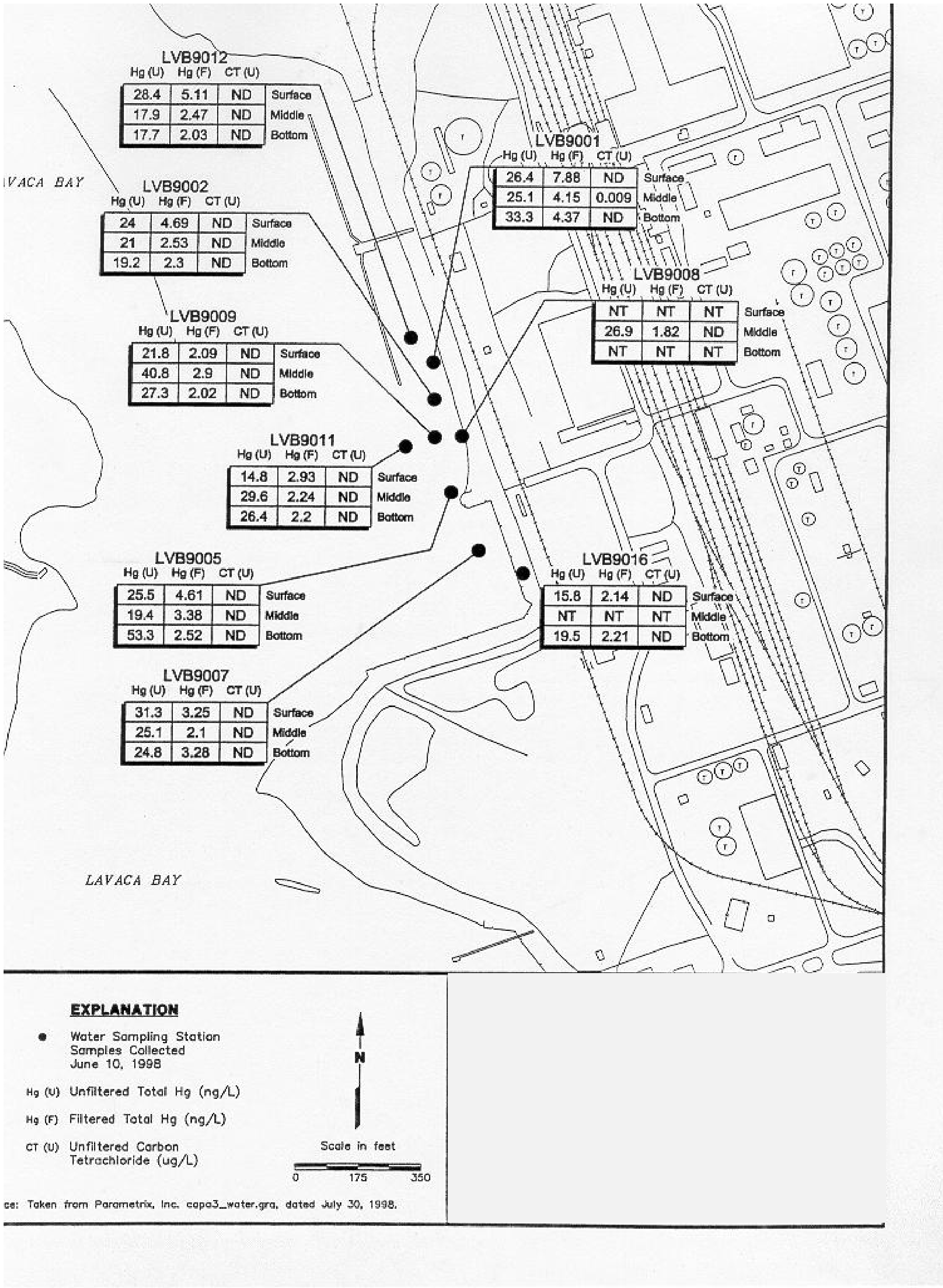


Figure 5-11

CAPA Cross Section

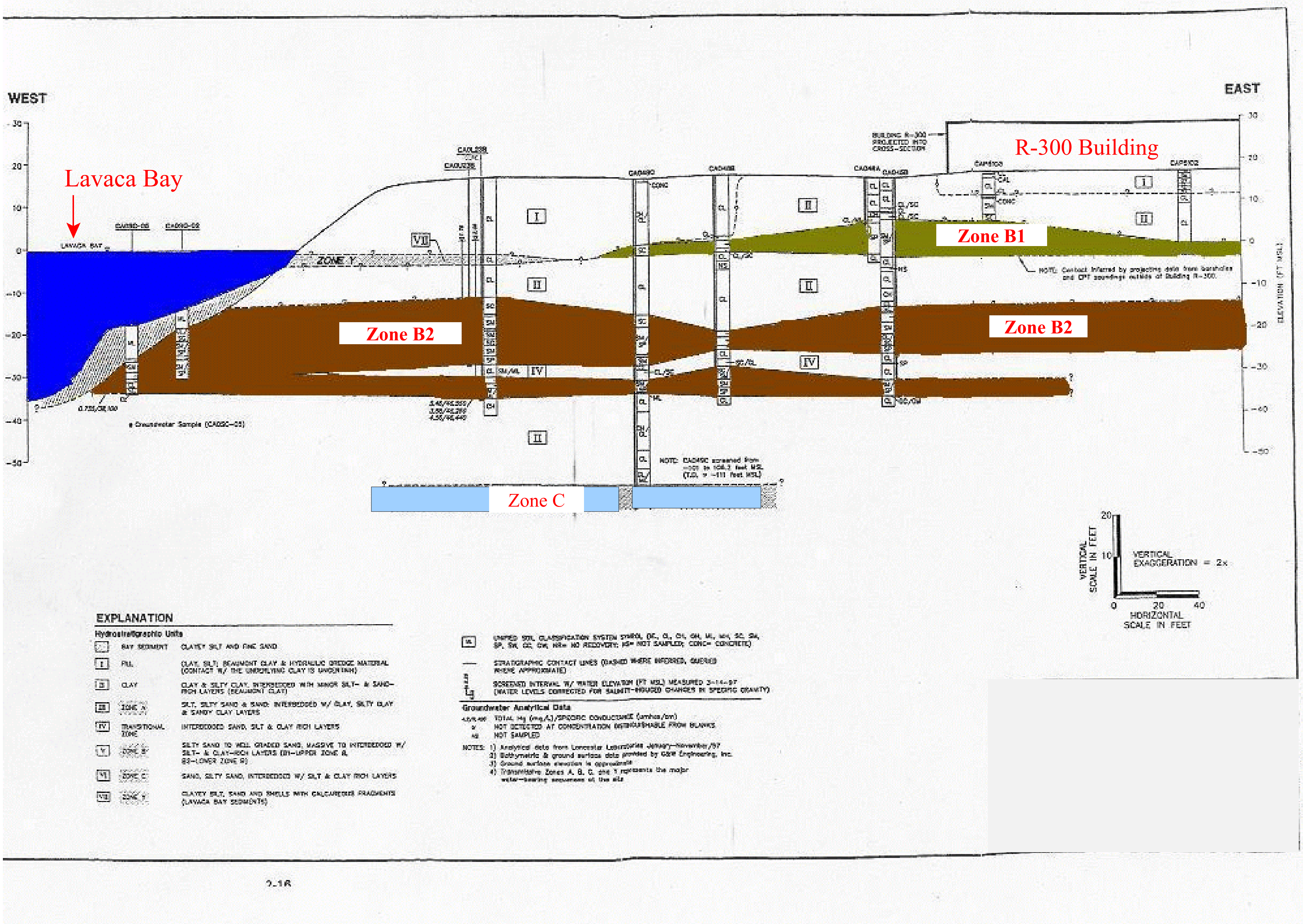


Figure 5-12
Unfiltered Total Mercury in Zone B1 Ground Water

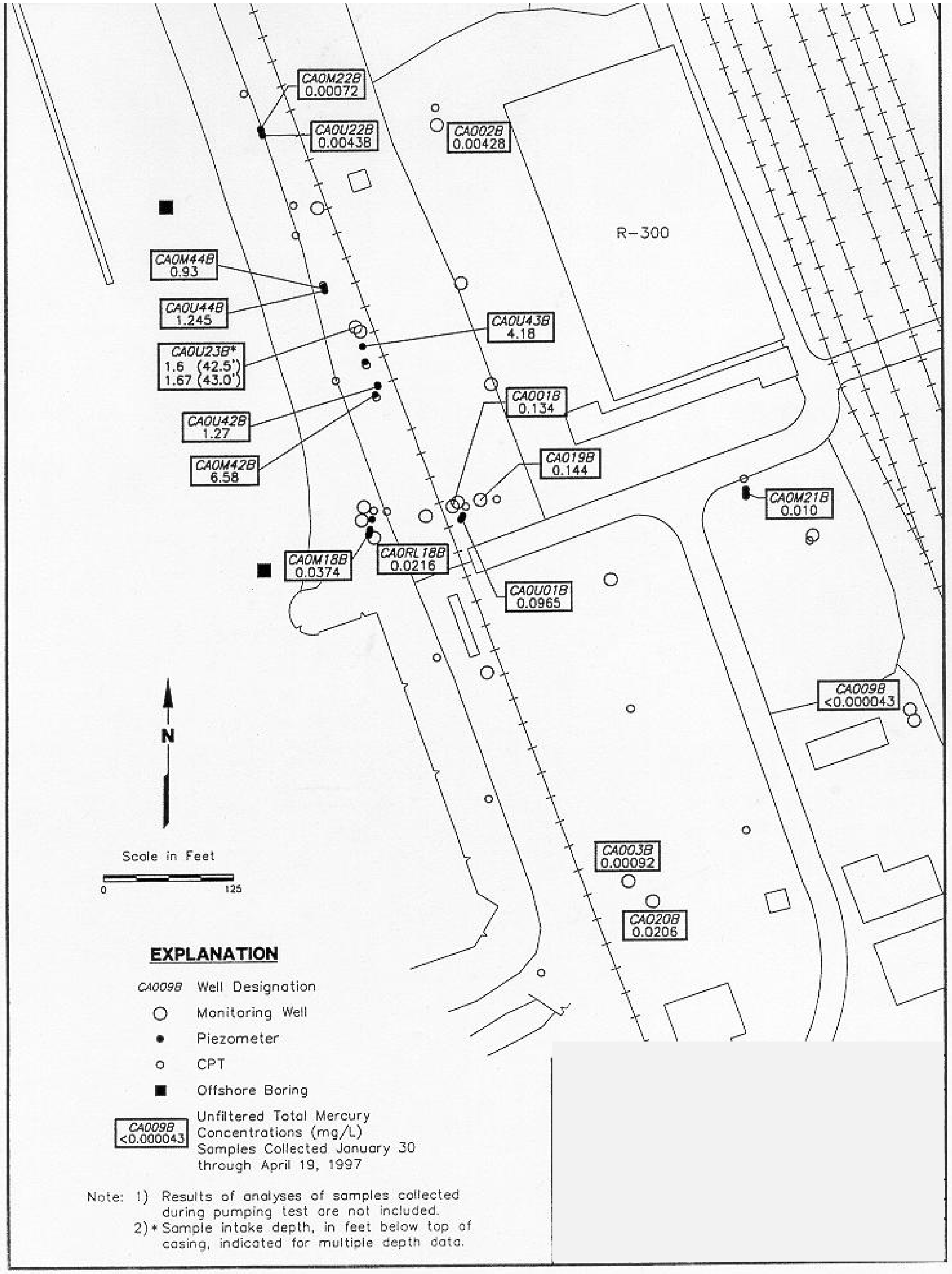
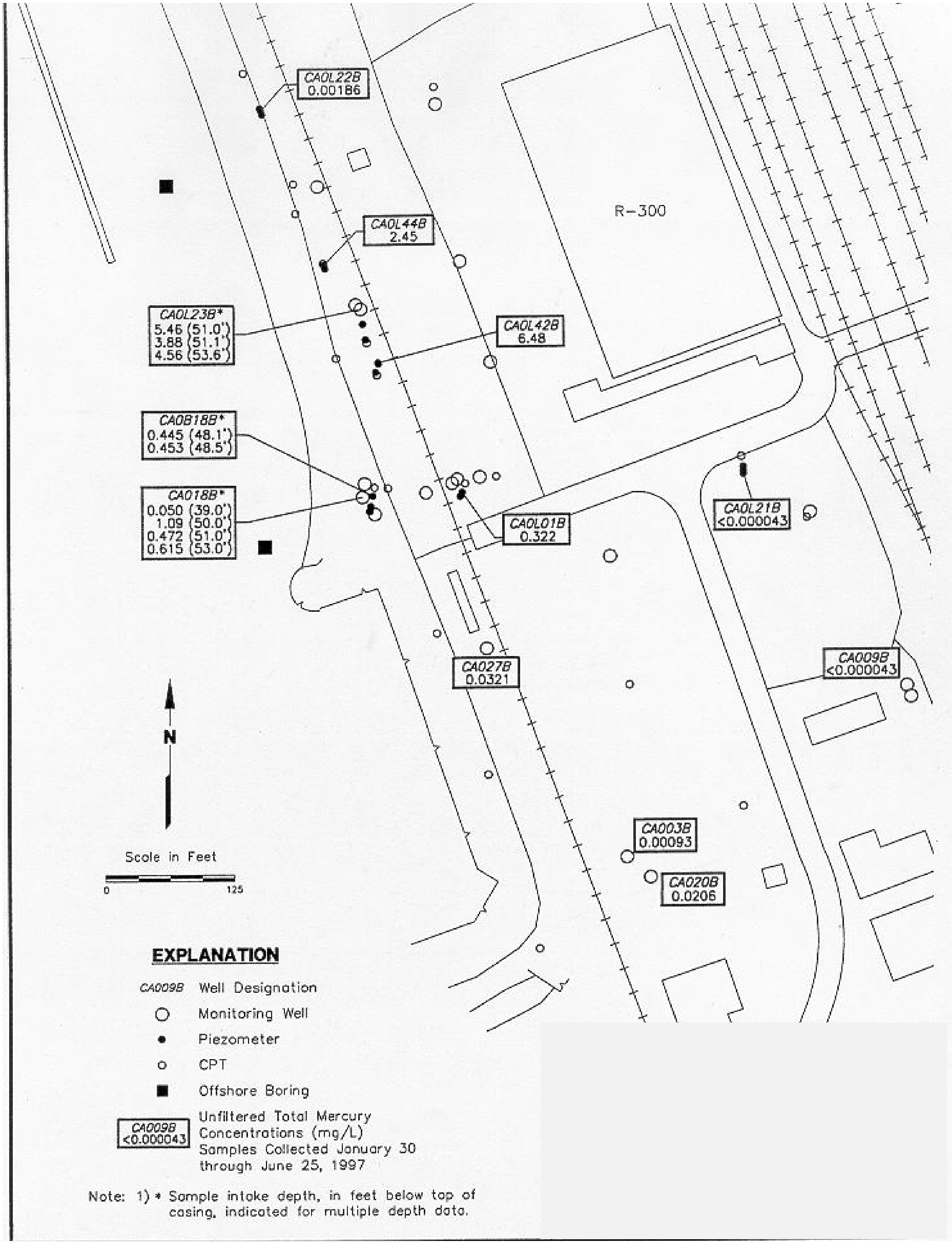


Figure 5-13
Unfiltered Total Mercury in Zone B2 Ground Water



SECTION 6
Current and Potential Future Land and Resource Use

The Site is bordered by State Highway 35 to the north and surrounded to the east, south, and west by Lavaca Bay, Cox Bay, Cox Marsh, and Cox Lake. Surrounding land uses are industrial, residential, and agricultural (pasture), as shown in Figure 6-1. Land uses adjacent to the Alcoa facility are principally industrial, including Formosa Hydrocarbons Production Corporation, Central Power & Light Company, and Calhoun County Navigational District (CCND). Agricultural pasturelands are located to the east of the Alcoa property, including the Brookings Property located between the Alcoa facility and Cox Creek, and the Traylor Property located across Cox Creek. Both areas are used for beef cattle grazing. No agricultural crops are grown in the immediate area although residents of Point Comfort may have home gardens.

Lavaca Bay is a secondary estuary associated with the larger Matagorda Bay System that consists of Matagorda Bay, Lavaca Bay, Tres Palacios Bay, Carancahua Bay, and Turtle Bay. Lavaca Bay is also associated with a number of smaller bays such as Keller Bay, Chocolate Bay, and Cox Bay. The Matagorda Bay System is typical of most Gulf of Mexico estuaries that generally consist of a complex lagoonal system. The Matagorda Bay System is nearly isolated from the Gulf of Mexico by barrier islands and is fed by several rivers and tributaries. The Bay is used for both commercial and recreational purposes. The area is attractive to industry because of the availability of navigable waterways, including a deep-water port at Point Comfort that is served by the 38-foot deep Matagorda Ship Channel. Constructed platforms within the bays are used in oil and gas production and are common in portions of Lavaca and Matagorda Bays.

Recreational fishing as well as commercial shrimping, fishing, crabbing, and oystering occur in Lavaca Bay. There are numerous fishing facilities located in or near Lavaca Bay, including boat ramps, piers, docks, and bait shops (Figure 6-2). Within the local Texas coastal communities, fishing is an important recreational activity. Other recreational activities such as swimming do occur, although access is typically more restricted. An important swimming area in the immediate vicinity of the Alcoa facility is the Lighthouse Beach Fishing Pier, located in Port Lavaca (Point #1, Figure 6-2).

Future uses of Lavaca Bay are anticipated to remain the same. However, Calhoun County and the city of Port Lavaca have developed plans for expanded facilities to promote tourism and recreational use of the Lavaca Bay area. Port Lavaca has developed a master plan that incorporates improvements of the marina and bay front access with park facilities that promote waterfront recreational activities.

Ground water in Calhoun County and southwestern Jackson County is of generally poor quality due to naturally high total dissolved solids (TDS) and high chloride content and, therefore, is not extensively used as a drinking water supply. A zone of fresh to slightly saline ground water (TDS of less than 1,000 to 3,000 ppm) is present in the vicinity of the site at a depth of 200 to 400 feet below ground level. This interval is overlain and underlain by moderately saline to very saline ground water (TDS content of 3,000 to 35,000 ppm). Ground water exploration by Alcoa during development of the facility did not identify ground water with favorable quality, and therefore the facility never has used site ground water as a source of drinking water. Currently, site drinking water is obtained from a well field 8 miles away from the site. A search of state water well records indicated that there is currently no use of the shallow ground water from the transmissive zones investigated during the RI. A water well inventory was conducted during the RI in Point Comfort. The results of the inventory revealed that ground water wells were not completed in the transmissive zones that were the focus of the RI because other sources of water have always been available in the city. Thus, shallow ground water in the areas of the site with TDS less than 10,000 ppm, has not been used in the past, is not used now, nor will it likely be used in the future.

Figure 6-1

Current Land Use

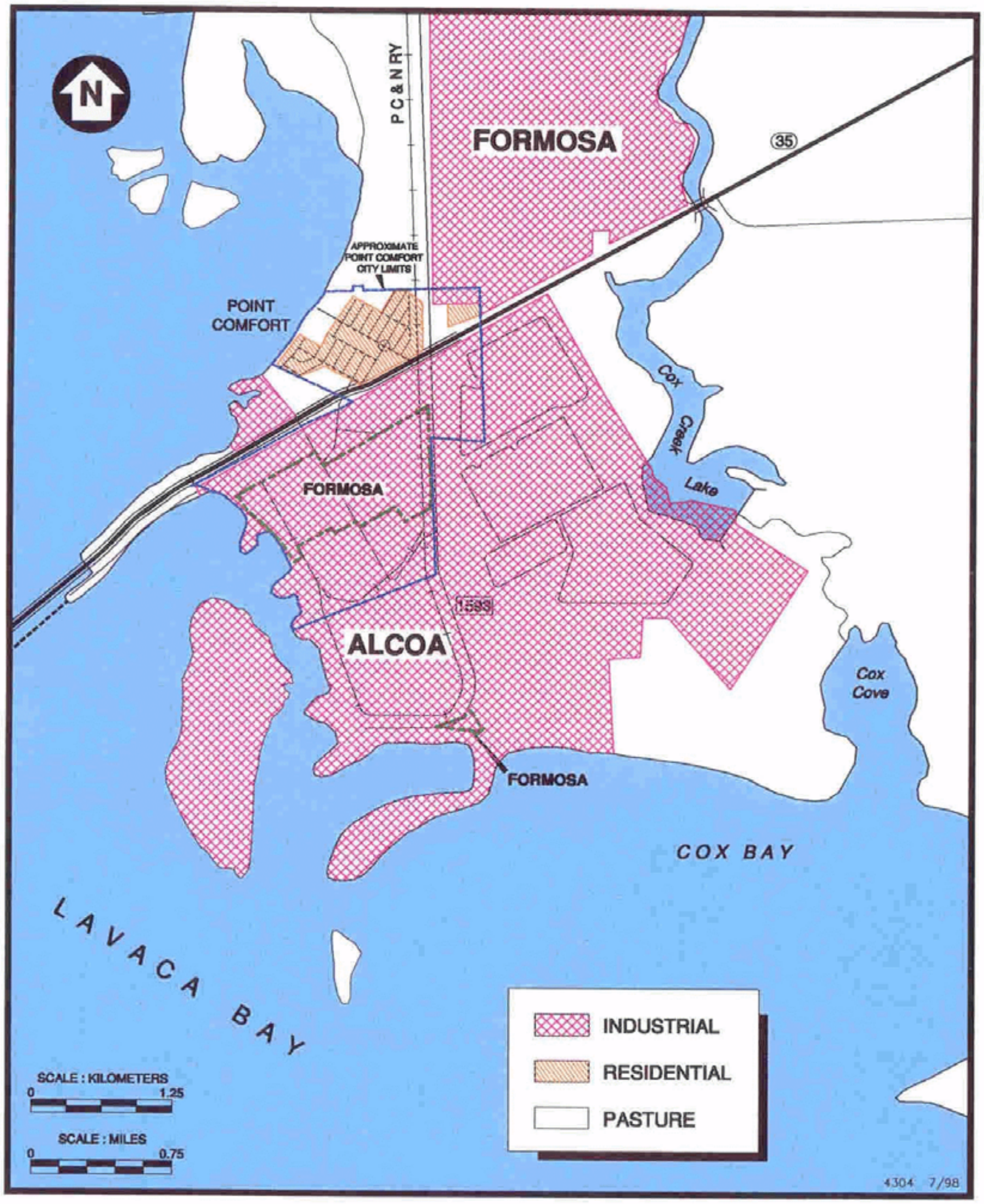
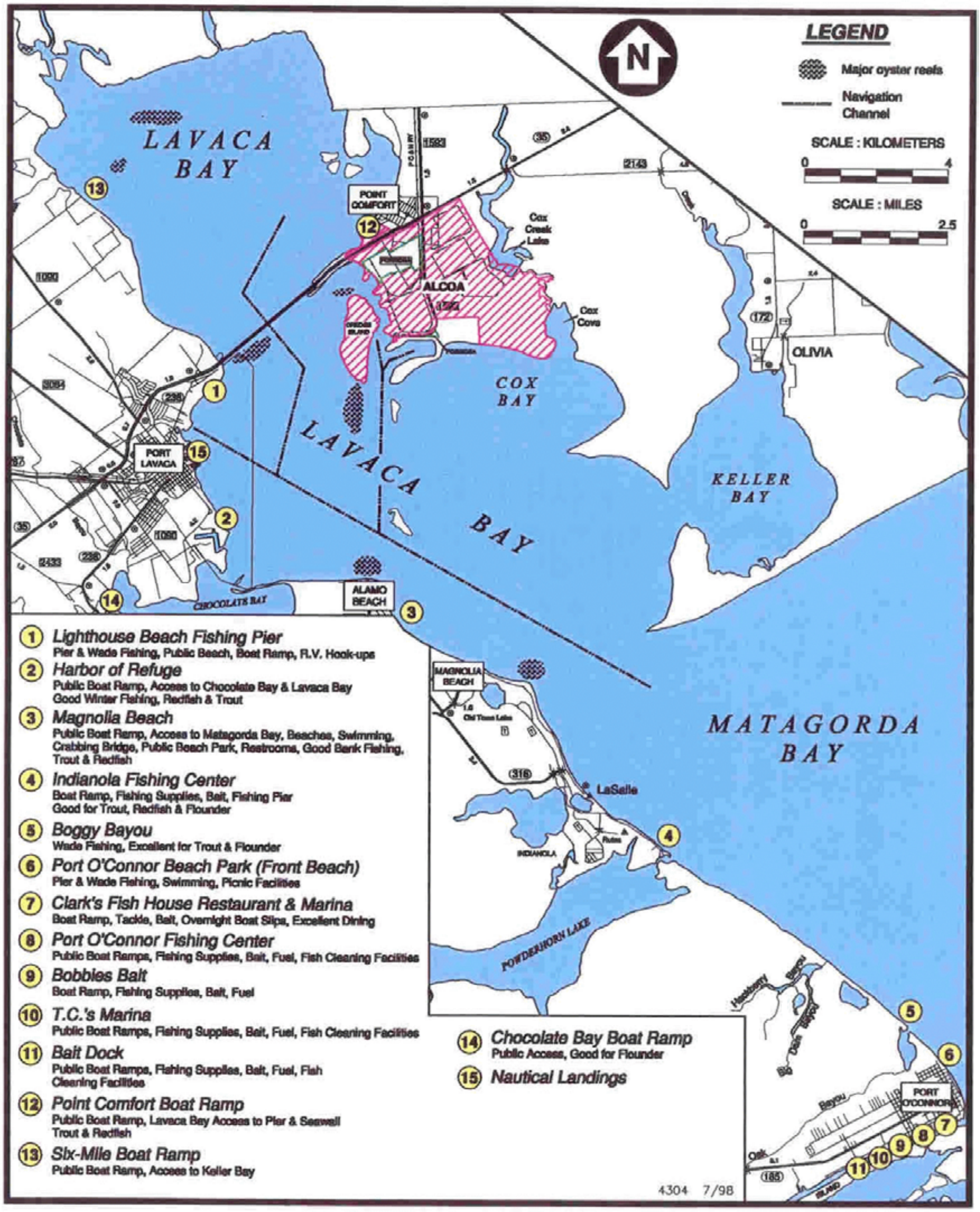


Figure 6-2

Area Fishing Facilities



SECTION 7
Summary of Site Risks

A BLRA was performed to estimate the probability and magnitude of potential adverse human health and environmental effects from exposure to contaminants associated with the Site assuming no remedial action was taken. It provides the basis for taking action and identifies the contaminants and exposure pathways that need to be addressed by the remedial action. The public health risk assessment followed a four step process: 1) hazard identification, which identified those hazardous substances which, given the specifics of the site were of significant concern; 2) exposure assessment, which identified actual or potential exposure pathways, characterized the potentially exposed populations, and determined the extent of possible exposure; 3) toxicity assessment, which considered the types and magnitude of adverse health effects associated with exposure to hazardous substances, and 4) risk characterization and uncertainty analysis, which integrated the three earlier steps to summarize the potential and actual risks posed by hazardous substances at the site, including carcinogenic and non-carcinogenic risks and a discussion of the uncertainty in the risk estimates. A summary of those aspects of the human health risk assessment which support the need for remedial action is discussed below followed by a summary of the environmental risk assessment.

Human Health Risk Assessment

CHEMICALS OF CONCERN

As discussed in the *Project Management Plan*, a data assessment step was incorporated into the RI/FS process to focus data needs and objectives for subsequent phases of the RI. The data assessment provided a conservative framework to identify chemicals, pathways, media, and possible source areas of potential concern. If a chemical, pathway, medium or potential source area was shown to pose insignificant risk during the data assessment, it was eliminated from further consideration, and was not evaluated in the BLRA.

Ecological risk-based values were developed for a range of potential land uses and specific habitat types at the site. Several groups of PSAs with similar habitats were grouped into Habitat Areas and evaluated in the BLRA. These habitat areas represent all of the PSAs that have or are surrounded by habitats suitable for ecological receptor use.

COPCs are defined as those chemicals that exceeded screening criteria identified in the data assessment and required quantification in the BLRA. COPCs were developed separately for human health and ecological risk assessment. Table 7-1 provides a list of COPCs and associated PSAs that were evaluated in the human health BLRA. The COPCs retained for the ecological BLRA and associated PSAs are summarized in Table 7-2.

In the BLRA, EPA uses a concentration for each COPC to calculate the risk. This concentration, called the exposure point concentration, is a statistically-derived number based on all the sampling data for the site. Generally, the 95 percent upper confidence limit (UCL) on the arithmetic mean concentration for a chemical is used as the exposure point concentration. The 95 percent UCL on the arithmetic mean is defined as a value that, when calculated repeatedly for randomly drawn subsets of the site data, equals or exceeds the true mean 95 percent of the time.

The COPCs were selected to represent potential site related hazards based on toxicity, concentration, frequency of detection, and mobility and persistence in the environment and can be found in Tables 3-3, 3-8 and 3-9 of the BLRA. From this, a subset of the chemicals were identified in the Feasibility Study as presenting a significant current or future risk and are referred to as the chemicals of concern in this ROD and summarized in Tables 7-3 through 7-5. These tables contains the exposure point concentrations used to evaluate the reasonable maximum exposure scenario (RME)in the baseline risk assessment for the chemicals of concern. Estimates of average or central tendency exposure concentrations for the chemicals of concern and all COPCs can be found in Tables 3-3, 3-8 and 3-9 of the BLRA.

EXPOSURE ASSESSMENT

An exposure assessment was conducted as part of the BLRA. The exposure assessment consists of characterizing the potentially exposed receptors, identifying exposure pathways, and quantifying exposure. An exposure pathway usually includes the following: (1) a source and means of contaminant release; (2) a transport medium (e.g., air, ground water, etc.); (3) a point of contact with the medium (i.e., receptor); and (4) an intake route (e.g., inhalation, ingestion, etc.). The conceptual site models developed for the site (as described in Section 5) were used in determining the appropriate exposure pathways for the risk assessment. Table 7-6 presents a compilation of the risk scenarios evaluated in the BLRA.

Plant/Mainland:

For the Plant/Mainland PSAs, the exposure pathways evaluated were inhalation of vapors and fugitive dust from soil, direct or incidental skin contact and ingestion of soil. Since none of the PSAs evaluated in the BLRA are operational, the only current receptor that may contact contaminants is a maintenance worker, or for the two perimeter PSAs (CF Bean Property and Exxon Station), a trespasser. Possible future industrial land use scenarios were evaluated to determine if a particular land use and exposure scenario may pose potential adverse risks in the future. Therefore, a general industrial worker receptor and a construction worker receptor were included in the BLRA. A conservative screening-level analysis of potential risks to off-site receptors was conducted. Results from the analysis indicated that indirect exposure pathways to off-site receptors were insignificant when compared to exposure to on-site receptors.

Dredge Island:

The Dredge Island was evaluated in the BLRA based on its configuration and environmental setting following completion of the non-time critical removal action. A large portion of the

Island will be contained within the diked area with mercury-containing soils that will eventually be covered with "clean" dredge sediments. The remaining portions of the Island outside the diked area could have limited future human use. If left undeveloped, the Island will return to a natural state and support ecological receptors. One likely future human use is development by the CCND for possible commercial purposes. If the CCND undertook development work, some construction activities would be required. Therefore, potential exposure pathways for the construction worker include: (1) incidental ingestion of soil; (2) dermal contact with soil; and (3) inhalation of vapors and fugitive dust from soil.

Lavaca Bay:

There are multiple current uses of Lavaca Bay, including recreational (fishing, boating, swimming) and commercial (shrimping and commercial shipping/barge traffic). If development of Lavaca Bay occurs in the future, it is most likely that the development will occur to enhance or expand its value for recreational or commercial purposes. Therefore, the exposure assessment will focus on potential exposures associated with current recreational and/or commercial uses.

In areas of Lavaca Bay there are opportunities for direct contact with contaminated sediments. The areas of interest include shallow portions of the Bay near the causeway where access is provided to wade fishermen, as well as along the Alcoa shoreline and the shoreline of Dredge Island. These shoreline areas also have higher average sediment contaminant concentrations.

Exposure to mercury through ingestion of contaminated fish may occur throughout Lavaca Bay, including the Closed Area and open areas of the Bay. Anglers and commercial shrimpers catch fish at many different locations throughout the Bay. A site-specific fish consumption survey indicated that the persons with the highest ingestion rates of fish and shellfish from Lavaca Bay are avid anglers and commercial shrimpers. No other "subsistence" populations were identified.

TOXICITY ASSESSMENT

Excess lifetime cancer risks were determined for each exposure pathway by multiplying a daily intake level with the chemical specific cancer potency factor. Cancer potency factors have been developed by EPA from epidemiological or animal studies to reflect a conservative "upper bound" of the risk posed by potentially carcinogenic compounds. That is, the true risk is unlikely to be greater than the risk predicted. The resulting risk estimates are expressed in scientific notation as a probability (e.g. 1×10^{-6} for 1/1,000,000) and indicate (using this example), that an average individual is not likely to have greater that a one in a million chance of developing cancer over 70 years as a result of site-related exposure (as defined) to the compound at the stated concentration. All risks estimated represent an "excess lifetime cancer risk" - or the additional cancer risk on top of that which we all face from other causes such as cigarette smoke or exposure to ultraviolet radiation from the sun. The chance of an individual developing cancer from all other (non-site related) causes has been estimated to be as high as one in three. EPA's generally acceptable risk range for site related exposure is 10^{-4} to 10^{-6}. Current EPA practice considers carcinogenic risks to be additive when assessing exposure to a mixture of hazardous substances. A summary of the cancer toxicity data relevant to the chemicals of concern is presented in Table 7-7.

In assessing the potential for adverse effects other than cancer, a hazard quotient (HQ) is calculated by dividing the daily intake level by the reference dose (RfD) or other suitable benchmark. Reference doses have been developed by EPA and they represent a level to which an individual may be exposed that is not expected to result in any deleterious effect. RfDs are derived from epidemiological or animal studies and incorporate uncertainty factors to help ensure that adverse health effects will not occur. A HQ less than or equal to 1 (≤ 1) indicates that a receptor's dose of a single contaminant is less than the RfD, and that toxic noncarcinogenic 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 (e.g. liver) within or across those media to which the same individual may reasonably be exposed. A HI ≤ 1 indicates that toxic noncarcinogenic effects are unlikely. A summary of the noncarcinogenic toxicity data relevant to the chemicals of concern is presented in Table 7-8.

RISK CHARACTERIZATION

The final step of the risk assessment process is called risk characterization. Risk characterization combines the exposure assessment with the toxicity assessment. The toxicity assessment evaluates the relationship between a dose of a chemical and the predicted occurrence of an adverse health effect. In the risk assessment, toxic effects are separated into two categories: cancer effects and noncancer effects. For noncancer effects, the risk is expressed as a HI. An HI greater than 1 indicates a potential for adverse effects. Potential cancer effects are characterized in terms of the excess chance of an individual developing cancer over a lifetime as a result of exposure to a potential carcinogen. An excess cancer risk of 1×10^{-6} is used by EPA as a starting point for determining remediation goals. Acceptable exposure levels for carcinogens are generally at concentrations that represent an excess cancer risk of between 1×10^{-4} and 1×10^{-6}. The hazards and/or cancer risk presented in the risk characterization should be viewed along with uncertainties that exist in the data, assumptions, methods and endpoints that are being studied.

Plant/Mainland:

Surface soils at the Witco and Smelter Areas result in excess cancer risk between 1×10^{-4} and 1×10^{-6} for a current receptor. Cancer risks for all other PSAs were below 1×10^{-6} for the current receptor. Potential risks from surface soils at the Mainland Shoreline #3, Witco, and Smelter Area are between 1×10^{-4} and 1×10^{-6} for the future construction worker. Cancer risks for the future construction worker at all other PSAs were below 1×10^{-6}. Estimated cancer risks for the future industrial worker at the CF Bean Property, CAPA, Witco and Smelter Areas are between 1×10^{-4} and 1×10^{-6}. Cancer risk estimates for all other PSAs were below 1×10^{-6}. The majority of risks for all scenarios is a result of exposure to PAHs in soil.

Within the footprint of the R-300 Building at CAPA, the HI is greater than 1 based on estimated exposure to mercury for industrial exposure scenarios. The majority of the HI is from incidental ingestion of mercury-contaminated soil. The HI for CAPA outside the footprint of the R-300 Building was less than 1 for all exposure scenarios.

Dredge Island:

The only contaminant of concern at Dredge Island was mercury. The HI calculated for ingestion of and dermal contact with soil was less than 1 when both the predicted mean and maximum mercury concentrations were used.

Lavaca Bay:

The risk characterization for the Bay evaluated dermal contact with sediments, fish consumption by recreational anglers and bycatch consumption by commercial shrimpers. The recreational angler risk characterization evaluated people who caught and consumed fish exclusively from Lavaca Bay, including a portion from the Closed Area. Also, the recreational risk characterization evaluated anglers who fished and consumed fish from the Closed Area. Risks for dermal contact with sediments was based on the assumption that anglers are exposed to contaminated sediments while fishing the shoreline near the Highway 35 causeway. The HI for dermal exposure to mercury in sediments was significantly below levels of concern. Also, the lifetime incremental cancer risk was estimated at 3×10^{-6} for dermal exposure to total PAHs in sediments.

The risk characterization for fish consumption presented in the BLRA was estimated both qualitatively and quantitatively for women of child-bearing age. The developing fetus represents the most sensitive receptor for methylmercury exposure. For the qualitative evaluation, a weight-of-evidence approach was used to present the potential risk results. The weight-of-evidence approach estimated risks using various methylmercury toxicity criteria. EPA uses a methylmercury toxicity value referred to as an RfD. The Agency for Toxic Substances and Disease Registry (ATSDR) uses a toxicity value referred to as the MRL. During the RI, Alcoa developed a methylmercury toxicity value, that was reviewed by an external peer review group. The alternative toxicity value was also used in the risk characterization. An independent review of the methylmercury toxicity value was completed by the National Academy of Science (NAS) after EPA Region 6 approved the Baseline Risk Assessment.

EPA Region 6 approved the Baseline Risk Assessment for the Alcoa/Lavaca Bay Site in June 2000. The findings from the NAS study were released in July 2000. On the basis of its evaluation, the NAS committee concluded that the value of EPA's current RfD for methylmercury, of 0.1 µg/kg per day, is a scientifically justifiable level for the protection of public health. Based on the results of the NAS report, the risk characterization contained in the Baseline Risk Assessment for the Site for women of child-bearing age who consume mercury-contaminated seafood had to be reviewed.

The approved Baseline Risk Assessment utilized the reasonable maximum exposure (RME) scenario to describe the potential risk to a woman of child-bearing age who consumed fish containing mercury. The RME relies on the application of multiple assumptions and/or calculations such as ingestion rate, concentration of mercury in fish, fraction ingested from the contaminated source, each with its own level of uncertainty. Use of the RME is designed to overpredict risks for most of the population. As such, the RME is useful for predicting human health risk and associated remedial actions. Another way to evaluate risk is to use average assumptions, rather than the more conservative assumptions included in an RME.

Based on results from a survey of anglers, women of child-bearing age consumed an average of approximately 18 grams of fish per day. The value used for fish consumption rate in the BLRA (the RME value) was the 90th percentile value, or 45 grams/day. These consumption rates are well above values utilized by EPA for consumption of marine fish (mean of 7.2 and 95th percentile value of 26 grams/day) based on the National Marine Fisheries Survey and also above results from other surveys. This consumption rate also is well in excess of the non-site specific default rate TNRCC could apply to recreational fisherman in its risk assessments conducted for remedial decision making.

Predicted health risks associated with consumption of fish from Lavaca Bay (i.e., Lavaca Bay Fisherman and Closed Area Fisherman) as well as all bays (i.e., the "All Fishermen" scenario) using the average consumption rate (18 grams/day) and RME consumption rate (45 grams/day) are as follows:

	Hazard Index	
Exposure Group	Average Consumption Rate	RME Consumption Rate
All Fishermen[4]	<1	1.7
Lavaca Bay Fishermen[5]	<1	2.2
Lavaca Bay Closed Area Fishermen[6]	1.7	4.0
Closed Area[7]	2.1	5.0

The current EPA reference dose suggests that pregnant women that consume fish from Lavaca Bay at the RME fish consumption rate used in the BLRA could put their unborn child at risk for potential neurodevelopmental effects. Due to background levels of mercury not associated with Alcoa PCO, this same statement could also apply to other bays on the Texas coast. Using average consumption rates (1 fish meal every 10 days), rather than the RME consumption rate derived from the angler study, consumption of fish from the Closed Area is the only scenario that would pose a potentially unacceptable risk.

[4] All Fishermen - fishermen who fished in Lavaca Bay, but who fished mostly in other Texas bays

[5] Lavaca Bay Fishermen - fishermen who fished mostly in Lavaca Bay, but not in the Closed Area

[6] Lavaca Bay and Closed Area Fishermen - fishermen who fished mostly in Lavaca Bay, but occasionally in the Closed Area

[7] Closed Area Fishermen - fishermen who fished mostly in the Closed Area

Table 7-9 presents the carcinogenic risk summary evaluated for present and potential future exposure to soil for the Former Witco Area. Table 7-10 presents the non-carcinogenic risk summary for current exposure to soils within the footprint of the R-300 building area while Table 7-11 presents the non-carcinogenic risk summary for future exposure to soils with the footprint of the R-300 building. Only those exposure pathways deemed relevant to the remedy being proposed are presented in this ROD. Readers are referred to the baseline risk assessment for a more comprehensive risk summary of all exposure pathways evaluated for all chemicals of potential concern and for estimates of the central tendency risk.

UNCERTAINTY ANALYSIS

The risks/hazards determined in the BLRA are the results of conditional estimates given multiple assumptions for exposure, toxicity, and other variables. Therefore, uncertainty is inherent to the risk assessment process. The uncertainty analysis identifies the relative contribution to overall uncertainty from each assumption or data point used in the risk assessment. The purpose of the uncertainty analysis is to provide decision makers with additional information on the assumptions and data used in the BLRA and the implications and limitations of these assumptions. Uncertainty in a BLRA is generally derived from three primary sources: 1) accurate characterization and representation of site contamination and conditions; 2) accurate assessment of potential exposure; and 3) known (or unknown) health effects related to the chemicals and the relevance of these toxicities at the estimated exposures. Section 3.5 of the BLRA provides a detailed discussion of the uncertainties of the BLRA.

Two areas of uncertainty that are discussed in the Baseline Risk Assessment are the reference dose (RfD) for methylmercury and the finfish/shellfish consumption rates. In general, the RfD is not a “bright line” between safety and toxicity; however, there is a progressively greater concern about the likelihood of adverse effects above this level. The RfD is used to estimate a level of environmental exposure at or below which no adverse effect is expected to occur. The RfD is an estimate, with uncertainty spanning perhaps an order of magnitude, of a daily exposure to the human population that is likely to be without appreciable risk during a lifetime. RfDs are based on an assumption of lifetime exposure and may not be appropriately applied to less-than lifetime exposure situations.

The Consumption Study conducted by Alcoa was designed to evaluate fishing and consumption patterns of individuals living near the Bay because these individuals are the most likely to fish most frequently in the Bay. These data were important to assess Natural Resource Damages as well as to support the RME scenario in the BLRA. The survey was conducted in November when there likely is greater frequency of fishing activities and higher consumptive use of the fish resources when compared to the rest of the year. As a result, some parameters, especially the consumption rate, were highly influenced by specific fishing patterns that are more common for this time of the year. Approximately 3,500 surveys were sent out to licensed fishermen. About 2,000 people responded (35% of respondents were women of child-bearing age). Of the almost 2,000 respondents who reported fishing along the Texas coast, 370 reported fishing in Lavaca Bay occasionally, and 23 reported fishing in the Closed Area at least once. (This second value would be smaller now since Cox Bay has been removed from the Closed Area and several anglers in the Consumption Study reported fishing only in the Cox Bay area of the Closed Area.) It is important to note that, in general, the fishermen with the highest consumption rates typically fished outside Lavaca Bay and ate mostly flounder.

The predicted health risks associated with consumption of fish from Lavaca Bay, as well as all bays, using the average consumption rate and reasonable maximum exposure (RME) consumption rates were presented in the Proposed Plan. Potential health risks were estimated for four different exposure groups. Using both the average and RME fish consumption rates, the potential health risks for "Lavaca Bay Fishermen", are similar to the potential health risks for "All Fishermen". The predicted risk for "Lavaca Bay Closed Area Fishermen" and "Closed Area Fishermen" are approximately twice as high as the potential risk for a Lavaca Bay Fishermen or All Fishermen. Therefore, the predicted unacceptable health risk from consuming fish and shellfish associated with releases from the Alcoa Point Comfort operations is focused generally within the Closed Area of Lavaca Bay. Additionally, based on the average consumption rate (which is similar to the recommended fish consumption rate of 24 grams/day presented in EPA's fish consumption advisory), the predicted unacceptable risks are generally restricted to exposure scenarios where a receptor consumes fish and shellfish from the current fish closure area.

Ecological Risk Assessment

Potential risks to ecological receptors were also evaluated in the BLRA. The BLRA represents the final level of the ecological risk assessment process. The process began with a screening assessment . The preliminary screening identified a number of COPCs at different sites. After the COPCs were identified, problem formulation documents were developed for several priority chemicals (lead, PAHs, inorganic mercury and methylmercury). Problem formulation ended in identifying site-specific assessment endpoints and measurement endpoints for further evaluation in the BLRA. Assessment endpoints evaluated for each priority chemical in the BLRA were identified by considering a combination of factors, including site ecology, exposure potential, and chemical sensitivities.

Lavaca Bay:

The COPCs in Lavaca Bay include inorganic mercury, methylmercury, and PAHs. The ecological evaluation for Lavaca Bay included a variety of endpoints, including benthos, zooplankton, birds, and fish. The pathways and COPCs for exposure included direct contact with mercury and PAHs in sediments for benthos, indirect contact with chemicals detected in ground water that may be transported to Lavaca Bay, direct contact with mercury in surface water for zooplankton, direct contact with mercury in sediments for larvae stages of fish, and bioaccumulation/biomagnification of methylmercury and ingestion of contaminated prey for fish and birds. The assessment and measurement endpoints are presented below.

RECEPTORS FOR LAVACA BAY ASSESSMENT ENDPOINTS

ASSESSMENT ENDPOINT	COPC(s)	SITE-SPECIFIC RECEPTOR(S)
Benthos	Inorganic and Methyl Mercury LPAHs and HPAHs	Polychaete and Amphipod
Vertebrate carnivore (fish)	Methyl Mercury	Red Drum and Black Drum
Zooplankton	Methyl Mercury	Copepods
Vertebrate carnivore (bird)	Inorganic and Methyl Mercury	Willet
Vertebrate carnivore (bird)	Methyl Mercury	Forster's Tern and Tricolored Heron
Fish/Shellfish Embryo/Larval Life Stage	Inorganic Mercury	Red Drum, Black Drum, and Oyster

LAVACA BAY MEASUREMENT ENDPOINTS FOR MERCURY AND PAHs

ASSESSMENT ENDPOINT(S)	MEASUREMENT ENDPOINT(S)
Benthos	Measured and compared inorganic mercury, methyl mercury, and PAH concentrations in Bay System sediment to toxicological effect concentrations for benthos. Measured concentrations of mercury in sediments and assessed toxicity to benthos through growth and/or survival bioassay with *Neanthes arenaceodentata* and *Leptocheirus*. Also assessed sediment toxicity of mercury to benthos by conducting a benthic species survey.
Zooplankton	Measured and compared methyl mercury concentrations (i.e., 95 percent UCL of the mean) in Lavaca Bay surface water to a chronic toxicological effect concentration for zooplankton.
Fish/Shellfish	Measured and compared inorganic mercury concentrations (i.e., 95 percent UCL of the mean) in Lavaca Bay surface water and sediment to a chronic toxicological effect concentration for fish egg/embryo and oyster larvae life stage.
Vertebrate Carnivore, fish	Measured and compared methyl mercury concentrations (i.e., 95 percent UCL of the mean) in Lavaca Bay sediment and food items to a toxicological effect level for carnivorous fish.
Vertebrate Carnivore, bird (invertebrate-eating)	Measured and compared inorganic and methyl mercury concentrations in Lavaca Bay sediment and food items to a chronic toxicological effect level for carnivorous birds.
Vertebrate Carnivore, bird (fish-eating)	Measured and compared methyl mercury concentrations (i.e., 95 percent UCL of the mean) in Lavaca Bay food items to a chronic toxicological effect level for carnivorous birds.

The risks for benthos were quantified for PAHs based on literature-derived toxicity reference values (TRVs). For mercury, risks were evaluated based on results of the Sediment Quality Triad (SQT) Study. The aquatic life TRVs and fish dietary TRVs are presented below.

AQUATIC LIFE TRVs

ANALYTE	TEST ORGANISM	TRV (ppb)	ENDPOINT	REFERENCE
Water Column Exposures				
Methyl mercury	Cladoceran (*Daphnia magna*)	0.004 (NOEC)[1] <0.04 (LOEC)	Reproduction	EPA, 1985d
Inorganic mercury	Fish (fathead minnow)	0.023 (NOEC)[1] <0.23 (LOEC)	Larval Growth	EPA, 1985d
	Catfish	0.2	Embryo-Larval Survival	Birge et al., 1979
Arsenic	Community	7.8	Standard	30 *TAC* '307.6
Cyanide	Community	5.6	Standard	30 *TAC* '307.6
Fluoride	Cladoceran (*Daphnia magna*)	3,706 (NOEC) 7,412 (LOEC)	Reproduction	Dave, 1984
Sediment Exposures				
Mercury	Community	4,600	Growth/Survival/ Species Abundance	SQT Report
		150	ER-L	Long et al., 1995
		710	ER-M	Long et al., 1995
	Oyster	590	AET	PSEP, 1988
	Benthos	2,100	AET	PSEP, 1988
	Amphipod	2,100	AET	PSEP, 1988
LPAH	Community	552	ER-L	Long et al., 1995
		3,160	ER-M	Long et al., 1995
	Oyster	5,200	AET	PSEP, 1988
	Amphipod	24,000	AET	PSEP, 1988
	Benthos	13,000	AET	PSEP 1988
HPAH	Community	1,700	ER-L	Long et al., 1995
		9,600	ER-M	Long et al., 1995
	Oyster	17,000	AET	PSEP, 1988
	Amphipod	69,000	AET	PSEP, 1988
	Benthos	69,000	AET	PSEP 1988
Total PAH	Community	4,022	ER-L	Long et al., 1995
		44,792	ER-M	Long et al., 1995

1 Estimated from LOEC using an uncertainty factor of ten.

FISH DIETARY TRVs

ANALYTE	TEST ORGANISM	TRV (ppb)	ENDPOINT	REFERENCE
Methyl mercury	Fish (rainbow trout)	24 (NOAEL) 25 (LOAEL)	Growth	Wobeser, 1975 Rodgers and Beamish, 1982
	Fathead Minnow	3.6 (NOAEL) 11 (LOAEL)	Mortality; Morbidity	Rabuck et al., 1997
	Killifish	1.9	Behavioral Changes	Matt et al., 1998

Results of the risk assessment for benthos suggest that portions of the Bay, near the Witco Harbor and the CAPA, have sufficient concentrations of PAHs to pose potential for localized impacts on benthic survival and reproduction. Concentrations of mercury in some areas near the CAPA exceeded the No Observed Effect Concentration (NOEC) for benthos for mercury measured in the SQT Study.

For fish, several different risk assessment techniques were used to evaluate potential risks for two assessment endpoints. First, a qualitative risk evaluation was conducted to determine the potential risks associated with early life stages of fish and shellfish from direct contact with mercury in sediments. Few studies and little information was available in the literature to allow quantification of risk from this pathway. Results of this qualitative analysis suggest that sediment concentrations of mercury, specifically in the areas north and east of Dredge Island, are within the range associated with adverse health effects, thus presenting a possible risk. Second, a risk evaluation of food exposure models for carnivorous fish suggest that ingestion, and bioaccumulation, of contaminated prey items are below levels of concern for fish species for all areas of Lavaca Bay. Third, an assessment of the limited critical tissue data available through the literature indicated that mercury tissue concentrations in Lavaca Bay fish suggest potential risk for behavioral and reproductive effects. The areas of Lavaca Bay with these elevated tissue levels correspond to those areas of concern for sediment mercury concentrations noted in the qualitative direct contact evaluation.

The risks to bird populations were based on identifying representative receptors (least terns, heron, and willets) and quantifying a dose based on the composition of prey species in the diet. Results of the evaluation of potential risks to birds suggest that this dose is below levels of concern for all areas of Lavaca Bay.

Plant/Mainland:

The Plant/Mainland Areas have very limited habitat for ecological receptors because the Alcoa facility has been developed for industrial uses and will continue to be used for industrial purposes in the future. However, there is potential for ecological exposure at some the PSAs and sections of the Plant/Mainland were grouped into several larger exposure areas. The groupings are based on similar habitat types and the proximity of the habitats to one another. The Plant/Mainland Areas and associated COPCs evaluated in the problem formulation are shown below.

ECOLOGICAL RISK ASSESSMENT COPCs

PSA/Habitat Area	COPCs IN SOIL
CAPA	Mercury, Selenium
West Habitat Area	Mercury, Selenium, HPAH
Mainland Shoreline #3	Mercury
North Habitat Area	Antimony, Copper, Lead, Selenium
CF Bean Property	Antimony, Arsenic, Copper, Lead, Nickel, Selenium
East Habitat Area	Antimony, Copper, Lead, Selenium, HPAH

HPAH: High Molecular Weight Polynuclear Aromatic Hydrocarbons include pyrene, chrysene, benzo(a)pyrene, benzo(a)anthracene, benzo(b)fluoranthene, benzo(k)fluoranthene, dibenzo(a,h)anthracene, indeno(1,2,3-cd)pyrene, and benzo(g,h,i)perylene

Surficial soil data were compared to ecological risk-based values for several assessment endpoints, including wildlife, plants, and detritivores (an organism that eats dead, decaying plant material). Several groups of PSAs with similar habitats were grouped into Habitat Areas and evaluated in the BLRA. The assessment endpoints and measurement endpoints are presented below.

IDENTIFICATION OF RECEPTORS, HABITAT, AND EXPOSURE PATHWAYS FOR THE TERRESTRIAL SYSTEM

RECEPTOR	ASSESSMENT ENDPOINT(S)	COPC(S)	EXPOSURE PATHWAY(S)	ASSOCIATED HABITAT(S)
Plants	Herbaceous/ Woody Vegetation	Other Metals	Direct Contact	Grassland, Shrubland, Woodland, High Marsh, Low Marsh
Earthworm	Detritivore	Mercury, Other Metals	Soil Contact, Soil Ingestion	Varied
Scissor-Tailed Flycatcher	First-Order Carnivore	Mercury, Other Metals, HPAHs	Food-Chain Exposure	Shrubland, Woodland

Cattle Egret	First-Order Carnivore	Mercury	Food-Chain Exposure	High Marsh
Great Horned Owl[1]	First-Order Carnivore	Mercury	Food-Chain Exposure	Grassland, Shrubland, Woodland
RECEPTOR	**ASSESSMENT ENDPOINT(S)**	**COPC(S)**	**EXPOSURE PATHWAY(S)**	**ASSOCIATED HABITAT(S)**
Rice Rat[1]	Omnivore	Mercury	Direct Soil Ingestion	High Marsh, Low Marsh
Cotton Rat[1]	Herbivore	Mercury	Direct Soil Ingestion	Grassland, Shrubland, Woodland
Robin	First-Order Carnivore	Mercury, Other Metals, HPAHs	Food-Chain Exposure, Direct Soil Ingestion	Grassland
Shrew	First-Order Carnivore	Mercury, Other Metals, HPAHs	Food-Chain Exposure, Direct Soil Ingestion	Grassland, Shrubland, Woodland, High Marsh, Low Marsh

[1] Identified as low or negligible risk in the terrestrial data assessment. Evaluated in the BLRA at Dredge Island only.

PLANT/MAINLAND MEASUREMENT ENDPOINTS

ASSESSMENT ENDPOINT	**MEASUREMENT ENDPOINT**
Vegetation	Measure and compare other metal COPC concentrations in select PSA soils to toxicological effect levels for plants.
Detritivores	Measure and compare inorganic and methyl mercury and other metal COPC concentrations in selected PSA soils to chronic toxicological effect concentration for detritivores.
Vertebrate Carnivores	Measure and compare inorganic and methyl mercury, HPAH and other metal COPC concentrations in selected PSA soils to a chronic toxicological effect level for carnivorous birds and mammals.

At the Plant/Mainland, potential risks were predicted to plants and detritivores in the CF Bean Property and Mainland Shoreline #3. The risk assessment for wildlife suggested that there is probable risk to small mammals from exposure to copper at the CF Bean Property, and high-molecular-weight PAHs (HPAHs)[8] at Witco, as well as possible risks to small mammals and birds from exposure to HPAHs at the West Habitat Area and from exposure to HPAHs at the Witco Areas. An assessment of potential risks from mercury to ecological receptors on Dredge Island suggests that residual levels of mercury in soil remaining after the removal action will be below levels likely to pose risk to terrestrial wildlife or aquatic wildlife species. Potential risk is predicted for detritivores exposed to mercury concentrations remaining on Dredge Island. However, these

[8] PAHs are composed of carbon and hydrogen atoms arranged in the form of two or more aromatic (benzene) rings. HPAHs contain four or more rings.

risks must be considered in relation to the industrial nature of the developed portions of the Island and the environmental values appropriate for this type of use.

CAPA Focused Investigation:

Inorganic mercury and selenium were evaluated as COPCs for the shrew and robin at the CAPA. Development at CAPA has resulted in non-suitable cover and foraging habitat, but it is recognized that limited infrequent exposure can occur in the CAPA. Therefore, the ecological assessment evaluated the potential for adverse effects from short-term exposures. The HQs for mercury or selenium did not exceed a value of 1 and, thus, no risk is predicted for birds or mammals.

Plant/Mainland Ground Water Investigation:

Ground water at the eastern perimeter was screened against ecological data. Measured concentrations of arsenic, cyanide, and fluoride in a well (PE06A) located on the eastern perimeter boundary exceeded ecological screening criteria. The potential for significant concentrations of arsenic, cyanide, and fluoride migrating to a point of ecological exposure in Cox Marsh was modeled in the RI. The expected ecological exposure concentrations of these compounds (Fluoride-2.15 mg/L, Arsenic-0.03 mg/L, and Cyanide-0.002 mg/L) at the point of discharge into surface water are below ecological risk-based screening criteria. The ecological risk-based screening values for fluoride, arsenic, and cyanide are 3.7 mg/L, 0.078 mg/L, and 0.0056 mg/L, respectively.

Ground water at the Cametco/Municipal Landfill was screened against ecological data. Measured concentrations of aluminum, arsenic, cyanide, and fluoride in a monitoring well exceeded ecological screening criteria. The potential for significant concentrations of aluminum, arsenic, cyanide, and fluoride migrating to a point of ecological exposure in Lavaca Bay was modeled in the RI. The expected ecological exposure concentrations of these compounds (Fluoride-1.3 mg/L, Arsenic-0.004 mg/L, and Cyanide-0.001 mg/L) are below ecological risk-based screening criteria. The ecological risk-based screening values for fluoride, arsenic, and cyanide are 3.7 mg/L, 0.078 mg/L, and 0.0056 mg/L, respectively. Due to the high sorptive capacity of soil, aluminum is not expected to be transported in Zone A ground water to Lavaca Bay.

Basis for Action

The risk assessment showed the following potential noncarcinogenic hazard indices greater than one, cumulative excess carcinogenic risks exceeding 1×10^{-4}, and environmental impacts: 1) noncarcinogenic risk to a future industrial worker, future construction worker, and current maintenance worker exposed to mercury-contaminated soils within the footprint of the R-300 building; 2) noncarcinogenic risk to a woman of childbearing age consuming fish from within Lavaca Bay and the Closed Area of Lavaca Bay; 3) carcinogenic risk to a future industrial worker in the Witco Area; and 4) ecological impacts. It is the EPA's current judgment that the Selected Remedy identified in this Record of Decision is necessary to protect the public health or welfare or the environment from actual or threatened releases of hazardous substances into the environment.

Table 7-1

Summary of PSAs and COPCs Evaluated in the Human Health Risk Assessment

PSA	COPCs In Soils
Enron Tanks	Acenaphthene, Anthracene, Benzo(a)anthracene, Benzo(a)pyrene, Benzo(b)fluoranthene, Benzo(k)fluoranthene, Chrysene, Dibenz(a,h)anthracene, Fluorene, Indeno(1,2,3-cd)pyrene, Naphthalene
Witco	Anthracene, Benzo(a)anthracene, Benzo(a)pyrene, Benzo(b)fluoranthene, Benzo(k)fluoranthene, Chrysene, Dibenz(a,h)anthracene, Indeno(1,2,3-cd)pyrene, Vinyl Chloride
CF Bean Property	Benzo(a)anthracene, Benzo(a)pyrene, Benzo(b)fluoranthene, Dibenz(a,h)anthracene, Indeno(1,2,3-cd)pyrene
Mainland Shoreline #3	Benzo(a)anthracene, Benzo(a)pyrene, Benzo(b)fluoranthene, Benzo(k)fluoranthene, Chrysene, Dibenz(a,h)anthracene, Indeno(1,2,3-cd)pyrene
Smelter	Benzo(a)anthracene, Benzo(a)pyrene, Benzo(b)fluoranthene, Benzo(k)fluoranthene, Chrysene, Dibenz(a,h)anthracene, Indeno(1,2,3-cd)pyrene, PCBs
Fire Training Area	Benzo(a)pyrene
Exxon Station	Benzo(a)pyrene
CAPA	Mercury, Benzo(a)anthracene, Benzo(a)pyrene, Benzo(b)fluoranthene, Dibenz(a,h)anthracene, PCBs
Construction Debris Landfill	Benzo(a)pyrene, Benzo(b)fluoranthene, Dibenz(a,h)anthracene, Indeno(1,2,3-cd)pyrene
Waste Oil Management Area	PCBs
AREA	**COPCs in Soil**
Dredge Island	Inorganic Mercury
WELL	**COPCs in Ground Water**
PN03A	Arsenic and Fluoride
AREA	**COPCs in Fish Tissue**
Lavaca Bay	Methylmercury
AREA	**COPCs In Sediment**
Lavaca Bay	Inorganic mercury, methylmercury, acenapthene, acenaphthylene, anthracene, benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, benzo(k)fluoranthene, benzo(g,h,i)pyrelene, chrysene, dibenz(a,h)anthracene, indeno(1,2,3-cd)pyrene, fluoranthene, fluorene, naphthalene, phenanthrene, pyrene

Table 7-2

Ecological Risk Assessment COPCs

PSA/Habitat Area	COPCs In Soil
CAPA	Mercury, Selenium
West Habitat Area	Mercury, Selenium, HPAH
Mainland Shoreline #3	Mercury
North Habitat Area	Antimony, Copper, Lead, Selenium
CF Bean Property	Antimony, Arsenic, Copper, Lead, Nickel, Selenium
East Habitat Area	Antimony, Copper, Lead, Selenium, HPAH
AREA	**COPCs IN WATER, SEDIMENT, AND BIOTA**
Lavaca Bay	Methylmercury, inorganic mercury, PAHs

HPAH: High Molecular Weight Polynuclear Aromatic Hydrocarbons include pyrene, chrysene, benzo(a)pyrene, benzo(a)anthracene, benzo(b)fluoranthene, benzo(k)fluoranthene, dibenzo(a,h)anthracene, indeno(1,2,3-cd)pyrene, and benzo(g,h,i)perylene

Table 7-3 Summary of Chemicals of Concern and Medium-Specific Exposure Point Concentrations								
Scenario Timeframe: Current **Medium:** Soil **Exposure Medium:** Soil								
Exposure Point	Chemical of Potential Concern	Concentration Detected		Units	Frequency of Detection	Exposure Point Concentration	Exposure Point Concentration Units	Statistical Measure
		Min	Max					
Waste Oil Management Area								
Soil: Ingestion, Dermal Contact, Inhalation	PCB-1248	0.10	3.34	ppm	1/3	3.34	ppm	Max
Smelter Spent Potlining Storage Area								
	Benzo(a)pyrene	0.315	0.315	ppm	1/3	0.315	ppm	Max
	Benzo(b)fluoranthene	0.064	0.570	ppm	3/3	0.570	ppm	Max
	Dibenz(a,h)anthracene	–	0.043	ppm	0/0	0.043	ppm	½ Sample DL
	Indeno(1,2,3-cd)pyrene	0.166	0.166	ppm	1/3	0.166	ppm	Max
Enron Tanks								
	Acenaphthene	–	0.047	ppm	0/3	0.047	ppm	½ Sample DL
	Anthracene	0.818	167.00	ppm	2/3	167.00	ppm	Max
	Benzo(a)anthracene	0.035	0.269	ppm	2/3	0.269	ppm	Max
	Benzo(a)pyrene	0.032	0.164	ppm	2/3	0.164	ppm	Max
	Benzo(b)fluoranthene	0.029	0.417	ppm	2/3	0.417	ppm	Max
	Benzo(k)fluoranthene	--	0.096	ppm	0/3	0.096	ppm	½ Sample DL
	Chrysene	0.040	0.579	ppm	2/3	0.579	ppm	Max
	Dibenz(a,h)anthracene	--	0.096	ppm	0/3	0.096	ppm	½ Sample DL
	Fluorene	2.590	2.590	ppm	1/3	2.590	ppm	Max
	Indeno(1,2,3-cd)pyrene	0.101	0.101	ppm	1/3	0.101	ppm	Max
	Naphthalene	0.599	0.599	ppm	1/3	0.599	ppm	Max
Fire Training Area								
	Benzo(a)pyrene	0.055	0.436	ppm	2/3	0.436	ppm	Max
Exxon Station								
	Benzo(a)pyrene	0.196	0.658	ppm	½	0.658	ppm	Max

Exposure Point	Chemical of Potential Concern	Concentration Detected		Units	Frequency of Detection	Exposure Point Concentration	Exposure Point Concentration Units	Statistical Measure
		Min	Max					
CF Bean Property								
	Benzo(a)anthracene	0.217	2.700	ppm	4/4	2.700	ppm	Max
	Benzo(a)pyrene	0.175	2.030	ppm	4.4	2.030	ppm	Max
	Benzo(b)fluoranthene	0.230	2.230	ppm	4/4	2.230	ppm	Max
	Dibenz(a,h)anthracene	0.040	0.435	ppm	3/4	0.435	ppm	Max
	Indeno(1,2,3-cd)pyrene	0.112	1.400	ppm	4/4	1.400	ppm	Max
Mainland Shoreline #3								
	Benzo(a)anthracene	16.300	25.300	ppm	3/3	25.300	ppm	Max
	Benzo(a)pyrene	20.800	33.000	ppm	3/3	33.000	ppm	Max
	Benzo(b)fluoranthene	19.200	30.000	ppm	3/3	30.000	ppm	Max
	Benzo(k)fluoranthene	15.000	21.500	ppm	3/3	21.500	ppm	Max
	Chrysene	20.000	30.400	ppm	3/3	30.400	ppm	Max
	Dibenz(a,h)anthracene	4.530	7.030	ppm	3/3	7.030	ppm	Max
	Indeno(1,2,3-cd)pyrene	12.100	18.800	ppm	3/3	18.800	ppm	Max
Construction Debris Landfill								
	Benzo(a)pyrene	0.059	1.810	ppm	3/3	1.810	ppm	Max
	Benzo(b)fluoranthene	0.080	3.120	ppm	3/3	3.120	ppm	Max
	Dibenz(a,h)anthracene	0.140	0.754	ppm	1/3	0.754	ppm	Max
	Indeno(1,2,3-cd)pyrene	0.038	2.030	ppm	3/3	2.030	ppm	Max
CAPA - Outside Building R-300								
	Mercury					93	ppm	95% UCL
	Benzo(a)anthracene					2.9	ppm	95% UCL
	Benzo(a)pyrene					3.3	ppm	95% UCL
	Benzo(b)fluoranthene					4.6	ppm	95% UCL
	Dibenzo(a,h)anthracene					0.24	ppm	95% UCL
	PCBs					1.2	ppm	95% UCL
CAPA - Within Footprint of Building R-300								
	Mercury - gravimetric data					39,000	ppm	95% UCL

Exposure Point	Chemical of Potential Concern	Concentration Detected		Units	Frequency of Detection	Exposure Point Concentration	Exposure Point Concentration Units	Statistical Measure
		Min	Max					
	Benzo(a)anthracene					3.5	ppm	95% UCL
	Benzo(a)pyrene					4.9	ppm	95% UCL
	Benzo(b)fluoranthene					7.1	ppm	95% UCL
	Dibenzo(a,h)anthracene					0.316	ppm	95% UCL
Witco Area								
	Anthracene	0.030	50.900	ppm	26/28	23.66	ppm	95% UCL
	Benzo(a)anthracene	0.030	162.00	ppm	27/28	69.33	ppm	95% UCL
	Benzo(a)pyrene	0.030	168.00	ppm	27/28	84.48	ppm	95% UCL
	Benzo(b)fluoranthene	0.030	287.00	ppm	25/28	86.16	ppm	95% UCL
	Benzo(k)fluoranthene	0.030	135.00	ppm	20/28	42.46	ppm	95% UCL
	Chrysene	0.040	181.00	ppm	27/28	88.04	ppm	95% UCL
	Dibenz(a,h)anthracene	0.040	39.900	ppm	20/28	16.46	ppm	95% UCL
	Indeno(1,2,3-cd)pyrene	0.040	105.00	ppm	26/28	45.14	ppm	95% UCL
	Vinyl Chloride	0.001	0.005	ppm	1/6	0.005	ppm	Max
Smelter Area								
	Benzo(a)anthracene	0.040	35.00	ppm	21/22	20.83	ppm	95% UCL
	Benzo(a)pyrene	0.030	47.80	ppm	21/22	24.64	ppm	95% UCL
	Benzo(b)fluoranthene	0.110	81.50	ppm	22/22	35.92	ppm	95% UCL
	Benzo(k)fluoranthene	0.030	81.50	ppm	21/22	25.53	ppm	95% UCL
	Chrysene	0.040	64.00	ppm	21/22	30.56	ppm	95% UCL
	Dibenz(a,h)anthracene	0.040	14.80	ppm	17/22	7.19	ppm	95% UCL
	Indeno(1,2,3-cd)pyrene	0.050	31.90	ppm	20/22	17.42	ppm	95% UCL
	PCBs	0.002	3.38	ppm	3/8	1.28	ppm	95% UCL
Dredge Island								
	Inorganic Mercury			ppm		0.700	ppm	Removal Action Level

Table 7-4
Summary of Chemicals of Concern and
Medium-Specific Exposure Point Concentrations - Mercury

Scenario Timeframe: Current
Medium: Fish/Shellfish
Exposure Medium: Fish/Shellfish

Exposure Point	Species	Concentration Detected		Units	Frequency of Detection	Exposure Point Concentration	Exposure Point Concentration Units	Statistical Measure
		Min	Max					
Closed Area								
Fish/Shellfish Tissue	Red Drum	0.08	4.45	ppm	290/290	1.38	ppm	95% UCL
	Spotted Seatrout	0.18	1.49	ppm	51/51	0.58	ppm	95% UCL
	Southern Flounder	0.16	1.21	ppm	9/9	0.76	ppm	95% UCL
	Black Drum	0.02	3.76	ppm	274/274	0.87	ppm	95% UCL
	Other finfish species[1]	0.07	1.72	ppm	61/61	0.51	ppm	95% UCL
	Oysters	0.03	0.26	ppm	25/25	0.13	ppm	95% UCL
	Blue Crabs	0.03	2.54	ppm	543/543	0.50	ppm	95% UCL
	Shrimp	0.002	0.14	ppm	17/17	0.10	ppm	95% UCL
	By-catch - Finfish[2]	0.03	3.76	ppm	149/149	0.77	ppm	95% UCL
	By-catch - Shellfish[3]	0.032	2.54	ppm	543/543	0.50	ppm	95% UCL
Open Area								
	Red Drum	0.06	1.30	ppm	87/87	0.46	ppm	95% UCL
	Spotted Seatrout	0.09	0.88	ppm	29/29	0.38	ppm	95% UCL
	Southern Flounder	0.03	0.32	ppm	12/12	0.19	ppm	95% UCL
	Black Drum	0.02	1.10	ppm	104/104	0.32	ppm	95% UCL
	Other finfish species[1]	0.01	1.35	ppm	93/93	0.23	ppm	95% UCL
	Oysters	0.01	0.05	ppm	25/25	0.04	ppm	95% UCL
	Blue Crabs	0.03	0.52	ppm	118/118	0.19	ppm	95% UCL
	Shrimp	0.006	0.06	ppm	6/6	0.06	ppm	Max
	By-catch - Finfish[2]	0.01	0.60	ppm	113/113	0.19	ppm	95% UCL
	By-catch - Shellfish[3]	0.03	0.52	ppm	118/118	0.19	ppm	95% UCL

1 Includes sand seatrout, gaftopsail catfish, Atlantic croaker, and sheepshead

2 Finfish average 77% of by-catch consumed and concentration was weighted by species based on average consumption. Weights from finfish species reportedly consumed were as follows: 3.3% black drum, 84.1% flounder, and 12.6% sheepshead

3 Shellfish is assumed to be 100% blue crab since relatively little shrimp and no oysters were reportedly consumed as by-catch by commercial shrimpers

Exposure Point	Species	Concentration Detected		Units	Frequency of Detection	Exposure Point Concentration	Exposure Point Concentration Units	Statistical Measure
		Min	Max					
Other Bays								
	Red Drum	0.06	0.19	ppm	6/6	0.19	ppm	Max
	Spotted Seatrout	0.09	0.14	ppm	5/5	0.14	ppm	Max
	Southern Flounder	0.03	0.07	ppm	3/3	0.07	ppm	Max
	Black Drum	0.02	0.60	ppm	6/6	0.60	ppm	Max
	Other finfish species[1]	0.01	0.32	ppm	40/40	0.09	ppm	95% UCL
	Oysters	0.001	0.011	ppm	22/22	0.01	ppm	95% UCL
	Blue Crabs	0.0001	0.20	ppm	13/13	0.20	ppm	Max
	Shrimp	0.0001	0.01	ppm	22/22	0.01	ppm	95% UCL
	By-catch - Finfish[2]	0.01	0.60	ppm	113/113	0.11	ppm	95% UCL
	By-catch - Shellfish[3]	0.0001	0.20	ppm	13/13	0.20	ppm	Max

Table 7-5
Summary of Chemicals of Concern and
Medium-Specific Exposure Point Concentrations

Scenario Timeframe: Current
Medium: Surface Sediment
Exposure Medium: Sediment

Exposure Point	Chemical of Potential Concern	Concentration Detected		Units	Frequency of Detection	Exposure Point Concentration	Exposure Point Concentration Units	Statistical Measure
		Min	Max					
Sediment: Dermal Contact	Total Mercury	0.013	2.38	ppm	27/28	0.96	ppm	95% UCL
	Methyl mercury	0.027	4.99	ppb	26/26	0.0032	ppm	95% UCL
	Acenapthene	0.3	1,080	ppb	15/16	1.08	ppm	Max
	Acenaphthylene	0.2	272	ppb	13/16	0.27	ppm	Max
	Anthracene	1.1	1,890	ppb	16/16	1.89	ppm	Max
	Benzo(a)anthracene	2.2	2,760	ppb	16/16	2.76	ppm	Max
	Benzo(a)pyrene	2.0	5,430	ppb	16/16	5.43	ppm	Max
	Benzo(b)fluoranthene	3.2	6,460	ppb	16/16	6.46	ppm	Max
	Benzo(g,h,i)perylene	1.8	3,290	ppb	16/16	3.29	ppm	Max
	Benzo(k)fluoranthene	1.4	2,230	ppb	16/16	2.23	ppm	Max
	Chrysene	2.2	2,990	ppb	16/16	2.99	ppm	Max
	Dibenz(a,h)anthracene	0.1	796	ppb	15/16	0.80	ppm	Max
	Fluoranthene	2.8	7,930	ppb	16/16	7.93	ppm	Max
	Fluorene	0.2	428	ppb	15/16	0.43	ppm	Max
	Indeno(1,2,3-cd)pyrene	1.5	3,830	ppb	16/16	3.83	ppm	Max
	Naphthalene	0.4	114	ppb	15/16	0.11	ppm	Max
	Phenanthrene	1.0	3,310	ppb	15/16	3.31	ppm	Max
	Pyrene	2.6	5,970	ppb	16/16	5.97	ppm	Max
	Total PAHs	22.9	40,301	ppb		40.30	ppm	Max
	Total Carcinogenic PAH	10.4	21,476	ppb		21.48	ppm	Max
	B(a)P TEQ	2.9	7,526	ppb		7.53	ppm	Max

Table 7-6

Exposure Scenarios Evaluated in the Baseline Risk Assessment

PSA	FUTURE INDUSTRIAL WORKER	FUTURE CONSTRUCTION WORKER	CURRENT MAINTENANCE WORKER	CURRENT TRESPASSER YOUTH SCENARIO
Waste Oil Management Area	X	X	X	NE
Smelter Spent Potlining Storage Area	X	X	X	NE
Enron Tanks	X	X	X	NE
Fire Training Area	X	X	X	NE
Exxon Station	X	X	X	X
CF Bean Property	X	X	X	X
Mainland Shoreline #3	NE	X	NE	NE
Construction Debris Landfill	NE	NE	X	NE
Smelter Area	X	X	X	NE
Witco Area	X	X	X	NE
CAPA	X	X	X	NE
Dredge Island	NE	X	NE	NE

NE = Not Evaluated

Table 7-7
Cancer Toxicity Data Summary

Pathway: Ingestion, Dermal

Chemical of Concern	Oral Cancer Slope Factor	Dermal Cancer Slope Factor	Slope Factor Units	Weight of Evidence/Cancer Guideline Description	Source	Date (MM/DD/YYYY)
Benzo(a)anthracene	7.3 E-01		(mg/kg)/day	B2	IRIS	1998
Benzo(a)pyrene	7.3 E-00		(mg/kg)/day	B2	IRIS	1998
Benzo(b)fluoranthene	7.3 E-01		(mg/kg)/day	B2	IRIS	1998
Benzo(k)fluoranthene	7.3 E-02		(mg/kg)/day	B2	IRIS	1998
Chrysene	7.3 E-03		(mg/kg)/day	B2	IRIS	1998
Dibenz(a,h)anthracene	7.3 E-00		(mg/kg)/day	B2	IRIS	1998
Indeno(1,2,3-cd)pyrene	7.3 E-01		(mg/kg)/day	B2	IRIS	1998
Vinyl Chloride	1.9		(mg/kg)/day	B2	HEAST	1997

Pathway: Inhalation

Chemical of Concern	Unit Risk	Units	Inhalation Cancer Slope Factor	Units	Weight of Evidence/Cancer Guideline Description	Source
Benzo(a)anthracene	8.80E-04	µg/m^3			B2	IRIS
Benzo(a)pyrene	8.80E-04	µg/m^3			B2	IRIS
Benzo(b)fluoranthene	8.80E-04	µg/m^3			B2	IRIS
Benzo(k)fluoranthene	8.80E-04	µg/m^3			B2	IRIS
Chrysene	8.80E-04	µg/m^3			B2	IRIS
Dibenz(a,h)anthracene	8.80E-04	µg/m^3			B2	IRIS
Indeno(1,2,3-cd)pyrene	8.80E-04	µg/m^3			B2	IRIS
Vinyl Chloride	8.40E-05	µg/m^3			B2	HEAST

Key **EPA Group:**

IRIS: Integrated Risk Information System, U.S. EPA
HEAST: Health Effects Assessment Summary Tables

A - Human carcinogen
B1 - Probable human carcinogen - Indicates that limited human data are available
B2 - Probable human carcinogen - Indicates sufficient evidence in animals and inadequate or no evidence in humans
C - Possible human carcinogen
D - Not classifiable as a human carcinogen
E - Evidence of noncarcinogenicity

This table provides carcinogenic risk information which is relevant to the contaminants of concern in soil. At this time, slope factors are not available for the dermal route of exposure. Thus, the dermal slope factors used in the assessment have been extrapolated from oral values. An adjustment factor is sometimes applied, and is dependent upon how well the chemical is absorbed via the oral route. Adjustments are particularly important for chemicals with less than 50% absorption via the ingestion route. However, adjustment is not necessary for the chemicals evaluated at this site. Therefore, the same values presented above were used as the dermal carcinogenic slope factors for these contaminants.

Table 7-8
Non-Cancer Toxicity Data Summary

Pathway: Ingestion, Dermal

Chemical of Concern	Chronic/ Subchronic	Oral RfD Value	Oral RfD Units	Dermal RfD	Dermal RfD Units	Primary Target Organ	Combined Uncertainty/ Modifying Factors	Sources of RfD: Target Organ	Dates of RfD: Target Organ (MM/DD/YYYY)
Acenaphthene	Chronic	6.00E-02	mg/kg-d			liver	--	IRIS	1998
Anthracene	Chronic	3.00E-01	mg/kg-d			no effects	--	IRIS	1998
Fluoranthene	Chronic	4.00E-02	mg/kg-d			liver	--	IRIS	1998
Fluorene	Chronic	4.00E-02	mg/kg-d			blood	--	IRIS	1998
Naphthalene	Chronic	4.00E-02	mg/kg-d			weight loss	--		
Pyrene	Chronic	3.00E-02	mg/kg-d			kidney	--	IRIS	1998
Methylmercury	Chronic	1.00E-04	mg/kg-d			central nervous system/ fetus	--	IRIS	1998
Inorganic Mercury									

Pathway: Inhalation

Chemical of Concern	Chronic/ Subchronic	Oral RfD Value	Oral RfD Units	Dermal RfD	Dermal RfD Units	Primary Target Organ	Combined Uncertainty/ Modifying Factors	Sources of RfD: Target Organ	Dates of RfD: Target Organ (MM/DD/YYYY)
Acenaphthene	--								
Anthracene	--								
Fluoranthene	--								
Fluorene	--								
Naphthalene	--								
Pyrene	--								
Methylmercury	--								
Inorganic Mercury	--								

This table provides non-carcinogenic risk information which is relevant to the contaminants of concern in soil.

Table 7-9
Risk Characterization Summary - Carcinogens

Scenario Timeframe: Future
Receptor Population: Industrial Worker
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Chemical of Concern	Carcinogenic Risk			
				Ingestion	Inhalation	Dermal	Exposure Routes Total
Witco Area							
Soil	Soil	Soil On-Site Direct Contact	Benzo(a)anthracene	4.9E-06	3.8E-09	5.7E-07	5e-06
			Benzo(a)pyrene	5.9E-05	4.6E-09	7.0E-06	7e-05
			Benzo(b)fluoranthene	6.0E-06	4.7E-09	7.1E-07	7e-06
			Benzo(k)fluoranthene	3.0E-07	2.3E-09	3.5E-08	3e-07
			Chrysene	6.2E-08	4.8E-09	7.3E-09	7e-08
			Dibenz(a,h)anthracene	1.2E-05	9.0E-10	1.4E-06	1e-05
			Indeno(1,2,3-cd)pyrene	3.2E-06	2.5E-09	3.7E-07	4e-06
			Vinyl Chloride	1.7E-09	0.00E-0	2.5E-06	3e-06
							1e-04

This table provides risk estimates for the significant routes of exposure. These risk estimates are based on a reasonable maximum exposure and were developed by taking into account various conservative assumptions about the frequency and duration of exposure to soil, as well as the toxicity of the COCs.

Table 7-10
Risk Characterization Summary - Non-Carcinogens

Scenario Timeframe: Current
Receptor Population: Maintenance Worker
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Chemical of Concern	Primary Target Organ	Non-Carcinogenic Hazard Quotient			
					Ingestion	Inhalation	Dermal	Exposure Routes Total
Chlor-Alkali Process Area - Inside Building R-300 Footprint								
Soil	Soil	Soil On-Site Direct Contact	Inorganic Mercury		13.2	0.004	1.4	14.6

This table provides hazard quotients (HQs) for each route of exposure and the hazard index (sum of hazard quotients) for all routes of exposure. The Risk Assessment Guidance (RAGS) for Superfund states that, generally, a hazard index (HI) greater than 1 indicates the potential for adverse noncancer effects. The estimated HI of 14.6 indicates that the potential for adverse noncancer effects could occur from exposure to contaminated soil containing mercury.

Table 7-11
Risk Characterization Summary - Non-Carcinogens

Scenario Timeframe: Future
Receptor Population: Industrial Worker
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Chemical of Concern	Primary Target Organ	Non-Carcinogenic Hazard Quotient			
					Ingestion	Inhalation	Dermal	Exposure Routes Total
Chlor-Alkali Process Area - Inside Building R-300 Footprint								
Soil	Soil	Soil On-Site Direct Contact	Inorganic Mercury		63.6	0.4	3.7	67.7

This table provides hazard quotients (HQs) for each route of exposure and the hazard index (sum of hazard quotients) for all routes of exposure. The Risk Assessment Guidance (RAGS) for Superfund states that, generally, a hazard index (HI) greater than 1 indicates the potential for adverse noncancer effects. The estimated HI of 67.7 indicates that the potential for adverse noncancer effects could occur from exposure to contaminated soil containing mercury.

SECTION 8
Remedial Action Objectives

Remedial action objectives (RAOs) are established to support the evaluation of remedial alternatives for areas with the potential for unacceptable risk as identified in the BLRA. The RAOs are established by specifying contaminants and media of concern, potential exposure pathways, and remediation goals. In evaluating the remedial options for addressing the site, RAOs are developed for Lavaca Bay, the CAPA and Witco.

Lavaca Bay

The RAOs for Lavaca Bay are to (1) eliminate or reduce to the maximum extent practical mercury loading from on-going unpermitted sources to Lavaca Bay; (2) reduce to an appropriate level mercury in surface sediments in sensitive habitats; and (3) reduce to an appropriate level mercury in surface sediments in open-water that represent a pathway by which mercury may be introduced into the food chain. These objectives are designed to allow the reduction of mercury levels in fish tissue such that the overall risk throughout Lavaca Bay will approach that which would be present but for the historic Point Comfort Operations. The predicted health risks associated with consumption of fish from Lavaca Bay, as well as all bays, using the average consumption rate and reasonable maximum exposure (RME) consumption rates were presented in the Proposed Plan. Potential health risks were estimated for four different exposure groups. Using both the average and RME fish consumption rates, the potential health risks for "Lavaca Bay Fishermen", are similar to the potential health risks for "All Fishermen". The predicted risk for "Lavaca Bay and Closed Area Fishermen" and "Closed Area Fishermen" are approximately twice as high as the potential risk for "Lavaca Bay Fishermen" or "All Fishermen". Therefore, the predicted unacceptable health risk from consuming fish and shellfish associated with releases from the Alcoa Point Comfort operations is focused generally within the Closed Area of Lavaca Bay. The ultimate result of remedial actions in Lavaca Bay will be the reduction of mercury in upper trophic level fish/shellfish to levels that would be protective of human consumption and not pose an unacceptable ecological risk.

Even though predicted unacceptable risk may be present due to non-site related contamination, a remedial action at a Superfund site is to address contamination at or from the site. At the Alcoa site, even though there may be unacceptable risks identified for "Lavaca Bay Fishermen", the predicted risk is not significantly different than the predicted risk present for "All Fishermen". The general area around the Closed Area of Lavaca Bay is that area in which unacceptable risks from consumption of fish and shellfish can be attributed to past releases from Alcoa given the uncertainties associated with the toxicity of methylmercury, fish consumption rates and sediment to biota accumulation factors. Therefore, the remedial actions to reduce or control risk to human health and the environment are focused within the Closed Area of Lavaca Bay and areas of Lavaca

Bay in the general vicinity of the current Closed Area. Regardless of the fish consumption rate used (RME or average), there is no change in the remedial actions proposed for the site.

Uptake of mercury into the food chain is the result of elevated concentrations of bioavailable mercury in surface sediments concentrated in habitats that either are preferential for methylation and/or are biologically active zones (productive or preferential feeding areas for aquatic organisms). Based on current understanding of the dynamics of Lavaca Bay, actions have been or are being taken to address fully all known ongoing and unpermitted sources of mercury to the Bay that contribute significantly to risk. Residual contamination in sediments will thus be the remaining focus, with emphasis on localized areas that represent critical habitat types and/or higher concentrations of bioavailable mercury in sediments.

The RAOs for mercury in sediment have two quantitative target cleanup goals, depending on the location of the sediment. The target cleanup goals are:

- For sediments in fringe marsh-type habitat, eliminate the exposure pathway that is presented by sediments that on average exceed 0.25 ppm mercury.

- For sediments in open-water habitat, eliminate the exposure pathway that is presented by sediments that on average exceed 0.5 ppm mercury.

Lower sediment concentration levels are recommended for fringe marsh-type habitats because an evaluation of the Biota Sediment Accumulation Factors (BSAF) measured during the Prey Item Study shows that the rate of methylmercury uptake in the critical habitats is approximately twice that which occurs in the open water habitat. The specific target sediment cleanup value for critical habitats (fringe marsh-type), 0.25 ppm mercury, is based on a weight-of-evidence evaluation of empirical measurements of the ratio of tissue-to-sediment concentration determined during the RI phase of the project and long-term tissue monitoring data. Achieving this sediment target goal in these areas will result in a substantial reduction of mercury entering the food chain.

The target cleanup goal for sediments in open-water, on average, is 0.5 ppm mercury. The focus of achieving this goal will be additional source reduction, which further addresses bioavailable sediments through sediment remedial actions.

The ecological risk assessment concluded that no risk is predicted for fish-eating birds through bioaccumulation of mercury in prey items. Also, no mortality or reproductive risks were predicted for carnivorous fish through bioaccumulation of methylmercury. However, potential risk was noted for direct contact with sediments with elevated mercury concentrations in portions of Lavaca Bay for early life stages of fish and shellfish. A critical tissue evaluation also noted that mercury concentrations found in fish (gulf killifish, red drum, and black drum) in these same areas are within the range associated with behavioral, and possibly reproductive, effects. From the literature, it appears that for small resident fish confined to small areas of marsh, adverse behavioral and reproductive effects start appearing with fish muscle concentrations of approximately 0.5 ppm. For larger migratory fish such as red drum, levels in excess of 2 ppm mercury in fish tissue may be sufficient to adversely affect survival and/or reproduction. Enhanced natural recovery, one of the risk reduction options proposed in the FS, is expected to reduce surface sediment concentrations below the long-term remedial goals (0.25 and 0.50 mg/kg mercury). Achieving these sediment goals is expected to result in reductions in fish tissue levels such that there are no unacceptable risks to ecological receptors even for the most conservative risk estimate noted above.

- The target sediment goal of 0.25 ppm mercury for fringe marsh-type habitat is expected to reduce fish tissue levels of the smaller resident species, such as noted for killifish within marshes in the Closed Area to the north and east of Dredge Island, below the 0.5 ppm mercury tissue level noted for potential behavioral effects.

- The target sediment goals of 0.25 ppm mercury for fringe marsh-type habitat and 0.5 ppm mercury for open water is expected to result in mercury concentrations below the 2 ppm mercury concentration noted for fish tissue that relates to adverse effects in survival and reproduction for large predatory carnivorous fish.

PAHs are another analyte of concern, and they exceed risk-based levels in isolated portions of the Closed Area. The RAO for PAHs is to reduce sediment concentrations below the ERM, which equates to 44.8 ppm total PAH. The areas where this concentration is exceeded are also areas where mercury is a potential concern. Reductions in PAH concentrations will be accomplished through remedial actions at the Witco area, mercury sediment removal actions and natural recovery.

To summarize, the RAO for mercury is action based as described in the Preferred Remedial Alternative. Target sediment cleanup goals have been set based on the locations where finfish and shellfish data from previous sampling efforts suggests the opportunity for mercury to enter the food chain is concentrated. The target sediment cleanup goal is 0.25 ppm mercury for critical habitats (fringe marsh-type) and 0.5 ppm mercury for open water. Although these goals were quantitatively developed for protection of human health, these mercury levels also will be protective of potential ecological receptors.

Chlor-alkali Process Area

The general RAO for CAPA soils is to reduce the future exposure potential of site workers (e.g., construction worker, general industrial worker, and maintenance worker) to mercury in soils in the Building R-300 vicinity. The exposure pathways considered when developing the RAOs are the incidental ingestion of and dermal contact with soils. The mercury concentration for soils for direct contact to be addressed by the RAO, described in the *CAPA Data Report*, is 466 mg/kg. In addition, the remedial action at the CAPA should address those areas of soil that exceed the TNRCC commercial/industrial soil protection concentration limit for mercury (adjusted for consideration of occupational air standards for on-site workers) of 180 mg/kg. The RAO for CAPA soils does not include reducing the potential for ongoing leaching of mercury for these soils to underlying ground water, since control of CAPA ground water discharge to the bay will be performed as part of the Bay remedial action alternative.

Witco

The RAO for soils in the Witco Area is to reduce the future exposure potential of site workers (e.g., construction worker, general industrial worker, and maintenance worker) to PAHs in surficial soils at the Stormwater Sump and Separator Area and Former Tank Farm Area. The exposure pathways considered when developing the RAO are incidental ingestion of and dermal contact with soils. For the seven carcinogenic PAHs, the following preliminary remediation goals are presented as cleanup levels for the Witco Area soils.

Benz(a)anthracene	32 mg/kg
Benzo(a)pyrene	3.2 mg/kg
Benzo(b)fluoranthene	32 mg/kg
Benzo(k)fluoranthene	320 mg/kg
Chrysene	3200 mg/kg
Dibenz(a,h)anthracene	3.2 mg/kg
Indeno(1,2,3-c,d)pyrene	32 mg/kg

SECTION 9
Description of Alternatives

This section summarizes the remedial alternatives developed during the Feasibility Study (FS). These alternatives are analyzed in more detail in the FS, which is part of the Administrative Record.

Under its legal authorities, EPA's primary responsibility at Superfund sites is to undertake remedial actions that are protective of human health and the environment. In addition, Section 121 of CERCLA establishes several other statutory requirements and preferences, including: a requirement that EPA's remedial action, when complete, must comply with all federal and more stringent state environmental and facility siting standards, requirements, criteria or limitations, unless a waiver is invoked; a requirement that EPA select a remedial action that is cost-effective and that utilizes permanent solutions and alternative treatment technologies or resource recovery technologies to the maximum extent practicable; and a preference for remedies in which treatment which permanently and significantly reduces the volume, toxicity or mobility of the hazardous substances is a principal element over remedies not involving such treatment. Response alternatives were developed to be consistent with these Congressional mandates. Treatment of contaminated sediments is not practical because of the high volume anticipated and the low concentration of mercury. Therefore, treatment alternatives for sediment were not generated. The remedial action alternatives for the Alcoa/Lavaca Bay site are as follows:

Bay System

RAA Bay-1: No Action

RAA Bay-2: Source Control

RAA Bay-3: Source Control, Dredging, Addressing Key Biological Uptake Areas

RAA Bay-4A: Source Control, Dredging, Addressing Key Biological Uptake Areas, and Enhanced Natural Recovery North of Dredge Island

RAA Bay-4B: Source Control, Dredging, Addressing Key Biological Uptake Areas, and Removal North of Dredge Island

RAA Bay-5: Extensive Removal

Chlor-Alkali Process Area Soils

RAA CAPA-1: No Action

RAA CAPA-2: Fencing and Institutional Controls

RAA CAPA-3: Capping and Institutional Controls

RAA CAPA-4: Soil Excavation, Stabilization and On-Site Disposal

RAA CAPA-5: Soil Excavation, Thermal Desorption and On-Site Disposal

Former Witco Processing Area

RAA Witco-1: No Action

RAA Witco-2: Capping and Institutional Controls

RAA Witco-3: Soil Excavation and On-Site Disposal

Common Elements of Remedial Alternatives

Bay System

Three actions have already been taken or are currently underway and are common to all of the Bay Remedial Action Alternatives. The actions taken include the following:

Dredge Island Stabilization and Northern Marsh Removal

The Dredge Island stabilization project included relocating the contents of the Dredge Material Placement Areas (DMPAs) containing elevated levels of mercury (approximately 523,000 CY) into the Gypsum Placement Areas (GPAs). In addition, the containment dikes surrounding the GPAs were raised so they will not be overtopped during a severe storm (e.g., hurricane). This required increasing 10,700 linear feet of dike to an approximate elevation of 30 feet. The work began on November 1998 and was completed during the summer of 2001. The estimated cost for the work was $38,560,000. As part of this work, the marshes on the north end of the Island were removed. A final cover for the disposal areas will consist of dredged material taken from an area of Lavaca Bay that has mercury concentrations below human health and ecological risk-based values.

CAPA Sediment Removal

As part of the dredging treatability study, roughly 70,000 cubic yards of contaminated sediments were dredged in the channel area adjacent to the former CAPA. The CAPA sediments were dredged hydraulically. The contractor used silt curtains that surrounded the dredge area to minimize impacts to the water column. The sediments were disposed at Alcoa's dredge disposal lakes adjacent to the bauxite residue lakes. Within the lakes, the sediment was allowed to settle out from the dredge slurry and the decant water was returned back to the bay. Water quality monitoring as well as post-dredge sediment sampling was completed during the dredging. The dredging required roughly 21 days to complete in August 1998. Phase II of the treatability study involved dredging 10,000 cubic yards of sediment from a location near Dredge Island and disposing the material on Dredge Island. This work required 17 days to complete in January 1999. The cost to complete both dredging treatability studies was $1,952,000. Dredging was effective from a mass removal standpoint in areas with high mercury concentrations and that have the potential for sediment resuspension from influences such as navigational traffic. Resuspension of sediment material and transport offsite from the dredge areas was not significant based on the results of water quality (turbidity and mercury concentration) monitoring. Monitoring of oyster tissue confirmed that tissues mercury levels were well below concentrations of concern.

CAPA Ground Water Treatment

As part of the CAPA ground water treatability study, four ground water extraction wells were installed and operated to provide hydraulic control of ground water migration to the bay. Ground water collected from the wells is treated using an air stripper and carbon adsorption system and then discharged to Lavaca Bay. The system has been operating since 1998 and has been successful in reversing the ground water gradient in the area of CAPA. Monitoring of the treatment system effluent is performed on a regular basis. Surface water monitoring will be used to evaluate the effectiveness of the CAPA hydraulic control remedy. Extraction system and treatment capital costs (not including future equipment replacement costs) were approximately $175,000.

Summary of Alternatives

Bay System

As described in Section 8, the RAO for Lavaca Bay is based on mercury concentrations in fish and shellfish that are protective for individuals who consume the fish and shellfish. In order to achieve acceptable levels of mercury in fish and shellfish, the remedial actions need to address the media that affect the biota. The RI concluded that contaminant concentrations in fish and shellfish tissue are influenced by a sediment-based food web. Therefore, the proposed remedial actions focus on current and future sources that contribute to continued contamination of sediments and biological media associated with such sediments.

The areas targeted for potential remedial action in the Bay system were identified based on total mercury and PAH concentrations in surface sediments, habitat types, potential for sediment resuspension due to influences such as ship traffic, and observed mercury concentrations in biota. Potential areas of biological uptake include the northern fringe marshes on Dredge Island, the Witco marsh, and the southern causeway marshes. Ongoing sources that can supply mercury to the critical uptake areas include the ground water discharge into Lavaca Bay from the CAPA, surface water runoff from Dredge Island soils, and sediments in the channel around the Witco Area and the CAPA. The ongoing source that can supply PAH to Lavaca Bay is the PAH DNAPL at the Witco Area.

In addition, other areas with elevated surface sediment mercury concentrations have been identified in the Bay. These areas, if continually impacted by external ongoing sources and/or if disturbed, could serve as additional sources of mercury to biological uptake areas. These areas include the Witco Channel, areas bordering Alcoa's Industrial Channel, an area north of Dredge Island and an area southwest of Dredge Island.

As discussed earlier, elemental mercury and carbon tetrachloride DNAPL are present at the base of the B2 sand unit at the CAPA. Although there has been substantial data collected, to date, none indicates that elemental mercury or carbon tetrachloride DNAPL are migrating directly into Lavaca Bay. Nevertheless, the presence of these constituents is a potential source of concern. Because elemental mercury and carbon tetrachloride DNAPL are not currently entering Lavaca Bay, monitoring will be conducted to further evaluate the potential for future migration of these materials directly into Lavaca Bay. If it is determined that there is a completed migration pathway for elemental mercury and carbon tetrachloride DNAPL to enter Lavaca Bay, the DNAPL remediation technologies discussed in Section 2.3.5.2 of the Feasibility Study will be considered to address the discharge.

Even though remedial actions are proposed as part of each alternative, mercury levels in fish and shellfish will not be immediately reduced. The mercury levels in fish and shellfish will decrease over time once the sources of mercury in Lavaca Bay have been addressed. To evaluate the effectiveness of the proposed remedy, long-term monitoring of fish, shellfish, and sediments will be conducted. A detailed monitoring program will be established later during design of the selected Bay System remedy. At a minimum, the effectiveness of the remedy will be evaluated once every five years. Generally, the monitoring program will discuss anticipated ranges and timeframes for decreases of mercury-tissue levels in fish and shellfish and mercury concentrations in surface sediments. For fish and shellfish, shorter-term quantitative goals will be developed during the remedial design to help measure progress towards the ultimate remedial objectives. The shorter-term quantitative goals will describe a range of concentration levels in fish and shellfish and time intervals over which recovery should occur, taking into account variability and uncertainty in parameters that could affect recovery rates. Trend analysis will be utilized to evaluate the reductions of mercury in fish and shellfish over time. If the anticipated reductions of mercury in fish/shellfish and/or sediments are not achieved within the anticipated timeframe, an evaluation of the remedy effectiveness will be undertaken.

For a period of time after remedial actions are completed in Lavaca Bay, the levels of mercury in fish and shellfish within the TDH fish closure area will continue to be at levels that present a potentially unacceptable risk for people who consume the fish and shellfish. For this reason, the current TDH closure order will continue in effect as an institutional control to manage this exposure.

RAA Bay -1: No Action

Estimated Capital Cost:	*$ 0*
Estimated Annual O & M Costs:	*$ 0*
Estimated Present Worth:	*$ 0*

The no action alternative is retained to serve as a baseline against which other alternatives are evaluated. This alternative assumes that there will be no further removal, remedial, or institutional activities performed to address the bay sediments or ongoing sources. Current institutional controls that would continue to be implemented include the Texas Department of Health's closure of waters for the consumption of finfish and shellfish.

The remaining alternatives rely for protectiveness in part upon work already completed or presently ongoing. The three actions already undertaken are described above.

RAA Bay -2 - Source Control

Estimated Capital Cost:	*$ 1,300,000*
Estimated Annual O & M Costs:	*$ 250,000*
Estimated Present Worth:	*$ 4,900,000*
Implementation Time:	*6 months*

This alternative addresses and controls the ongoing sources to the bay and includes the following actions: 1) extraction and treatment of CAPA ground water; and 2) installation of a DNAPL collection trench and sheet piling vertical barrier at the Witco Area. Mercury-contaminated ground water beneath the CAPA would be hydraulically controlled by a series of extraction wells installed during the ground water treatability study. West of the former Witco Tank Farm Area, a collection trench would be installed for the purpose of intercepting PAH DNAPL potentially migrating to Lavaca Bay. The actual lengths, paths, and configurations of the collection trench and sheet piling barrier systems would be refined during the remedial design. Areas of Lavaca Bay impacted by elevated mercury levels that are not actively remediated, are expected to recover with time to acceptable levels due to natural recovery of the sediments through sedimentation. The areas of Lavaca Bay not addressed as part of the remedial alternative include the Witco marshes, southeastern causeway marshes, Witco Channel, areas bordering Alcoa's Industrial Channel, the area north of Dredge Island and the area southwest of Dredge Island. This alternative controls and eliminates the ongoing sources of PAH contamination to Lavaca Bay by implementing remedial actions in the Witco area. Areas of the bay that currently have elevated PAH levels are expected to naturally recover to acceptable levels once the upland sources have been eliminated. Long-term monitoring of the sediment and fish would be required to confirm the reduction of mercury in fish tissue such that the overall risk throughout Lavaca Bay will approach that which would be present but for the historic Point Comfort operations. The ultimate result of remedial actions in Lavaca Bay will be the reduction of mercury in upper trophic fish/shellfish to levels that would be protective for human consumption and not pose an unacceptable ecological risk. For a period of time after remedial actions are completed in Lavaca Bay, the levels of mercury in fish and shellfish within the TDH fish closure area will remain at levels that present a potentially unacceptable risk for people who consume the fish and shellfish. The current TDH closure order will continue in effect as an institutional control to manage this exposure.

RAA Bay -3: Source Control, Dredging and Key Biological Uptake Area Response

Estimated Capital Cost:	*$ 6,400,000*
Estimated Annual O & M Costs:	*$ 250,000*
Estimated Present Worth:	*$ 9,900,000*
Implementation Time:	*6 months*

This alternative would include dredging the Witco channel and active remediation in the Witco marsh in addition to the activities proposed in RAA Bay-2. A total of about 200,000 cubic yards of sediments would be dredged from the Witco channel over a period of approximately six months. Dredged sediments would be placed and confined within the stabilized Dredge Island. Dredged sediments will not be stabilized or treated prior to disposal. Remediation of the Witco marsh would consist of either dredging or filling the marsh. The cost estimate presented above is based on filling the Witco Marsh. The cost would rise by approximately $200,000 if the Witco Marsh is dredged. If the Witco marsh were filled, first a berm along the perimeter of the marsh would be constructed and then clean sediment or fill would be placed behind the berm. Approximately 63,000 cubic yards of sediments would be removed if the Witco marsh were dredged. This alternative controls and eliminates the ongoing sources of PAH contamination to Lavaca Bay by implementing upland remedial actions in the Witco area. Dredging of the Witco Channel will address some areas of the bay that currently have elevated PAH levels. Other areas in the bay that have elevated PAH levels are expected to naturally recover to acceptable levels once the upland sources have been eliminated. Areas of concern in Lavaca Bay impacted by elevated mercury levels that are not actively remediated, are expected to recover with time to acceptable levels due to natural recovery of the sediments through sedimentation. The areas of Lavaca Bay not addressed as part of the remedial alternative include the southern causeway marshes, areas bordering Alcoa's Industrial Channel, the area north of Dredge Island and the area southwest of Dredge Island. Long-term monitoring of the sediment and fish would be required to monitor the reduction of mercury in fish tissue such that the overall risk throughout Lavaca Bay will approach that which would be present but for the historic Point Comfort operations. The ultimate result of remedial actions in Lavaca Bay will be the reduction of mercury in upper trophic fish/shellfish to levels that would be protective for human consumption and not pose an unacceptable ecological risk. For a period of time after remedial actions are completed in Lavaca Bay, the levels of mercury in fish and shellfish within the TDH fish closure area will remain at levels that present a potentially unacceptable risk for people who consume the fish and shellfish. The current TDH closure order will continue in effect as an institutional control to manage this exposure.

RAA Bay - 4A: Source Control, Dredging, Key Biological Area Response, and Enhanced Natural Recovery North of Dredge Island

Estimated Capital Cost:	*$ 8,400,000*
Estimated Annual O & M Costs:	*$ 250,000*
Estimated Present Worth:	*$ 12,000,000*
Implementation Time:	*12 months*

In addition to the activities proposed for RAA Bay-2 and RAA Bay-3, alternative 4A includes enhanced natural recovery of the area north of Dredge Island. The area north of Dredge Island would receive a thin cap over the entire area to enhance the natural recovery process currently occurring in the bay. Approximately 75,000 to 145,000 cubic yards of capping material would be required for the area north of Dredge Island. The placement of a thin layer cap would require 4 to 8 months to be completed. Dredged sediments will not be stabilized or treated prior to disposal. The cost estimate presented above is based on filling the Witco Marsh. The cost would rise by approximately $200,000 if the Witco Marsh is dredged. This alternative controls and eliminates the ongoing sources of PAH contamination to Lavaca Bay by implementing upland remedial actions in the Witco area. Dredging of the Witco Channel will address some areas of the bay that currently have elevated PAH levels. Other areas in the bay that have elevated PAH levels are expected to naturally recover to acceptable levels once the upland sources have been eliminated. Areas of concern in Lavaca Bay impacted by elevated mercury levels that are not actively remediated, are expected to recover with time to acceptable levels due to natural recovery of the sediments through sedimentation. The areas of Lavaca Bay not addressed as part of the remedial alternative include the southern causeway marshes, areas bordering Alcoa's Industrial Channel, and the area southwest of Dredge Island. Long-term monitoring of sediment and fish would be required to monitor the reduction of mercury in fish tissue such that the overall risk throughout Lavaca Bay will approach that which would be present but for the historic Point Comfort operations. The ultimate result of remedial actions in Lavaca Bay will be the reduction of mercury in upper trophic fish/shellfish to levels that would be protective for human consumption and not pose an unacceptable ecological risk. For a period of time after remedial actions are completed in Lavaca Bay, the levels of mercury in fish and shellfish within the TDH fish closure area will remain at levels that present a potentially unacceptable risk for people who consume the fish and shellfish. The current TDH closure order will continue in effect as an institutional control to manage this exposure.

RAA Bay - 4B: Source Control, Dredging, Address Key Biological Area, and Removal North of Dredge Island

Estimated Capital Cost:	*$ 16,100,000*
Estimated Annual O & M Costs:	*$ 250,000*
Estimated Present Worth:	*$ 19,600,000*
Implementation Time:	*12 months*

RAA Bay-4B would include dredging the open water area north of Dredge Island, in addition to the activities proposed for RAA Bay-2 and RAA Bay-3. Approximately 583,000 cubic yards of dredge material would be removed from this area and would require 12 to 15 months to complete. Dredged sediments would be placed and confined within the stabilized Dredge Island. Dredged sediments will not be stabilized or treated prior to disposal. The cost estimate presented above is based on filling the Witco Marsh. The cost would rise by approximately $200,000 if the Witco Marsh is dredged. This alternative controls and eliminates the ongoing sources of PAH contamination to Lavaca Bay by implementing upland remedial actions in the Witco area. Dredging of the Witco Channel will address some areas of the bay that currently have elevated PAH levels. Other areas in the bay that have elevated PAH levels are expected to naturally recover to acceptable levels once the upland sources have been eliminated. Areas of concern in Lavaca Bay impacted by elevated mercury levels that are not actively remediated, are expected to recover with time to acceptable levels due to natural recovery of the sediments through sedimentation. The areas of Lavaca Bay not addressed as part of the remedial alternative include the southern causeway marshes, areas bordering Alcoa's Industrial Channel, and the area southwest of Dredge Island. Long-term monitoring of sediment and fish would be required to monitor the reduction of mercury in fish tissue such that the overall risk throughout Lavaca Bay will approach that which would be present but for the historic Point Comfort operations. The ultimate result of remedial actions in Lavaca Bay will be the reduction of mercury in upper trophic fish/shellfish to levels that would be protective for human consumption and not pose an unacceptable ecological risk. For a period of time after remedial actions are completed in Lavaca Bay, the levels of mercury in fish and shellfish within the TDH fish closure area will remain at levels that present a potentially unacceptable risk for people who consume the fish and shellfish. The current TDH closure order will continue in effect as an institutional control to manage this exposure.

RAA Bay - 5: Extensive Removal

Estimated Capital Cost:	*$ 29,500,000*
Estimated Annual O & M Costs:	*$ 250,000*
Estimated Present Worth:	*$ 33,100,000*
Implementation Time:	*24 months*

This alternative would include enhanced natural recovery in the area southwest of Dredge Island, removal of the Witco marsh and southern marshes, as well as dredging of the areas bordering the channel, the open water area north of Dredge Island, and the Witco channel. Approximately

783,200 cubic yards of sediments would be removed during the dredging of the open water area north of Dredge Island and the Witco Channel. An additional 164,000 cubic yards of sediments would be removed from the Witco and southern Causeway marshes. Dredging of the marshes would require approximately 1 to 2 years to complete. The areas bordering the channel contain moderately contaminated surface sediments and higher levels of contamination at depth. Roughly 400,000 cubic yards of contaminated sediments would be removed from the areas bordering the channel. Dredging of the areas bordering the channel would require roughly six months to two years to complete. Dredged sediments would be placed and confined within the stabilized Dredge Island. Dredged sediments will not be stabilized or treated prior to disposal. The cost estimate presented above is based on filling the Witco Marsh. The cost would rise by approximately $200,000 if the Witco Marsh is dredged. The area southwest of Dredge Island would receive a thin (6-inch-thick) cap over the entire area to enhance the natural recovery process currently occurring in the Bay. Placement of approximately 265,000 cubic yards of capping material southwest of Dredge Island would require roughly 7 to 14 months to be completed. RAA Bay-5 addresses three methylmercury bioaccumulation areas (Witco, Northern Fringe, and Southeastern Causeway marshes) by removing them. Three areas of Lavaca Bay with elevated surface sediment mercury concentrations are addressed (removal of areas bordering the industrial channel, open water areas north of Dredge Island, and enhanced natural recovery of an area southwest of Dredge Island). This alternative controls and eliminates the ongoing sources of PAH contamination to Lavaca Bay by implementing upland remedial actions in the Witco area. Dredging of the Witco Channel will address some areas of the bay that currently have elevated PAH levels. Other areas in the bay that have elevated PAH levels are expected to naturally recover to acceptable levels once the upland sources have been eliminated. Long-term monitoring of sediment and fish would be required to monitor the reduction of mercury in fish tissue such that the overall risk throughout Lavaca Bay will approach that which would be present but for the historic Point Comfort operations. The ultimate result of remedial actions in Lavaca Bay will be the reduction of mercury in upper trophic fish/shellfish to levels that would be protective for human consumption and not pose an unacceptable ecological risk. For a period of time after remedial actions are completed in Lavaca Bay, the levels of mercury in fish and shellfish within the TDH fish closure area will remain at levels that present a potentially unacceptable risk for people who consume the fish and shellfish. The current TDH closure order will continue in effect as an institutional control to manage this exposure.

Chlor-alkali Process Area Soils

The soil samples with mercury concentrations exceeding the screening values were generally associated with the process features such as trenches and sumps and foundation joints. The lateral extent of the area to be addressed is approximately 1.5 acres. The primary potential receptor for exposure to subsurface soils is the future construction worker and the maximum depth of exposure is 15 feet. Using this depth to define the vertical extent of soils to be addressed, the soil remediation volume is approximately 32,000 cubic yards.

RAA CAPA -1: No Action

Estimated Capital Cost: $ 0
Estimated Annual O & M Costs: $ 0
Estimated Present Worth: $ 0
Implementation Time:

The no action alternative is retained to serve as a baseline against which other alternatives are evaluated. This alternative assumes that there will be no further removal, remedial, institutional activities performed to address CAPA soils

RAA CAPA -2: Fencing and Institutional Controls

Estimated Capital Cost: $ 39,000
Estimated Annual O & M Costs: $ 0
Estimated Present Worth: $ 39,000
Implementation Time: 2 months

Under this alternative, site worker access to the Building R-300 and the area immediately west of the building would be restricted, and this area would be isolated by construction of a perimeter fence. The area could be available for use by the plant in the future, provided an appropriate industrial hygiene and worker safety program were developed. The Building R-300 area would be deed recorded as containing soils with elevated mercury concentrations.

RAA CAPA -3: Capping and Institutional Controls

Estimated Capital Cost: $ 232,000
Estimated Annual O & M Costs: $ 0
Estimated Present Worth: $ 232,000
Implementation Time: 6 months

Alternative 3 uses capping and institutional controls to meet the remedial action objective. In this alternative, the walls and roof of Building R-300 would be demolished, and the building slab and the area immediately west of Building R-300 would be capped with a clay sublayer covered by crushed rock. Excavation of any soils below or immediately west of Building R-300 would only be permitted after a worker safety program was developed. The Building R-300 area would be deed recorded as containing soils with elevated mercury concentrations.

RAA CAPA - 4: Soil Excavation, Stabilization and On-site Disposal

Estimated Capital Cost: *$ 5,300,000*
Estimated Annual O & M Costs: *$ 0*
Estimated Present Worth: *$ 5,300,000*
Implementation Time: *24 months*

Under this alternative, the Building R-300 walls, roof, and slab are demolished. Approximately 32,000 cubic yards of contaminated soil are excavated from the building vicinity to a depth of 15 feet. The excavation would be backfilled with clean fill material and vegetation planted. The excavated material would be stabilized and disposed of on-site in Alcoa's mud lakes.

RAA CAPA - 5: Soil Excavation, Thermal Desorption and On-site Disposal

Estimated Capital Cost: *$ 26,000,000*
Estimated Annual O & M Costs: *$ 0*
Estimated Present Worth: *$ 26,000,000*
Implementation Time: *36 months*

Like Alternative 4, Alternative 5 uses soil removal to attain the RAO. The excavated soils are treated on-site using thermal desorption while elemental mercury is recovered for shipment to an off-site recycler. The treated soil is transported for on-site disposal in Alcoa's mud lakes.

Former Witco Process Area

The actions proposed at the Witco Area would be implemented in the Stormwater Sump and Separator Area (approximately 3,000 square feet in area) and the Former Tank Farm Area (approximately 150,000 square feet in area). These actions would address soils contaminated with PAHs.

RAA Witco -1: No Action

Estimated Capital Cost: *$ 0*
Estimated Annual O & M Costs: *$ 0*
Estimated Present Worth: *$ 0*
Implementation Time:

The no action alternative is retained to serve as a baseline against which other alternatives are evaluated. Under this alternative, no remedial action or institutional controls are implemented.

RAA Witco -2: Capping and Institutional Controls

Estimated Capital Cost:	*$*	*50,000*
Estimated Annual O & M Costs:	*$*	*2,000*
Estimated Present Worth:	*$*	*75,000*
Implementation Time:	*3 months*	

Under Alternative 2, soils contaminated with PAHs, would be covered with six inch caps at the Stormwater Sump and Separator Area and the Former Tank Farm Area. Institutional controls requiring an industrial hygiene/worker safety program would be imposed prior to future excavation within these two areas.

RAA Witco - 3: Soil Excavation and On-site Disposal

Estimated Capital Cost:	*$*	*132,000*
Estimated Annual O & M Costs:	*$*	*0*
Estimated Present Worth:	*$*	*132,000*
Implementation Time:	*6 months*	

Alternative 3 consists of the excavation of soils to a depth of six inches in the Stormwater Sump and Separator Area and Former Tank Farm Area. The excavated soils would be disposed of on-site in Alcoa's Bauxite Residue Lakes.

SECTION 10
Summary of Comparative Analysis of Alternatives

The EPA uses nine NCP criteria to evaluate remedial alternatives for the cleanup of a release. These nine criteria are categorized into three groups: threshold, balancing, and modifying. The threshold criteria must be met in order for an alternative to be eligible for selection. The threshold criteria are overall protection of human health and the environment and compliance with Applicable or Relevant and Appropriate Requirements (ARARs). The balancing criteria are used to weight major tradeoffs among alternatives. The five balancing criteria are long-term effectiveness and permanence; reduction of toxicity, mobility or volume through treatment; short-term effectiveness; implementability; and cost. The modifying criteria are state acceptance and community acceptance. The following table briefly describes the evaluation criteria.

EVALUATION CRITERIA FOR SUPERFUND REMEDIAL ALTERNATIVES
Threshold Criteria
Overall Protection of Human Health and the Environment addresses whether an alternative provides adequate protection of human health and the environment and describes how risks posed through each exposure pathway are eliminated, reduced, or controlled, through treatment, engineering controls, and/or institutional controls.
Compliance with Applicable or Relevant and Appropriate Requirements (ARARs) addresses whether a remedy will meet Federal and state environmental statutes, regulations, and other promulgated requirements that pertain to the site, or whether a waiver is justified.
Balancing Criteria
Long-Term Effectiveness and Permanence refers to expected residual risk and the ability of a remedy to maintain reliable protection of human health and the environment over time, once clean-up levels have been met.
Reduction of Toxicity, Mobility, or Volume Through Treatment evaluates an alternative's use of treatment to reduce the harmful effects of principal contaminants, their ability to move in the environment, and the amount of contamination present.
Short-Term Effectiveness addresses the period of time needed to implement the remedy and any adverse impacts that may be posed to workers, the community and the environment during construction and operation of the remedy until cleanup levels are achieved.
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 agencies are also considered.
Cost includes estimated capital and annual operations and maintenance costs, as well as present worth cost. Present worth cost is the total cost of an alternative over time in terms of today's dollar value. Cost estimates are expected to be accurate within a range of +50 to -30 percent.

Modifying Criteria
State/Support Agency Acceptance considers whether the State agrees with the EPA's analyses and recommendations, as described in the RI/FS and Proposed Plan.
Community Acceptance considers whether the local community agrees with EPA's analyses and preferred alternative. Comments received on the Proposed Plan are an important indicator of community acceptance.

A detailed analysis was performed on the alternatives using the nine evaluation criteria in order to select a site remedy. Following the detailed analysis of each individual alternative, a comparative analysis, focusing on the relative performance of each alternative against the nine criteria, was conducted. This comparative analysis can be found in the FS The following is a summary of the comparison of each alternative's strength and weakness with respect to the nine evaluation criteria.

Bay System

Overall Protection of Human Health and the Environment

All of the alternatives, with the exception of Alternative 1, are protective of human health and the environment. Under all alternatives, it is assumed that the fish closure order would remain in place until such time as the Texas Department of Health determines that fish and shellfish levels have been reduced to levels that are protective of human health. Alternative 1 provides no additional protection of human health and the environment. Alternative 2 is not as protective as Alternatives 3 through 5 since only the potential sources are addressed and bay sediments would recover naturally over a period of 10-15 years. Alternative 3 is protective of human health and the environment by addressing potential source areas, dredging areas of mercury-contaminated sediments in the Witco cut, and addressing a biological uptake area in the Witco Marsh. Alternatives 4A and 4B are again protective, but provide a greater degree of protection by addressing an area of mercury-contaminated sediments north of Dredge Island. Alternative 5 would increase protection by removing an extensive volume of mercury-contaminated sediments.

Compliance with ARARs

The remedial actions under proposed remedial actions 2 through 5, would be designed and implemented in such a manner that they comply with chemical-specific, location-specific, and action-specific ARARs.

Long-term Effectiveness and Permanence

In all of the active bay remedial alternatives, the known major sources of ongoing mercury and PAH releases to bay sediments are addressed by proposed remedial actions or responses already taking place. RAA Bay-3, -4A, -4B, and -5 provide the greatest long-term effectiveness and permanence, since key sources are eliminated and the identified areas most important for mercury methylation and uptake are actively managed. RAA Bay-2 provides a similar level of long-term effectiveness and permanence; however, it will require more time to accomplish due to the increased reliance on natural recovery. RAA Bay-2 through RAA Bay-5 effectively control and eliminate the ongoing sources of PAH re-contamination to Lavaca Bay. In each alternative, long-term monitoring of sediment and fish would be required to confirm the reduction of mercury in fish tissue such that the overall risk throughout Lavaca Bay will approach that which would be present but for the historic Point Comfort operations.

Reduction of Toxicity, Mobility, or Volume of Contaminants through Treatment

Because of the relatively high volume of sediments involved, and the low concentrations of mercury involved, treatment of sediments was not considered. The toxicity and mobility of mercury in CAPA ground water discharging to the Bay will be significantly reduced through treatment by carbon adsorption.

Short-term Effectiveness

Remedial alternative 5 has the lowest short-term effectiveness due to the extensive dredging required under this alternative. Remedial alternative 2 has the highest short-term effectiveness since there is only natural recovery of sediments. Alternatives 3, 4A, and 4B have moderate short term effectiveness.

Implementability

The dredging treatability study concluded that dredging was effective for mass removal of contaminated sediments in areas with high mercury concentrations. Local contractors have completed hydraulic dredging and disposal of sediments regularly at the Point Comfort facility. Therefore, all of the alternatives that include dredging are rated high for implementability. Alternative 4A is more difficult to implement than Alternatives 2 and 3 due to the placement of a thin layer cap to accelerate natural recovery. Thin layer capping is not a common activity completed by local contractors. However, contractors are familiar with beach nourishment, which is discharging of clean sediments hydraulically upland on shore. A major consideration in selection of equipment and placement of the thin layer cap is the need for controlled, accurate placement and the resulting density and rate of application of capping material. Also, thin layer capping has been successfully used on other sediment capping projects. Alternatives 4B and 5 are considered harder to implement due to the larger volumes of sediments that would be removed. Implementability of alternatives 3 and 4A are high since dredging has been shown to be implementable for mass removal.

Cost

There are no costs associated with the No Action alternative. Cost for Alternatives 2 - 5 would include long-term monitoring costs of sediments, fish and shellfish. Of the remaining options, Alternative 2 has the lowest cost ($4,900,000). Alternative 3 and Alternative 4A have similar costs at $9,900,000 and $12,000,000 respectively. Alternatives 4B and 5 are considerably more expensive at costs of $19,600,000 and $33,100,000.

State/Support Agency Acceptance

During implementation of the RI, FS, and BLRA, EPA has worked under a Cooperative Management Agreement between the State of Texas (represents TNRCC, Texas Parks and Wildlife and General Land Office) and NOAA (also represents U.S. Fish and Wildlife). The State of Texas and NOAA have concurred on the RI, FS, and BLRA, the underlying studies upon which selection of the remedial action is based.

Community Acceptance

During the public comment period for the proposed plan, only three entities submitted written comments. In general, all comments supported the preferred alternative presented in the Proposed Plan, although there were comments regarding the risk assessment and monitoring. The responses to these comments are included in the Responsiveness Summary to this ROD.

Chlor-Alkali Process Area Soils

Overall Protection of Human Health and the Environment

Alternative 1 is not protective of human health and the environment. Even though Alternative 2 is considered protective, it is less protective than the other remedial alternatives because only fencing and institutional controls are considered. Alternative 3 is protective because the exposure pathway of concern is cut off by capping of contaminated soils. Alternatives 4 and 5 are the most protective remedies since the contaminated soils are removed.

Compliance with ARARs

All alternatives, except Alternative 1, would comply with chemical-specific requirements and there are no location-specific ARARs for any of the alternatives. The action-specific requirements vary with the alternatives. However, all of the ARARs should be readily achievable.

Long-term Effectiveness and Permanence

All of the alternatives, except for Alternative 1 are effective and provide varying levels of permanence. Alternatives 2 and 3 do not include treatment, but manage the residual risk from untreated soils by institutional controls and/or capping. Alternative 3 is more effective and permanent than Alternative 2 because the soils are capped rather than relying on fencing. The adequacy and reliability of these alternatives are ensured by enforcement of these controls. However, Alternative 3 is more permanent because the soils are capped. Alternatives 4 and 5 manage residual risk by removal of soils from the CAPA. Thermal treatment included in Alternative 5 is a more reliable treatment technology than stabilization included in Alternative 4.

Reduction of Toxicity, Mobility, or Volume of Contaminants through Treatment

The toxicity, mobility and volume of mercury in CAPA soils will not be reduced by Alternatives 1, 2, or 3. Alternative 4 reduces the mobility and toxicity of mercury in soil, but increases the volume of treatment residuals relative to the initial untreated soil volume. Alternative 5 reduces the toxicity, mobility and volume of mercury in CAPA soils using treatment.

Short-term Effectiveness

The short-term effectiveness in limiting impacts to human health and the environment for Alternatives 2 and 3 is high due to the limited disturbance of contaminated soils during implementation of these alternatives. A greater potential for generation of mercury vapor or mercury-containing dusts exists for Alternatives 4 and 5 since excavation of contaminated soils will be performed. Alternatives 2 and 3 would achieve the RAO within a relatively short period of time while Alternatives 4 and 5 would require significantly longer time periods to meet the RAO.

Implementability

Alternatives 2 and 3 can be easily implemented. Alternatives 4 and 5 are more difficult to implement due to extensive excavation and treatment activities required, and the operation of on-site soil treatment facilities. Alternative 4 would be the most difficult to implement due to technical difficulties associated with mixing of soils with stabilization agents and the limited track record of this technology for mercury treatment.

Cost

Alternative 2 has the lowest cost ($39,000) followed by Alternative 3 ($232,000). Alternatives 4 and 5 are considerably more expensive with costs of $5,300,000 and $26,000,000 respectively.

State/Support Agency Acceptance

During implementation of the RI, FS, and BLRA, EPA has worked under a Cooperative Management Agreement between the State of Texas (represents TNRCC, Texas Parks and Wildlife and General Land Office) and NOAA (also represents U.S. Fish and Wildlife). The State of Texas and NOAA have concurred on the RI, FS, and BLRA, the underlying studies upon which selection of the remedial action is based.

Community Acceptance

During the public comment period for the proposed plan, only three entities submitted written comments. No comments were received regarding the proposed CAPA soils remedy.

Former Witco Process Area

Overall Protection of Human Health and the Environment

Alternative 1 is not protective of human health and the environment. Alternative 2 is considered protective because it prevents exposure to Witco soils by using soil caps. Alternative 3 is slightly more protective than Alternative 2 since the soils in the Stormwater Sump and Separator Area and Former Tank Farm are excavated.

Compliance with ARARs

All alternatives, except Alternative 1, would comply with chemical-specific requirements and there are no location-specific ARARs for any of the alternatives. The action-specific requirements vary with the alternatives. However, all of the ARARs should be readily achievable.

Long-term Effectiveness and Permanence

All of the alternatives, except Alternative 1, are effective and permanent. Alternative 2 does not include treatment, but manages the residual risk from untreated soils by institutional controls and capping. The adequacy and reliability of this alternative is ensured by enforcement of these controls. Alternative 3 manages the residual risk by removing soils from the Tank Farm and Sump and Separator Area.

Reduction of Toxicity, Mobility, or Volume of Contaminants through Treatment

The toxicity, mobility and volume of PAHs in Witco soils will not be reduced by any of the alternatives, although Alternative 3 removes the PAH-containing soils from the Witco Area.

Short-term Effectiveness

The short-term effectiveness of Alternative 2 is high due to the limited disturbance of contaminated soils during implementation. A greater potential for fugitive dust emissions exists for Alternative 3 since excavation of PAH-contaminated soil will be required.

Implementability

All of the alternatives are readily implementable. Alternative 3 is slightly more difficult to implement due to the excavation and soil transportation activities.

Cost

Alternatives 2 and 3 have similar costs of $75,000 and $132,000 respectively.

State/Support Agency Acceptance

During implementation of the RI, FS, and BLRA, EPA has worked under a Cooperative Management Agreement between the State of Texas (represents TNRCC, Texas Parks and Wildlife and General Land Office) and NOAA (also represents U.S. Fish and Wildlife). The State of Texas and NOAA have concurred on the RI, FS, and BLRA, the underlying studies upon which selection of the remedial action is based.

Community Acceptance

During the public comment period for the proposed plan, only three entities submitted written comments. No comments were received regarding the proposed Witco soils remedy.

SECTION 11
Principal Threat Wastes

The NCP establishes an expectation that EPA will use treatment to address the principal threats posed by a site wherever practicable. Identifying principal threat wastes combines concepts of both hazard and risk. In general, principal threat wastes are those source materials considered to be highly toxic or highly mobile which generally cannot be contained in a reliable manner or would present a significant risk to human health or the environment should exposure occur. Non-principal threat wastes are those source materials that generally can be reliably contained and that would present only a low risk in the event of exposure.

For this site, there are PAH DNAPLs at the former Witco Area that are considered principal threat wastes. The PAH DNAPLs are considered principal threat wastes because they are mobile and are not contained in a reliable manner. Based on the results of the RI, it was determined that PAH-containing DNAPL was migrating from the former Witco Coal Tar Tank Farm into Lavaca Bay. Sediment sampling has shown that PAH concentrations in sediments near the Witco Area are elevated. In addition, PAH concentrations in Bay sediments are elevated at the sediment surface, indicating that an ongoing source of PAHs may be present.

The elemental mercury that was identified at the CAPA in Zone B is not considered a principal threat waste because it has not been shown to be highly mobile and is of limited areal extent. The weight-of-evidence suggests that the mercury DNAPL observed at the CAPA is currently contained within a structural low in Zone B2/B. Lavaca Bay sediments, CAPA soils and Witco soils are considered non-principal threat waste.

SECTION 12
Selected Remedy

Bay System

Summary of the Rationale for the Selected Remedy

The selected remedial alternative to address the identified risks associated with mercury and PAHs in Lavaca Bay is RAA Bay-4A. This alternative focuses on control, removal, and isolation of identified current and potential future sources of mercury and PAHs input within the Bay. In addition to the source control and dredging activities, RAA Bay-4A actively addresses marshes which are the most critical remaining mercury bioaccumulation areas identified within the bay. EPA selected RAA Bay-4A because it addresses the current and future sources of mercury and PAHs that can contribute to continued contamination of sediments and biological media associated with such sediments. In addition, RAA Bay-4A offers, relative to its costs, the best overall protection of human health and the environment and the shortest time to achieve compliance with the RAOs. That is, the difference in cost between RAA Bay-4A and Bay-3 ($2,100,000) offers a large increase in protectiveness. However, the cost increase between RAA Bay-4A and Bay-4B ($7,600,000) does not significantly increase protectiveness.

Description of the Selected Remedy

Three actions have occurred or are ongoing that address the major sources of mercury into the bay. These actions include:

- **Dredge Island Stabilization and Northern Marsh Removal:** The Dredge Island stabilization project included relocating the contents of the DMPAs containing elevated levels of mercury (approximately 523,000 CY) into the GPAs. In addition, the containment dikes surrounding the GPAs were raised so they will not be overtopped during a severe storm (e.g., hurricane). This required increasing 10,700 linear feet of dike to an approximate elevation of 30 feet. The work began in September 1998 and was completed during the summer of 2001. The estimated cost for the work was $38,560,000. As part of this work, the marshes on the north end of the Island were removed. A final cover for the disposal areas will consist of dredged material taken from an area of Lavaca Bay that has mercury concentrations below human health and ecological risk-based values.
- **CAPA Sediment Removal:** As part of the dredging treatability study, roughly 70,000 cubic yards of contaminated sediments were dredged in the channel area adjacent to the former CAPA. The CAPA sediments were dredged hydraulically. The contractor used silt curtains

that surrounded the dredge area to minimize impacts to the water column. The sediments were disposed at Alcoa's dredge disposal lakes adjacent to the bauxite residue lakes. Within the lakes, the sediment was allowed to settle out from the dredge slurry and the decant water was returned back to the bay. Water quality monitoring as well as post-dredge sediment sampling was completed during the dredging. The dredging required roughly 21 days to complete in August 1998. Phase II of the treatability study involved dredging 10,000 cubic yards of sediment from a location near Dredge Island and disposing the material on Dredge Island. This work required 17 days to complete in January 1999. The cost to complete both dredging treatability studies was $1,952,000. Dredging was effective from a mass removal standpoint in areas with high mercury concentrations and that have the potential for sediment resuspension from influences such as navigational traffic. Resuspension of sediment material and transport offsite from the dredge areas was not significant based on the results of water quality (turbidity and mercury concentration) monitoring. Monitoring of oyster tissue confirmed that tissues mercury levels were well below concentrations of concern.

- **CAPA Ground Water Treatment:** As part of the CAPA ground water treatability study, four ground water extraction wells were installed and operate to provide hydraulic control of ground water migration to the bay. Ground water collected from the wells is treated using an air stripper and carbon adsorption system and then discharged to Lavaca Bay. The system has been operating since 1998 and has been successful in reversing the ground water gradient in the area of CAPA. The hydraulic control system will continue to be operated as part of the remedial action for the Site. Monitoring of the treatment system effluent is performed on a regular basis. Surface water monitoring will be used to evaluate the effectiveness of the CAPA hydraulic control remedy. Extraction system and treatment capital costs (not including future equipment replacement costs) were approximately $175,000.

In addition to those actions that have already been implemented, the selected remedy includes the following components:

- **Installation of a DNAPL Collection or Containment System at the Witco Area** - West of the former Witco Tank Farm Area, a collection trench or containment system will be installed for the purpose of intercepting DNAPL potentially migrating to Lavaca Bay. Recovered DNAPL will be collected and sent off site for disposal. The specific areas of shoreline to be addressed by a remedy may be modified based on site conditions observed during remedy implementation. The use of either a DNAPL containment or collection technology will be refined during the remedial design.
- **Dredging of the Witco Channel** - Approximately 200,000 cubic yards of mercury-contaminated sediment will be dredged and disposed of in an on site confined disposal facility located on Dredge Island. The dredged sediments will not be treated or stabilized before disposal. A final cover for the disposal areas will consist of dredged material taken from an area of Lavaca Bay that has mercury concentrations below human health and ecological risk-based values.

- **Remediation of the Witco Marsh by Dredging or Filling** - Remediation of the Witco marsh would consist of either dredging or filling the marsh. If the Witco marsh were filled, first a berm along the perimeter of the marsh would be constructed and then clean sediment or fill would be placed behind the berm. Approximately 63,000 cubic yards of sediments would be removed if the Witco marsh were dredged.
- **Enhanced Natural Recovery North of Dredge Island** - The area north of Dredge Island would receive a thin cap over the entire area to accelerate the natural recovery process currently occurring in the bay. Approximately 75,000 to 145,000 cubic yards of capping material would be required for the area north of Dredge Island.
- **Natural Recovery of Sediments** - Other areas in the bay that have elevated PAH levels in sediments are expected to naturally recover to acceptable levels once the upland sources have been eliminated. Areas of concern in Lavaca Bay impacted by elevated mercury levels that are not actively remediated, are expected to recover with time to acceptable levels due to natural recovery of the sediments through sedimentation. The areas of Lavaca Bay not addressed as part of the remedial alternative include the southern causeway marshes, areas bordering Alcoa's Industrial Channel, and the area southwest of Dredge Island. It is estimated that surficial sediment mercury levels in all areas are expected to decline to levels in the current range of open areas of the Bay within a 5 to 10 year time frame.
- **Monitoring** - Long term monitoring of sediments and fish will be required to confirm the natural recovery of sediment and fish tissue to acceptable levels. In addition, monitoring of surface water will be conducted to evaluate the effectiveness of the CAPA hydraulic containment system. Full details of the monitoring program will be established during the design of the selected Bay System remedy.
- **Institutional Controls to Manage Exposure to Finfish/Shellfish** - The fish closure originally established by the Texas Department of Health in 1988 and updated in January 2000 will remain in place to control the consumption of finfish and shellfish for the "Closed Area".

EPA will review the Site at least once every five years after the initiation of remedial action at the Site to assure that the remedial action continues to protect human health and the environment since hazardous substances, pollutants or contaminants will remain at the Site.

The selected remedy may change somewhat as a result of the remedial design and construction processes. Changes to the remedy described in this Record of Decision will be documented in a technical memorandum in the Administrative Record for the Site, an Explanation of Significant Differences (ESD) or an Amendment to the Record of Decision, as appropriate.

Summary of the Estimated Remedy Costs

Table 12-1 shows the estimated cost for the selected remedy. The cost summary is based on the capital and annual operating and maintenance cost to implement the remedy. The information in the cost summary is based on the best available information regarding the anticipated scope of the selected remedy. Changes in the cost elements are likely to occur as a result of new information and data collected during the engineering design of the remedial alternative. Changes in cost for the selected remedy may be documented in the form of a memorandum to the file, an ESD, or an Amendment to the ROD depending upon NCP requirements for the change in question. Net present values are estimated using a discount rate of 7% and an operating period of 30 years. The accuracy of the cost estimates shall be within +50 percent to -30 percent.

Expected Outcomes of the Selected Remedy

The RAOs for Lavaca Bay are to: 1) eliminate or reduce to the maximum extent practical mercury and PAH loading from on-going unpermitted sources to Lavaca Bay; 2) reduce to an appropriate level mercury in surface sediments in sensitive habitats; 3) reduce to an appropriate level mercury in surface sediments in open-water that represent a pathway by which mercury may be introduced into the food web; and 4) reduce PAH sediment concentrations to below the NOAA ER-M value (44.8 ppm total PAH).

Ongoing Sources to Lavaca Bay: The selected remedy addresses all known on-going sources of mercury and PAHs. A hydraulic control system which was installed in 1998 is in place to address the discharge of mercury-contaminated ground water into Lavaca Bay. Alcoa completed a non-time critical removal action to address the runoff from Dredge Island soils. Mercury-contaminated sediments along the CAPA shoreline and north of Dredge Island were dredged as part of a treatability study in 1999. The selected remedy will address the contaminated sediments remaining in the Witco Channel that can be resuspended. The discharge of PAH-containing DNAPL from the Witco area will be controlled as part of the selected remedy.

Reduction of Mercury Levels in Sensitive Habitats: Potential areas of biological uptake with the bay were marsh areas identified along the northern end of Dredge Island, and the northern portion of the Closed Area. As part of the non-time critical removal action on Dredge Island, the fringe marshes along Dredge Island were removed. The selected remedy will address the Witco Marsh. The specific target sediment cleanup value for sensitive habitats is 0.25 ppm mercury. Achieving this sediment target goal in these areas will result in a substantial reduction of the uptake of mercury into the food chain.

Reduction of Mercury Levels in Open Water: Open water areas of Lavaca Bay, if continually impacted by ongoing unpermitted sources and/or if disturbed, could potentially serve as additional sources of mercury to biological uptake areas. The area north of Dredge Island will receive a thin layer cap to accelerate the natural recovery processes taking place in Lavaca Bay. The target cleanup goal for sediments in open-water, on average, is 0.5 ppm. For all other areas of Lavaca Bay, it is anticipated that natural recovery by sedimentation will help to meet the target mercury levels in sediments.

The remedial action objectives address the exposure pathways and contaminant levels in the exposure media. Achievement of the RAOs are designed to allow the reduction of mercury levels in fish tissue such that the overall risk throughout Lavaca Bay will approach that which would be present but for the historic Point Comfort Operations. Recovery, which is estimated to occur in 10-15 years, will be achieved when mercury levels in upper trophic biota in the Closed Area of Lavaca Bay are low enough to be protective of human health and not pose an unacceptable ecological risk.

Chlor-Alkali Process Area Soils

Summary of the Rationale for the Selected Remedy

The selected remedial alternative to reduce the future exposure potential of site workers to mercury in soils in the Building R-300 vicinity is RAA CAPA-3. EPA selected RAA CAPA-3 because it readily achieves the RAO, is easily implemented and can be readily monitored by regular visual inspection. In addition, RAA CAPA-3 offers, relative to its costs, the best overall protection of human health and the environment and the shortest time to achieve compliance with the RAOs. That is, the difference in cost between CAPA-3 and CAPA-2 ($193,000) offers a large increase in protectiveness. However, the cost increase between RAA CAPA-3 and CAPA-4 ($5,068,000) does not significantly increase protectiveness.

Description of the Selected Remedy

Under the selected remedy the walls and roof of Building R-300 will be removed and hauled off-site. The building slab and the area immediately west of Building R-300 will be capped with a clay sublayer covered by crushed rock with an average thickness of 6 inches. Existing loose concrete rubble in the area will be removed. The cap will be crowned to facilitate run-off. The capped area would be maintained by a regular inspection and maintenance program. Excavation of any soils below or immediately west of Building R-300 would only be permitted after a worker safety program is developed for the specific excavation activity and repair of the cap would be required after excavation. The Building R-300 area would be deed recorded as containing soils with elevated mercury levels.

EPA will review the Site at least once every five years after the initiation of remedial action at the Site to assure that the remedial action continues to protect human health and the environment since hazardous substances, pollutants or contaminants will remain at the Site. The selected remedy may change somewhat as a result of the remedial design and construction processes. Changes to the remedy described in this Record of Decision will be documented in a technical memorandum in the Administrative Record for the Site, an ESD or an Amendment to the Record of Decision, as appropriate.

Summary of the Estimated Remedy Costs

Table 12-2 shows the estimated cost for the selected remedy. The cost summary is based on the capital and annual operating and maintenance cost to implement the remedy. The information in the cost summary is based on the best available information regarding the anticipated scope of the selected remedy. Changes in the cost elements are likely to occur as a result of new information and data collected during the engineering design of the remedial alternative. Changes in cost for the selected remedy may be documented in the form of a memorandum to the file, an ESD, or an Amendment to the ROD depending upon NCP requirements for the change in question. Net present values are estimated using a discount rate of 7% and an operating period of 30 years. The accuracy of the cost estimates shall be within +50 percent to -30 percent.

Expected Outcomes of the Selected Remedy

The selected remedy is anticipated to reduce the future exposure potential of site workers to mercury in soils in the Building R-300 vicinity. The majority of risk associated with CAPA soils within the footprint of Building R-300 is associated with direct exposure via ingestion of soil. The potential for exposure of a site worker will be reduced by capping of the affected soil, deed recordation and the requirement that a worker safety program be developed before excavation of any soils below or immediately west of Building R-300. The remediation goals and performance standards for the selected remedy are presented in Section 8 of this ROD.

Former Witco Area Soils

Summary of the Rationale for the Selected Remedy

The selected remedial alternative to reduce the future exposure potential of site workers to PAHs in surficial soils in the Stormwater Sump and Separator Area and Former Tank Farm Area is RAA Witco-2. Although Alternative 3 is the most protective of the alternatives, the selected alternative provides a remedy that is protective of human health and the environment, is easier to implement, has less short-term impacts, and is less expensive. Reliability of the selected remedy will be ensured by enforcement of institutional controls and inspections of the caps.

Description of the Selected Remedy

The selected remedy uses capping to attain the remedial action objective. Under this alternative, the Stormwater Sump and Separator Area and Former Tank Farm Area will be capped with soil caps with an average thickness of 6 inches. The caps will be crowned to facilitate run-off. After capping, any future excavation of any soils in these areas would only be permitted after a worker safety program is developed for the specific excavation activity and repair of the cap would be required after excavation. These areas would be deed recorded as containing soils with elevated PAH concentrations.

EPA will review the Site at least once every five years after the initiation of remedial action at the Site to assure that the remedial action continues to protect human health and the environment since hazardous substances, pollutants or contaminants will remain at the Site. The selected remedy may change somewhat as a result of the remedial design and construction processes. Any changes to the remedy described in this Record of Decision will be documented in a technical memorandum in the Administrative Record for the Site, an ESD or an Amendment to the Record of Decision, as appropriate.

Summary of the Estimated Remedy Costs

Table 12-3 shows the estimated cost for the selected remedy. The cost summary is based on the capital and annual operating and maintenance cost to implement the remedy. The information in the cost summary is based on the best available information regarding the anticipated scope of the selected remedy. Changes in the cost elements are likely to occur as a result of new information and data collected during the engineering design of the remedial alternative. Changes in cost for the selected remedy may be documented in the form of a memorandum to the file, an ESD, or an Amendment to the ROD depending upon NCP requirements for the change in question. Net present values are estimated using a discount rate of 7% and an operating period of 30 years. The accuracy of the cost estimates shall be within +50 percent to -30 percent.

Expected Outcomes of the Selected Remedy

The selected remedy is anticipated to reduce the future exposure potential of site workers to PAHs in soils at the Stormwater Sump and Separator Area and Former Tank Farm Area. The potential for exposure of a site worker will be reduced by capping of the affected soil, deed recordation and the requirement that a worker safety program be developed before excavation of any soils at the Stormwater Sump and Separator Area and Former Tank Farm Area. The remediation goals and performance standards for the selected remedy are presented in Section 8 of this ROD.

Table 12-1
Cost Estimate Summary for RAA Bay-4A

Item	Unit	Unit Cost	No. of Units	Total Cost
Mobilization/Demobilization	Percent	8%	$5,529,000	$442,000
CAPA Groundwater				
-Ground Extraction and Treatment	LS	$0	1	$0
Witco Channel				
- Hydraulic Dredge	CY	$15	200,000	$3,000,000
Witco Marsh				
- Construction Dike	CY	$50	2,100	$105,000
- Fill to Create Upland	CY	$19	36,000	$684,000
Witco DNAPL	LS	$1,920,000	1	$1,210,000
Area North of Dredge Island				
- Enhanced Natural Recovery	CY	$12	145,000	$1,740,000
Engineering Design	LS	$680,000	1	$680,000
Construction Monitoring/Maintenance	LS	$496,000	1	$496,000
Long-term Maintenance/Monitoring				
- CAPA[1]	LS	$1,700,000	1	$1,365,000
- Lavaca Bay[2]	LS	$1,639,737	1	$1,660,000
- Witco DNAPL[3]				$ 545,000
Contingency	Percent	30%	1	$3,722,000
Total Estimated Cost				$16,129,000

[1] Includes $110,000 annually for 30 years at a discount rate of 7%

[2] Fish tissue monitoring in yrs 1-10, 15, 20, 30 and sediment monitoring in yrs 2, 4, 6, 8, 10, 15, 20, 30

[3] Includes $44,000 annually for 30 years at a discount rate of 7%

Table 12-2
Cost Estimate Summary for RAA CAPA-3

Item	Unit	Unit Cost	No. of Units	Total Cost
Mobilization/Demobilization	LS	$10,000	1	$10,000
Subgrade Preparation	LS	$5,000	1	$5,000
Rubble Handling	LS	$8,000	1	$8,000
Building R-300 Removal	LS	$160,000	1	$160,000
Clay Base (3 inches)	CY	$8	600	$4,800
Crushed Rock (6 in average thickness)	CY	$25	1,200	$30,000
Institutional Control	LS	$5,000	1	$5,000
Total Present Worth Cost				$232,000
Engineering	Percent	10%	1	$23,200
Contingency	Percent	20%	1	$51,000
Total Estimated Cost				$300,000

Table 12-3
Cost Estimate Summary for RAA Witco-2

Item	Unit	Unit Cost	No. of Units	Total Cost
Clear and Grub Areas	LS	$2,000	1	$2,000
Soil Cap Construction	CY	$8	2,833	$22,667
Institutional Control	LS	$5,000	1	$5,000
Engineering & Supervision	Percent	10%	1	$6,000
Mobilization/Demobilization	Percent	15%	1	$4,500
Miscellaneous Costs (PPE, H&S, Monitoring)	Percent	10%	1	$3,000
Construction Expense/Contractor's Fee	Percent	20%	1	$6,000
Total Present Worth Capital Cost				$50,000
Annual Site Inspection	LS			$1,000
Erosion Repair	LS			$1,000
Total Present Worth O&M Costs				$25,000
Subtotal Present Worth (30yrs, 7%)				$75,000

SECTION 13
Statutory Determinations

The remedial action selected for implementation at the Alcoa/Lavaca Bay Site is consistent with CERCLA and, to the extent practicable, the NCP. The selected remedies for the Bay System, Chlor-Alkali Process Area Soils and Former Witco Area Soils are protective of human health and the environment, will comply with ARARs and are cost effective. In addition, the selected remedies utilize permanent solutions and alternate treatment technologies or resource recovery technologies to the maximum extent practicable, and satisfy the statutory preference for treatment that permanently and significantly reduces the mobility, toxicity or volume of hazardous substances as a principal element.

Bay System

Protection of Human Health and the Environment

The remedy at this Site will adequately protect human health and the environment by eliminating, reducing or controlling exposures to human and environmental receptors through treatment, engineering controls and institutional controls. Continued operation of the CAPA ground water system, completion of the removal action on Dredge Island, and containment or recovery of PAH DNAPL at the former Witco Processing Area will address sources of mercury and PAHs, that if not addressed, could continue to result in elevated levels of mercury and PAHs in sediments in Lavaca Bay. In addition, dredging along the CAPA shoreline area and north of Dredge Island (completed during the treatability studies), along with the planned dredging of the Witco Channel will remove contaminated sediments that could act as secondary sources of mercury and PAHs. Confinement of contaminated sediments on Dredge Island, which lies within the area of contamination, will eliminate the pathway for contaminants to be reintroduced into the bay system. Also, the selected remedy addresses marsh area habitats where mercury methylation appears to contribute significantly to uptake in the higher trophic finfish species. The marshes around Dredge Island were removed during the non-time critical removal action and the Witco Marsh will be capped or removed during implementation of the remedial action. Capping of the impacted sediments in the open water area north of Dredge Island will limit the opportunity for recontamination of adjacent habitat areas if these sediments were resuspended. In addition, the thin layer cap will enhance the natural recovery process of the area north of Dredge Island. These actions address the media that affect the biota and should result in achieving acceptable levels of mercury in fish and shellfish. Sediments that are not actively remediated will recover to acceptable levels through natural sedimentation. Long term monitoring of sediments and fish will be required to confirm the natural recovery of sediment and fish tissue to acceptable levels. In addition, monitoring of surface water will be conducted to evaluate the effectiveness of the CAPA hydraulic containment system.

The RAOs for the Bay System are designed to allow the reduction of mercury levels in fish tissue such that the overall risk throughout Lavaca Bay will approach that which would be present but for the historic Point Comfort operations. The RAOs in the Proposed Plan set out numerical mercury sediment goals but do not specifically set a protective fish concentration level. Target cleanup goals for sediments are based on the locations where finfish and shellfish data suggest the opportunity for mercury to enter the food chain is concentrated.

The predicted health risks associated with consumption of fish from Lavaca Bay, as well as all bays, using the average consumption rate and RME consumption rates were presented in the Proposed Plan. Potential health risks were estimated for four different exposure groups. Using both the average and RME fish consumption rates, the potential health risks for "Lavaca Bay Fishermen"[4], are not significantly different than the potential health risks for "All Fishermen"[5]. The predicted risks for "Lavaca Bay and Closed Area Fishermen"[6] and "Closed Area Fishermen"[7] are approximately twice as high as the potential risks for "Lavaca Bay Fishermen" or "All Fishermen". The predicted unacceptable health risk from consuming fish and shellfish associated with releases from the Alcoa Point Comfort operations is focused within the Closed Area of Lavaca Bay and areas of Lavaca Bay in the general vicinity of the Closed Area. At the Alcoa site, even though there are unacceptable risks identified for "Lavaca Bay Fishermen", the predicted risk appears to be no different than the predicted risk present for "All Fishermen". The Closed Area of Lavaca Bay is generally that area in which unacceptable risks from consumption of fish and shellfish can be attributed to past releases from Alcoa given the uncertainties associated with the toxicity of methylmercury, fish consumption rates and sediment to biota accumulation factors. The remedial actions to reduce or control risk to human health and the environment are focused generally on the vicinity of the current Closed Area. Long term monitoring will be required to confirm the recovery of fish tissue to acceptable levels. The current fish closure order would remain in place as an institutional control until such time as the Texas Department of Health determines that fish and shellfish levels have been reduced to levels that are protective of human health. Achieving the sediment cleanup goals is expected to result in reductions in fish tissue levels such that there are no unacceptable risks to ecological receptors even for the most conservative risk estimate. Implementation of the selected remedy will not pose any unacceptable short-term risks or cause any cross-media impacts.

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[4] Lavaca Bay Fishermen - fishermen who fished mostly in Lavaca Bay, but not in the Closed Area

[5] All Fishermen - fishermen who fished in Lavaca Bay, but also in other Texas Bays

[6] Lavaca Bay and Closed Area Fishermen - fishermen who fished mostly in Lavaca Bay, but occasionally in the Closed Area

[7] Closed Area Fishermen - fishermen who fished mostly in the Closed Area

Compliance With ARARs

The selected remedy will comply with all federal and any more stringent state ARARs that pertain to the Site. Section 121(d) of CERCLA states that remedial actions must attain or exceed ARARs. ARARs are derived from both Federal and State environmental laws and include regulations, standards, criteria, or limitations not promulgated under Federal or State laws. State standards that constitute ARARs are those laws that are promulgated, substantive in nature, more stringent than Federal requirements, consistently applied and identified by the State in a timely manner. The ARARs are divided into 3 categories: 1) location-specific, 2) chemical-specific, and 3) action-specific. In addition to ARARs in determining the necessary level of cleanup for protection of health or the environment, EPA may also consider non-promulgated advisories or guidance issued by Federal or State government that are not legally binding. Such materials are identified in the remedy selection process as to-be-considered (TBC). The ARARs are presented below and discussed in more detail in Appendix A of the Feasibility Study.

Location-Specific ARARs

Location-specific requirements are restrictions placed on the types of activities that can be conducted or on the concentration of hazardous substances that can be present solely because of the location where they will be conducted. Table 13-1 summarizes the location-specific ARARs while Appendix A of the FS provides additional detail.

Location-specific ARARs are divided into the following six sections:

- Oyster Waters/Reefs;
- Critical Areas for Fish and Wildlife Resources;
- Critical Habitat for Endangered or Threatened Species;
- Recreational/Commercial Waters; and
- Coastal Zones

Chemical-Specific ARARs

Chemical-specific requirements are health- or risk-based numerical values or methodologies that specify the acceptable amount or concentration of a chemical that may be found in, or discharged to, the environment. For bay sediments, no federal or state sediment quality criteria have been promulgated. The specific target sediment cleanup value for critical habitats, 0.25 ppm mercury, is based on a weight-of-evidence evaluation of empirical measurements of the ratio of tissue-to-sediment concentration determined during the RI phase of the project and long-term tissue monitoring data. The target cleanup goal for sediments in open-water, on average, is 0.5 ppm mercury.

Action-Specific ARARS

Action-specific ARARs are usually technology- or activity-based requirements or limitations on actions taken with respect to hazardous wastes. These requirements are triggered by the particular remedial activities that are selected to accomplish a remedy. Table 13-1 summarizes the action-specific ARARs while Appendix A of the FS provides additional detail.

Action-specific ARARs are divided into the following five sections:

- Sediment Removal (Dredging) and Disposal in an On-Site Confined Disposal Facility
- Capping Contaminated Sediment
- CAPA Hydraulic Controls
- Witco DNAPL Collection and Containment
- Soil Excavation, Treatment, and Capping

Cost-Effectiveness

In the Lead Agency's judgment, the selected remedy is cost-effective because the remedy's costs are proportional to its overall effectiveness (see 40 CFR 300.430(f)(1)(ii)(D)). This determination was made by evaluating the overall effectiveness of those alternatives that satisfied the threshold criteria (i.e., that are protective of human health and the environment and comply with all federal and any more stringent ARARs, or as appropriate, waive ARARs). Overall effectiveness was evaluated by assessing three of the five balancing criteria -- long-term effectiveness and permanence; reduction in toxicity, mobility, and volume through treatment; and short-term effectiveness, in combination. The overall effectiveness of each alternative then was compared to the alternative's costs to determine cost-effectiveness. The relationship of the overall effectiveness of the selected remedial alternative was determined to be proportional to its costs and hence represents a reasonable value for the money to be spent.

The present worth cost of RAA Bay-4A, the selected remedy at $12,000,000 is somewhat higher than RAA Bay-3 at $9,900,000 but considerably less than the cost of RAA Bay-4B at $19,600,000. RAA Bay-4A offers, relative to its costs, the best overall protection of human health and the environment and the shortest time to achieve compliance with the RAOs. That is, the difference in cost between RAA Bay-4A and Bay-3 ($2,100,000) offers a large increase in protectiveness while the cost increase between RAA Bay-4A and Bay-4B ($7,600,000) does not significantly increase protectiveness.

Utilization of Permanent Solutions and Alternative Treatment Technologies (or Resource Recovery Technologies) to the Maximum Extent Practicable

EPA has determined that the selected remedy represents the maximum extent to which permanent solutions and treatment technologies can be utilized in a practicable manner at the site. The selected remedy provides the best balance of trade-offs in terms of the five balancing criteria, considering State and community acceptance, while also considering the statutory preference for treatment as a principal element and the bias against off-site treatment and disposal.

The selected remedy utilizes permanent solutions and treatment technologies to the maximum extent. RAA Bay-4A effectively controls the known sources of mercury and PAHs that can impact Lavaca Bay. Recovered ground water from the CAPA recovery system is treated before discharge into Lavaca Bay. In addition, mercury-contaminated sediments in Lavaca Bay that can be resuspended will be dredged and disposed of in a confined disposal facility. These actions remove mercury that could enter Lavaca Bay or are already present in the Bay. In addition, key areas of mercury methylation are removed as part of the selected remedy. Areas of Lavaca Bay that are not actively remediated will naturally recover over time. DNAPL releases from the former Witco area, which are considered principal threat wastes, will either be contained or collected. The selected remedy requires less time to meet the RAO than RAA Bay-2 because there is less reliance on natural recovery of sediments.

Preference for Treatment a Principal Element

Because of the relatively high volume of sediments involved, and the low concentrations of mercury involved, treatment of sediments was not considered. The volume of mercury in CAPA ground water discharging to Lavaca Bay will be significantly reduced through treatment by carbon adsorption.

Five-Year Review Requirements

Because this remedy will result in hazardous substances remaining on-site above levels that allow for unlimited use and unrestricted exposure, a 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.

Chlor-Alkali Process Area Soils

Protection of Human Health and the Environment

The remedy for CAPA soils will adequately protect human health and the environment by eliminating, reducing or controlling exposures to human and environmental receptors through capping and institutional controls. The selected remedy, RAA CAPA-3, eliminates the pathway of concern by capping of contaminated soils within the footprint of Building R-300. In addition, institutional controls requiring development of an industrial hygiene/worker safety program prior to work in this area will control the risk to human health from possible ingestion and dermal exposure to mercury-contaminated soil. The selected remedy will reduce potential human health risk levels from exposure to mercury-contaminated soils such that the non-carcinogenic hazard index will not exceed 1. Finally, the selected remedy does not pose unacceptable short-term risk.

Compliance With ARARs

Chemical specific ARARs are usually health or risk based numerical values or methodologies that, when applied to site specific conditions, result in the establishment of numerical values. These values establish the acceptable amount or concentration of a chemical that may be found in, or discharged to, the environment. The potential exposure pathway for contamination is dermal contact and ingestion of soil. There are no promulgated Federal regulatory cleanup standards for soil; therefore, risk based criteria have been identified for this media (see Section 8 - Remedial Action Objectives).

Cost-Effectiveness

In the Lead Agency's judgment, the selected remedy is cost-effective because the remedy's costs are proportional to its overall effectiveness (see 40 CFR 300.430(f)(1)(ii)(D)). This determination was made by evaluating the overall effectiveness of those alternatives that satisfied the threshold criteria (i.e., that are protective of human health and the environment and comply with all federal and any more stringent ARARs, or as appropriate, waive ARARs). Overall effectiveness was evaluated by assessing three of the five balancing criteria -- long-term effectiveness and permanence; reduction in toxicity, mobility, and volume through treatment; and short-term effectiveness, in combination. The overall effectiveness of each alternative then was compared to the alternative's costs to determine cost-effectiveness. The relationship of the overall effectiveness of the selected remedial alternative was determined to be proportional to its costs and hence represents a reasonable value for the money to be spent.

The present worth cost of RAA CAPA-3, the selected remedy, at $232,000 is somewhat higher than RAA CAPA-2 at $39,000 but considerably less than the cost of RAA CAPA-4 at $5,300,000. The selected remedy offers, relative to its costs, the best overall protection of human health and the environment and the shortest time to achieve compliance with the RAOs. That is, the difference in cost between the selected remedy and CAPA-2 ($193,000) offers a large increase in protectiveness since the impacted soils are capped instead of fenced off while the cost increase between the selected remedy and CAPA-4 ($5,068,000) does not significantly increase protectiveness.

Utilization of Permanent Solutions and Alternative Treatment Technologies (or Resource Recovery Technologies) to the Maximum Extent Practicable

EPA has determined that the selected remedy represents the maximum extent to which permanent solutions and treatment technologies can be utilized in a cost-effective manner at the site. The selected remedy provides the best balance of trade-offs in terms of the five balancing criteria, considering State and community acceptance, while also considering the statutory preference for treatment as a principal element and the bias against off-site treatment and disposal. The selected remedy satisfies the criteria for long-term effectiveness by capping of the contaminated soil thereby effectively reducing the potential for direct contact. The selected remedy does not present any short-term risks, is easily implemented, and takes the shortest time to achieve compliance with the RAOs. In addition, the cost of the selected remedy is significantly lower than RAA CAPA-4 while providing protection of human health and the environment. Based on evaluation of the five balancing criteria, it was determined that extent of treatment found to be practicable was “no treatment”.

Preference for Treatment a Principal Element

The selected remedy does not satisfy the statutory preference for treatment since the CAPA soils are not considered principal threat wastes.

Five-Year Review Requirements

Because this remedy will result in hazardous substances remaining on-site above levels that allow for unlimited use and unrestricted exposure, a 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.

Former Witco Area Soils

Protection of Human Health and the Environment

The remedy for the Former Witco Area Soils will adequately protect human health and the environment by eliminating, reducing or controlling exposures to human and environmental receptors through capping and institutional controls. The selected remedy, RAA Witco-2, eliminates the pathway of concern by capping of contaminated soils in the former tank farm and sump and separator. In addition, institutional controls requiring development of an industrial hygiene/worker safety program prior to work in this area will control the risk to human health from possible ingestion and dermal exposure to mercury-contaminated soil. The selected remedy will reduce potential human health risk levels from exposure to mercury-contaminated soils such that the non-carcinogenic hazard index will not exceed 1. Finally, the selected remedy does not pose unacceptable short-term risk.

Compliance With ARARs

Chemical specific ARARs are usually health or risk based numerical values or methodologies that, when applied to site specific conditions, result in the establishment of numerical values. These values establish the acceptable amount or concentration of a chemical that may be found in, or discharged to, the environment. The potential exposure pathway for contamination is contact and ingestion of soil. There are no promulgated Federal regulatory cleanup standards for soil; therefore, risk based criteria have been identified for this media (see Section 8 - Remedial Action Objectives).

Cost-Effectiveness

In the Lead Agency's judgment, the selected remedy is cost-effective because the remedy's costs are proportional to its overall effectiveness (see 40 CFR 300.430(f)(1)(ii)(D)). This determination was made by evaluating the overall effectiveness of those alternatives that satisfied the threshold criteria (i.e., that are protective of human health and the environment and comply with all federal and any more stringent ARARs, or as appropriate, waive ARARs). Overall effectiveness was evaluated by assessing three of the five balancing criteria -- long-term effectiveness and permanence; reduction in toxicity, mobility, and volume through treatment; and short-term effectiveness, in combination. The overall effectiveness of each alternative then was compared to the alternative's costs to determine cost-effectiveness. The relationship of the overall effectiveness of the selected remedial alternative was determined to be proportional to its costs and hence represents a reasonable value for the money to be spent.

The present worth cost of RAA Witco-2, the selected remedy, at $75,000 is somewhat lower than RAA Witco-3 at $132,000. The selected remedy offers, relative to its costs, the best overall protection of human health and the environment and the shortest time to achieve compliance with the RAOs. That is, the cost increase between the selected remedy and Witco-3 ($57,000) does not significantly increase protectiveness.

Utilization of Permanent Solutions and Alternative Treatment Technologies (or Resource Recovery Technologies) to the Maximum Extent Practicable

EPA has determined that the selected remedy represents the maximum extent to which permanent solutions and treatment technologies can be utilized in a cost-effective manner at the site. The selected remedy provides the best balance of trade-offs in terms of the five balancing criteria, considering State and community acceptance, while also considering the statutory preference for treatment as a principal element and the bias against off-site treatment and disposal. The selected remedy satisfies the criteria for long-term effectiveness by capping of the contaminated soil thereby effectively reducing the potential for direct contact. The selected remedy does not present any short-term risks, is easily implemented, and takes the shortest time to achieve compliance with the RAOs. In addition, the cost of the selected remedy is significantly lower than RAA Witco-3 while providing protection of human health and the environment. Based on evaluation of the five balancing criteria, it was determined that extent of treatment found to be practicable was "no treatment".

Preference for Treatment a Principal Element

The selected remedy does not satisfy the statutory preference for treatment since the Witco soils are not considered principal threat wastes.

Five-Year Review Requirements

Because this remedy will result in hazardous substances remaining on-site above levels that allow for unlimited use and unrestricted exposure, a 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.

Table 13-1
Applicable or Relevant and Appropriate Requirements (ARARs)

STANDARD, REQUIREMENT, CRITERIA, OR LIMITATION	CITATION	DESCRIPTION	MEDIA	RATIONALE & DISCUSSION
BAY SYSTEM				
LOCATION SPECIFIC				
Oyster Waters/Reefs	30 TAC §307.7(b)(3)(B)(iii)	Mandates that oyster waters should be maintained so that concentrations of toxic materials do not cause edible species of clams, oysters, mussels to exceed acceptable guidelines for the protection of public health.	Bay System	These guidelines are action levels for molluscs and shellfish provided by the FDA. The FDA action level for methylmercury is 1 ppm in the edible portion. The selected remedial action is designed so that the FDA action level is not exceeded.
	31 TAC §501.14(h)	Prohibits activities that have adverse effects or degradation on shellfish	Bay System	The selected remedy will meet this ARAR by ensuring that there will be no adverse effects or degradation on shellfish occur.
Critical Areas for Fish and Wildlife Resources: Aquatic, avian, and terrestrial species are present with and around Lavaca Bay. Remedial actions that impact fish and wildlife resources are subject to these regulations.	40 CFR §6.302(g)	Requires all parties involved in actions that will result in the control or structural modification of a natural stream or body of water for any purpose, to take action to protect the fish and wildlife resources that may be affected by the action.	Bay System	The responsible party (e.g., Alcoa) must consult with the USFWS, the NMFS, and the TPWD to ascertain the measures necessary to mitigate, prevent, and compensate for project-related losses of fish and wildlife resources and to enhance these resources. This section also requires that a study of the fish and wildlife resources be included in the NEPA EA or EIS, although Alcoa would not be required to do this since CERCLA removal actions generally are exempt from producing an EA/EIS. Fish and wildlife resources are already documented in the Aquatic and Terrestrial Habitat Mapping Study report.

STANDARD, REQUIREMENT, CRITERIA, OR LIMITATION	CITATION	DESCRIPTION	MEDIA	RATIONALE & DISCUSSION
	40 CFR Part 230	The purpose of Part 230 is to control the discharges of dredged or fill materials (§230.1). Site impacts caused by fill activities would also be covered by Part 230, as are impacts resulting from dredging activities.	Dredged Material	Discharge of dredged or fill material will be controlled under the remedial action.
	31 TAC §501.14(h) 31 TAC §501.14(j)	Prohibits the location of facilities in a coastal natural resource area (CNRA) that is a wildlife habitat unless the design, construction, and operation will prevent adverse impacts and there is no practicable alternative. These sections also specify compensatory mitigation. Finally, these regulations state that actions should not be conducted during spawning or nesting seasons or during seasonal migration periods in order to minimize impacts.	Bay System	The remedial action will be designed to comply with this ARAR.
Critical Habitat for Endangered / Threatened Species: Remedial actions that impact rare, threatened, and endangered species may be subject to applicable federal and state requirements. The Endangered Species Act of 1973 (16 USC 1531) and subsequent regulations govern the protection of endangered or threatened species and provides ARARs for the remediation and management of Lavaca Bay sediments.	40 CFR §6.302(h)	The Endangered Species Act prohibits federal agencies' programs (e.g., CERCLA) from jeopardizing threatened or endangered species or adversely modifying habitats essential to their survival.	Sediments	For actions where USEPA is the lead agency, the responsible party (e.g., Alcoa) must identify designated endangered or threatened species or their habitat that may be affected by the remedial action. The Aquatic and Terrestrial Habitat Mapping Study satisfies the requirement to identify endangered species and their habitat.

STANDARD, REQUIREMENT, CRITERIA, OR LIMITATION	**CITATION**	**DESCRIPTION**	**MEDIA**	**RATIONALE & DISCUSSION**
	40 CFR §230.30	The purpose of 40 CFR §230 is to control the discharges of dredged or fill materials (§230.1).	Sediments	The major potential impacts include: covering or otherwise directly killing species; the destruction of habitat to which these species are limited. The remedial action will be designed to meet this ARAR.
	50 CFR Part 402	If listed species or their habitat may be affected, formal consultation with the USFWS, TPWD, and the NMFS must be undertaken, as appropriate. 50 CFR Part 402 provides procedures for interagency cooperation and interaction.	Sediments	If the consultation reveals that the activity may jeopardize a listed species or habitat, mitigation measures need to be considered.
	31 TAC §501.14(h)	Prohibits development in critical areas if the activity will jeopardize the continued existence of endangered or threatened species or will result in the destruction or adverse modification of their habitat. This section also specifies compensatory mitigation.	Sediments	The remedial action will be designed to meet this ARAR.
Recreational / Commercial Waters: These requirements are applicable to areas of Lavaca Bay that could be disturbed by the remediation and management of Lavaca Bay sediments.	40 CFR §230.51	The discharge of dredged or fill materials can affect the suitability of recreational and commercial fishing grounds as habitat for populations.	Sediments	The remedial action will be designed to meet this ARAR.

STANDARD, REQUIREMENT, CRITERIA, OR LIMITATION	CITATION	DESCRIPTION	MEDIA	RATIONALE & DISCUSSION
	40 CFR §230.52	The disposal of dredged or fill material may adversely modify or destroy water use for recreation by changing turbidity, suspended particulates, temperature, dissolved oxygen, dissolved materials, toxic materials, pathogenic organisms, quality of habitat, and the aesthetic qualities of sight, taste, odor, and color.	Sediment	The remedial action will be designed to meet this ARAR.
	31 TAC §501.14(j)(2)(G)	Adverse effects can be minimized by following procedures to prevent or minimize any potential damage to the aesthetically pleasing features of the site, particularly with respect to water quality. In addition, adverse effects on human use potential from dredging can be minimized by timing dredging and dredged material disposal/placement to avoid seasons or periods when human recreational activity associated with the site is most important.	Sediment	The remedial action will be designed to meet this ARAR.

STANDARD, REQUIREMENT, CRITERIA, OR LIMITATION	CITATION	DESCRIPTION	MEDIA	RATIONALE & DISCUSSION
Coastal Zone Management: The Coastal Zone Management Act of 1972 (16 USC §§1451 et seq.) requires the development and implementation of programs to manage the land and water resources of the coastal zone, including ecological, cultural, historic, and aesthetic values. States must implement programs in conformity with EPA guidance. Remedial actions that impact the coastal zone are subject to 15 CFR Part 923-Coastal Zone Management Program Regulations which is administered by NOAA and provides the criteria for approving state programs. Texas' approved Coastal Management Program administered by the Texas Coastal Coordination Council is recorded at 31 TAC Chapter 501.	31 TAC §501.14(j)	Dredging and dredged material disposal and placement shall not cause or contribute, after consideration of dilution and dispersion, to the violation of any applicable surface water quality standards. Section 501.14(j)(2)(F) cites methods to minimize the effects of activities on plant and animal populations.	Sediment	The remedial action will be designed to meet this ARAR.
	31 TAC §501.14(h)(1)(G)	Development in critical areas shall not be authorized if significant degradation will occur.	Bay System	The remedial action will be designed to meet this ARAR.

STANDARD, REQUIREMENT, CRITERIA, OR LIMITATION	CITATION	DESCRIPTION	MEDIA	RATIONALE & DISCUSSION
	31 TAC §501.14(i)(1)(H)	Where practicable, pipelines, transmission lines, cables, roads, causeways, and bridges shall be located in existing rights-of-way or previously disturbed areas if necessary to avoid or minimize adverse effects and if it does not result in unreasonable risks to human health, safety, and welfare.	Bay System	The remedial action will be designed to meet this ARAR.
ACTION SPECIFIC				
<u>Sediment Removal and Disposal in an On-Site Confined Disposal Facility</u>	33 CFR Part 325	The US Army Corps of Engineers (USACE) requirements for dredge spoil dewatering discharges in 33 CFR Part 325 will serve as an ARAR for the sediment removal and disposal in the confined disposal facility on Dredge Island. Discharge limits of dredge spoil decant water should be set at a limit of 5 µg/L of total mercury, based on the existing USACE discharge permit for dredging.	Sediment	Dredge spoil decant water and storm water discharges from remedial actions must be controlled as needed to allow compliance with the Plant Operation's wastewater discharge permit. This can be accomplished by requiring coordination between the contractor and Plant Operations with respect to timing, sampling, and reporting of discharges.

STANDARD, REQUIREMENT, CRITERIA, OR LIMITATION	CITATION	DESCRIPTION	MEDIA	RATIONALE & DISCUSSION
	31 TAC §§57.41-51 31 TAC §§57.61-77	Shell dredging on the Texas Gulf Coast is regulated by the TPWD under 31 TAC §§57.41-51 and the issuance of marl, sand, and gravel permits is regulated under 31 TAC §§57.61-77. Section 57.42(3) states that dredging operations for the removal, taking, and carrying away of shell and mudshell may be conducted except that operations may not be conducted within ½ mile of any shoreline and operations may not be conducted in marginal water less than four feet in depth.	Sediment	The remedial action will be designed to meet this ARAR.
	40 CFR Part 125, Subpart K	Potential sources of toxic and hazardous pollutants (e.g., dredge spoils, heavy equipment, etc.) associated with the removal action will need to be identified and a Best Management Practices (BMPs) plan will need to be established with specific objectives to prevent and mitigate such releases.	Sediment	The remedial action will be designed to meet this ARAR.
	40 CFR Part 125, Subpart L	Could require that Alcoa provide data regarding the composition of the discharge and its toxicity for establishing discharge limits, similar to what is required for the existing NPDES permitted outfalls.	Sediment	If required, the necessary information will be collected.
Capping Lavaca Bay Sediments	40 CFR Part 230 Clean Water Act §404(b)(1) Guidelines	Regulates the discharges of dredged or fill material to waters of the U.S.	Sediments	The remedial action will be designed to meet this ARAR.
	Section 10 of the Rivers and Harbors Act	Prohibits the unauthorized obstruction or alteration of any navigable water of the U.S.	Sediments	The remedial action will be designed to meet this ARAR.

STANDARD, REQUIREMENT, CRITERIA, OR LIMITATION	CITATION	DESCRIPTION	MEDIA	RATIONALE & DISCUSSION
	33 CFR Part 323 31 TAC §501.14	Specify that placement of dredge material must not adversely impact sensitive areas and must not cause or contribute to the violation of Surface Water Quality Standards.	Sediments	The remedial action will be designed to meet this ARAR
	30 TAC Chapter 314	Chapter 314 adopts by reference 40 CFR Part 129, Subpart A, Toxic Pollutant Standards and Prohibitions. The provisions of this subpart apply to owners or operators of specified facilities discharging into navigable waters.	Sediments	The remedial action will be designed to meet this ARAR
	15 CFR Part 923 15 CFR Part 930	Coastal Zone Management Act requirements for dredging and dredged material disposal and placement are in 15 CFR Parts 923 and 930. Part 923 sets requirements for State coastal management programs, while Part 930 deals with federal consistency with approved Coastal Management Plans.	Sediment	The remedial action will be designed to meet this ARAR
	30 TAC Chapter 307	The general criteria set forth in this chapter apply to surface water in the state and specifically apply to substances attributed to waste discharges or the activities of man.	Sediments	The remedial action will be designed to meet this ARAR

STANDARD, REQUIREMENT, CRITERIA, OR LIMITATION	CITATION	DESCRIPTION	MEDIA	RATIONALE & DISCUSSION
CAPA Hydraulic Controls	40 CFR Part 122 30 TAC Chapter 308	The National Pollutant Discharge Elimination System (NPDES) program is the national program for issuing, monitoring, and enforcing permits for direct discharges. 40 CFR Part 122 requires permits for the discharge of "pollutants" from any "point source" into "waters of the United States." 30 TAC Chapter 308 discusses the criteria and standards for the NPDES.	Ground Water	Under the Superfund Program, an on-site discharge from a CERCLA site to surface water must meet the substantive NPDES requirements, but need not obtain an NPDES permit nor comply with the administrative requirements of the permitting process. The TNRCC set the discharge standards presented in this ROD and Appendix A of the FS.
	40 CFR Part 125, Subpart K	Best management practices (BMP) under 40 CFR Part 125, Subpart K can be required for the groundwater treatment system on a case-by-case basis. BMPs are actions or procedures to prevent or minimize the potential for the release or discharge of toxic pollutants or hazardous substances in significant amounts.	Ground Water	Specific goals of BMP provisions include ensuring that a discharger institutes good housekeeping practices; ensuring proper chemical storage; and controlling contaminated site runoff, leachate, and drainage from materials storage areas, spills, and leaks.
Witco DNAPL Collection and Containment	30 TAC Chapter 120	Requires the use of “Best Available Control Technology” and a demonstration that emissions will not be deleterious to human health will be required	Air	If contaminant-specific emission rates are calculated to be below thresholds specified in 30 TAC §106.533 and §106.262, then the BACT and human health demonstrations will not be required.
	30 TAC Chapter 335, Subchapter C - Hazardous Waste Generators Chapter 335, Subchapter O - Land Disposal Restrictions	Any hazardous wastes generated during excavation will need to meet the standards for hazardous waste generators	Soil	The remedial action will be designed to meet this ARAR

SECTION 14
Documentation of Significant Changes

The Proposed Plan for the Alcoa/Lavaca Bay Site was released for public comment on June 21, 2001. The Proposed Plan identified RAA Bay-4A (Source Control, Hot Spot Removal, Key Biological Area Response, and Enhanced Natural Recovery North of Dredge Island) as the preferred alternative for the Bay System, RAA CAPA-3 (Capping and Institutional Control) as the preferred alternative for Chlor-Alkali Process Area Soils, and RAA Witco-2 (Capping and Institutional Controls) as the preferred alternative for Former Witco Area Soils. EPA reviewed all written and oral comments submitted during the public comment period and determined that no significant changes to the remedies, as originally identified in the Proposed Plan, were necessary or appropriate.

One change from the Proposed Plan is a clarification of the anticipated results of the RAOs. As presented in the Proposed Plan, the RAOs are designed to allow the reduction of mercury levels in fish tissue such that the overall risk throughout Lavaca Bay will approach that which would be present but for the historic Point Comfort operations. The predicted health risks associated with consumption of fish from Lavaca Bay, as well as all bays, using the average consumption rate and reasonable maximum exposure (RME) consumption rates were presented in the Proposed Plan. Potential health risks were estimated for four different exposure groups. Using both the average and RME fish consumption rates, the potential health risks for "Lavaca Bay Fishermen", are not significantly different than the potential health risks for "All Fishermen". The predicted risk for "Lavaca Bay and Closed Area Fishermen" and "Closed Area Fishermen" are approximately twice as high as the potential risk for a "Lavaca Bay Fishermen" or "All Fishermen". Therefore, the predicted unacceptable health risk from consuming fish and shellfish associated with releases from the Alcoa Point Comfort operations is focused generally within the vicinity of the Closed Area of Lavaca Bay.

Even though predicted unacceptable risk may be present due to non-site related contamination, a remedial action at a Superfund site is to address contamination at or from the site. At the Alcoa site, even though there may be unacceptable risks identified for "Lavaca Bay Fishermen", the predicted risk appears to not be significantly different than the predicted risk for "All Fishermen". The Closed Area of Lavaca Bay is generally that area in which unacceptable risks from consumption of fish and shellfish can be attributed to past releases from Alcoa given the uncertainties associated with the toxicity of methylmercury, fish consumption rates and sediment to biota accumulation factors. Therefore, the remedial actions to reduce or control risk to human health and the environment are focused within the Closed Area of Lavaca Bay and areas of Lavaca Bay in the general vicinity of the current Closed Area. Regardless of the fish consumption rate used (RME or average), there is no change in the remedial actions proposed for the site.

The cost estimates presented in the ROD are slightly different than the cost estimates presented in the FS. The FS used a 5% discount rate for calculating the present worth costs. A discount rate of 7% should have been used in calculating the present worth costs. Accordingly, the cost estimates presented in the ROD are based on a 7% discount rate.

Appendix A
Responsiveness Summary

Alcoa/Lavaca Bay Superfund Site
Point Comfort, Texas
Record of Decision
Responsiveness Summary

The Responsiveness Summary provides information about the views of the public, government agencies, the support agency, and potentially responsible parties (PRPs) regarding both the remedial alternatives and general concerns about the site submitted during the public comment period. It also documents in the record how public comments were considered in the decision-making process and provides answers on behalf of EPA to the issues raised.

This Responsiveness Summary is prepared from written and oral comments received during the public comment period on the Proposed Plan. The comment period ran from June 21, 2001, until August 29, 2001. A public meeting to discuss the proposed plan was held on June 28, 2001, at the Bauer Community Center in Port Lavaca, Texas. A transcript of the meeting was prepared and is part of the Administrative Record, along with written comments received by EPA.

Potentially Responsible Party Comments

1. **Comment:** Alcoa maintains that the alternate reference dose (RfD) that was specifically approved by EPA for the Lavaca Bay site is more appropriate than the EPA RfD that was recently posted on the Integrated Risk Information System for both procedural and substantive reasons. Procedurally, EPA specifically approved the development of the alternative RfD. The effort to develop a methyl mercury RfD representative of the Lavaca Bay fish eating population was undertaken only after receiving written verification from EPA that the effort would be appropriate and, consistent with policy directives developed by Administrator Browner. The Company, relying on that specific approval, invested significant financial and technical resources. On a substantive level, EPA's subsequent decision to reject the extensively peer reviewed alternative RfD is a decision which does not follow good science with respect to the application of site specific risk assessments. As discussed below, the use of the highly conservative EPA IRIS RfD overstates the potential risk to Lavaca Bay. It is not our intention to question whether the use of the EPA RfD is a reasonable point of departure to begin the development of environmental programs with the ultimate aim of reducing the mercury burden in the environment. However, EPA should reconsider the application of the RfD specific to Lavaca Bay.

   Response: The alternative reference dose is part of the Administrative Record for the Alcoa (Point Comfort)/Lavaca Bay Superfund site and is presented in the Baseline Risk Assessment prepared for the site. The alternative reference dose (RfD) and EPA Integrated Risk Information System (IRIS) RfD are used in the remedial decision-making process. The alternative RfD illustrates the uncertainty surrounding the EPA RfD. All RfDs have an order of magnitude uncertainty (a factor of 3 above and below the RfD).

   Comment Continued: Alcoa objects to the quantitative exclusion of the Seychelles Islands data during the development of EPA's RfD. It is a very important piece of information in the proper evaluation of the toxicity of methyl mercury. It should be included in the quantitative estimate of the methyl mercury RfD. In fact, ATSDR considered the Seychelles Islands data when estimating its minimal risk level (MRL), which serves as their basis for making public health decisions. Additionally, the Food and Drug Administration (FDA) has chosen to delay revising its action level pending the findings of prospective studies of fish-eating populations in the Seychelles Islands (EPA, 2000). Furthermore, the Texas Department of Health, under contract to ATSDR to perform public health evaluations at Texas Superfund sites, continues to use an RfD that is essentially equivalent to that which was derived in the Lavaca Bay site-specific alternative RfD. The TDH recently reduced the size of the Closed Area after reviewing both Alcoa and TDH fish tissue data.

Response: As explained briefly in the Proposed Plan, historically, the development of a new RfD for mercury followed a trajectory quite separate from the site-specific investigations in progress at Lavaca Bay.

Congress directed EPA, through the House Appropriations Report for Fiscal Year 1999, to contract with the National Research Council (NRC), a body of the National Academy of Sciences (NAS), to evaluate data on the health effects of methylmercury. The NRC reviewed three studies that it considered suitable for quantitative analysis: the Seychelles Islands study, the Faroe Islands study and the New Zealand study. The NRC chose the Faroe Islands study as the most appropriate study on which to base an RfD and EPA concurs with this assessment. The Faroe Islands and the New Zealand studies found dose-related adverse effects to in utero methylmercury exposure, whereas the Seychelles study did not find evidence of dose related adverse effects. The Faroe Islands study, the larger of the two studies that identified methylmercury-related developmental neurotoxicity, provided the statistical power to detect adverse outcomes. The EPA IRIS Workgroup agreed with the NRC that a positive study that shows statistically significant associations between prenatal exposure and adverse outcomes, is the strongest public health basis for an RfD.

Use of the RfD or other data by other state and federal regulatory authorities is interesting but not of primary relevance to the issue immediately at hand, selection of a remedial action under CERCLA and the National Contingency Plan. Although all the agencies named in the comment are generally involved in protection of public health, there is little if any redundancy in the specific missions of ATSDR, FDA, TDH, and EPA. A close look at the kinds of studies conducted by these agencies, not surprisingly, indicates that while they may draw from common sources of information, the purposes for which the information is used are very different. A detailed analysis of the differences is beyond the scope of this response, but suffice it to say that the methodologies employed by each agency (and sometimes by different programs within each agency) are structured differently to accomplish different objectives. Generally, there is great diversity in risk assessment policies, procedures, assumptions, and other choices. The legal context which requires a particular kind of risk assessment in service of a particular regulatory objective determines the goals and methods to be used in conducting it. For EPA's purposes in the Superfund program, those choices are guided by the Risk Assessment Guidance for Superfund (RAGS).

EPA relies heavily on information concerning contaminant toxicity and the potential for human exposure to support its decisions concerning "protectiveness." EPA's risk assessment methods provide a framework for considering site-specific information in these areas in a logical and organized way. To improve program efficiency and consistency, EPA has extensive guidance for characterizing site-specific risks and identifying preliminary remediation goals. 55 FR 8709 (March 8, 1990). Thus, other state and federal programs' use of the RfD is not necessarily relevant to the validity of an EPA risk assessment conducted according to the CERCLA, the NCP, Risk Assessment Guidance for Superfund and other relevant guidance. Region 6 has considered the information generated by Alcoa, included it in the Administrative Record for this Site, and used portions of it as appropriate in the site-specific risk assessment.

Comment continued: Based upon a review of the published information, it is clear to Alcoa that the fish consumption patterns of the Seychelles Islands are very similar to Lavaca Bay consumption patterns. Section 2.2.6 of the "Reference Dose to Methylmercury" (EPA, 2000), discusses the effect of continuous vs. sporadic fish consumption. The authors arbitrarily conclude that binge eating consumption patterns of the Faroese may be more like those in the U.S. since "Most sport fishers consume fish on an intermittent basis." While this may be an accurate statement for some areas of the U.S., the temperate climate and abundant fisheries of Lavaca Bay and surrounding bays, allow productive fishing throughout virtually the entire year. Moreover, the results of the Site Specific Consumption Study confirm that binge eating is not the prevalent consumption pattern on the Texas Gulf Coast.

Marine mammals apparently contribute significantly to the diet of the Faroese. During the Lavaca Bay Consumption Study, no respondent reported eating marine mammals. This distinction is significant. Given the much higher concentrations of mercury (and presumably polychlorinated biphenyls) in marine mammal muscle and blubber compared to that in fish, exposure patterns and mercury body burdens are likely to be very different between the Faroese and the Lavaca Bay fish-eating population. The difference in exposure potential between the Faroe Islands and Lavaca Bay fish-eating populations makes an RfD based on the Faroe Islands data (i.e., IRIS RfD) inappropriate for use in Lavaca Bay.

Response: The people in the Faroe Islands had a sporadic exposure pattern, whereas, the people in the Seychelles Islands had a more continuous exposure pattern. The degree to which the differences in exposure pattern between the studies accounts for differences in outcome is uncertain. In the U.S., including people consuming fish from Lavaca Bay, both patterns of exposure could be exhibited. Sport fishers could consume fish on a sporadic basis. Therefore the fish consumption pattern of the Faroe Islands can be used to represent the pattern of exposure in the U.S. population to methylmercury from fish consumption.

The Faroese consume fish approximately three meals a week as well as Pilot-whale meat. Pilot-whale meals are relatively infrequent (less than once per month). Infrequent consumption of whale-meat by the Faroese does not preclude the use of the Faroe Islands study as a basis of an appropriate RfD.

Comment continued: Furthermore, in EPA's recent response to comments (see Attachment A for responses and Attachment B for public comments) on the Methyl Mercury RfD, EPA provides fish tissue mercury data from samples collected in the U.S (Table A-2) to show that mercury concentrations in U.S. fish are similar to concentrations measured near the Faroe Islands. EPA provides maximum concentrations in this table but later states, "These levels do not simply reflect a maximum far above the remainder of the data." These concentrations are, in general, much higher than even the maximum concentrations measured in Lavaca Bay, except for fish caught in the Closed Area. Additionally, the species listed in EPA's table are freshwater fish and thus are not species found in Lavaca Bay. Through the Lavaca Bay Consumption Study, Alcoa documented the types of fish caught in Lavaca Bay as well as the quantity of fish consumed. The RfD for Lavaca Bay should be based on a population whose exposure patterns and exposure potential are similar to those of the recreational anglers in Lavaca Bay. The Seychelles Islanders' exposure clearly is more similar to Lavaca Bay fishermen than the Faroese.

Response: The maximum concentrations of mercury in red drum, black drum, spotted seatrout and southern flounder in the closed area are within the range of maximum mercury concentrations for fish species listed in Table A-2. The frequency of fish consumption for the Seychelles Islanders, Faroese and Lavaca Bay residents (RME) are approximately 12, 3 and 2 meals per week, respectively. The frequency of fish consumption of Lavaca Bay residents appears to be reflected by the Faroese rather than the Seychelles Islanders.

Table A-2. Maximum Mercury Concentrations in Selected Fish Species

(Alcoa/Lavaca Bay fish are italicized)

Fish Species	***Maximum Mercury Concentration in ppm***
Largemouth bass	8.94
Smallmouth bass	5.0
Red drum (closed area)	*4.45*
Black drum (closed area)	*3.76*
Yellow perch	3.15
Chain pickerel	2.81
Lake trout	2.70
Walleye	2.04
Spotted seatrout (closed area)	*1.49*
Southern flounder (closed area)	*1.21*
Brown bullhead	1.10
Brook trout	0.98

Comment continued: Since other well-designed studies were available, it is inconceivable that NRC selected a critical study where polychlorinated biphenyl (PCB) concentrations were very high as the basis for the methyl mercury RfD, given that PCBs are known to cause neurotoxic effects following prenatal and postnatal exposure (ATSDR, 1998). PCBs have been measured in pilot whale blubber at about 30 parts per million (ppm) and it is estimated that the Faroese consume about 200 µg of PCBs per day via fish tissue, whale meat, and blubber ingestion (Weihe, et al, 1996). It should be noted that this value is much greater than the RfD for Aroclor 1254 and similar to the Lowest Observable Adverse Effects Level (LOAEL) provided in the EPA IRIS toxicity profile that serves as the basis for the RfD. In addition, the FDA recommends a Tolerable Daily Intake for PCBs of about 60 to 70 µg PCBs per day for adults.

Notwithstanding the issue of co-contamination in the critical study, PCB data for fish collected in Lavaca Bay (TDH, 1998) show significantly lower PCB concentrations (most samples did not contain detectable results for PCBs) than the concentrations likely to be present in the fish and marine mammals around the Faroe Islands. The difference in potential PCB exposure makes an RfD based on the Faroe Islands data inappropriate for making risk management decisions at Lavaca Bay.

Response: The neurological effects of polychlorinated biphenyls (PCBs) can be separated from the neurological effects of methylmercury. In the Faroe Islands study, Grandjean et al. (1997) performed a series of analyses to ascertain if the PCB and methylmercury effects could be separated. The regression coefficients for mercury adjusted for PCBs are not significantly different from those not adjusted for PCBs with the exception of the Boston Naming test.

Grandjean, P., P. Weihe, R. White, F. Debes, S. Arak, K. Yokoyama, K. Murata, N. Sorensen, R. Dahl, and P. Jorgensen. 1997. Cognitive deficit in 7-year-old children with prenatal exposure to methylmercury. Neurotoxicol. Teratol. 19 (6): 417- 428.

Comment continued: If risk is estimated based upon EPA's RfD and the 90th percentile ingestion rate (as determined in the Consumption Survey), any female of childbearing age consuming fish from Texas bays is potentially at risk. This suggested result, however, is an artifact of the risk assessment process, specifically an overly conservative RfD. It simply does not accurately reflect an actual or even potential risk since neurotoxicity has not been observed in the Texas bays fish-eating population. (An epidemiological study has not been performed for the Texas Coast but ATSDR has completed a Public Health Assessment [Attachment C] for the Lavaca Bay area and, in general, risk to the fish-eating population was not predicted, except to those eating fish from the Closed Area.) In addition, this conclusion is not consistent with existing TDH or EPA fishing advisories for mercury or ATSDR's 1995 Public Health Assessment (see Attachment C) and TDH's 2000 Health Consultation (see Attachment D) performed for the area. We do not believe that EPA's arbitrary adoption of the IRIS RfD is a responsible way to communicate potential risks associated with Lavaca Bay.

In conclusion, Alcoa does not support using EPA's RfD for making risk management decisions at Lavaca Bay because it: 1) is based on a critical study with very different exposure than that which may occur at Lavaca Bay; 2) is generally inconsistent with the practices used by other health agencies charged with protecting human health (e.g., TDH), and 3) Alcoa, with specific approval from EPA, conducted a site specific risk study and the results of that peer reviewed evaluation are available for making risk decisions about the Lavaca Bay Superfund Site.

Response: The purpose of the EPA risk assessment is different than the mission of other agencies. Using the EPA RfD for methylmercury and the 90^{th} percentile ingestion rate for women of childbearing age (45 g/day), the children of women that eat fish exclusively from other bays have a noncarcinogenic hazard quotient of approximately one and are not considered at risk.

The EPA RfD is appropriate for risk management decisions because: 1) sporadic exposure of the critical study could occur at Lavaca Bay, 2) other health agencies may consider different factors than EPA in developing their health value, and 3) the alternative RfD is part of the Administrative Record for the Alcoa (Point Comfort)/Lavaca Bay Superfund site and is presented in the Baseline Risk Assessment prepared for the site. The alternative reference dose and EPA's Integrated Risk Information System (IRIS) reference dose are used in the remedial decision-making process.

2. **Comment:** The EPA RfD of 0.1 mg/kg-day relies upon an uncertainty factor of 10 -- 3 to account for 1) pharmacokinetic variability, 2) uncertainty in estimating an ingested mercury dose from cord-blood mercury concentration and 3) pharmacodynamic variability and uncertainty (EPA, 2001). In other words, to derive the RfD, EPA had to make assumptions about mercury intake (i.e., fish and marine mammal consumption and corresponding mercury concentrations in the ingested fish and whales) of an individual given the cord-blood levels.

The results of a questionnaire given to adults in the Faroe Islands indicated a daily consumption of 72 grams of fish, 12 grams of whale muscle, and 7 grams of blubber. Average mercury concentrations in cod fish, the most commonly consumed fish by the Faroese, are about 0.07 part per million (ppm) while whale muscle in the Faroe Islands area contained an average mercury concentration of 3.3 ppm, about half of which was methyl mercury (Clewell et al., 1998). TERA (TERA, 2000) estimated a total daily intake of 25 μg of mercury per day from ingestion of fish and marine mammals (5 μg from fish and 20 μg from whale tissue).

Based on the results of the Consumption Study conducted by Alcoa and the immense fish tissue database for Lavaca Bay, Alcoa has an excellent understanding of the daily dose of mercury the fish-eating population ingests. In fact, we have determined that the average Lavaca Bay fish consumer ingests about 5 μg of mercury per day, and the high-end (RME) Lavaca Bay fish consumer ingests about 12 μg of mercury per day. The high-end Lavaca Bay/Closed Area fisherman ingests about 24 μg of mercury per day.

Since much is known about ingested mercury dose to the Lavaca Bay fishermen, it is unnecessary and overly conservative to apply an uncertainty factor of 3 in the RfD to account for uncertainty in estimating an ingested mercury dose from cord-blood mercury concentration in the critical study. In addition, in the critical study for the RfD, no threshold arose related to neurotoxicity within the range of exposures in the Faroe Islands (EPA, 2001). Given the similar dose between the Faroese and the Lavaca Bay fishermen, one would expect to see similar toxicity. Toxicity, however, has not been observed in the Lavaca Bay fish-eating population. (An epidemiological study has not been performed for the Texas Coast but ATSDR has completed a Public Health Assessment [Attachment C] for the Lavaca Bay area and, in general, risk to the fish-eating population was not predicted, except to those eating fish from the Closed Area.)

Alcoa requests that EPA reduce the uncertainty factor of 10 used in the RfD to 3 for the Lavaca Bay site. We believe this adjustment is appropriate for the Lavaca Bay site for the reasons listed above.

Response: All RfDs have an order of magnitude uncertainty (a factor of 3 above and below the RfD). A composite uncertainty factor of 10 was used in deriving the RfD for methylmercury. The UF accounted for 1) pharmacokinetic variability and uncertainty in estimating an ingested mercury dose from cord-blood mercury concentration (a factor of 3 was applied) and 2) pharmacodynamic variability and uncertainty (a factor of 3 was applied). Choosing an overall uncertainty factor of 10 is supported by additional analyses of the Faroese neuropsychological data, wherein the observations made of the most highly exposed subgroup were excluded from the model (Grandjean et al., 1997). Associations remained significant when the part of the cohort with maternal-hair mercury concentrations greater than 10 ppm was excluded from the analyses. This finding indicates that it would be reasonable to expect some percentage of the population to show effects at or below 10 ppm hair mercury, or at levels at or below 40 ppb cord-blood. Since the RfD is based on human data, additional uncertainty factors are not needed.

Much is known about ingested methylmercury dose to the Lavaca Bay fishers from the site-specific fish and shellfish consumption study and the analysis of fish and shellfish for mercury. The relationship between maternal blood and fetal blood was not measure at the Lavaca Bay site. The pharmacokinetic variability still remains and an uncertainty factor of 3 is warranted.

The population of the Faroe Islands is descended from Scandinavian stock that settled many generations ago, and is extremely homogeneous. The average toxicodynamic response of this population compared with that of the Lavaca Bay fishers, which is genetically much more diverse, is unknown. Therefore the pharmacodynamic variability still remains and an uncertainty factor of 3 is warranted.

3. **Comment:** Alcoa is concerned about the conflicting and confusing messages that the public receives given the inconsistencies in the different policies of the different agencies charged with protecting human health. For example, TDH believes that catching and consuming fish from

Lavaca Bay poses no adverse risk and, as such, their fishing advisory only applies to the Closed Area of Lavaca Bay. EPA's fish consumption advisory is general in nature and would not even require that the catching and eating fish from the Closed Area be curtailed. However, when using the RME ingestion rate coupled with EPA's RfD to develop a Remedial Action Objective (RAO), all of Lavaca Bay as well as Lavaca Bay present unacceptable risks to the fish eating populations. As such, Alcoa would be responsible for reducing fish tissue concentrations to levels below which TDH and EPA find of concern. Alcoa believes that this is, in part, due to an overly conservative RfD coupled with a high-end ingestion rate. If the EPA RfD is used as the basis for the RAO for Lavaca Bay, Alcoa requests that this issue be considered when making risk management decisions for the site.

Response: EPA recognizes that numerous Federal and state agencies are involved in establishing protective levels of mercury in fish and shellfish. However, agencies such as the Texas Department of Health consider both the potential risk associated with consuming seafood with elevated mercury concentrations as well as the nutritional benefits from consuming seafood. In predicting risks at Superfund sites using RAGS, EPA does not have the latitude to consider health benefits from fish consumption but evaluates the risk to human health from consuming fish.

The purpose of the risk assessment is to provide a framework for developing risk information necessary to assist decision-making at remedial sites. A risk assessment provides a consistent process for evaluating and documenting threats to human health and the environment. One objective of the risk assessment is to provide an analysis of the risks that exist if no remediation or institutional controls are applied. The results of the baseline risk assessment are used to determine whether remediation is necessary, to help provide justification for performing remedial action, and to assist in determining what exposure pathways need to be remediated. A second objective of the risk assessment is to use the risks and exposure pathways developed in the baseline risk assessment to target chemical concentrations associated with levels of risk that will be adequately protective of human health and the environment.

The likelihood of the exposure actually occurring should also be considered when deciding the appropriate level of remediation. Risk assessments conducted at Superfund sites should take into consideration background concentrations and conditions and should identify critical assumptions and uncertainties in the risk assessment. Key assumptions and uncertainties in both contaminant toxicity and human and environmental exposure estimates must be documented in the baseline risk assessment as well as the sources and effects of uncertainties and assumptions on the risk assessment results. These assumptions and uncertainties must be considered in developing remediation goals. As noted above, a Superfund risk assessment is not an end in itself. Rather, it is a study performed in a particular way in order to inform the risk management decision, the outcome of the NCP process which relies on Remedial Investigation, Risk Assessment and Feasibility Study. The purpose of the process as a whole is select and implement remedies that abate risks to human health and the environment.

Using the results of the Baseline Risk Assessment, the following Remedial Action Objectives (RAOs) were presented in the Proposed Plan:

1) eliminate or reduce to the maximum extent practical mercury loading from on-going unpermitted sources to Lavaca Bay;
2) reduce to an appropriate level mercury in surface sediments in sensitive habitats; and
3) reduce to an appropriate level mercury in surface sediments in open-water that represent a pathway by which mercury may be introduced into the food chain.

These RAOs are designed to allow the reduction of mercury levels in fish tissue such that the overall risk throughout Lavaca Bay will approach that which would be present but for the historic Point Comfort operations. The RAOs in the Proposed Plan set out numerical mercury sediment goals but do not specifically set a protective fish concentration level.

Target sediment cleanup goals for sediments are based on the locations where finfish and shellfish data suggest the opportunity for mercury to enter the food chain is concentrated.

Two areas of uncertainty that are discussed in the Baseline Risk Assessment are the finfish/shellfish consumption rates and the reference dose (RfD) for methylmercury. In general, the RfD is not a "bright line" between safety and toxicity; however, there is a progressively greater concern about the likelihood of adverse effects above this level. The RfD is used to estimate a level of environmental exposure at or below which no adverse effect is expected to occur. The RfD is an estimate, with uncertainty spanning perhaps an order of magnitude, of a daily exposure to the human population that is likely to be without appreciable risk during a lifetime. RfDs are based on an assumption of lifetime exposure and may not be appropriately applied to less-than lifetime exposure situations.

The predicted health risks associated with consumption of fish from Lavaca Bay, as well as all bays, using the average consumption rate and reasonable maximum exposure (RME) consumption rates were presented in the Proposed Plan. Potential health risks were estimated for four different exposure groups. Using both the average and RME fish consumption rates, the potential health risks for "Lavaca Bay Fishermen"[8], are not significantly different than the potential health risks for "All Fishermen"[9]. The predicted risk for "Lavaca Bay and Closed Area

[8] Lavaca Bay Fishermen - fishermen who fished mostly in Lavaca Bay, but not in the Closed Area

[9] All Fishermen - fishermen who fished in Lavaca Bay, but also in other Texas Bays

Fishermen"[10] and "Closed Area Fishermen"[11] are approximately twice as high as the potential risk for a Lavaca Bay Fishermen or All Fishermen. Therefore, the predicted unacceptable health risk from consuming fish and shellfish associated with releases from the Alcoa Point Comfort operations is focused within the Closed Area of Lavaca Bay and areas of Lavaca Bay in the general vicinity of the Closed Area. Additionally, based on the average consumption rate (which is similar to the recommended fish consumption rate of 24 grams/day presented in EPA's fish consumption advisory), the predicted unacceptable risks are generally restricted to exposure scenarios where a receptor consumes fish and shellfish from the current fish closure area.

It should be clarified that EPA's January 2001 Consumption Advisory is a national advisory concerning risks associated with mercury in freshwater fish caught by friends and family. In the advisory, EPA recommends that to protect against the risks of mercury in fish caught in freshwater, fish consumption should be limited to one meal per week for adults (one fish meal is considered 6 ounces or 24 grams per day of cooked fish). EPA recommends that women who are or could become pregnant, nursing mothers and young children follow the FDA advice for coastal and ocean fish caught by family and friends. The FDA advises pregnant women and women of childbearing age not to eat shark, swordfish, king mackerel, and tilefish. FDA further states that these women can safely eat 12 ounces per week (12 ounces per week is equivalent to 48 grams/day) of cooked fish. The FDA consumption advisory rate is similar to the RME fish consumption rate of 45 grams/day.

Even though predicted unacceptable risk may be present due to non-site related contamination, a remedial action at a Superfund site is to address contamination at or from the site. At the Alcoa site, even though there may be unacceptable risks identified for "Lavaca Bay Fishermen", the predicted risk appears to not be significantly different than the predicted risk present for "All Fishermen". The Closed Area of Lavaca Bay and areas of Lavaca Bay in the general vicinity of the Closed Area are the areas in which unacceptable risks from consumption of fish and shellfish can be attributed to past releases from Alcoa given the uncertainties associated with the toxicity of methylmercury, fish consumption rates and sediment to biota accumulation factors. Therefore, the remedial actions to reduce or control risk to human health and the environment are focused within the current Closed Area and areas of Lavaca Bay in the general vicinity of the Closed Area. Regardless of the fish consumption rate used (RME or average), there is no change in the remedial actions proposed for the site.

4. **Comment:** Since the alternate RfD for the Lavaca Bay site was developed in 1998 and more recent data may be available, an independent review of the alternate RfD was performed to determine if it is still appropriate given more recent publications. This review is contained in Attachment E.

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10 Lavaca Bay and Closed Area Fishermen - fishermen who fished mostly in Lavaca Bay, but occasionally in the Closed Area

11 Closed Area Fishermen - fishermen who fished mostly in the Closed Area

Response: The Preamble to the 1990 National Contingency Plan gives guidance to EPA about the manner in which EPA should consider information on toxicity proffered by PRPs or other interested parties:

> "...EPA will, of course, consider such public comments on toxicity. However, it is important to note that the Superfund risk assessment process typically relies heavily on existing toxicity information or profiles that EPA has developed on specific chemicals. EPA believes that the use of a consistent data base of toxicological information is important in achieving comparability among its risk assessments. This information generally includes estimated carcinogen exposures that may be associated with specific lifetime cancer risk probabilities (risk-specific doses or RSDs) and exposures to noncarcinogens that are not likely to present appreciable risk of significant adverse effects to humans (including sensitive subgroups) over lifetime exposures (reference doses or RfDs). EPA has also developed toxicity information for some ecosystem receptors. Where no toxicological information is available in EPA's data base, then EPA routinely considers other available information, including information provided by PRPs or other interested parties. Depending on the evidence, however, EPA may feel it is not appropriate to assess the toxicity of specific chemicals quantitatively because of the questions of reliability and consistency in data development. EPA may decide to address these chemicals qualitatively.

The results of the baseline risk assessment are used to understand the types of exposures and risks that may result from Superfund sites. Key assumptions and uncertainties in both contaminant toxicity and human and environmental exposure estimates must be documented in the baseline risk assessment as well as the sources and effects of uncertainties and assumptions on the risk assessment results. Exposure assumptions or other information, such as additional toxicity information, may be evaluated to determine whether the risks are likely to have been under-or overestimated. These key assumptions and uncertainties must also be considered in developing remediation goals. 55 FR 8711.

Generally, the assumptions used in conducting CERCLA risk assessments are precautionary in nature. Where there are options or variables available among the assumptions to be used, generally the assumption chosen for use will be conservative so as not to underestimate risks. The RfD for mercury used in the risk assessment for the Lavaca Bay Site is based on the 2000 National Academy of Sciences report. Use of the RfD is consistent with current national policy, and appropriate for use in this Superfund risk assessment. To the extent that Alcoa has developed additional, site-specific information which may have some bearing on risk issues in contexts other than Superfund risk assessment, Alcoa is at liberty to use that data in an appropriate context.

5. **Comment:** Page 12. On page 9 (Role of Ongoing Sources, CAPA Groundwater), the range of mercury flux estimates is listed as 0.4 to 90 pounds per year. However, in a subsequent section

(page 12, Sitewide Investigations, Groundwater, Plant/Mainland Perimeter Study), the range is given as 10 to 50 pounds per year. Later in the PRAP, the range is again given as 0.4 to 90 pounds per year. Alcoa suggests that the text be revised on page 12 to ensure consistency throughout the document.

Response: EPA agrees with the comment and will consistently present the mercury flux estimate of 0.4 to 90 pound per year in the Record of Decision.

6. **Comment:** Page 23, end of first partial paragraph. The sentence, "The HI for this exposure pathway was significantly below levels of concern" should be revised as follows: "The HI <u>and cancer risk estimates</u> for this exposure pathway <u>were</u> significantly below levels of concern" to make it clear that cancer risks were also estimated for this pathway.

   Response: EPA will include the following text in the Record of Decision. "The HI for dermal exposure to mercury in sediments was significantly below levels of concern. Also, the lifetime incremental cancer risk was estimated at 3×10^{-6} for dermal exposure to total PAHs in sediments."

7. **Comment:** Page 23, end of third full paragraph. The last two sentences, "As such, the RME is useful for predicting human.....more conservative assumptions included in an RME" should be deleted. We suggest inserting the following text to provide additional information related to the objectives of the Consumption Study and what these data represent.

   "The Consumption Study was designed to evaluate fishing and consumption patterns of individuals living near the Bay because these individuals are the most likely to fish most frequently in the Bay. These data were important to assess Natural Resource Damages as well as to support the RME scenario in the BLRA. The study was conducted during November, a month where fishing is extremely productive, to ensure that fish consumption was not under-estimated for the remainder of the year.

   Approximately 3,500 surveys were sent out to licensed fishermen. About 2,000 people responded (35% of respondents were women of child-bearing age). Of the almost 2,000 respondents who reported fishing along the Texas coast, 370 reported fishing in Lavaca Bay occasionally, and 23 reported fishing in the Closed Area at least once. (This second value would be smaller now since Cox Bay has been removed from the Closed Area and several anglers in the Consumption Study reported fishing only in the Cox Bay area of the Closed Area.) It is important to note that, in general, the fishermen with the highest consumption rates typically fished outside Lavaca Bay and ate mostly flounder."

   Response: EPA concurs with the above comment but prefers to modify the last sentence of the first paragraph to be consistent with the uncertainty discussion of the Baseline Risk Assessment.

Therefore the recommended last sentence of the first paragraph will not be included but the following text will be included.

> "The survey was conducted in November when there likely is greater frequency of fishing activities and higher consumptive use of the fish resources when compared to the rest of the year. As a result, some parameters, especially the consumption rate, were highly influenced by specific fishing patterns that are more common for this time of the year."

The remainder of the suggested text will be included in the uncertainty discussion in the risk assessment portion of the Record of Decision.

8. **Comment:** Page 24, first sentence of first paragraph. The sentence should be revised as follows: "Predicted health risks associated with consumption of fish from Lavaca Bay (i.e., Lavaca Bay Fisherman and Closed Area fisherman) as well as all bays (i.e., the "All Fishermen" scenario) using the average site-specific consumption rate (18 grams/day) and RME consumption rate (45 grams/day) as well as EPA's average and RME consumption rates (7 and 26 grams/day) are as follows:"

   Response: The purpose of the remedy selection process is to implement remedies that eliminate, reduce, or control risks to human health and the environment. Remedial actions are to be implemented as soon as site data and information make it possible to do so. 40 C.F.R. §300.430(a)(1). Site-specific data needs, the evaluation of alternatives, and the documentation of the selected remedy should reflect the scope and complexity of the site problems being addressed. 40 C.F.R. §300.430(a)(1)(ii)(C).

   As reflected in the above quotations from the NCP, the question of how much investigation is sufficient to support a remedial action decision is a site-specific one. At this site, a number of Alcoa's comments on the Proposed Plan raise issues associated with various input parameters for the risk assessment. In many of these instances, the practical outcome – anything from an action level for a particular environmental medium to a component of the proposed remedial action – do not change. The remedial investigation, risk assessment, and feasibility study carried out at this site beginning in 1994 has been thorough, comprehensive, and appropriate to the scope and complexity of environmental problems presented by this site. Given that each step in the NCP process is sequential, and that subsequent steps rely on data generated in earlier ones, revisiting at this stage issues which were adequately addressed in earlier stages of the process for this site serves no good purpose and may result in delay in implementing the remedial action.

9. **Comment:** Page 24, summary table with Hazard Indices. The table should be revised as follows: (Note that a Closed Area Fisherman scenario was not included since no anglers reported fishing *only* in the Closed Area. Rather, the Lavaca Bay/Closed Area fisherman

scenario was used to represent the angler that fishes in Lavaca Bay and reported fishing in the Closed Area.)

Scenarios	Site-Specific Ave. Ingestion Rate (18 g/d)	Site-Specific RME Ingestion Rate (45 g/d)	EPA, 1997 Ave. Ingestion Rate (7 g/d)	EPA, 1997 95th percentile Ingestion Rate (26 g/d)
All[1]	<1	2	<1	<1
LB[2]	<1	2	<1	1
LB/CA[3]	2	4	<1	2

Notes:

1 All Fishermen – fishermen who fished in Lavaca Bay, but who fished mostly in other bays.

2 LB Fishermen – Lavaca Bay fishermen who fished mostly in Lavaca Bay, but not in the Closed Area.

3 LB/CA Fishermen – Lavaca Bay fishermen who fished in Lavaca Bay and reported consuming fish from the Closed Area.

Response: At the Alcoa site, even though there are unacceptable risks identified for "Lavaca Bay Fishermen", the predicted risk appears to not be significantly different than the predicted risk present for "All Fishermen". The Closed Area of Lavaca Bay is generally that area in which unacceptable risks from consumption of fish and shellfish can be attributed to past releases from Alcoa given the uncertainties associated with the toxicity of methylmercury, fish consumption rates and sediment to biota accumulation factors. Therefore, the remedial actions to reduce or control risk to human health and the environment are focused within the current Closed Area and areas of Lavaca Bay in the general vicinity of the Closed Area. Regardless of the fish consumption rate used (RME or average), there is no change in the remedial actions proposed for the site.

10. **Comment:** Page 24, first paragraph after table. Please insert these sentences after "The current EPA reference dose suggest that pregnant women that consume fish at the RME fish consumption rate used in the Baseline Risk Assessment could put their unborn child at risk for potential neurodevelopmental effects, regardless of whether those fish were from Lavaca Bay or any other bay on the Texas Coast". "It should be noted that the RME ingestion rate, because of the design of the Consumption Study, likely overestimates risk for most, if not all, of the fish-eating population for long-term consumption. Another way to evaluate risk is to use average assumptions, rather than the more conservative assumptions included in the RME."

We believe these changes are especially important for the following reason. EPA's national advisory concerning risks associated with methyl mercury in fish is based on approximately 24 grams of fish ingestion per day. If an RAO is developed based on a 45 g/day ingestion rate, the RAO would be much less than what an "acceptable" concentration would be using EPA's ingestion rate. In essence, the remedy would not be achieved until fish concentrations in Lavaca Bay are less than what would trigger a concern under EPA's consumption advisory.

Response: The purpose of the EPA risk assessment is different than the mission of other agencies. Using the EPA RfD for methylmercury and the 90th percentile ingestion rate for women of childbearing age (45 g/day), the children of women that eat fish exclusively from other bays have a noncarcinogenic hazard quotient of approximately one and are not considered at risk.

11. **Comment:** Page 27, end of first partial paragraph. The last sentence, "The ultimate result of remedial actions in Lavaca Bay will be the reduction of mercury in upper trophic fish/shellfish to levels that would be protective of human consumption and not pose an unacceptable ecological risk," should be deleted. This sentence is not only redundant, more importantly, the referenced sentence is misleading – it might be interpreted to suggest that Alcoa will be responsible for reducing fish tissue mercury concentrations to levels that are below mercury advisories for fish ingestion currently in place from other health agencies (EPA and TDH for recreationally-caught fish and FDA for commercially-available fish) or ATSDR's 1995 Public Health Assessment (see Attachment C) and TDH's 2000 Health Consultation (see Attachment D) performed for the area.

Response: As discussed earlier, EPA recognizes that numerous Federal and state agencies are involved in establishing protective levels of mercury in fish and shellfish. However, agencies such as the Texas Department of Health consider both the potential risk associated with consuming seafood with elevated mercury concentrations as well as the nutritional benefits from consuming seafood. In predicting risks at Superfund sites, EPA does not have the latitude to consider health benefits from fish consumption but evaluates the risk to human health from consuming fish.

The predicted health risks for "All Fishermen" using the average consumption rate and reasonable maximum exposure (RME) consumption rates was presented in the Proposed Plan. Potential health risks were estimated for four different exposure groups. Using both an average and RME fish consumption value, the potential health risks for "Lavaca Bay Fishermen" is similar to the potential health risks for "All Fishermen." The predicted risk for "Lavaca Bay Closed Area Fishermen" and "Closed Area Fishermen" are approximately twice as high as the potential risk for "Lavaca Bay Fishermen" or "All Fishermen."

Therefore, the predicted unacceptable health risk from consuming fish and shellfish associated with releases from the Alcoa Point Comfort operations is focused generally within the Closed Area of Lavaca Bay.

The above mentioned sentence will be revised to read as follows:

> The predicted health risks associated with consumption of fish from Lavaca Bay, as well as all bays, using the average consumption rate and reasonable maximum exposure (RME) consumption rates were presented in the Proposed Plan. Potential health risks were estimated for four different exposure groups. Using both the average and RME fish consumption rates, the potential health risks for "Lavaca Bay Fishermen", are similar to the potential health risks for "All Fishermen". The predicted risk for "Lavaca Bay and Closed Area Fishermen" and "Closed Area Fishermen" are approximately twice as high as the potential risk for "Lavaca Bay Fishermen" or "All Fishermen". Therefore, the predicted unacceptable health risk from consuming fish and shellfish associated with releases from the Alcoa Point Comfort operations is focused generally within the Closed Area of Lavaca Bay. The ultimate result of remedial actions in Lavaca Bay will be the reduction of mercury in upper trophic level fish/shellfish to levels that would be protective of human consumption and not pose an unacceptable ecological risk.
>
> Even though predicted unacceptable risk may be present due to non-site related contamination, a remedial action at a Superfund site is to address contamination at or from the site. At the Alcoa site, even though there are unacceptable risks identified for "Lavaca Bay Fishermen", the predicted risk is not significantly different than the predicted risk present for "All Fishermen". The general area around the Closed Area of Lavaca Bay is that area in which unacceptable risks from consumption of fish and shellfish can be attributed to past releases from Alcoa given the uncertainties associated with the toxicity of methylmercury, fish consumption rates and sediment to biota accumulation factors. Therefore, the remedial actions to reduce or control risk to human health and the environment are focused within the Closed Area of Lavaca Bay and areas of Lavaca Bay in the general vicinity of the current Closed Area. Regardless of the fish consumption rate used (RME or average), there is no change in the remedial actions proposed for the site.

12. **Comment:** Page 28 -- Remedial Action Objectives, Chlor-Alkali Process Area. The CAPA discussion in the last paragraph on this page notes "In addition, the remedial action at the CAPA should address those areas of soil that exceed the TNRCC commercial/industrial soil protection concentration limit of mercury of 180 mg/kg." This RAO is inconsistent with the approved Feasibility Study (FS). As shown on Figure 3-1 of the FS, there are two locations (one near the northwest corner of R-300 and one about 100 feet south of the former retort building) that have mercury concentrations above 180 mg/kg and are located outside the

remediation area proposed in the FS. The concentrations in these samples were 367 and 356 mg/kg.

The CAPA data evaluation used a construction worker scenario for the basis of the 466 mg/kg RBV given land use assumptions at the site. Other TNRCC and EPA industrial worker values were available (analogous to the TRRP value of 180 mg/kg since it did not exist when the CAPA Focused Investigation and data evaluation were conducted) but Alcoa felt that a more site-specific value was more appropriate. Thus, several RBVs were calculated for several land use options (Appendix F of the CAPA SAP). Given the assumptions for the site, the construction worker value was slightly lower than the general industrial worker. As such, Alcoa does not believe that it is appropriate to apply the 180 mg/kg value for CAPA soils.

Response: At the request of the state of Texas, EPA included the secondary soil remediation goal of 180 mg/kg mercury. The 180 mg/kg mercury soil remediation goal is based on TNRCC's commercial/industrial soil protective concentration limit for mercury (adjusted for consideration of occupational air standards for on-site workers). In reviewing the results from the CAPA Focused Investigation Data Report, the 95% upper confidence level mercury concentration in CAPA soils outside the footprint of the R-300 building is 93 mg/kg. Applying the TNRCC remediation goal of 180 mg/kg mercury does not alter the proposed remedial actions at CAPA. Areas inside the footprint of Building R-300 require remediation while the levels of mercury outside of the footprint of Building R-300 are below are potential remediation goals.

13. **Comment:** Page 32, RAA Bay-2, Source Control. The first paragraph mentions the Witco DNAPL "collection trench and sheet piling vertical barrier." The paragraph also mentions that the specifications of the systems "would be refined during the remedial design." This language is taken directly from the FS and provides the flexibility to change the design. However, the data collected during the geotechnical design phase (information collected voluntarily by Alcoa in order to expedite the remedial activity if possible) indicates that any option, including sheet piling, slurry wall, etc. that provides containment and prevents downgradient migration could be suitable. Alcoa suggests that the language of the PRAP be revised to be specific in terms of the intent but leave the design specifics until such time as final design issues can be negotiated.

Response: As described in Section 2.2.3.4 of the Feasibility Study, migration of DNAPL present in the fill layer west of the former Witco Coal Tar Tank Farm directly into the Bay sediments represents a potential ongoing source of PAHs to the bay. The suspected DNAPL seepage may occur over a section of shoreline west of the former Witco Tank Farm area. Control of DNAPL seepage from this section of shoreline would be expected to satisfy the RAO. The specific areas of shoreline to be addressed by a remedy may be modified based on site conditions observed during remedy implementation. Two general DNAPL remediation technologies were evaluated for use in the Feasibility Study, These two technologies were containment and collection. The use of either a DNAPL containment or collection technology will be refined during the remedial design.

14. **Comment:** Page 25, third paragraph, second sentence. "The objectives are designed…but for the historic Point Comfort operations." This sentence is unnecessary and potentially misleading. The remedial objectives are designed to remove certain contaminated sediment. As EPA states, achieving the sediment target goals is expected to reduce mercury in the food chain, that consequence is biological not remedial.

Response: The remedial action objective (RAO) provides a general description of what the remedial action will accomplish. Remediation goals are a subset of RAOs and consist of medium-specific or operable unit specific chemical concentrations that are protective of human health and the environment and serve as goals for the remedial action. The RAOs aimed at protecting human health and the environment should specify: 1) The contaminants of concern, 2) exposure routes and receptors, and 3) an acceptable contaminant level or range of levels for such exposure medium (i.e., a preliminary remediation goal). RAOs include both a contaminant level and an exposure route recognizing that protectiveness may be achieved by reducing exposure as well as reducing contaminant levels.

Even though the human health risk is associated with consumption of mercury-contaminated fish and shellfish, the remedial actions are not designed to clean fish. However, EPA can establish remediation goals for mercury-contaminated sediments that should ultimately result in a reduction of mercury levels in fish and shellfish. Therefore, it is appropriate to state that an objective of the remedial action is to reduce mercury levels in fish tissue such that the overall risk throughout Lavaca Bay will approach that which would be present but for the historic Point Comfort operations. EPA recognizes that there are risks associated with "Lavaca Bay Fishermen" that are similar to that for "All Fishermen". For this reason, the objective of reducing mercury in fish tissue is applicable to that area of Lavaca Bay in which the unacceptable risks can be attributed to past releases from Alcoa. The Closed Area of Lavaca Bay is generally that area in which unacceptable risks from consumption of fish and shellfish can be attributed to past releases from Alcoa given the uncertainties associated with the toxicity of methylmercury, fish consumption rates and sediment to biota accumulation factors.

15. **Comment:** Page 26, first incomplete paragraph, last sentence, "Achieving this sediment target goal…" should be modified as follows:

"Achieving this sediment target goal in these areas will result in a substantial reduction of mercury into the food chain." to more accurately portray the benefits of the proposed remedial actions."

Response: The proposed changes will be included in the Record of Decision.

16. **Comment:** Page 28, fourth paragraph, next to last sentence, "Generally the monitoring program will discuss…surface sediments," should be modified. The monitoring program will not anticipate ranges or timeframes for decreases of mercury-tissue levels. It will simply be a monitoring program. Alcoa expects to evaluate monitoring results with EPA and other interested persons.

Response: As discussed above, it is appropriate to state that an objective of the remedial action is to reduce mercury levels in fish tissue such that the overall risk throughout Lavaca Bay will approach that which would be present but for the historic Point Comfort operations. Therefore, it is necessary to monitor fish and shellfish to evaluate the effectiveness of the remedial actions selected for the site.

EPA believes that it is possible to identify an anticipated range for decreases of mercury levels in fish and shellfish. In April 1988, the Texas Department of Health (TDH) closed part of Lavaca Bay to the taking of finfish and crabs due to mercury contamination of the seafood. In March 1999, Alcoa provided the TDH and the Citizens Advisory Panel to Alcoa (CAPA2) with results of finfish and shellfish sampling conducted as part of the RI. The data showed an apparent decrease in mercury levels in fish and crabs from the Cox Bay area. CAPA2 asked TDH to assess these data and consider re-evaluating the extend of the Closed Area. Based on sampling conducted by TDH in April and May of 1999, TDH removed the Cox Bay area for the Closed Area in January 2000. It can therefore be concluded that mercury levels in fish and shellfish have significantly decreased over 12-year timeframe. One of the suspected reasons for the decrease of mercury levels in fish and shellfish in the Cox Bay area is that mercury-contaminated sediments were buried by anthropogenic inputs of cleaner sediment.

Therefore, if the selected remedial action addresses all known sources of mercury into Lavaca Bay, it is anticipated that mercury levels in fish and shellfish will show significant decreases within 10 -15 years after completion of the remedial action.

17. **Comment:** Page 30, second paragraph, next to last sentence, (repeated on pages 31, 32 and 37) should be revised as follows:

"Long-term monitoring of the sediment and fish would be required to monitor the reduction of mercury in fish tissue. Such that the overall risk throughout Lavaca Bay will approach that which would be present but for the historic Point Comfort operations."

Response: The above revision will be presented in the relevant sections of the Record of Decision.

Calhoun County Navigation District Comments

18. **Comment:** On page 43 of the proposed plan, the EPA identifies RAA Bay-4A as the preferred remedial alternative for the Bay system. Bay RAA-4A includes the recovery and treatment of mercury contaminated groundwater from beneath the chlor-alkali plant area ("CAPA") using groundwater recovery wells. The CCND supports the removal of mercury from the groundwater and eliminating the aquifer as an ongoing source of mercury into the Bay. What operating and monitoring requirements will the EPA put in place to ensure the continued long term effectiveness of the treatment and recovery system?

    Response: The details of the long term monitoring plan for the CAPA groundwater extraction system will be developed as part of the detailed site-wide Operations and Maintenance Plan. The details of the plan will be discussed with the public as it is developed.

19. **Comment:** RAA Bay-4A provides for "Long-term monitoring of the sediment and fish" to "confirm the reduction of mercury in fish tissue." The CCND supports this requirement. What long term maintenance and monitoring requirements will be required for Alcoa's Dredge Island Confined Disposal Facility ("CDF").

    Response: In April 1998, EPA signed an Action Memorandum authorizing Alcoa to undertake a non-time critical removal action on Dredge Island. The primary objective of the proposed removal action was to minimize the potential for the release of hazardous constituents located on Alcoa's dredge disposal island in the event that a severe storm (i.e., hurricane) strikes the area, and to minimize erosion of mercury-contaminated soils outside the containment dikes into Lavaca Bay.

    The following discussion on the maintenance and monitoring requirements on Dredge Island was presented in the Action Memorandum.

    > No institutional controls at the state or local level will be necessary since contaminated soils will be excavated and disposed of in the GPAs on Dredge Island. Since the excavated materials will be disposed of on the Island and the south end of the island will be fortified, post-removal site controls will be implemented. The post-removal site controls include four inspections per year, erosion repairs, south shoreline maintenance, and dewatering.

In addition, the final cover for the confined dredge disposal areas on the Island will consist of dredged material, hydraulically placed, taken from an area of Lavaca Bay that has mercury concentrations below human health and ecological risk-based values. After this final placement of dredge material, the Island will consist of a "basin" encircled by dikes whose crest elevation will be at least four feet higher than the top of the dredge materials (which will form the "floor" of the basin). The capacity provided between the dike crest and the dredge material "floor" will be used for management of storm water (rainfall). This water will be captured and released in a manner that will minimize erosion of the final cover to prevent exposure of dredge material (i.e., CERCLA sediments, maintenance dredge material from future dredging, etc.) or currently existing waste material (waste gypsum, CAPA era dredge material, etc.) contained within the dikes. Outlet structures releasing water from within the basins to the Bay will be designed so that there will be very low velocity flow prior to release. These low velocity areas will allow any eroded cover material to settle out within the sedimentation areas prior to the discharge of the rainwater. As part of the ongoing operation and maintenance program, this eroded material will be periodically replaced onto any erosion features of the cover. Non-erosion, energy dissipating outlets will be placed on the outside of the dike face to convey the water from the basin to the Bay.

Public Comments

20. **Comment:** With regard to perimeter ground water flow into the environment there is no mention of explicit plans to monitor long term ground water movement. Will all monitoring wells continue to be evaluated around the entire area? How often?

Response: Ground water investigations at the Site during the RI indicated that a risk driver for ground water remediation currently exists only at the CAPA. Contaminants were detected in ground water samples at other areas of the Site, but did not require remediation because concentrations were below levels that present a risk to human health and/or the environment.

A perimeter approach to ground water investigation was used during the RI and this approach could form the basis for any monitoring program. This approach would be based on the fact that ground water beneath the Site is not used as source of drinking water and, therefore, the pathway of concern with regard to ground water is the off-site migration of contaminated ground water and its potential effect on human health and the environment. However, monitoring at interior waste management areas could be considered in developing a monitoring plan. Monitoring could also be considered at areas where known ground water contamination exists or at areas hydraulically downgradient of areas of known ground water contamination. These areas include locations where fate and transport modeling was used to estimate future ground water contamination conditions. However, it is premature to have a monitoring plan that can be approved at the time of the ROD since the remedial actions have not been implemented. The details of the monitoring plan will be developed as part of the overall Operations and Maintenance (O&M) Plan for the site.

21. **Comment:**

a) Insufficient details are available in the document to approve of the monitoring plan at this time. If the language in the ROD is left as written; "At a minimum, the effectiveness of the remedy will be evaluated once every five years," then one can certainly expect a minimum of monitoring. Given the relatively brief estimated 10-15 year recovery period, there should be a shorter, mandated monitoring schedule to check the remediation efforts or to discover the existence of any previously undetected sources. Five year intervals are simply too long and could be stretched even longer due to any number of sampling problems that might arise and the time required to prepare the report. While finfish are longer lived, shellfish are not and should show earlier signs of reduced mercury levels. Therefore, a monitoring plan should be designed to include sampling and reporting on 2-3 year intervals.

Response: It is premature to have a monitoring plan that can be approved at the time of the ROD since the remedial actions have not been implemented. The details of the monitoring plan will be developed as part of the overall Operations and Maintenance (O&M) Plan for the site. As the O&M Plan is developed it will be shared with the public. The five year review period mentioned in the Proposed Plan is the maximum time period under Superfund that remedy effectiveness can be evaluated when wastes are left in place. EPA anticipates that the effectiveness of the remedy will be evaluated earlier than five years. However, appreciable changes of mercury levels in upper trophic level finfish are not expected to occur until at least two or three years after completion of all remedial actions. Alcoa has been conducting fish and shellfish monitoring at least annually since 1996 and EPA anticipates that the same sampling frequency will occur during the first five years.

Comment continued:

b) Has a "safe" level of mercury in the upper trophic biota been established and agreed upon by all parties? Will this "end point" change in the next 10-15 years for protection of either humans or ecosystems? Which of the upper trophic biota will be monitored? This "safe" level should be clearly delineated in the ROD and monitoring plan or there will be nothing to evaluate.

Response: The "safe" level of mercury in the upper trophic biota has not been established. Based on uncertainties around the RfD, fish consumption rate, and sediment to biota accumulation factor, it is unlikely that a single "safe" level will be developed. The more probable outcome will be a "range" of protective mercury levels in the upper trophic biota.

When EPA conducts a five year review, the Agency evaluate the overall protectiveness of the remedy as well as changes in applicable or relevant and appropriate requirements (ARARs). At the time of the five year review, the agency will evaluate the overall protectiveness of the remedy.

During the past five years, Alcoa has regularly sampled red drum, black drum and blue crab. Although the details of the species to be sampled will be included in the monitoring plan, it is anticipated that both red drum and blue crab would continue to be sampled.

Comment continued:

c) There needs to be a more specific plan for evaluating the remedy before waiting until the end of the estimated 10-15 year recovery time frame. With sampling occurring on 2-3 year intervals, there should be sufficient data within 6 years to evaluate and re-design key remediation plans, based on specific levels of contaminants in fish, shellfish, and sediments.

Response: As previously discussed, it is anticipated that annual finfish and/or shellfish sampling will occur during the first five years after completion of the remedial actions. Discernible changes of mercury levels in upper trophic finfish is not expected to occur until two to five years following completion of the remedial actions.

Appendix B
Concurrence Letter

Honker

TEXAS NATURAL RESOURCE CONSERVATION COMMISSION

Protecting Texas by Reducing and Preventing Pollution

RECEIVED
2002 JAN 25 PM 4: 7
AR/OK/TX BRANCH
SUPERFUND DIV.
DIRECTOR'S OFC.

Mr. Myron O. Knudson, P.E.
Director
Superfund Division
U.S. Environmental Protection Agency, Region 6
1445 Ross Avenue
Dallas, Texas 75202

Re: Record of Decision (ROD) for the Alcoa (Point Comfort)/Lavaca Bay Superfund Site, Point Comfort, Texas.

Dear Mr. Knudson:

The Texas Natural Resource Conservation Commission (TNRCC) has completed its review of the above referenced document. We concur that the remedy for the Alcoa/Lavaca Bay Superfund Site, as described in the December 2001 ROD, is the most appropriate for this site. United States Environmental Protection Agency staff should be commended for the amount of work and coordination necessary to move the ROD for this complex site to completion.

Sincerely,

Jeffrey A. Saitas, P.E.
Executive Director

P.O. Box 13087 • Austin, Texas 78711-3087 • 512/239-1000 • Internet address: www.tnrcc.state.tx.us

Appendix C
Administrative Record Index