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ALCOA (Point Comfort)/ Lavaca Bay

Lavaca Bay, Texas
CERCLIS #TXD008123168

Site Exposure Potential

The ALCOA/Lavaca Bay Superfund site is located in Calhoun County, Texas. It is near the City of Point Comfort on the eastern shore of Lavaca Bay, an embayment of the Matagorda Bay estuarine system (Figure 1). In addition to the ALCOA Point Comfort Operations Plant, the Superfund site includes Dredge Spoil Island and nearby portions of Lavaca Bay, Cox Bay, Cox Creek, Cox Cove, Cox Lake, and western Matagorda Bay. (Cox Bay, Cox Creek, Cox Cove, and Cox Lake are also known as Huisache Bay, Huisache Creek, Huisache Cove, and Huisache Lake, respectively.) Next to the ALCOA facility are industrial and agricultural areas to the north and northeast, Cox Lake to the east, the Port Lavaca-Point Comfort turning basin and industrial areas to the south, and Lavaca Bay to the west and southwest (Figure 2). The ALCOA facility consists of process areas, surface impoundments, and landfills covering approximately 1,400 hectares. The facility now processes and refines bauxite. Historical operations included a chlor-alkali processing plant (operated from 1966 to 1979), an oil and gas plant, an aluminum smelter (operated from 1949 to 1980), a coal tar processing facility (operated by WITCO from 1964 to 1985), and a cryolite plant (operated from 1962 to 1980; ALCOA 1994). The dredge spoil island is approximately 400 m west of the processing plant. This island

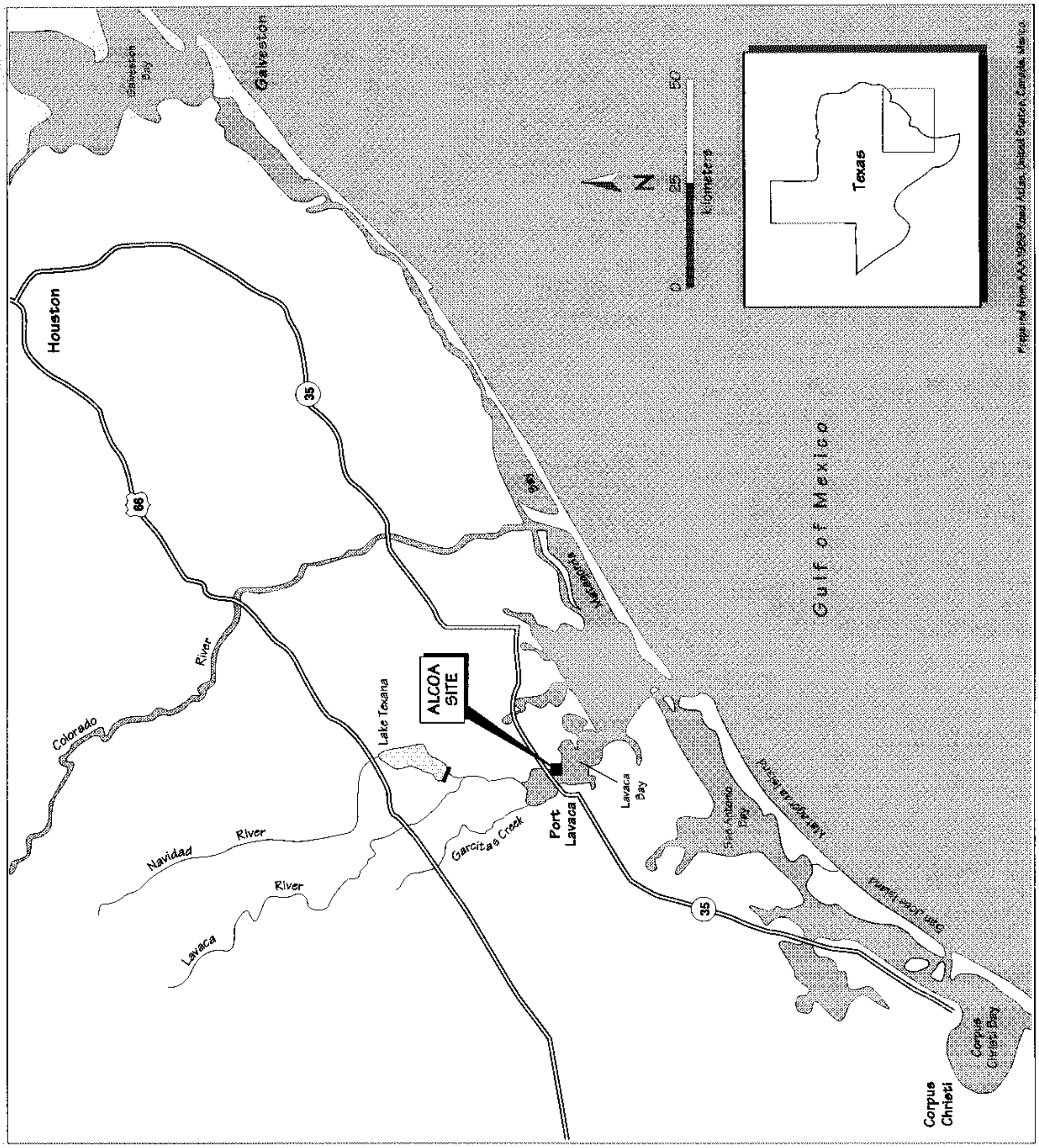
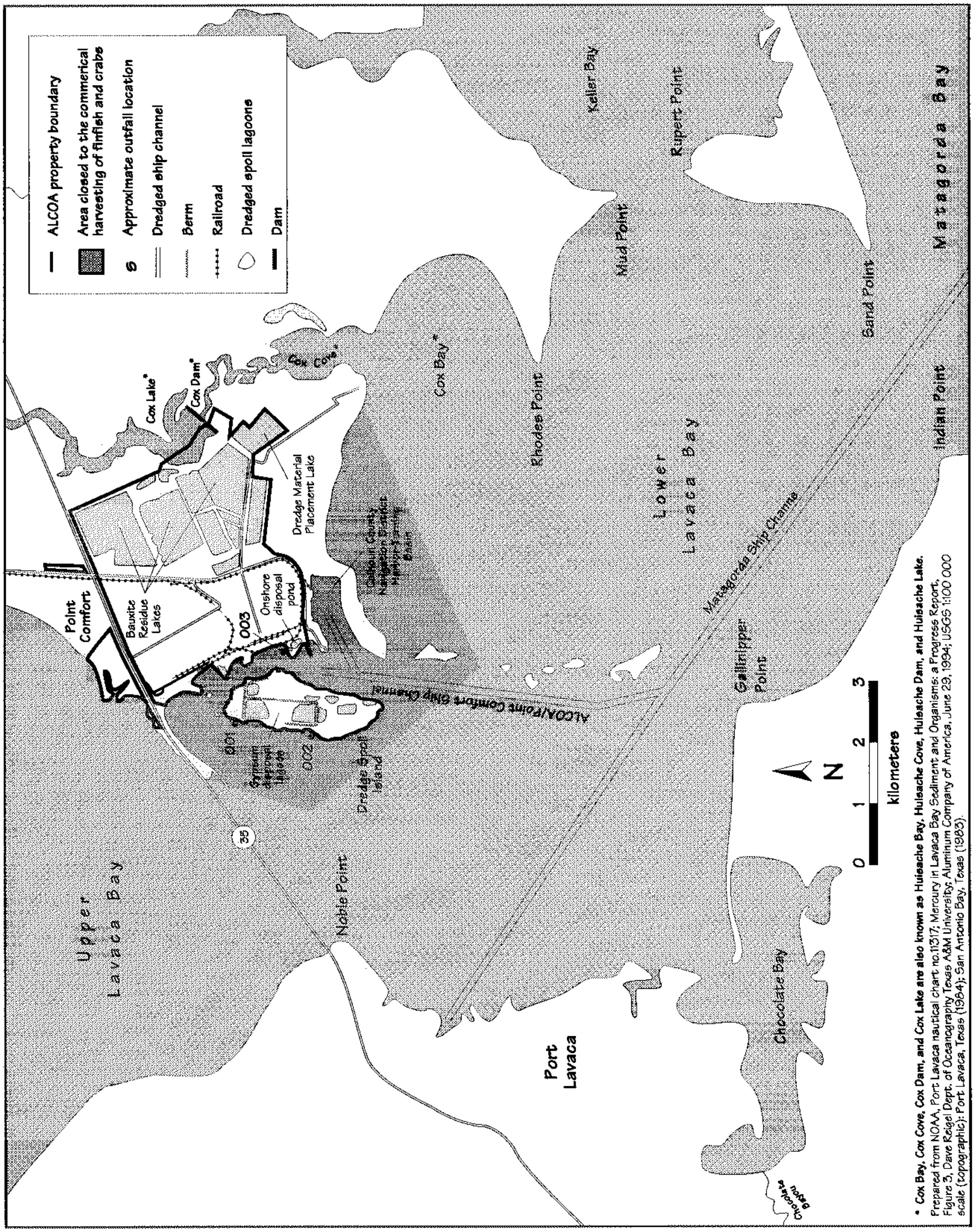


Figure 1. Location of the Aluminum Company of America (ALCOA) on the eastern shore of Lavaca Bay, Texas.



* Cox Bay, Cox Cove, Cox Dam, and Cox Lake are also known as Huisache Bay, Huisache Cove, Huisache Dam, and Huisache Lake.

Prepared from NOAA, Port Lavaca nautical chart no.11317; Mercury in Lavaca Bay Sediment and Organisms: a Progress Report, Figure 3, Dave Reigel Dept. of Oceanography Texas A&M University; Aluminum Company of America, June 29, 1994; USGS 1:100 000 scale (topographic): Port Lavaca, Texas (1984); San Antonio Bay, Texas (1983).

Figure 2. Detail of Aluminum Company of America site.

was created of spoil from periodic dredging of the ALCOA ship channel and other navigation channels in Lavaca Bay. The major features on the island are a 37-hectare gypsum disposal lagoon, and an approximately 20-hectare dredge spoil disposal area with five lagoons (Figure 2).

At the chlor-alkali process area (CAPA), brine was treated by electrolysis to manufacture chlorine gas and sodium hydroxide from 1966 to 1979 (USEPA 1993a). Mercury was used as a cathode for electrolysis, and was discharged as part of the waste stream. Over the life of the CAPA plant, mercury-containing wastes were discharged to the gypsum disposal lagoon on the offshore island, into an onshore disposal pond, and into several Bauxite Residue Lakes. From 1966 to 1970, the wastewater was primarily discharged into the gypsum disposal lagoon, and through lagoon Outfalls 001 and 002 into Lavaca Bay (Figure 2). According to waste stream calculations, an estimated 30 kg per day of mercury were discharged to this lagoon, and an estimated 44,000 kg of mercury were discharged to Lavaca Bay between 1966 and 1970 through Outfalls 001 and 002 (USEPA 1993a). Also between 1966 and 1970, mercury-contaminated wastewaters were intermittently discharged to an onshore disposal pond, and then into Lavaca Bay at Outfall 003 (Roy F. Weston, Inc. 1993). When the plant processes were modified in 1970 the mercury in the waste stream was reduced to approximately 6 kg per day. From 1970 to 1979, mercury wastes were discharged to Bauxite Residue Lakes 1, 2, and 3. A 1970 explosion at the plant released an unknown amount of mercury into Lavaca Bay.

Carbon tetrachloride was also used at the CAPA, and PCB-containing materials were shipped to ALCOA's Point Comfort plant (ALCOA 1994). Other potential contaminant sources include liquid and solid wastes in surface impoundments and disposal of solid wastes in landfills (ALCOA 1994).

There are three relatively shallow, water-bearing, transmissive zones, generally separated by clay layers under the CAPA area and the operations plant. Shallow groundwater is approximately 5 m below the surface. Groundwater from the middle transmissive zone discharges into the ALCOA ship channel near the CAPA. In general, groundwater flows from a mound in the interior of the peninsula toward discharge areas along adjacent surface water bodies and the bays (Radian Corp. 1994).

The potential contaminant transport pathways from the ALCOA site to NOAA trust resources and their habitats are groundwater migration, surface runoff, and air transport of contaminated dust. Groundwater is probably the primary transport pathway. During the CAPA operational period, the primary pathway of contaminant transport to trust habitats was the direct discharge of mercury-containing wastewater through Outfalls 001, 002, and 003.

Sediments containing mercury attributed to ALCOA wastewater discharges have been dredged periodically and placed into dredge spoil areas located on the offshore dredge spoil island and in the dredge material placement lake in the southeast corner of the facility. Because of their proximity to the bay, the dredge spoil areas on the island have a high potential to release mercury-containing sediments into Lavaca Bay (USEPA 1993a). Several instances have occurred in which these dredge spoil lagoons have breached, releasing mercury-contaminated sediment and water to Lavaca Bay (USEPA 1993a).

Mercury that has been released may continue to spread in Lavaca Bay through channel dredging; shrimp trawling and oyster dredging; dispersion via wind, tides, and river currents; and transfer through the aquatic food chain. In addition, Central Power and Light's E.S. Joslin power station pumps approximately 870 million liters per day of once-through cooling water from the turning basin at Point Comfort to Cox Bay, creating a circulation from Cox Bay back to the turning basin that may influence mercury distribution in this area (Ward 1994).

NOAA Trust Habitats and Species

Habitats of concern to NOAA are the surface water, associated bottom substrates, and estuarine emergent wetlands associated with Matagorda, Lavaca, and Cox bays; Cox Cove; and Cox Creek. Wetlands and creeks near the site provide significant spawning, nursery, and adult forage habitat for diverse, abundant populations of NOAA trust species (Table 1; Ward et al. 1980; Nelson et al. 1992; Dailey personal communication 1994; Weixelman personal communication 1994). The Matagorda Bay system is a principal embayment of the Texas and Gulf of Mexico coasts. The bay is a broad (1,200 km^2), shallow (mean depths of 3 m) lagoon estuary nearly isolated from the Gulf of Mexico by barrier island-peninsulas typical of Gulf Coast embayments (Ward et al. 1980; U.S. Department of Commerce 1992).

Matagorda Bay is comprised of several important subsystems that are hydrographically or morphologically well-identified. Lavaca Bay, in the northwestern arm of the system, receives discharges from the Lavaca and Navidad rivers and several other creeks associated with specific local drainage areas (e.g., Garcitas Creek and Chocolate Bayou). The mouth of Lavaca Bay is partially confined by the Indian Point and Sand Point prominences, and the Sand Point Reef complex. Tertiary embayments of Lavaca Bay include Chocolate, Keller, and Cox bays (Ward et al. 1980; U.S. Department of Commerce 1992).

Salinities in Lavaca Bay near the site range from 0 to 25 ppt and fluctuate throughout the year depending on rainfall, saltwater intrusion, and freshwater inflow via the Lavaca and Navidad rivers (Dailey personal communication 1994). The shallowness of the Matagorda Bay system, combined with frequent strong winds, induces a nearly homogeneous vertical salinity regime.

Table 1. Primary NOAA trust resources in Lavaca and Matagorda bays near the ALCOA site, Point Comfort, Texas.

Species		Habitat Use			Fishery	
Common Name	Scientific Name	Spawning Ground	Nursery Ground	Adult Forage	Comm. Fishery	Recr. Fishery
ESTUARINE/MARINE SPECIES						
Bay anchovy	*Anchoa mitchilli*	♦	♦	♦		
Sheepshead	*Archosargus probatocephalus*		♦	♦		♦
Hardhead catfish	*Arius felis*	♦	♦	♦		
Silver perch	*Bairdiella chrysoura*	♦	♦	♦		
Gafftopsail catfish	*Bagre marinus*	♦	♦	♦		♦
Gulf menhaden	*Brevoortia patronus*		♦	♦		
Crevalle jack	*Caranx hippos*		♦	♦		♦
Bull shark	*Carcharhinus leucas*		♦	♦		♦
Sand seatrout	*Cynoscion arenarius*		♦	♦		♦
Spotted seatrout	*Cynoscion nebulosus*	♦	♦	♦		♦
Sheepshead minnow	*Cyprinodon variegatus*	♦	♦	♦		
Gizzard shad	*Dorosoma cepedianum*	♦	♦	♦		
Killifish	*Fundulus* spp.	♦	♦	♦		
Goby	*Gobiosoma* spp.	♦	♦	♦		
Pinfish	*Lagodon rhomboides*		♦	♦		♦
Spot	*Leiostomus xanthurus*		♦	♦		
Tarpon	*Megalops atlanticus*		♦			
Silverside	*Menidia* spp.	♦	♦	♦		
Atlantic croaker	*Micropogonias undulatus*		♦	♦		♦
Striped mullet	*Mugil cephalus*		♦	♦		
Gulf flounder	*Paralichthys albigutta*		♦	♦	♦	♦
Southern flounder	*Paralichthys lethostigma*		♦	♦	♦	♦
Black drum	*Pogonias cromis*		♦	♦	♦	♦
Red drum	*Sciaenops ocellatus*		♦	♦		♦
INVERTEBRATE SPECIES						
Blue crab	*Callinectes sapidus*	♦	♦	♦	♦	♦
American oyster	*Crassostrea virginica*	♦	♦	♦	♦	♦
Bay squid	*Lolliguncula brevis*	♦	♦	♦		
Gulf stone crab	*Menippe adina*	♦	♦	♦	♦	
Hard clam	*Mercenaria mercenaria*	♦	♦	♦		
Grass shrimp	*Palaemonetes pugio*	♦	♦	♦		
Brown shrimp	*Penaeus aztecus*		♦	♦	♦	♦
Pink shrimp	*Penaeus duorarum*		♦	♦	♦	
White shrimp	*Penaeus setiferus*		♦	♦	♦	♦
Common rangia	*Rangia cuneata*	♦	♦	♦		

The range of tidal amplitude in the Matagorda Bay complex is generally less than 0.5 m. Estuary substrate is mainly mud and sand with isolated areas of aquatic vegetation. Submerged aquatic vegetation in the Matagorda Bay system is mostly shoal grass (*Halodule beaudettei*) and widgeon grass (*Ruppia maritima*), while Lavaca Bay substrates have very little vegetation (Ward et al. 1980; Dailey personal communication 1994).

Matagorda Bay is transected by a network of dredged navigation channels. The 11.5-m deep Matagorda Bay Ship Channel, which extends about 27 km northwest from the Gulf of Mexico to lower Lavaca Bay, is the largest channel in Matagorda Bay. The 4-m deep Port Lavaca Ship Channel extends northwest beyond the northern limit of the Matagorda Bay Ship Channel, allowing navigational maritime traffic to access Port Lavaca (U.S. Department of Commerce 1992). Additional prominent channels in the area include Red Bluff Channel, King Fisher Marine Channel, and the Harbor of Refuge Channel.

Those species in greatest numbers in the Matagorda Bay complex include bay anchovy, Gulf menhaden, brown shrimp, white shrimp, grass shrimp, and blue crab (Dailey personal communication 1994). Bay anchovy, a pelagic estuarine species, is present year-round and reaches peak spawning densities in the Matagorda system from October through March. Gulf menhaden, a schooling pelagic clupeid, use surface water near the site as a year-round rearing area, while adults are abundant from April through October (Nelson et al. 1992). Surface water near the site also provides important rearing habitat to white, brown, pink, and grass shrimp. White shrimp are abundant in the estuary throughout all seasons, with peak rearing densities from March through late November. Adult white shrimp reach peak densities in the spring and fall. Adult pink shrimp are common from February through May. Brown shrimp return to the Matagorda Bay complex from early April through late July, while juveniles are abundant throughout the year except during January and February. Grass shrimp reside in the estuary year-round (Nelson et al. 1992). There are adult blue crab in the estuary year-round, with greatest densities from February through late August. Juveniles are also common throughout the year, with highest concentrations from February through late September. Adults commonly mate from March through November (Berringer 1994).

Spotted seatrout, an important game fish in the estuary, use surface water near the site to spawn, rear, and forage throughout the year. This species normally spawns from April through September. Southern flounder migrate out of the estuary to spawn during the winter and return in the spring. Juvenile southern flounder are present year-round. Adult red drum use the passes between many of the estuarine barrier islands to spawn from August through mid-November. Juvenile red drum typically remain in the estuary year-round for the first four years of life (Dailey personal communication 1994). Juvenile and adult black drum are present in the estuary year-round. Adults spawn in the estuary from February though late March. Atlantic croaker, one of the several sciaenid fishes of the Gulf that support a significant commercial and recreational fishery, also use surface water near the site as a year-round rearing area. Adults are seasonally abundant from April through November (Ward et al. 1980; Nelson et al. 1992).

Bay anchovy, silverside, killifish, striped mullet, sheepshead minnow, and grass shrimp are important components of the forage base in the estuary.

These species are most commonly preyed upon by red drum, spotted seatrout, southern flounder, sheepshead, black drum, and hardhead catfish (Dailey personal communication 1994).

The fisheries within Lavaca Bay and the adjoining embayments that compose the Matagorda Bay complex are a significant resource to the commercial and recreational fishing industry in Texas (Ward et al. 1980; Dailey personal communication 1994; Weixelman personal communication 1994). In 1975, 1,459,000 kg of seafood was harvested from the Matagorda Bay system (Ward et al. 1980). Lavaca Bay also supports several major fisheries that harvest numerous finfish species, blue crab, and shrimp (Ward et al. 1980; Dailey personal communication 1994; Weixelman personal communication 1994). Lavaca Bay north of Highway 35 is closed to shrimping because of its significance as a juvenile shrimp nursery area. Southern and central Lavaca Bay support a moderate shrimp fishery (Dailey personal communication 1994). Though bay surface waters are closed to net finfishing, the Lavaca River supports a sporadic freshwater commercial fishery using trot lines (Ward et al. 1980; Dailey personal communication 1994).

Southern flounder, Gulf flounder, black drum, oyster, blue crab, white shrimp, brown shrimp, pink shrimp, and Gulf stone crab are commercially harvested near the site. The black drum fishery uses only trot lines, while southern flounder are caught with gigs (spears). The state strictly manages the shrimp fishery, and enforces specified seasons and catch limits. Recreational fishing in the Matagorda Bay complex is popular year-round, with the greatest fishing pressure on spotted seatrout, southern flounder, and red drum. Atlantic croaker, sheepshead, sand seatrout, black drum, blue crab, and gafftopsail catfish attract a moderate sport effort. Additional species caught recreationally include crevalle jack, bull shark, pinfish, brown shrimp, white shrimp, and oyster (Dailey personal communication 1994).

In 1989, the Texas Department of Health closed portions of Lavaca Bay south and west of the ALCOA facility to the taking of fish and crab because mercury levels in edible tissues exceeded the established guideline of 1.0 ppm (Figure 2). These restrictions are difficult to enforce: people probably still periodically eat seafood taken from within these areas (Berringer personal communication 1994).

Many areas of the Matagorda Bay complex are also subject to periodic shellfish closures after it rains, due to fecal coliform contamination. Shellfish harvesting is restricted around the ALCOA site during and after periods of high rainfall.

Surface water of Lavaca and Matagorda bays provides habitat for four species of marine turtle listed as threatened or endangered under the Federal Endangered Species Act. The loggerhead turtle (*Caretta caretta*) and the green turtle (*Chelonia mydas*), federally listed as threatened; and the Kemp's ridley turtle (*Lepidochelys kempii*) and the leatherback turtle (*Dermochelys coriacea*), listed as endangered, are seen in the estuary year-round. Atlantic bottlenose dolphin (*Tursiops truncatus*) visit the Matagorda Bay complex year-round and forage on estuarine finfish (Dailey personal communication 1994).

Site-Related Contamination

Mercury is the contaminant of main concern at the ALCOA site. Data collected for the expanded site inspection (Roy F. Weston, Inc. 1993), the Lavaca Bay Sediment Sampling Data Report (Woodward-Clyde 1992), and other site investigations (Radian Corp. 1994), indicate that groundwater, surface water, sediments, and soils are contaminated with mercury and, to a lesser extent, with PCBs, PAHs, and VOCs such as carbon tetrachloride.

Groundwater sampled near the CAPA in 1993 contained dissolved mercury concentrations (maximum 361 µg/l) that exceeded the marine acute AWQC (2.1 µg/kg) by more than two orders of magnitude (McCulley et al. 1994). Surface water samples from the Point Comfort area had mercury concentrations exceeding acute and chronic marine AWQC concentrations. Mercury concentrations in Lavaca Bay sediment exceeded NOAA's ERM screening guideline by up to 35 times. Concentrations exceeding ERL guidelines have been detected approximately 5 km from the dredge spoils island, in both upper and lower Lavaca Bay. Lavaca Bay biota also have been shown to have elevated mercury concentrations (Table 2).

PAHs have been detected in sediment collected near ALCOA, at a maximum total PAH concentration of 31 mg/kg (GERG 1990), which exceeds the ERL guideline of 4.0 mg/kg (Long and MacDonald 1992). Total PAHs in oyster tissue (maximum 1.4 µg/kg) and fish muscle tissue (maximum 37 µg/kg) from samples collected in Lavaca Bay near the ALCOA facility indicate probable uptake of PAHs from the sediments (GERG 1990).

Summary

Lavaca Bay supports numerous NOAA trust resources, and is especially important as a nursery ground and adult forage area. Mercury is the primary contaminant of concern associated with ALCOA's Point Comfort chlor-alkali plant. PCBs and PAHs have also been used at the site and detected in environmental and biological media. The most recent sampling indicates that mercury contamination is widespread in Lavaca Bay sediment and biota, and is concentrated near the ALCOA Point Comfort operation and in nearby Cox Bay. Groundwater transport is a source of mercury loading to Lavaca Bay, and contaminated sediment is a continuing source of mercury contamination to biota in the Bay.

Table 2. Maximum mercury concentrations in marine surface water, sediment, and biota from selected areas around the ALCOA Point Comfort operation.

Location	Surface water (µg/l)	Sediment (mg/kg) dry weight	Biota (mg/kg) wet weight Finfish	Oysters	Crab
RECENT DATA					
ALCOA/Point Comfort	0.85[a]	1.20[b]	1.5[c]	1.4[c]	NA
ALCOA Channel	NA	17[d]	NA	NA	NA
Offshore of Outfall 001	NA	25[d]	NA	NA	NA
Offshore of Outfall 002	NA	0.55[d]	NA	NA	NA
Onshore near Outfall 003	NA	23[d]	NA	NA	NA
Lavaca Bay North of Hwy 35	NA	6.6[d]	1.6[e]	0.08[e]	2.0[e]
Lavaca Bay South of Hwy 35	NA	7.3[d]	NA	NA	4.5[f]
Lavaca Bay North of Hwy 35	NA	0.41[b]	NA	NA	NA
Cox Bay	0.52[a]	0.58[b]	NA	NA	NA
DATA PRIOR TO 1980[g]					
Point Comfort	3.0	7.1	5.6	0.24	1.9
Cox Bay	0.3	3.4	2.41	NA	NA
SCREENING GUIDELINES[h]			NA	NA	NA
Marine Acute AWQC	2.1				
Marine Chronic AWQC	0.025				
ERL		0.15			
ERM		0.71			

NA: Not available or not analyzed
a: Bowman 1988.
b: Roy F. Weston 1993.
c: GERG 1990.
d: Woodward-Clyde 1992.
e: Evans and Engel 1994.
f: USEPA 1993a.
g: Bowman 1988. Results from sampling during the 1970s.
h: Marine ambient water quality criteria for the protection of aquatic organisms (U.S. EPA 1993b); Effects range-low (ERL) and Effects range-median (ERM; Long and MacDonald 1992).

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