HEALTH CONSULTATION

COX BAY

Calhoun County, Texas

June 8, 2000

Prepared by

Texas Department of Health
1100 West 49th Street
Austin, TX 78751

BACKGROUND AND STATEMENT OF ISSUES

The Citizen's Advisory Panel to the ALCOA (Aluminum Company of America) Point Comfort Operation in Calhoun County, Texas requested that the Texas Department of Health (TDH) evaluate the potential health risks associated with consumption of seafood taken from the closed area of Cox Bay. Cox Bay is a small portion of Lavaca Bay, both of which have been partially designated federal Superfund sites due to deposition of mercury by the ALCOA plant. Mercury contamination in Lavaca Bay is attributed to wastewater discharge from a chloralkali plant that ALCOA operated from 1965 to 1979. ALCOA estimated that prior to 1970, approximately 67 pounds of mercury were discharged into the bay each day.

Since the early 1970s, TDH has consistently found elevated levels of mercury in fish and crabs from Cox Bay. In April 1988, the Texas Department of Health closed part of the bay to the taking of finfish and crabs due to mercury contamination of the seafood. The closure area extends north and east from a line drawn between Marker 74 and the tip of Cox Point (Map, Appendix 1).

In March of 1999, ALCOA provided TDH and the Citizens' Advisory Panel to ALCOA (CAPA) with results of their "Finfish, Shellfish, and Prey Item Monitoring Study" for 1996-1998 [1]. ALCOA had collected 346 fish and crab samples from an area of Cox Bay included in the closure order and analyzed them for mercury content (Table 1). The mercury levels found in both fish and crabs was lower than those previously found in fish and crabs from this area. TDH was asked to use these data to reconsider and reevaluate the need for the closure in this area. TDH reviewed ALCOA's data and concluded that additional sampling to confirm the results was warranted prior to making any changes to prior regulatory decisions.

Table 1. Mercury in fish collected from the closed area of Cox Bay by ALCOA (1996-98)

Species	Number of samples	Mercury concentration (mg/kg)		Fish length (inches)	
		Average	Range	Average	Range
Red Drum	71	0.54	0.22-1.77	22	20-27
Black Drum	86	0.38	0.05-1.56	17	13-26
Spotted Seatrout	10	0.37	0.23-0.55	19	17-20
Southern Flounder	2	0.162	0.12-0.19	18	17-23
All Finfish	**169**	**0.363**	**0.12-1.77**	**19**	**13-27**
Blue Crab	177	0.22	0.039-1.08	na[1]	na
All Seafood	**346**	**0.292**	**0.039-1.77**	**na**	**na**

[1]na -not applicable

In April and May of 1999, the TDH Seafood Safety Division collected samples of finfish and crabs from Cox Bay. Seventeen samples were collected from two sites within the closed area (a point south of the Central Power and Light Company discharge and a point near the ALCOA turning basin) and 13 samples were taken from two sites outside the closed area (at Rhodes Point and at the mouth of Huisache Cove). The highest levels of mercury were found in black drum (Table 2).

Table 2. Average mercury concentrations (mg/kg) in fish collected from Cox Bay by the Texas Department of Health, 1999						
	Inside			Outside		
Species	Sample Size	Concentration (95% UCL)	Range	Sample Size	Concentration (95% UCL)	Range
Black drum	6	0.382 (0.525)	0.410-0.773	3	0.268 (0.313)	0.200-0.331
Spotted Seatrout	1	0.250 (na)	na[1]	1	0.140 (na)	na
Southern Flounder	3	0.179 (0.201)	0.141-0.208	2	0.194 (na)	0.151-0.237
Sheepshead	1	0.061 (na)	na	2	0.056 (na)	0.054-0.057
Gafftopsail Catfish	1	0.295 (na)	na	na	na[2]	na
All Finfish	**12**	**0.286 (0.379)**	**0.141-0.773**	**8**	**0.180 (0.234)**	**0.054-0.331**
Blue Crabs[3]	5	0.227 (0.245)	0.174-0.253	5	0.138 (0.163)	0.061 - 0.176
All Seafood	**7**	**0.269 (0.336)**	**0.061-0.773**	**13**	**0.164 (0.242)**	**0.054 - 0.331**

[1] na - not applicable
[2] No gafftopsail catfish caught outside closure area of bay
[3] Average of five composite samples of five crabs, each (25 total)

DISCUSSION

Methylmercury (MeHg)Toxicity

Mercury is a naturally-occurring element found throughout the environment. The mercury in air, water, and soil is primarily inorganic in nature. Under favorable conditions, microorganisms in the water convert inorganic mercury in the water to organic mercury, predominantly methylmercury. Fish may then absorb this contaminant from the water or by ingestion of contaminated prey. Many species of fish concentrate methylmercury and store it in edible tissues. Older and larger predatory fish are likely to contain higher concentrations of mercury than do younger, smaller fish or non-predatory species.

The neurologic effects resulting from ingestion of methylmercury are well documented. Clinical signs of toxicity may include ataxia, tremor, hearing loss, and difficulty with speech. Chronic exposure to methylmercury may cause permanent central nervous system damage.

The developing nervous system is the critical target organ for MeHg toxicity. Thus, young children and fetuses are especially vulnerable. MeHg may be carried to an infant through breast milk or to the fetus through the placenta. Neurological effects in children range from delayed mental and physical development to a severe syndrome similar to cerebral palsy, depending on extent of exposure [2]. The effects of MeHg on the very young have been reported in several studies for both nonfish-eating and fish-eating populations. Studies relevant to this health consultation are briefly summarized below.

Non-Fish Eating Population

Marsh *et al.* [3] described developmental neurological abnormalities in eighty-one Iraqi infants whose mothers ate bread made from methylmercury-contaminated grain. These investigators found a positive correlation between infant exposure dose, as defined by maternal hair mercury levels at parturition, and delayed walking and talking. The Environmental Protection Agency (EPA) used the Marsh data to develop an oral reference dose for developmental effects of exposure to methylmercury. Using the lower 95% confidence limit on the 10% incidence of developmental abnormalities, the benchmark dose[1] was calculated as 11 mg mercury per kg hair, corresponding to 44 µg mercury per liter of blood (µg/L). Assuming steady-state conditions and first-order kinetics for mercury, EPA used a simple pharmacokinetic model to convert the benchmark dose to an estimated total daily dietary intake of 65 µg of methylmercury. From the total daily dietary intake, the EPA calculated a daily intake of 1.1 µg/kg/day as the no observable adverse effect level (NOAEL). The EPA applied an uncertainty factor of 10 to the NOAEL to derive an oral reference dose of 0.0001 mg/kg/day.

The World Health Organization (WHO) had previously analyzed the same data and concluded that maternal hair mercury concentrations of between 10 to 20 mg/kg may be associated with a 5 percent increase in the risk of developmental abnormalities. The WHO estimated a threshold for these effects of approximately 10 mg mercury per kg hair. For a 60-kg pregnant woman, a hair concentration of 10 mg/kg corresponds to an estimated intake of methylmercury of 0.9 µg/kg/day [4], a value that approximates the EPA's NOAEL.

Fish Eating Populations

The research community has expressed concern about using the Iraqi data, which are based on the consumption of contaminated bread, to set acceptable levels of exposure to methylmercury from consumption of contaminated seafood. Recent reports on fish eating populations are now available, the most cited of which are the Seychelles Child Development Study (SCDS) [5,6,7], the Faeroe Islands study [8,9], and the New Zealand study [10,11].

In the SCDS, investigators examined children at 6½, 19, 29 and 66 months of age for developmental and neurobehavioral deficits. In the 66-month cohort, total mercury concentrations in maternal hair segments corresponding to the period of pregnancy ranged from

[1] Benchmark dose (BMD): a dose that corresponds to a specific incidence of the benchmark response (BMR), usually 10% above the background incidence of the BMR. The lower 95% confidence limit on the BMD roughly corresponds to a NOAEL for quantal developmental toxicity data.

0.5 to 26.7 mg/kg and averaged 6.8 mg/kg (n=711). The average maternal total hair mercury level at parturition in the high-exposure subgroup was 15.3 mg/kg. At 6½, 19, 29, and 66 months of age, the researchers were not able to detect adverse effects that they could attribute to mercury exposure. Concerns have been raised that the tests used in this study were not sensitive enough to detect subtle, domain specific effects.

.

Grandjean *et al.* [8,9] studied people from the Faeroe Islands, another population having the potential for MeHg exposures from a diet high in fish and whale products. Results from a questionnaire given to adults on the island indicated a daily consumption of 72 grams of fish, 12 grams of whale muscle, and 7 grams of blubber. The most common fish consumed contained an average mercury concentration of 0.07 ppm, while whale muscle contained an average mercury concentration of over 3 ppm, about half of which was MeHg. The tests used by these authors were perhaps more sensitive than those used in the Seychelles studies. These authors concluded that maternal hair mercury levels of less than 10 mg/kg were associated with subtle effects in the domains of language, attention, memory, and visuospatial and motor functioning. However, these effects were not adjusted for PCB exposure, another potential neurotoxin. Based on available information it is impossible to determine whether any of the subtle effects observed at maternal hair levels below 10 ppm are the result of MeHg exposure, PCB exposure, a combination of exposures, or other confounding factors. The Faeroe Islands study does not provide the quantitative dose-response information needed to derive an RfD.

Data from a study of a New Zealand fish-eating population provided quantitative dose-response information. The original reports of analyses of these data using discrete categories of maternal hair mercury concentrations showed a correlation between prenatal exposure to high mercury levels and poorer performance on psychological and developmental tests [10,11]. Multiple regression analyses using hair mercury concentration as a continuous variable revealed no such association [13], but the neurodevelopmental scores of a single child whose mother's hair mercury level during pregnancy was almost four times that of the other mothers (86 mg/kg) strongly influenced the results. However, when this child's results were excluded from the data set, the BMD ranged from 7.4 to 10 mg/kg, doses that are again consistent with the 11-mg/kg BMD established by the EPA using the data from the Iraqi study.

After reviewing studies of seafood-consuming populations exposed to methylmercury, the Agency for Toxic Substances and Disease Registry (ATSDR) used data from the Seychelles study to derive a chronic oral minimal risk level (MRL; Table 3) of 0.0003 mg/kg/day. The MRL is an estimate of a chronic daily human exposure that is likely to be without appreciable risk of adverse noncancer health effects. ATSDR used these data to construct the MRL because: 1) all fish sampled from the waters around the islands contain some mercury and the Seychellois regularly consume large quantities of a variety of ocean fish (typically, Seychelles Islanders eat twelve or more portions of fish each week); 2) the median total mercury concentration in 350 fish sampled from 25 species consumed by the Seychellois was <1 ppm (range 0.004-0.75 ppm), comparable to concentrations in fish commercially available in the U.S. (mercury levels in the Seychellois are 10-20 times higher than in the U.S. population, not because the Seychellois consume more highly-contaminated fish, but because they eat much greater quantities of fish); 3) few confounding factors are present in this population: the Seychelles are far removed from industrial facilities; the population is healthy; and Seychellois women use little alcohol and tobacco; 4) the initial sample size was large (778 mother-infant pairs) and more than 90 percent of the participants remained active in the study five years after its initiation; and, 5) the investigators used standardized developmental and neurobehavioral tests to assess the effects of mercury on children exposed prenatally, during infancy and in early childhood [12].

Table 3. Comparison of studies used to decide health effects from mercury.

Agency	Study Site	Hair level (mg/kg)	NOAEL[a] (mg/kg/day)	UF[b]	MRL or RFD (mg/kg/day)	Explanation
EPA	Iraq	11	.0011	10	0.0001 (RFD)	10% incidence in developmental abnormalities at 11 ppm in hair of non-fish eating population
WHO	Iraq	10-20	0.0009		na[c]	5% increase in risk of developmental abnormalities at 10-20 ppm in hair
ATSDR	Seychelles	15.3	0.0013	4.5	0.0003 (MRL)	no developmental delays in children whose mothers were in the highest exposure subgroup with mean hair mercury levels of 15.3 mg/kg hair

[a] No Observed Adverse Effect Level
[b] Uncertainty Factor
[c] na - not applicable

Toxicological Evaluation

The studies summarized above confirm that maternal hair mercury levels during pregnancy adequately represent prenatal exposure to methylmercury. For this assessment, TDH used ATSDR's guidelines to examine risks to adults and children exposed to methylmercury through consumption of fish and crabs from Cox Bay.

To assess the possibility of health effects associated with exposure to mercury from eating seafood from Cox Bay, TDH estimated potential exposure doses using both the average concentrations of mercury in the seafood and the 95th percentile[2] of the arithmetic average of the mercury concentrations. While the arithmetic average is most representative of the concentration that a person might consume over time, the 95th percentile of the average provides a conservative estimate of the average concentration and is useful to account for sampling variability, differences in consumption, and possible seasonal variations in fish tissue

[2] The 95th percentile of the arithmetic average is a value that, when calculated repeatedly for randomly drawn subsets of the data, equals or exceeds the true average 95% of the time. TDH estimated the 95th percentile of the average by defining the distribution of the mercury values and then randomly drawing 1,000 samples from that distribution. Averages were obtained for each of the 1,000 samples and the 950th rank-ordered average was defined as the 95th percentile. The 95th percentile of the average provides a conservative estimate of the average concentration to which a person may be exposed.

concentrations of chemicals. For health effects due to mercury, the TDH compared the estimated exposure doses with ATSDR's minimal risk level (MRL) of 0.0003 mg/kg/day to calculate the number of fish meals required to exceed a safe intake level. Exposure to doses similar to ATSDR's MRL provides a margin of safety that is at least four and one-half times lower than the level at which no adverse effects were found in children exposed to mercury during pregnancy [11]. Using the arithmetic average concentration of mercury in seafood from within the closed area of Cox Bay, TDH estimated that 70 kg adults could consume approximately 2½ eight-ounce meals each week, while children (body weight 15-35 kg) could eat approximately 1 to 2½ *four-ounce* meals each week of fish harvested from within the closed area of Cox Bay without exceeding the minimal risk level for methylmercury. Using the 95th percentile of the arithmetic average, TDH found that 70 kg adults could eat approximately two eight-ounce meals per week from Cox Bay without exceeding the MRL of 0.0003 mg/kg, while children may consume form one to two *four-ounce* meals each week, depending on their age and weight, without exceeding the MRL (Table 4).

Table 4. Recommended Limitations on Long-Term Seafood Consumption by Body Weight

Estimates based on an average mercury level of 0.2685 mg/kg and a 95th percentile of the average of 0.336 mg/kg in the 17 fish and crab samples collected from the closed area of Cox Bay, Spring 1999

Chemical Name: **Mercury**
Population: **Adults and Children**
Minimum Risk Level: **0.0003 mg/kg/day**

Body Weight (kg)	Age Range (years)	Daily Consumption of MeHg to meet MRL (μg/day)	Number of meals per week that may be consumed without exceeding the minimum risk level (MRL).	
			Arithmetic Average 0.2685 mg/kg	95th Percent Upper Confidence Limit on Arithmetic Average 0.336 mg/kg
Child: average meal size = 4 ounces				
15	3 to 6	4.5	1.0	0.8
35	10 to 11	10.5	2.4	1.9
Adult: average meal size = 8 ounces				
50		15	1.7	1.4
60		18	2.1	1.7
70		21	2.4	1.9
80		24	2.8	2.2
90		27	3.1	2.5
100		30	3.4	2.8

PUBLIC HEALTH IMPLICATIONS

Although conflicting information exists as to levels of mercury that a pregnant woman can ingest without risking harm to the fetus, some consensus exists among the available studies that mercury levels between 10 and 20 mg/kg in maternal hair reflect exposure scenarios that should not result in either overt or subtle defects that could be attributed to methylmercury exposure during pregnancy.

The concentrations of mercury in fish and crabs from Cox Bay are similar to background levels found in seafood from many non-industrialized areas (12). Children born to women from the Seychelles Islands who regularly consumed approximately 12 meals per week of fish containing an average of 0.29 mg/kg mercury showed no developmental delays (total daily exposure approximately 110 µg mercury/day). The U.S. EPA has reported that, in the U.S., average consumption of fish and shellfish from marine, estuarine, and fresh waters is 30 grams per day (one meal per week) for the 50^{th} percentile of recreational fishers and 140 grams per day (4-5 meals per week) for the 90^{th} percentile (subsistence fishers) [14]. Assuming that seafood from Cox Bay contains an average of 0.27 mg/kg mercury, recreational and subsistence fishers would be exposed to 8 and 38 µg mercury per day, respectively (Upper 95% Confidence Limit = 10 and 47 µg/day, respectively), a dose that is well below the 110 µg/day to which the Seychellois are routinely subjected. Therefore, TDH concludes that eating fish from Cox Bay will not cause adverse health effects in children or adults.

ATSDR's Child Health Initiative

The TDH has prepared this consultation under a Cooperative Agreement with the Agency for Toxic Substances and Disease Registry (ATSDR). TDH has included the following information following ATSDR's Child Health Initiative [15].

ATSDR's Child Health Initiative recognizes that the unique vulnerabilities of infants and children demand special emphasis in communities faced with contamination of their water, soil, air, or food. Children who consume fish contaminated with mercury are at greater risk for toxic effects than are adults who consume such fish. Infants may be exposed through breast milk while fetuses may be exposed via transfer across the placenta. Children's smaller body size results in higher exposure doses for each kilogram of body weight. The developing body systems of children can sustain permanent damage if toxic exposures occur during critical growth stages. TDH evaluated the upper limits of fish consumption that would result in no significant risk to the fetus or to young children exposed after birth. TDH has determined that regular consumption of fish from Cox Bay at levels outlined in the present health consultation should not pose an increased risk to fetuses, infants, and young children. Although infants may be exposed to methylmercury through breast milk, evidence suggests that, unless mercury levels are very high in the mother's milk, the benefits of breast feeding outweigh the risks associated with this type of exposure [16, 17].

CONCLUSIONS

1. Consumption of up to two (2) eight-ounce meals per week of seafood from Cox Bay should not increase the risk of mercury-related effects on the sensitive subpopulation of women of childbearing age and their fetuses. Children 3 to 6 years of age may eat approximately one (1) *four-ounce* meal per week, while older children (body weight approximately 35 kg) may eat two (2) *four-ounce* meals each week without risk of

mercury-related adverse health effects. Based on available information, we have concluded that consumption of fish and shellfish from the closed area of Cox Bay presents no apparent public health hazard.

2. Sample sizes for both closed and open areas are small and the areas surveyed are limited. However, additional data from Cox Bay supplied by ALCOA are consistent with concentrations detected by TDH. The data from both sources suggest that mercury concentrations in fish from the closed area of Cox Bay are now lower than they were when TDH originally issued the closure order.

RECOMMENDATIONS

The TDH Seafood Safety Division has established criteria for issuing fish consumption advisories. TDH assumes that recreational fishers eat approximately thirty grams of fish per day (approximately one (1) eight-ounce meals per week) [18]. If adults cannot safely eat one eight-ounce meal each week, the Seafood Safety Division recommends that the Commissioner of Health issue or continue an advisory. Recommendations based on the findings of this health consultation follow.

1. Fish and crabs from the closed area of Cox Bay appear to be safe for consumption at or below the weekly consumption limits outlined in this report. Based on these data, reevaluation of the closure area of Cox Bay is warranted.

2. The Texas Department of Health should continue to survey Cox Bay at regular intervals to ensure that mercury levels in seafood from the area continue to pose no apparent threat to public health.

3. These recommendations refer only to that area of Cox Bay extending north and east from a line drawn between Marker 74 and Cox Point. Other areas of Lavaca Bay were not addressed in this health consultation and are not affected by these recommendations.

PUBLIC HEALTH ACTIONS

On January 13, 2000, the Texas Commissioner of Health issued an order to modify the 1988 closure order for Lavaca Bay, including Cox Bay. The modified order states that: “samples of fish and crabs taken from Cox Bay, Calhoun County, covered by Aquatic Life Order AL-1 issued by TDH on April 21, 1988, indicate that the levels of mercury have decreased to an acceptable level. Consumption of fish and crabs from Cox Bay no longer poses a health threat”; therefore, the closure order prohibiting the taking of seafood from Cox Bay has been rescinded.

REFERENCES

1. ALCOA 1999. Semi-annual finfish, blue crab and prey item monitoring study; volume B12a: Phase 3 Finfish/Shellfish sampling. Parametrix, Inc.

3. ATSDR, 1994. Agency for Toxic Substances and Disease Registry. Toxicological Profile for Mercury (Update). Atlanta Ga., May 1994.

3. Marsh DO, Clarkson TW, Cox C, et al. 1987. Fetal methylmercury poisoning: Relationship between concentration in single strands of hair and child effects. Arch Neurol 44:1017-1022.

4. WHO (World Health Organization), 1990. Methylmercury. Environmental Criteria, No. 101. World Health Organization, Geneva

5. Myers GJ, et al. 1995. Main neurodevelopmental study of Seychellois children following in utero exposure to methylmercury from a maternal fish diet: Outcome at six months. Neurotoxicology 16(4):653-664.

6. Davidson PW, et al.1998. Effects of prenatal and postnatal methylmercury exposure from fish consumption on neurodevelopment. Outcomes at 66 months of age in Seychelles Child Development Study. JAMA 280(8):701-707.

7. Davidson PW, et al. 1995. Longitudinal neurodevelopmental study of Seychellois children following in utero exposure to methylmercury from maternal fish ingestion: Outcomes at 19 and 29 months. Neurotoxicology 16(4):677-688.

8. Grandjean P, et al. 1992. Impact of maternal seafood diet on fetal exposure to mercury, selenium, and lead. Arch Environ Health 47:185-195.

9. Grandjean P, et al. 1997. Cognitive deficits in 7-year-old children with prenatal exposure to methylmercury. Neurotoxicol Teratol 19: 417-428.

10. Kjellstrom T., et al. 1986. Physical and mental development of children with prenatal exposure to mercury from fish. Stage 1: Preliminary tests at age 4. National Swedish Environmental Protection Board, Report 3080. Solna Sweden.

11. Kjellstrom T., et al. 1989. Physical and mental development of children with prenatal exposure to mercury from fish. Stage 2: Interviews and Psychological Tests at Age 6. National Swedish Environmental Board, Report 3642. Solna Sweden.

12. Agency for Toxic Substances and Disease Registry. 1999. Toxicological Profile for Mercury (Update). U.S. Department of Health and Human Services, Public Health Service, Agency for Toxic Substances and Disease Registry.

13. Crump, K, Kjellstrom, T, et al. 1998. Influence of prenatal mercury exposure upon scholastic and psychological test performance: benchmark analysis of New Zealand Cohort. Risk Anal 18 (6):701-713.

14. Environmental Protection Agency. 1996. Supplement toVolume II. Guidance for Assessing Chemical Contaminant Data for Use in Fish Advisories. Second Edition. Office of Science and Technology, Office of Water, U.S. Environmental Protection Agency, Washington, DC.

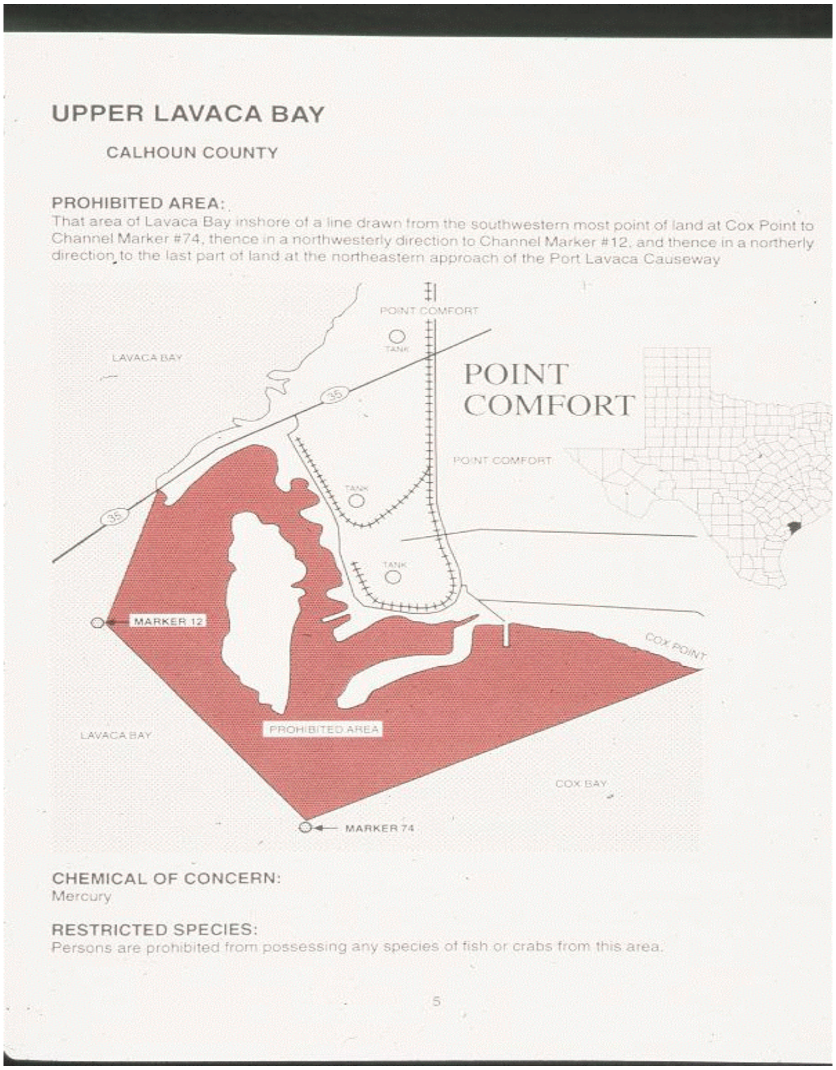
15. Agency for Toxic Substances and Disease Registry, Office of Children's Health. 1995. Child Health Initiative.

16. Grandjean P, Jorgensen PJ, Weihe P. 1994. Human milk as a source of methylmercury exposure in infants. Environ Health Persepec 102:74-7.

17. Grandjean P, Weihe P, White, PF. 1995. Milestone development in infants exposed to methylmercury from human milk. Neurotoxicology 16:127-33.

18. U.S. Environmental Protection Agency. 1995. Guidance for assessing chemical contaminant data for use in fish advisories. Volume I. Fish Sampling and Analysis, Second Edition. Office of Science and Technology, Office of Water, U.S. Environmental Protection Agency, Washington, DC.

Appendix 1. Cox Bay closure line as delineated in the 1988 closure order from the Texas Department of Health


UPPER LAVACA BAY

CALHOUN COUNTY

PROHIBITED AREA:
That area of Lavaca Bay inshore of a line drawn from the southwestern most point of land at Cox Point to Channel Marker #74, thence in a northwesterly direction to Channel Marker #12, and thence in a northerly direction to the last part of land at the northeastern approach of the Port Lavaca Causeway

CHEMICAL OF CONCERN:
Mercury

RESTRICTED SPECIES:
Persons are prohibited from possessing any species of fish or crabs from this area.

5

Appendix 2. Mercury data from fish and crabs collected from Cox Bay by the Texas Department of Health, Spring 1999

Mercury Concentrations in Fish and Crabs Taken from Inside the Closure Area of Cox Bay. Samples collected between April 27, 1999 and May 12, 1999.			
Sample Location Coordinates	**Sample #**	**Species (length in centimeters, weight in grams)**	**Total Mercury (mg/kg)**
28E 37' 49" 96E 33' 34"	LAV23-1	Spotted Seatrout (44.5, 700)	0.250
28E 37' 49" 96E 33' 34"	LAV23-2	Southern Flounder (46, 800)	0.208
28E 37' 49" 96E 33' 34"	LAV23-3	Black Drum (54, 2000)	0.264
28E 37' 49" 96E 33' 34"	LAV23-5	Gafftopsail Catfish (62, 2100)	0.295
28E 37' 34" 96E 33' 35"	LAV23-11	Southern Flounder (50, 1100)	0.187
28E 37' 34" 96E 33' 35"	LAV23-12	Southern Flounder (41.5, 700)	0.141
28E 37' 34" 96E 33' 35"	LAV23-13	Sheepshead (49, 1600)	<0.121
28E 37' 34" 96E 33' 35"	LAV23-14	Black Drum (66, 4600)	0.468
28E 37' 34" 96E 33' 35"	LAV23-15	Black Drum (56.5, 2300)	0.773
28E 37' 34" 96E 33' 35"	LAV23-16	Black Drum (49, 1300)	0.180
28E 37' 34" 96E 33' 35"	LAV23-17	Black Drum (49, 1300)	0.194
28E 37' 34" 96E 33' 35"	LAV23-18	Black Drum (46, 1100)	0.410
28E 38' 19" 96E 32' 35"	LAV39-1	Blue Crab Composite	0.253
28E 38' 19" 96E 32' 35"	LAV39-2	Blue Crab Composite	0.225
28E 38' 19" 96E 32' 35"	LAV39-3	Blue Crab Composite	0.243
28E 38' 19" 96E 32' 35"	LAV39-4	Blue Crab Composite	0.239
28E 38' 19" 96E 32' 35"	LAV39-5	Blue Crab Composite	0.174

Mercury Concentrations in Fish and Crabs Taken from Inside the Closure Area of Cox Bay. Samples collected between April 27, 1999 and May 12, 1999.			
Sample Location Coordinates	**Sample #**	**Species (Length in centimeters, weight in grams)**	**Total Mercury (mg/kg)**
28E 37' 10" 96E 30' 53"	LAV42-2	Blue Crab Composite	0.146
28E 37' 10" 96E 30' 53"	LAV42-3	Blue Crab Composite	0.176
28E 37' 10" 96E 30' 53"	LAV42-4	Blue Crab Composite	0.158
28E 37' 10" 96E 30' 53"	LAV42-5	Blue Crab Composite	0.151
28E 37' 03" 96E 30' 40"	LAV42-10	Blue Crab Composite	<0.121
28E 37' 03" 96E 30' 40"	LAV42-8	Sheepshead (48.25, 1800)	<0.114
28E 37' 03" 96E 30' 40"	LAV42-9	Sheepshead (49, 1500)	<0.107
28E 38' 20" 96E 30' 18"	LAV41-19	Spotted Seatrout (39, 400)	0.140
28E 38' 20" 96E 30' 18"	LAV41-20	Southern Flounder (44.5, 900)	0.151
28E 38' 20" 96E 30' 18"	LAV41-21	Southern Flounder (44, 800)	0.237
28E 38' 20" 96E 30' 18"	LAV41-24	Black Drum (49, 1700)	0.331
28E 38' 20" 96E 30' 18"	LAV41-25	Black Drum (49, 1600)	0.200
28E 38' 20" 96E 30' 18"	LAV41-26	Black Drum (46, 1600)	0.272

PREPARERS OF THE REPORT

Jerry Ann Ward, Ph.D.
Toxicologist
Seafood Safety Division
Bureau of Food and Drug Safety

Lisa Williams, M.S.
Toxicologist
Environmental Epidemiology and Toxicology Division

John F. Villanacci, Ph.D.
Co-Director
Environmental Epidemiology and Toxicology Division

ATSDR REGIONAL REPRESENTATIVE

George Pettigrew, P.E.
Senior Regional Representative
ATSDR - Region 6

ATSDR TECHNICAL PROJECT OFFICER

Alan Yarbrough
Environmental Health Scientist
Division of Health Assessment and Consultation
Superfund Site Assessment Branch
State Programs Section

CERTIFICATION

This Cox Bay Health Consultation was prepared by the Texas Department of Health under a cooperative agreement with the Agency for Toxic Substances and Disease Registry (ATSDR). It is in accordance with approved methodology and procedures existing at the time the Health Consultation was initiated.

Technical Project Officer, SPS, SSAB, DHAC, ATSDR

The Division of Health Assessment and Consultation, ATSDR, has reviewed this Health Consultation and concurs with its findings.

Chief, State Programs Section, SSAB, DHAC, ATSDR