

**TEXAS DEPARTMENT OF HEALTH
SEAFOOD SAFETY DIVISION**

**ASSESSMENT OF RISK
FOR CONSUMPTION OF FISH TAKEN FROM
BIG CYPRESS CREEK**

AUGUST 1995

MERCURY CONCENTRATION IN FISH TAKEN FROM BIG CYPRESS CREEK

LOCATION	SPECIES	SAMPLE LENGTH (inches)	TOTAL Hg (ppm)
SAMPLES COLLECTED APRIL 1995			
BIG CYPRESS CREEK	White Bass	13.8	0.19
	White Bass	14.2	0.25
	White Bass	15	0.11
	Largemouth Bass	14.2	0.12
	Largemouth Bass	15.7	0.44
	Largemouth Bass	16.1	0.56
	Largemouth Bass	17.3	0.16
	Largemouth Bass	26	0.94
	Freshwater Drum	17.7	0.23
	Freshwater Drum	19.7	0.29
	Freshwater Drum	29.1	1.29
	Common Carp	21.2	<0.039
	Common Carp	35	0.35
	Bowfin	24.4	0.94
	Bowfin	27.6	1.55
Chain Pickerel	17.7	0.32	
Black Crappie	9.8	0.06	
Channel Catfish	16.5	0.26	

	Flathead Catfish	44	0.95
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SUMMARY OF RESULTS-CYPRESS CREEK

FISH SPECIES(n)	AVG. SIZE	RANGE	MERCURY (ppm)	
			AVERAGE	RANGE
LARGEMOUTH BASS(ALL)	17.9"	(14-26")	0.44	0.12-0.94
LARGEMOUTH BASS(4)	15.8"	(14-18")	0.302	0.12-0.56
LARGEMOUTH BASS(1) 26		(>18")	0.94	
CRAPPIE(1)	9.8"	(10")		0.06
FRESHWATER DRUM(3)	22.2"	(17-29")	0.60	0.23-1.29
WHITE BASS(3)	14.3"	(13-15")	0.18	0.11-0.25
CHANNEL CATFISH(1)	16.5"	(16")		0.26
FLATHEAD CATFISH(1) 44"		(44")	0.95	
CHAIN PICKEREL(1)	17.7"	(18")		0.32
COMMON CARP(2)	28.1"	(21-35")	0.18	nd-0.35
BOWFIN(2)	26"	(24-28")	1.2	0.94-1.55

ALL FISH n=19 0.47ppm mercury

TOXICOLOGICAL EFFECTS OF MERCURY

Methylmercury is the most important form of mercury in terms of toxicity and health effects from environmental exposure. The amount of mercury in the body is largely dependent on the amount of seafood in the diet. The major source of mercury is natural degassing of the earth's crust. Sources of environmental contamination in the past have been coal burning, municipal incinerators, loss in water effluent from chlor-alkali plants, refining of petroleum products, mining, and smelting.

Clinical manifestations of mercury poisoning include paresthesia (tingling of skin), ataxia (incoordination), dysarthria (difficulty with words) and visual and hearing impairment, in that order.

Methylmercury easily crosses cell membranes and preferentially binds in the nervous system and brain.

Since there is no placental barrier to mercury, the fetus is at a particular risk for methylmercury poisoning. Severe derangement of the central nervous system can be caused by prenatal exposure. Methylmercury inhibits the growth of the fetal brain, possibly by destroying microtubules necessary for cell division occurring primarily during normal development (Clarkson, 1987). Effects range from personality changes (shyness, irritability) to a severe neurological syndrome similar to cerebral palsy (ATSDR, 1994). In previous outbreaks of severe mercury contamination, children exposed prenatally had permanent cerebral involvement whereas their mothers had mild manifestations or none.

HUMAN HEALTH RISK EVALUATION

ADULTS

In the general adult population, blood methylmercury concentrations of 200 ug/L (corresponding to approximately 50 ug/g in hair) have been associated with a 5% increased risk of parasthesia. Applying a ten fold margin of safety to adjust the lowest observable adverse effects level (LOAEL) to what is expected to be a no observable adverse effects level (NOAEL), an oral reference dose (RfD) of 0.0003 mg/kg per day was determined to be equivalent to a daily dose ten times below the LOAEL. The LOAEL is associated with a 5% chance of central nervous system effects such as incoordination in walking and tingling of the extremities and is based on sensitive individuals for chronic exposure (IRIS, 1994).

The EPA reference dose of 0.0003 mg/kg/day is calculated with a ten fold margin of safety below the LOAEL and is associated with a 5 ppm hair level of mercury. The resulting screening value for mercury in fish is 0.65 ppm for women of childbearing age consuming 30 grams per day.

INFANTS

The minimum risk level (MRL) used by the Agency for Toxic Substances and Disease Registry (ATSDR) for mercury was derived based on protection of the infant exposed prenatally to methylmercury. A summary of effects of 81 mother/infant pairs exposed prenatally to methylmercury from contaminated grain in Iraq was used as a basis for deriving the ATSDR minimum risk level. The lowest observed hair concentration during pregnancy in mothers whose children were reported to have symptoms (delayed onset of walking) was 14 ppm.

The estimated dose that would result in a hair level of 14 ppm is 0.0012 mg/kg/day. Considering this data is derived from actual studies of mother/infant pairs, an uncertainty factor of four is considered appropriate for deriving a reference dose for protection of infants exposed prenatally. The resulting dose of 0.0003 mg/kg/day by mothers would be associated with hair levels less than 5 ppm methylmercury.

For the fetus, a 5% risk of neurological and developmental abnormalities is associated with peak mercury concentrations of 10-20 ug/g in maternal hair (WHO, 1990). Chronic ingestion of mercury at a dose equivalent to EPA's reference dose of 0.0003 mg/kg/day is associated with a steady state hair level of 5 ug/g. This reference dose allows a 2-4 fold margin of safety below both the Lowest Observable Adverse Effects Level and the estimated 5% risk level, and should be adequate to protect infants exposed prenatally.

The EPA reference dose of 0.0003 mg/kg/day was used for protection of the public from the levels of mercury in Cypress Creek fish. This is a documented and widely used exposure level that allows ample protection of the public, including prenatally exposed infants from mercury in fish and which results in reasonable screening values for determining health risks.

ACCEPTABLE DAILY LIMIT OF METHYLMERCURY IN CYPRESS CREEK FISH

SPECIES	NUMBER OF MEALS PER MONTH EQUIVALENT TO REFERENCE DOSE*
Largemouth Bass (all)	5.8
Largemouth Bass 14-18"	8.5
Largemouth Bass >18"	2.7
Crappie	42.9
Freshwater Drum	4.3
White Bass	14.3
Channel Catfish	9.9
Flathead Catfish	2.7
Chain Pickerel	8.0
Common Carp	14.3
Bowfin	2.1
All Fish	5.5

Assumes a body weight of 65 kg for women of childbearing age and a meal size of approximately 8 ounces. Reference dose equals 0.0003 mg/kg/day.

SUMMARY

A total of 19 fish, representing nine commonly consumed species were collected from Cypress Creek in order to determine whether contaminant levels would indicate a public health concern. Methylmercury was detected in all samples at levels ranging between 0.039 and 1.55 ppm, depending on the species and size of fish analyzed.

Risk calculations indicate the level of fish consumption that would be required to meet the EPA reference dose of 0.0003 mg/kg/day, or level of daily exposure that is likely to be without appreciable risk of deleterious effects over a lifetime. Based on the EPA reference dose, consumption limits are recommended for largemouth bass >18", flathead catfish, and bowfin from Big Cypress Creek.

The estimate of average consumption of fish by the 50th percentile of recreational fishermen is 30 grams per day or one 8 oz meal per week. This value has a reasonable application for local consumption of fish by adults in East Texas Lakes and was used to derive a level of concern of 0.65 ppm methylmercury in fish for women of childbearing age.

The majority of the literature documenting the neurotoxic effects of methylmercury is based on the massive poisoning incident in Iraq where the primary toxicological effects were seen in children exposed prenatally to heavily contaminated and consumed grain. It was assumed that infants would not consistently consume fish at levels high enough to increase body burden. Because the majority of an infant's body burden of mercury comes from prenatal exposure or breastfeeding, consumption limits for this group are not recommended as the basis of fish consumption advisories. Adequate protection of the infant from prenatal exposure to mercury will be provided by basing advisories on consumption limits for women of childbearing age.

Adverse health effects would not be expected to occur in children born to mothers who ingest 0.0003 mg/kg/day mercury while pregnant. Chronic ingestion of mercury at a dose equivalent to the RfD would be associated with a less than 2% risk of lowest adverse effects (late walking) in infants exposed prenatally (TDH,1995). The consumption limits allow a ten fold margin of safety between lowest adverse effects (parasthesia) for adults consuming Cypress Creek fish.

Recommendations for Consumption Limits:

Species	# meals per month (8 oz)
Largemouth Bass >18"	3
Flathead Catfish	3
Bowfin	2

REFERENCES

ATSDR, 1994. Toxicological Profile for Mercury. U.S. Department of Health and Human Services, Public Health Service, Agency for Toxic Substances and Disease Registry, Atlanta, GA. TP-93/10.

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