

HEALTH CONSULTATION

Town Lake
Austin, Travis County, TX

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Prepared by

Texas Department of Health
Under Cooperative Agreement with the
Agency for Toxic Substances and Disease Registry

BACKGROUND AND STATEMENT OF ISSUES

Town Lake is a 525-acre water body on the Colorado River within the city limits of Austin, Texas in Travis County. This lake, which supplies drinking water and water for power plant cooling towers, has been under a fish consumption advisory since 1985 due to the presence of the pesticide chlordane. Public parks occupy much of the shoreline. The fish population includes various species of bass, catfish, sunfish, carp, shad and smallmouth buffalo.

In 1985, the Texas Department of Health (TDH) collected 58 fish samples from Town Lake between Tom Miller Dam and Longhorn Dam. Edible tissue from 38 of the fish was analyzed for pesticides; 25 samples contained chlordane. Chlordane concentrations in several species (common carp, gizzard shad, and striped bass) exceeded the U.S. Food and Drug Administration's (FDA's) action level of 300 µg-chlordane/kg-tissue. The 1985 samples also contained low levels of metals, polychlorinated biphenyls (PCBs), metabolites of dichlorodiphenyltrichloroethane (DDT), and very low levels of the pesticide dieldrin. The Austin-Travis County Health Department issued a health advisory in June 1987 based on the 1985 sample results. That advisory stated that people should not consume carp, shad, or striped bass from Town Lake and recommended only limited consumption of all other species of fish from the lake.

In 1990, TDH, in association with the Austin-Travis County Health Department, issued an amended consumption advisory. This advisory recommended that no species of fish from Town Lake be consumed due to chlordane contamination.

According to data from other agencies, chlordane levels in fish from Town Lake appear to have decreased between 1985 and 1990. In November 1994, the City of Austin requested that TDH re-evaluate the Town Lake fish consumption advisory. In response to that request, TDH collected 15 fish from Town Lake in February and July of 1995. These samples were analyzed for pesticides and PCBs. All 15 samples contained chlordane and five of the 15 samples contained PCBs. DDT and its metabolites also were found in the fish. Based on these data, TDH recommended that people limit consumption of fish taken from Town Lake to one meal per week.

Through a grant funded by the Texas Natural Resource Conservation Commission (TNRCC), TDH collected twelve fish from Town Lake in September 1998. Five fish (two smallmouth buffalo, one largemouth bass, one channel catfish, and one freshwater drum) were collected from the Holly Street Power Plant area near Longhorn Dam. Five fish (one largemouth bass, one blue catfish, one freshwater drum, and two flathead catfish) were caught in the headwaters of Town Lake near Tom Miller Dam. Two samples (two largemouth bass) were taken from beneath the MoPac (Loop 1) Bridge. The Texas Department of Health Bureau of Laboratories analyzed these fish for metals, PCBs, volatile and semivolatile organic compounds, and pesticides.

DISCUSSION

To assess the potential for health effects associated with exposure to contaminants in the fish, we estimated potential exposure doses using both the average contaminant concentrations and the 95th percentile of the arithmetic average¹ of the contaminant concentrations. We then estimated the potential exposure doses for both adults and children by assuming that a 70-kg adult eats eight (8) ounces of the fish per week while a 15-kg child eats four (4) ounces of the fish per week. For non-cancer health effects we compared the estimated exposure doses with the U.S. Environmental Protection Agency's (EPA's) reference doses (RfDs), the Agency for Toxic Substances and Disease Registry's (ATSDR's) minimal risk levels (MRLs), or other non-cancer health-based values. RfDs and MRLs are estimates of a daily human exposure to a contaminant that are unlikely to result in adverse health effects over a lifetime. For lead, we used EPA's Integrated Exposure Uptake Biokinetic (IEUBK) Model to estimate the potential impact that chronic ingestion of fish would have on children's blood lead levels [1]. For cancer endpoints we used the estimated exposure doses and EPA's chemical-specific cancer potency factors to estimate a theoretical excess lifetime risk for developing cancer.

Metals

Small quantities of cadmium, copper, mercury, selenium, and zinc were found in several fish. The presence of these metals does not pose a threat to public health. Edible tissues from five (5) fish contained small amounts of inorganic lead (non detect - 0.036 ug/kg). If fish from Town Lake account for 50% of the total daily meat consumption, the IEUBK model predicts that daily ingestion of fish from Town Lake will not increase children's (0-7 yrs of age) geometric mean blood lead level by more than 0.3 µg/dl. Although this model is not used to predict the effect on adult blood lead levels from eating these fish, we expect it to be negligible since the adult gastrointestinal tract does not absorb lead as efficiently as that of a child. From this information we have concluded that the lead in the fish from Town Lake poses no apparent public health hazard to children or adults.

¹The 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 percent of the time. We estimated the 95th percentile of the average by defining the distribution of each of the contaminants and then randomly drawing 1,000 samples of 12 fish from that distribution. Averages were obtained for each of the 1,000 samples of 12 fish 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.

PCBs, Volatile and Semivolatile Organic Compounds

PCBs, volatile organic compounds and semivolatile organic compounds other than pesticides were not detected in these samples.

Pesticides (DDT, DDE, DDD, Dieldrin, and Chlordane)

Six of the fish contained DDT and one of its metabolites, DDD. DDE, the most persistent metabolite of DDT, was present in all twelve samples (Table 1). Only one sample contained detectable levels of dieldrin (6.5 Fg/kg, reporting limit = 6 Fg/kg); this sample was excluded from further evaluation. Eight of the twelve 1998 samples contained components of technical chlordane (Table 2). The chlordane congeners in these samples consisted primarily of *cis*-chlordane and *trans*-nonachlor, a pattern consistent with environmental or biologic degradation. A comparison of chlordane concentrations in different species of fish taken from Town Lake in 1985, 1995, and 1998 is presented in Table 2. The concentrations for all species combined for each of these years is presented in Figure 1.

Table 1. Comparison of Contaminant Concentrations in Fish From Town Lake with Health-based Comparison Values*						
Chemical	# Detected/ # Sampled	Average Conc.	95% Upper Confidence Limit	Comparison Value**	Basis	HAC Exceeded
Pesticides (mg/kg)						
Chlordane	8/12	0.097	0.149	1.55	EPA Slope Factor: 0.35 per (mg/kg) day ⁻¹	no
				1.17	RfD:5E-4 mg/kg/day	
DDD	6/12	0.036	0.058	2.3	EPA Slope Factor: 0.24 per (mg/kg) day ⁻¹	no
DDT	6/12	0.021	0.034	1.6	EPA Slope Factor: 0.34 per (mg/kg) day ⁻¹	no
DDE	12/12	0.231	0.354	1.6	EPA Slope Factor: 0.34 per (mg/kg) day ⁻¹	no

*Assumes 70 kg adult ingesting 30 grams of fish per day (one eight-ounce meal per week) and, for carcinogenicity, an acceptable risk level of 1 x 10⁻⁴ for a lifetime of exposure.

**mg contaminant per kg fish tissue

SPECIES	1985 (Number; average length)	1995 (Number; average length)	1998 (Number; average length)
Common Carp	0.666 (n=6; 20")	0.155 (n=2; 22")	
Gizzard Shad	0.644 (n=7; 15")	0.170 (n=1; 17")	
White Bass	0.230 (n=1; 8")	0.230 (n=1; 17")	
Striped Bass		0.270 (n=1; 28")	
Redhorse Sucker		0.140 (n=1; 23")	
Channel Catfish	0.156 (n=2; 16.5")	0.74 (n=1; 25 ")	0.290 (n=1; 26")
Largemouth Bass	0.030 (n=7; 10")	0.030 (n=3; 20")	0.107 (n=4; 18.125")
Blue Catfish		0.051 (n=1; 25")	<0.010 (n=1; 32")
Flathead Catfish		0.220 (n=2; 24")	0.090 (n=2; 23.5")
Freshwater Drum		0.310 (n=2; 25")	0.187 (n=2; 23.25")
Smallmouth Buffalo			nd* (n=2; 20.5")

*nd-not detected

Since DDT, DDE, DDD, and chlordane all have been shown to affect the liver, we considered the potential for adverse effects of these contaminants to be additive. For non-cancer endpoints we evaluated the additive effects by calculating a hazard index (HI) from the hazard ratios for individual contaminants. To derive the HI, we first calculated a hazard ratio by dividing the estimated potential dose of each contaminant by its respective RfD. We derived a hazard index by summing the hazard ratios. A hazard ratio of less than one (1) indicates that the estimated exposure dose is lower than the RfD and, consequently, that adverse non-cancer health effects are unlikely. Similarly, for multiple contaminants, a HI of less than one (1) suggests that adverse non-cancer health effects are unlikely. While hazard ratios and HIs that are greater than one (1) do not necessarily mean that the contaminants represent a public health threat, they do suggest that further consideration may be warranted. The hazard ratios and the hazard index for these contaminants are presented in Table 3. Individual hazard ratios and the HIs for both the average concentration and the 95th percentile of the average concentration were less than one. Thus, adverse non-cancer health effects from exposure to these contaminants in fish from Town Lake are not likely to occur.

Chlordane, DDT, DDD, and DDE are all classified as probable human carcinogens based on an increased incidence of liver tumors in experimental animals. As with the non-cancer assessment we assumed that the carcinogenic risks are additive. In defining the theoretical excess lifetime cancer risk for each compound, TDH assumed an exposure period of 30 years. In Texas, the theoretical excess lifetime risk for cancer is considered unacceptable if it is greater than one excess cancer in 10,000 persons exposed to a carcinogen. Theoretical carcinogenic risks for

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each contaminant and the cumulative risks are presented in Table 4. The theoretical risks were all below one excess cancer in 10,000 exposed persons. Table 5 illustrates the number of fish meals per week people of different body weights would have to eat, over different durations of exposure, to exceed a theoretical excess cancer risk level of one in 10,000 exposed persons. Based on the available information, we have concluded that the pesticides found in the fish from Town Lake pose no apparent public health hazard.

Table 3. Noncarcinogenic Risks from Consumption of Fish Collected from Town Lake in September 1998				
CHEMICAL	Average Concentration (mg/kg)	Hazard Ratio	95% Upper Confidence Limit (mg/kg)	Hazard Ratio
CHLORDANE	0.097	8.3×10^{-2}	0.149	1.28×10^{-1}
DDE	0.231	3.08×10^{-2}	0.354	4.95×10^{-2}
DDT	0.021	1.8×10^{-2}	0.034	2.89×10^{-2}
DDD	0.036	1.98×10^{-1}	0.058	3.04×10^{-1}
HAZARD INDEX		3.30×10^{-1}		5.10×10^{-1}

Table 4. Carcinogenic Risks from Consumption of Fish Collected from Town Lake in September 1998				
CHEMICAL	AVERAGE CONCENTRATION (mg/kg)	CANCER RISK	95% Upper Confidence Limit (mg/kg)	CANCER RISK
CHLORDANE	0.097	6.24×10^{-6}	0.149	9.58×10^{-6}
DDE	0.231	1.44×10^{-5}	0.354	2.21×10^{-5}
DDT	0.021	1.30×10^{-6}	0.034	2.10×10^{-6}
DDD	0.036	1.58×10^{-6}	0.058	2.55×10^{-6}
CUMULATIVE RISK		2.35×10^{-5}		3.63×10^{-5}

⁸assumes a 70-kg adult eating one eight-ounce meal per week over a lifetime; acceptable risk level (ARL) = 1×10^{-4} or one excess cancer in 10,000 persons and an exposure period of 30 years.

Table 5. Number of Eight-Ounce Meals* per Week of Fish from Town Lake Containing up to 0.149 mg Chlordane per kg Edible Tissue that Adults of Various Body Weight Might Consume without Exceeding the 1 X 10 ⁻⁴ Risk Level					
Body Weight		Years of Exposure			
kg	lb	5	10	20	30
50	110	11	6	3	2
60	132	13	7	3	2
70	154	15	8	4	3
80	176	18	9	4	3
90	198	20	10	5	3
100	220	22	11	5	4

*Numbers of meals are rounded to the nearest whole number using standard mathematical rounding conventions

ATSDR's Child Health Initiative

The TDH has prepared this consult under a Cooperative Agreement with the Agency for Toxic Substances and Disease Registry (ATSDR). TDH has included the following information according to ATSDR's Child Health Initiative [2].

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. Infants who are breast-fed may be exposed to toxicants through their mother's milk, while fetuses may be exposed via trans-placental passage. Children who consume seafood containing chemical contaminants may be at greater risk for toxic effects than adults as their smaller size results in higher exposure doses per kilogram of body weight and because developing organ systems can sustain permanent damage if toxic exposures occur during critical growth stages. TDH evaluated the upper limits of consumption of fish from Town Lake that would result in no significant risk to the fetus or to young children exposed after birth. The Texas Department of Health has determined that regular consumption of fish from Town Lake poses no apparent health hazard to children.

CONCLUSIONS

1. Inorganic lead in fish from Town Lake poses no apparent health hazard either to young children or adults.
2. The concentration of chlordane in fish from Town Lake appears to have decreased between 1985 and 1998 (Figure 1). This change may be the result of decreases observed

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in several species of fish (Table 2). Additionally, in 1998, the samples consisted primarily of cis-chlordane and trans-nonachlor, a pattern consistent with environmental or biological degradation.

3. In 1995 all of the samples contained measurable levels of chlordane; in 1998 only 75% of the samples contained chlordane.
4. Assuming that the non-cancer adverse health effects from exposure to the pesticides in Town Lake are additive, we conclude that consuming fish from Town Lake poses no apparent public health hazard.
5. Assuming that the risk of cancer from exposure to the pesticides in fish from Town Lake is additive, we conclude that consuming fish from this lake poses no apparent public health hazard.

RECOMMENDATIONS FOR PUBLIC HEALTH ACTION

1. 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 meal per week) [3]. If analysis shows that eating one eight-ounce meal or less each week poses a public health hazard, the Seafood Safety Division recommends that the Commissioner of Health issue or continue an advisory. This health consultation suggests that chlordane levels in fish from Town Lake have decreased and that consuming fish from Town Lake poses no apparent public health hazard. Thus, based on the current data, continuation of the Town Lake fish consumption advisory first issued in 1985 should be reconsidered.

REFERENCES

2. IRIS, 1998. Integrated Risk Information System. # 271: Lead. U.S. Environmental Protection Agency, Office of Health and Environmental Assessment, Environmental Criteria and Assessment Office. Cincinnati, Ohio.
3. Agency for Toxic Substances and Disease Registry, Office of Children's Health. 1995. Child Health Initiative.
4. Environmental Protection Agency, 1997. Guidance for Assessing Chemical Contaminant Data for Use in Fish Advisories. Volume II. Risk Assessment and Fish Consumption Limits. 2nd edition. Office of Science and Technology, Office of Water, U.S. Environmental Protection Agency, Washington, D.C.

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CERTIFICATION

This 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.

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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