HEALTH CONSULTATION

TRINITY BAY

CHAMBERS COUNTY, TEXAS

December 1, 2000

Prepared by:

Texas Department of Health
Under Cooperative Agreement with the
Agency for Toxic Substances and Disease Registry
U.S. Department of Health and Human Services

BACKGROUND AND STATEMENT OF ISSUES

The Texas Natural Resource Conservation Commission (TNRCC) requested that the Texas Department of Health (TDH) evaluate potential health risks associated with consumption of fish and crabs taken from Trinity Bay. This request resulted from detection of mercury in water samples taken as part of TNRCC's routine monitoring of water bodies, placing it on the 303(d) List. Trinity Bay, located northeast of Galveston Bay and fed by the Trinity River, is part of the Galveston Bay system. Farming is the principal economic activity around the bay.

The Galveston Bay system is Texas' largest and most important estuarine source of seafood, generating nearly one billion dollars per year in commercial and recreational harvests. The Galveston Bay system accounts for approximately one third of the State's commercial fishing income and over one-half of the state's expenditures for recreational fishing. Nearly 300,000 licensed recreational anglers spend some two million hours sport-fishing in the area annually. More than three million people live in the five coastal counties bordering Galveston Bay; twenty percent of those people live within two miles of the bay or its tidal tributaries. The Galveston Bay system is home to one of the nation's largest petrochemical and industrial complexes. As a result, the bay receives treated wastewater from more than 1,400 industrial and municipal point source discharges that amount to more than 60% of the wastewater (by volume) discharged in Texas. Galveston Bay also receives non-point source pollutants in storm water runoff generated by agricultural, urban, suburban and rural land users within the bay area.

TDH's Seafood Safety Division (SSD) collected fish and crab samples from the bay in March 1999. Eight composite blue crab samples and thirty-two finfish consisting of fourteen smallmouth buffalo, six speckled trout, two gafftopsail catfish, three southern flounder, three blue catfish, one white-striped bass hybrid, two red drum, and one black drum were analyzed for metals, polychlorinated biphenyls (PCBs), pesticides, and semivolatile and volatile organic compounds (VOCs). Funding for this project was provided through a grant from the TNRCC.

Low levels of the pesticides chlordane, heptachlor epoxide, DDD, DDE, DDT, dieldrin, and hexaclorobenzene were found in a few samples (Table 1). Metals detected at low concentrations in these samples included cadmium, copper, lead, mercury, selenium, and zinc (Table 2).

DISCUSSION

Introduction

Deriving Health-based Assessment Comparison Values (HACs)

TDH screened the chemical contaminants in fish and crab samples taken from Trinity Bay for further consideration by comparing average contaminant concentrations to health-based assessment comparison (HAC) values for non-cancer and cancer endpoints. The U.S. Environmental Protection Agency's (EPA's) reference doses (RfDs) or the Agency for Toxic Substances and Disease Registry's (ATSDR) minimal risk levels (MRLs) were used to derive the noncancer HAC values. RfDs and MRLs are estimates of daily exposures to contaminants that

are unlikely to cause adverse noncancer health effects even if exposure occurs over a lifetime. The cancer risk comparison values that are used in this consultation are based on EPA's chemical-specific cancer slope factors, an estimated excess lifetime risk of one cancer in ten thousand exposed persons (1×10^{-4}), and an exposure period of 30 years. TDH used standard assumptions for body weight (70 kilograms, adult; 35 kilograms, child) and fish consumption (30 grams per day, adult; 15 grams per day, child) to calculate these comparison values [1].

Addressing the Potential for Cumulative Effects

When multiple chemicals affect the same target organ or when several chemicals present in seafood tissues are carcinogens, we assume that adverse effects are additive. To evaluate the potential public health impact of additive noncancerous health effects, we calculate the number of meals per week needed to exceed a hazard index (HI) of one (1.0). The HI is the sum of the ratios of the estimated exposure doses for each contaminant divided by its respective RfD (or MRL). A hazard index of less than one suggests that exposure to the combined contaminants, at the specified exposure levels, is unlikely to cause adverse noncancer health effects, even if exposure continues for many years. While a hazard index that is greater than one does not necessarily mean that exposure to the contaminants will result in adverse health effects, it does suggest that some public health intervention should be considered. To estimate the potential excess lifetime cancer risk associated with multiple carcinogens, a cumulative risk is calculated by adding the estimated risk associated with each of the contaminants. For carcinogenic chemicals, TDH recommends that consumption of fish contaminated with carcinogenic chemicals be limited to amounts that result in an estimated excess theoretical lifetime cancer risk of less than 1 in 10,000 persons exposed to those contaminants in seafood.

Addressing Children's Unique Vulnerabilities

TDH, EPA and ATSDR recognize that the unique vulnerabilities of infants and children demand special attention. For several reasons, children have a special vulnerability to some toxic substances. Children are smaller than adults, for instance, resulting in higher doses of chemical exposure per unit of body weight. Their body systems are still developing, making them less able than adults to metabolize, detoxify, and excrete some toxic substances. Children's developing body systems can sustain permanent damage if toxic exposures occur during critical growth stages. Consequently, children who consume seafood contaminated with toxic chemicals may be at greater risk for toxic effects than adults. Therefore, in accordance with ATSDR's *Child Health Initiative* [2] and the EPA's *National Agenda to Protect Children's Health from Environmental Threats* [3], we evaluated the potential public health hazards to children who eat fish from Trinity Bay.

Characterizing the Risk

Assessing noncancer health effects

Individually, the contaminants in fish and crab samples from Trinity Bay were found at average concentrations below their respective noncancer HAC values (Tables 1 and 2). Seven of the chlorinated hydrocarbon pesticides (chlordane, DDT, DDD, DDE, dieldrin, heptachlor epoxide, and hexachlorobenzene) detected in fish and crabs from Trinity Bay are known to have adverse noncancerous effects on the livers of experimental animals [4]. The hazard index for combined effects of these compounds was less than one (1.0).

Assessing cancer health effects

Seven of the chemicals (chlordane, DDE, DDT, DDD, dieldrin, heptachlor expoxide, and hexachlorobenzene) found in fish and crabs from Trinity bay are classified by the EPA as probable human carcinogens (Group B2) based on an increase in the incidence of tumors in laboratory animals [4]. Individually, the average concentrations of these contaminants in samples from Trinity Bay were below their respective cancer HAC values (Table 1). People who eat fish from the bay may be exposed to several of these chemicals at the same time. Based on previously stated assumptions, we estimate that people eating one meal per week of fish or crabs from the bay for 30 years could theoretically increase their excess lifetime cancer risk by approximately 1 in 200,000 persons exposed. Qualitatively, this is interpreted as no apparent increased risk of developing cancer during one's lifetime.

CONCLUSIONS AND PUBLIC HEALTH IMPLICATIONS

1. The contaminants measured in samples of fish and crabs from Trinity Bay pose no apparent public health hazard because regular consumption of these species of seafood would be unlikely to have an adverse impact on human health.

2. Fish and crabs from this water body may be consumed by the general public without restriction.

RECOMMENDATIONS AND PUBLIC HEALTH ACTION PLAN

TDH will continue to review seafood tissue data from Trinity Bay as additional information becomes available.

Table 1. Organic Contaminants in Seafood from Trinity Bay (mg/kg)				
Chemical	**Number Affected**	**Average Conc. (Range)**	**Comparison Value***	**Basis for Comparison Value**
Pesticides				
chlordane	18/40	0.03 (nd†-0.6)	1.2	EPA chronic oral RfD: 0.0005 mg/kg/day
			1.4	ATSDR chronic oral MRL: 0.0006 mg/kg/day
			1.6	EPA slope factor: 0.35 (mg/kg/day)-1
DDD	4/40	0.005 (nd-0.1)	1.2	EPA chronic oral RfD for DDT: 0.0005 mg/kg/day
			2.2	EPA slope factor 0.24 (mg/kg/day)-1
DDE	15/40	0.008 (nd-0.08)	1.2	EPA chronic oral RfD for DDT: 0.0005 mg/kg/day
			1.6	EPA slope factor: 0.34 (mg/kg/day)-1
DDT	2/40	0.0006 (nd-0.015)	1.2	EPA chronic oral RfD: 0.0005 mg/kg/day
			1.6	EPA slope factor: 0.34 (mg/kg/day)-1
dieldrin	2/40	0.0005 (nd-0.013)	0.12	EPA chronic oral RfD/ATSDR chronic oral MRL 0.00005 mg/kg/day
			0.03	EPA slope factor: 16 (mg/kg/day)-1
heptachlor expoxide	1/40	0.0003 (nd-0.012)	0.03	EPA chronic oral RfD: 0.000013 mg/kg/day
			0.06	EPA slope factor: 9.1 (mg/kg/day)-1
hexachlorobenzene	1/40	0.0002 (nd-0.008)	1.9	EPA chronic oral RfD: 0.0008 mg/kg/day
			0.047	ATSDR chronic oral MRL: 0.00002 mg/kg/day
			0.34	EPA slope factor: 1.6 (mg/kg/day)-1

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

† Not Detected at concentrations above the laboratory's reporting limit

Table 2. Inorganic Contaminants in Seafood from Trinity Bay				
Chemical	**Number Affected**	**Average Conc. (Range)**	**Comparison Value***	**Basis**
Metals				
cadmium	23/40	0.014 (0.0002-0.08)	0.47	ATSDR chronic oral MRL 0.0002 mg/kg/day
copper	40/40	1.3 (0.09-7.1)	--------	none available
lead	3/40	0.003 (nd†-0.6)	--------	IEUBK‡
mercury	9/40	0.03 (nd-0.24)	0.7	ATSDR chronic oral MRL 0.0003 mg/kg/day
selenium	40/40	0.5 (0.09-1.1)	12	EPA chronic oral RfD: 0.005 mg/kg/day
zinc	40/40	9.3 (2.4-40.2)	700	EPA chronic oral RfD/ATSDR chronic oral MRL: 0.3 mg/kg/day

**assumes 70 kg adult ingesting 30 grams of fish and crabs per day (one eight-ounce meal per week)*
†Not detected at concentrations above the laboratory's reporting limit
‡ Integrated Exposure Uptake Biokinetic Model, EPA

REFERENCES

1. Guidance for assessing chemical contaminant data for use in fish advisories. Volume II, 2nd edition. Fish Sampling and Analysis. U.S. Environmental Protection Agency Office of Science and Technology, Office of Water, Washington, DC. 1997.

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

3. The Children's Environmental Health Yearbook. U.S. Environmental Protection Agency. 1998

4. Integrated Risk Information System. U.S. Environmental Protection Agency, Office of Research and Development. National Center for Environmental Assessment. September 2000. Available from: URL: www.epa.gov/ngispgm3/iris/.

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CERTIFICATION

This Trinity 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.

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

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