HEALTH CONSULTATION

WEST GALVESTON BAY

GALVESTON COUNTY, TEXAS

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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

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 West Galveston Bay. This request resulted from the detection of mercury in water samples taken as part of TNRCC's routine monitoring of water bodies near industrial areas (303(d) list).

Galveston Bay is Texas' largest and most important estuarine source of seafood, generating nearly one billion dollars per year in commercial and recreational harvests. The bay 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 on the bay annually. More than three million people live in the five coastal counties bordering the Galveston Bay system with 20 percent of the population living within two miles of the Bay or its tidal tributaries. The Upper 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. It also receives non-point source pollutants in storm water runoff generated by agricultural, urban, suburban and rural land users within the Bay. The Brazoria National Wildlife Refuge is located along the mainland of West Galveston Bay. Galveston Island, with a population of about 60,000 comprises the southern shoreline.

In response to TNRCC's request, TDH collected and analyzed fish and crab samples from four sites within West Galveston Bay in May 1999. The study area encompasses all of West Galveston Bay from the Galveston Causeway to San Luis Pass. Thirty-two fish samples, consisting of seven spotted trout, seven southern flounder, six black drum, seven sheepshead, four Atlantic croaker, one red drum, and eight blue crab composite samples were analyzed for metals, polychlorinated biphenyls (PCBs), pesticides, and semi-volatile and volatile organic compounds (VOCs).

The organic compounds detected in fish and crab samples from West Galveston Bay are summarized in Table 1. Pyridine was found in all eight crab samples and at low levels in three fish samples. Low levels of the pesticide chlordane were found in a few samples. Metals detected in these samples included cadmium, copper, lead, mercury, selenium, and zinc.

DISCUSSION

Introduction

Deriving Health-based Assessment Comparison Values (HACs)

TDH screened the chemical contaminants found in the fish and crabs from West Bay for further consideration by comparing the average concentration of each contaminant to health-based assessment comparison (HAC) values for non-cancer and cancer endpoints. We used 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) 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 for a lifetime. The cancer risk comparison values that we 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 (1×10^{-4}) exposed people, 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 the HAC 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, we calculate a cumulative risk by adding the estimated risk associated with each of the contaminants. For carcinogenic chemicals, the Texas Department of Health 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 one or more contaminants in seafood.

Addressing the Unique Vulnerabilities of Children

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 or crabs from West Galveston Bay.

Risk Characterization

Assessing noncancer health effects

With the exception of the pyridine found in crabs, all the contaminants were found at average concentrations below their respective noncancer HAC values (Table 1). The Texas Department of Health laboratory investigated the origin of pyridine found in crab tissues and concluded that pyridine is a naturally-occurring component of crab tissue [4]. Pyridine in crabs does not appear to be the result of, or related to, environmental contamination and does not constitute a hazard to human health. Based on the contaminants that were found in the fish and crab samples, there were no additive noncancer effects for us to evaluate.

Assessing cancer health effects

All the contaminants found in the fish and crabs were found at average concentrations below their respective cancer HAC values (Table 1). Chlordane is classified as a probable human carcinogen (Group B2) based on an increase in the incidence of tumors in laboratory animals [5]. Based on previously-stated assumptions, we estimated that people eating one meal per week of fish and crabs from West Galveston Bay for 30 years would increase their theoretical excess lifetime cancer risk by approximately 3 in 10,000,000 persons exposed. Qualitatively, we interpret this to be an insignificant increase in the lifetime risk for development of cancer.

CONCLUSIONS AND PUBLIC HEALTH IMPLICATIONS

The Texas Department of Health has established criteria for issuing fish consumption advisories that are based on EPA guidelines [1]. If long-term consumption of one meal per week could have an adverse impact on human health, the Seafood Safety Division recommends that the Commissioner of Health issue an advisory. Based on the findings of this health consultation, we have determined that:

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

2. Fish and crabs from West Galveston Bay may be consumed by the general public without restriction.

RECOMMENDATIONS AND PUBLIC HEALTH ACTION PLAN

TDH will review future fish and crab tissue data from West Galveston Bay as this information becomes available.

Table 1. Contaminant Concentrations in Fish from West Galveston Bay (mg/kg)

Chemical	Number Affected/Number Sampled	Average Concentration (Range)	Comparison Value	Basis for Comparison Value
Pesticides (mg/kg)				
chlordane	9/40	0.0036 (nd-0.039)	1.2 1.4 1.6	EPA chronic oral RfD: 0.0005 mg/kg/day ATSDR chronic oral MRL: 0.0006 mg/kg/day EPA slope factor: 0.35 (mg/kg/day)-1
Semi-volatile Organic Compounds (mg/kg)				
pyridine-crabs	8/8	11.2 (5.1-23.0)	2.3	EPA chronic oral RfD: 0.001 mg/kg/ day
pyridine-finfish	3/32	0.138 (nd-1.6)	2.3	
pyridine-all samples	11/40	2.3 (nd-23.0	2.3	
Metals (mg/kg)				
cadmium	20/40	0.015 (nd-0.0847)	0.47	ATSDR chronic oral MRL: 0.0002 mg/kg/day
copper	17/40	1.53 (nd-8.8)	--------	None Available
lead	17/40	0.0136 (nd-0.089)	--------	IEUBK[3]
mercury	14/40	0.078 (nd-0.65)	0.7	ATSDR chronic oral MRL: 0.0003 mg/kg/day
selenium	40/40	0.58 (0.24-0.88)	12	EPA chronic oral RfD/ATSDR chronic oral MRL: 0 .005 mg/kg/day
Zinc	40/40	10.7 (2.7-48.3)	700	EPA chronic oral RfD: 0.3 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*
[2] *Not detected at concentrations above laboratory reporting limit*
[3] *Integrated Exposure Uptake Biokinetic Model*

REFERENCES

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

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5. IRIS. Integrated Risk Information System, September 2000. Environmental Protection Agency, Office of Research and Development, National Center for Environmental Assessment. www.epa.gov/ngispgm3/iris/.

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CERTIFICATION

This West Galveston 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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