TDH
TEXAS DEPARTMENT OF HEALTH

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May 12, 1997

Mr. William J. Greim
ATSDR - DHAC
1600 Clifton Rd. N.E.
Bldg.. 31, Exchange Park MS E-32
Atlanta, GA 30333

Dear Bill:

Attached is a draft health consultation regarding consumption of seafood from the Houston Ship Channel and Upper Galveston Bay. This area has been under a fish consumption advisory since September of 1990 due to contamination of catfish and crabs with dioxin. The consultation was requested by the Department's Seafood Safety Division. We have provided that Division a copy for their convenience. Please let us know when you have completed your certification process.

Sincerely,

Nancy B. Ingram
Public Health Technician
Health Risk Assessment and Toxicology Program

Attachment

TEXAS DEPARTMENT OF HEALTH

Austin Texas

INTER-OFFICE MEMORANDUM

TO: Kirk Wiles, R.S., Assistant Director
Seafood Safety Division

THRU: Judy P. Henry, M.S., Acting Director
Noncommunicable Disease Epidemiology and Toxicology

THRU: John F. Villanacci, Ph.D., Director
Health Risk Assessment and Toxicology Program

FROM: Lisa R. Williams, M.S., Toxicologist
Health Risk Assessment and Toxicology Program

DATE: May 12, 1997

SUBJECT: Health consultation for consumption of seafood from the Houston Ship Channel and Upper Galveston Bay

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Attached is the draft health consultation you requested for re-evaluation of the fish consumption advisory in the Houston Ship Channel and Upper Galveston Bay. This document has been forwarded to the Agency for Toxic Substances and Disease Registry for their certification. When we receive the certified document, we will provide a copy to you for your records.

HEALTH CONSULTATION

For Consumption of Seafood From Houston Ship Channel and Upper Galveston Bay

May 12, 1997

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 Department of Health (TDH) Seafood Safety Division (SSD) requested that the TDH Health Risk Assessment and Toxicology Program evaluate the potential human health risks associated with consumption of seafood taken from the Houston Ship Channel and adjacent waters, including Upper Galveston Bay, north of a line connecting Red Bluff Point, five Mile Cut Marker and Houston Point. This area has been under a consumption advisory since September of 1990 due to contamination of catfish and crabs with chlorinated dibenzo-p-dioxins and dibenzofurans (dioxin). This advisory recommends that no more than one meal, not to exceed eight ounces of catfish and crabs, be consumed each month; in addition, women of child bearing age, and children were advised not to consume catfish or crabs from this area.
In 1986, as part of the National Bioaccumulation Study of dioxin contaminated soil, water, sediment, air, and fish, the U.S. Environmental Protection Agency (EPA) found elevated concentrations of dioxin in fish and shellfish in 11 sites within EPA's Region 6. These sites were downstream of bleach kraft pulp and paper mill discharges [1]. Twelve seafood samples obtained from the Houston Ship Channel and Upper Galveston Bay by EPA and TDH in 1990 showed dioxin levels up to 15 parts per trillion (ppt) in catfish and crabs. On September 19, 1990, TDH issued advisories for three areas of Texas, including the Houston Ship Channel and Upper Galveston Bay.

In 1994, as part of the Near Coastal Water Grant, EPA provided funds to TDH to further investigate the presence of chemical contaminants in seafood from four locations along the Texas coast. As part of this study, five samples from the Houston Ship Channel and upper Galveston Bay were analyzed for dioxins. From this limited data set, a slight decrease was observed in average dioxin levels for sea catfish, blue crabs, and oysters as compared to the 1990 data (Appendix A).

DISCUSSION

In April of 1996, the SSD collected 24 seafood samples from the Houston Ship Channel and upper Galveston Bay in order to re-evaluate the consumption advisory issued in 1990. These samples, which consisted of 10 finfish, 4 composite oyster samples, and 10 composite crab samples were analyzed for dioxins (Appendix B). Results indicated that the Toxicity Equivalent Concentration (TEC) for dioxins and furans was 3.4 ppt. The major contributor to the TEC is 2,3,7,8-tetrachlorodibenzodioxin.

TABLE 1 SUMMARY OF 1996 DIOXIN SAMPLING RESULTS SEAFOOD OBTAINED FROM THE HOUSTON SHIP CHANNEL AND UPPER GALVESTON BAY

Species	# samples	Concentration Range (ppt) TEC*	Average Concentration (ppt) TEC	Associated Theoretical Lifetime Cancer Risk**	No. Meals per month equivalent to 1 x 10^{-4} risk***
Sea Catfish	3	7.0 - 14.3	10	2.9 x 10^{-4}	1.4
Blue Crabs	10	0.5 - 5.0	2.7	7.7 x 10^{-5}	2
Oysters	4	3.2 - 3.5	3.3	9.4 x 10^{-5}	4.2
Other finfish	7	0.06 - 6.1	1.6	4.6 x 10^{-5}	9
All seafood	24	0.06 - 14	3.4	9.7 x 10^{-5}	4.1

*The overall dioxin concentration (Toxicity Equivalency Concentration) is obtained by using toxic equivalency factors for the various dioxins and furans to normalize them to the toxicity of 2,3,7,8-tetrachlorodibenzodioxin (2,3,7,8-TCDD), the most toxic dioxin isomer
**Assumes an exposure period of 30 years, a consumption level of 30 grams/day, and a body weight of 70 kg
***fish meal size approximately eight ounces, crab meal size approximately seven crabs

Toxicological Evaluation

Dioxin

In 1985 the EPA classified dioxins and furans as Group B2, probable human carcinogens, based on increased incidence of hepatic carcinoma in laboratory animals. This means that although evidence of carcinogenicity in humans is inadequate, there are sufficient animal carcinogenicity data to consider dioxin a probable human carcinogen. The quantitative cancer slope factor that the EPA currently lists in the Health Effects Summary Tables (HEAST) is 1.56 x 10^{5} $(mg/kg/day)^{-1}$. This is based on increased incidence of liver tumors in animals exposed experimentally; however, this risk estimate is considered controversial and currently is being reevaluated by the EPA [2]. The overall dioxin concentration is obtained by using toxic equivalency factors for the various dioxins and furans to normalize them to the toxicity of 2,3,7,8-tetrachlorodibenzodioxin (2,3,7,8-TCDD), the most toxic dioxin isomer.

The theoretical excess lifetime risk of cancer associated with consumption of seafood from the advisory area of the Houston Ship Channel was based on a body weight of 70 kg, an exposure period of 30 years, and an average consumption of 30 grams per day, or approximately one 8 ounce meal per week. Thirty (30) grams per day represents an estimate of the average consumption of fish and shellfish from marine and fresh waters by the 50th percentile of recreational fishers [3]. Considering combined consumption of all species, the associated risk is 9.7 x 10^{-5}. The Texas Department of Health recommends that consumption of carcinogenic chemicals be limited to amounts that result in an estimated excess theoretical lifetime cancer risk of less than 1x10^{-4}.

Risk Interpretation by Species

The current consumption advisory for the Houston Ship Channel recommends limited consumption of catfish and crabs due to elevated levels of dioxin found in 1990. Results of samples collected for the 1994 EPA Near Coastal Waters Grant confirmed the need for a consumption advisory. The 1996 data includes catfish, blue crabs, oysters, and other finfish. In order to assess the potential risks associated with consumption of these species, we calculated a theoretical lifetime cancer risk associated with the individual species and an overall theoretical lifetime cancer risk for combined consumption of all species investigated. Results indicate that the carcinogenic risk associated with consuming 30 grams per day (approximately eight ounces per week) of catfish is the highest of all species investigated; with a theoretical lifetime risk of approximately 3×10^{-4}.

Consumption of approximately 14 crabs per month would exceed the 1×10^{-4} risk level. Based on an estimate that one crab would produce approximately three ounces of edible tissue, we estimate that 14 crabs per month would be equivalent to about two meals per month. There may be considerable variability in the number of meals obtained from 14 crabs due to seasonal variation and differences in individual crab size. Consuming 30 grams per day, or approximately 10 crabs per month is equivalent to a 7.7×10^{-5} risk level.

Four composite oyster samples contained an average level of 3.3 ppt dioxin. Oysters are regulated by the TDH Seafood Safety Division under the Texas Molluscan Shellfish Rules. Oysters in the advisory area of the Houston Ship Channel are not consumed by the public since they are currently restricted for direct marketing and recreational harvest; therefore, we considered risk determinations for this species unnecessary for this health consultation.

Seven finfish samples, including sea trout, flounder, sheepshead, red drum, and black drum contained an average concentration of 1.6 ppt dioxin. The theoretical lifetime cancer risk associated with consuming 30 grams per day of fish other than catfish is approximately 4.6×10^{-5}.

Non-Carcinogenic Risk

To evaluate non-carcinogenic risk, the average concentration of dioxin was compared to the Agency for Toxic Substances and Disease Registry's (ATSDR) Minimum Risk Level (MRL) of 1×10^{-9} $(mg/kg/day)^{-1}$ for chronic exposure to dioxin. The MRL is an estimate of daily human exposure to a contaminant that is unlikely to cause non-cancer adverse health effects over a lifetime. Catfish and crabs from the Houston Ship Channel Advisory Area exceeded the MRL for chronic oral exposure.

CONCLUSIONS

1. The average concentration of dioxin detected in catfish from the advisory area of the Houston Ship Channel is 10 ppt. Based on the 1996 data, the overall theoretical excess lifetime cancer risk for persons consuming four eight (8) ounce meals per month of catfish from the advisory area of the Houston Ship Channel is estimated to be 3×10^{-4}. Qualitatively this risk can be interpreted as a low increased risk for cancer over a lifetime of exposure.

2. The average concentration of dioxin detected in crabs from the advisory area of the Houston Ship Channel is 2.7 ppt. The theoretical excess cancer risk associated with consumption of approximately two crab meals per month (7 crabs per meal) is estimated to be 1×10^{-4}. Qualitatively, this is interpreted as a low increased risk for cancer over a lifetime of exposure.

3. Oysters contained an average level of 3.3 ppt dioxin. Since public consumption of oysters in the Houston Ship Channel is currently restricted, risk determinations for this species were not necessary for this consultation.

4. Other finfish contained an average concentration of 1.6 ppt dioxin, with an associated theoretical lifetime cancer risk of 4.6×10^{-5}. Qualitatively, this is interpreted as no apparent increased risk for cancer over a lifetime of exposure.

RECOMMENDATIONS

1. The Houston Ship Channel advisory of 1990 should continue to limit consumption of catfish and crabs.

2. If the restricted status of oysters in the Houston Ship Channel advisory area should change in the future, inclusion of oysters in the consumption advisory should be considered due to dioxin contamination of these oysters.

3. Other species of fish should remain excluded from the consumption advisory since they do not pose a significant health risk.

REFERENCES

1. EPA, 1987. The National Dioxin Study. U.S. Environmental Protection Agency, Washington, D.C. EPA 440/4-87-003.

2. IRIS, 1997. Integrated Risk Information System. U.S. Environmental Protection Agency, Office of Health and Environmental Assessment, Environmental Criteria and Assessment Office. Cincinnati, OH.

3. EPA, 1995. Guidance for Assessing Chemical Contaminant Data For Use in Fish Advisories. Vol. 1. Fish Sampling and Analysis, Office of Science and Technology. Wash. D.C.

APPENDICES

Appendix A

HISTORICAL SEAFOOD SAMPLING DATA HOUSTON SHIP CHANNEL AND UPPER GALVESTON BAY		
YEAR - LOCATION	**SPECIES**	**DIOXIN CONCENTRATION (PPT)**
1990 - Houston Ship Channel	Sea Catfish	14.96
	Croaker	1.19
	Blue crab	3.53
	Oysters	8.72
	Oysters	7.69
	Blue Catfish	3.2
	Red Drum	0.66
1990 - Upper Galveston Bay	Blue crab	6.23
	Oyster	4.8
	Red drum	nd
	Oyster	2.6
	Red drum	0.041
1994 - Houston Ship Channel	Sea catfish	4.8
1994 - Galveston Bay	Oysters	3.5
	Blue crabs	1.4
	Blue crabs	1.3
	Blue crabs	2.3

Appendix B
Dioxins and Furans in Seafood Taken From the Houston Ship Channel Advisory Area
April 1996

Sample #	HSC-1	HSC-3	HSC-4	HSC-5	HSC-6	HSC-7	HSC-8	HSC-9	HSC-11	SAJ-1	SAJ-2	TRI 359-1
FURANS (ppt)												
2378 TCDF	ND	0.8	3.7	2.1	3.8	**4.01**	**3.2**	0.7	0.7	0.1	0.45	5.1
12378 PeCDF	ND	0.3	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.098
23478 PeCDF	ND	ND	**0.2**	ND	0.2	0.2	ND	0.7	ND	ND	ND	0.3
123478 HxCDF	ND	ND	0.1	0.08	0.1	0.1	ND	ND	0.1	ND	ND	ND
123678 HxCDF	ND	ND	ND	ND	ND	0.06	ND	ND	ND	ND	ND	ND
234678 HxCDF	ND	ND	ND	ND	ND	ND	ND	ND	0.09	ND	ND	ND
123789 HxCDF	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1234678 HpCDF	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1234789 HpCDF	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
OCDF	ND	ND	ND	ND	ND	ND	0.1	ND	ND	ND	ND	ND
DIOXINS (ppt)												
2378 TCDD	8.0	0.6	**3.7**	**2.4**	4.5	**3.7**	3.9	13.6	5.7	0.4	2.8	2.7
12378 PeCDD	ND	ND	ND	ND	0.1	ND	ND	0.5	ND	ND	ND	ND
123478 HxCDD	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
123678 HxCDD	0.6	0.2	ND	ND	ND	ND	ND	0.7	0.3	ND	ND	0.3
123789 HxCDD	ND	ND	ND	ND	ND	0.09	0.1	ND	ND	ND	ND	ND
1234678 HpCDD	0.9	0.2	0.3	0.25	0.2	0.3	0.3	0.9	**0.46**	ND	0.2	0.6
OCDD	2.15	0.7	6.4	0.8	1.1	1.45	3.3	2.5	1.4	ND	0.7	5.3
TOXICITY WEIGHTED CONCENTRATION* PG/G	8.1	0.7	**4.2**	**2.6**	5.0	**4.2**	4.2	**14.3**	**6.1**	0.4	**2.8**	3.4

*concentration determined by using toxicity weighted total concentrations for furan and dioxin congeners with comparison to 2,3,7,8 TCDD

Date, Sample #,Species, Size,

HSC-1	Sea Catfish	37.5 cm
HSC-3	Spotted Sea trout	38 cm
HSC-4	Blue Crab	16 cm,17 cm,18 cm,17 cm
HSC-5	Blue Crab	18 cm,17.5 cm,18 cm,17 cm
HSC-6	Blue Crab	16.5 cm,16 cm,18 cm,17 cm
HSC-7	Blue Crab	17 cm,16 cm,17 cm,15 cm
HSC-8	Blue Crab	17 cm,16 cm,17 cm,18cm
HSC-9	Sea Catfish	35 cm,37 cm
HSC-11	Southern Flounder	38 cm
SAJ-1	Sheepshead	40 cm
SAJ-2	Southern Flounder	43 cm
TRI 359-1 Oyster		20 - 3-4"

Appendix B continued
Dioxins and Furans in Seafood Taken From the Houston Ship Channel Advisory Area
April 1996

Sample #	TRI 359-2	TAB-3	TAB-4	TAB-6	TAB-8	GAL 92-1	GAL 92-2	GAL 122-1	GAL 122-2	GAL 122-3	GAL 122-4	GAL 122-5
FURANS (ppt)												
2378 TCDF	4.9	0.5	0.1	0.4	ND	4.5	4.7	0.4	**1.8**	**1.47**	1.1	1.1
12378 PeCDF	0.08	ND	ND	ND	ND	ND	ND	0.05	0.3	ND	ND	**ND**
23478 PeCDF	0.3	ND	ND	ND	0.5	0.2	ND	ND	0.2	ND	ND	**0.1**
123478 HxCDF	ND	ND	ND	ND	ND	ND	ND	ND	0.2	ND	ND	ND
123678 HxCDF	ND	ND	ND	ND	ND	ND	ND	ND	0.07	0.05	ND	ND
234678 HxCDF	ND	ND	ND	ND	ND	ND	ND	ND	0.07	ND	ND	ND
123789 HxCDF	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1234678 HpCDF	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.7	ND	ND
1234789 HpCDF	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
OCDF	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.099	ND	ND
DIOXINS (ppt)												
2378 TCDD	2.8	0.4	0.95	ND	6.4	2.7	2.7	0.45	1.6	1.6	**1.3**	1.1
12378 PeCDD	ND	ND	ND	ND	0.4	ND	ND	ND	0.2	ND	ND	0.08
123478 HxCDD	0.2	ND	ND	ND	ND	0.2	0.2	0.07	0.1	ND	0.1	ND
123678 HxCDD	0.4	**0.16**	0.09	ND	0.9	0.3	0.35	0.08	0.2	0.2	0.2	ND
123789 HxCDD	0.3	**ND**	ND	**0.16**	0.4	0.3	ND	ND	ND	0.1	ND	ND
1234678 HpCDD	0.5	ND	0.2	0.3	1.1	0.9	0.9	0.3	0.3	2.4	ND	0.3
OCDD	4.5	1.6	0.55	0.8	2.1	10.4	9.2	6.0	2.7	11.6	2.3	2.2
TOXICITY WEIGHTED CONCENTRATION* PG/G	3.5	**0.47**	0.97	**0.06**	**7.0**	3.3	**3.2**	0.5	**2.1**	1.8	**1.4**	1.3

*concentration determined by using toxicity weighted total concentrations for furan and dioxin congeners with comparison to 2,3,7,8 TCDD

Sample #,Species, Size

TRI 359-2	Oyster	20 - 3-4"
TAB-3	Red Drum	68 cm
TAB-4	Southern Flounder	41.5 cm
TAB-6	Black Drum	51 cm
TAB-8	Sea Catfish	39 cm,40 cm,40 cm
GAL 92-1	Oyster	100 - 1-2"
GAL 92-2	Oyster	100 - 1-2"
GAL 122-1	Blue Crab	18 cm,15 cm,18 cm,17 cm
GAL 122-2	Blue Crab	15 cm, 16 cm,16 cm,17 cm
GAL 122-3	Blue Crab	19 cm,18 cm,15 cm,15cm
GAL 122-4	Blue Crab	15 cm,16 cm,18 cm,16 cm
GAL 122-5	Blue Crab	15 cm,14 cm,17 cm,15 cm,17 cm