TEXAS DEPARTMENT OF HEALTH

RISK DETERMINATION
FOR

CONSUMPTION OF FISH FROM
THE DONNA IRRIGATION SYSTEM

A Report Prepared
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INTRODUCTION

Polychlorinated biphenyls (PCB's) are a group of aromatic halogenated compounds commercially produced in the U.S. since 1920. Over 209 congeners of PCB's exist, while only 47 are toxicologically important. Monsanto, the largest producer of PCB's in the U.S. sold them under the trade name "Aroclor" and the term is frequently used interchangeably with PCB. Each aroclor is given a four digit number, the first two digits indicate the number of carbon atoms in the molecule and the second two indicate percent chlorination. The higher the degree of chlorination, the more toxic the aroclor.

PCB's are characterized by relatively high environmental persistence and toxicity. Generally, background levels of PCB's are higher in the aquatic environment than in the terrestial environment. Aquatic systems are the main ultimate sink of PCB's. Due to their highly lipophilic nature these compounds have strong tendencies to bioaccumulate in aquatic organisms and particularly in fish. The most common route of human exposure occurs through consumption of fish and shellfish from PCB contaminated waters.

PCB residues in adipose tissue of the general population in industrialized countries range from 1 to 5 parts per million. Plasma PCB residues in the general population have been found to range from 5 to 50 parts per billion. Because PCB's are lipophilic, they tend to accumulate in body fat and are rapidly removed from the bloodstream to be stored in body fat. The biological half life is approximately one year.

PCB's are capable of bioaccumulating in fish tissue at a rate of 31,000 times the level in surrounding water. The consistency of PCB's is similar to that of mineral oil, therefore they are rarely found in water and readily settle out to sediments below, where they may remain with a half life of approximately 4 years. The insolubility of PCB's in water helps to prevent contamination of drinking water supplies. Because PCB's strongly adhere to soil particles, leaching from soil to plants and vegetables does not occur. Fish are the best indicator of PCB's in the environment.

ENVIRONMENTAL SOURCES

* leaks or emmisions of capacitor and transmitter fluids
* production of herbicides, pesticides, chlorophenols and chlorobenzenes
* metal industry and mining (lubricating and hydraulic oils)
* plasticizer uses in paints, plastics, adhesives and caulking compounds
* laboratory immersion oils
* wood preservation (chlorophenols)
* agricultural work (pesticides and herbicides)
* dye carriers in carbonless copy paper
* burning of landfill or municipal waste containing PCB devices

CHRONOLOGY OF EVENTS

The Donna Irrigation District Reservoir is located in the Rio Grande Valley, in Hidalgo County, southwest of the city of Donna, Texas. Sampling sites were selected based on information reporting a high PCB concentration in a fish tissue sample collected by an EPA contract study on dietary intakes in the Rio Grande area. People were observed fishing at the site and trash and paths on the banks indicated this was a high use area.

Initial fish sampling was conducted on May 24, 1993. Eleven fish samples were collected and analyzed for PCB's, pesticides, and metals. Four of the eleven samples exceeded the FDA tolerance level of 2 ppm PCB's for fish and shellfish and two samples approached the tolerance level see Table 1. Pesticide and metal levels were not found to be of public health concern. A fish consumption advisory was issued for Donna Reservoir and its interconnecting canal system due to elevated levels of PCB's in fish tissue.

On June 29, 1993, the aquatic life survey team returned to the Rio Grande Valley to expand sampling in Hidalgo county. Irrigation districts and lakes were selected east and west of Donna Reservoir to determine the extent of the PCB contamination in Hidalgo county. Thirty fish samples were collected. PCB concentrations fell below the detection limit for all thirty samples. **The EPA "National Study of Chemical Residues in Fish" revealed a concentration of 6.5 - 1000 ppb PCB's in fish from the lower Rio Grande Valley** (EPA Contract Grant No. 68-C9-0013).

In January of 1994, 20 additional fish samples were collected from the Donna Irrigation System. Eight of twenty samples collected approached or exceeded the FDA action level for PCB's, with four fish containing between 4 ppm and 24 ppm. The Donna

Irrigation District was declared a prohibited area for the taking of aquatic life.

HISTORY OF REGULATION

More than one billion pounds of PCB's were produced in the U.S. before 1977, with Monsanto producing over 93%. In 1976, Congress passed the Toxic Substances Control Act. Among other things, the act required the Environmental Protection Agency to regulate PCB's. As a result of increasing research on the biological effects over this family of chemicals and a combination of governmental and public concern over environmental persistence, PCB manufacture was banned in the United States in 1977.

It is estimated that approximately one fourth of the U.S. production prior to the 1977 ban remains in electrical service today. It is probable than any power capacitor manufactured before 1979 is filled with 100% PCB dielectric fluid since the average lifetime of these units is 30 years. PCB's are carried long distances in air and have been found as far from industrialized areas as the seawater of Antarctica.

In 1979, the **Food and Drug Administration established a maximum tolerable level for PCB's in fish tissue at 2 parts per million.** FDA action levels relate to the suitability of seafood products for interstate commerce. The EPA risk based approach is considered to be more appropriate for defining human health risk for particular waterbodies and is designed for long term protection of consumers of locally caught fish. EPA recommends a screening value of 1.4 ppm and above as the level at which the states should consider a fish consumption ban (EPA, 1993).

TABLE 1

PCB'S IN FISH TISSUE TAKEN FROM THE DONNA IRRIGATION SYSTEM on May 26, 1993

LOCATION	SPECIES	C/S[a] (cm)	AROCLOR								
			1016	1221	1221	1232	1242	1248	1254	1260	1262
DONNA IRRIGATION CANAL	LARGEMOUTH BASS	S (44)	nd[b]	nd	nd	nd	nd	nd	1.4[c]	nd	nd
	CHANNEL CATFISH	C (48,44)	nd	nd	nd	nd	nd	nd	1.6	nd	nd
	SMALLMOUTH BUFFALO	C (44,43,42)	nd	nd	nd	nd	nd	nd	7.7	nd	nd
	SMALLMOUTH BUFFALO	C (48,44,48)	nd	nd	nd	nd	nd	nd	9.3	nd	nd
NORTH FLOODWAY (ARROYO COLORADO)	SMALLMOUTH BUFFALO	S (40)	nd	nd	nd	nd	nd	nd	4.8	nd	nd
DONNA RESERVOIR (EAST SIDE)	COMMON CARP	C (50,51,52)	nd	nd	nd	nd	nd	nd	nd	nd	nd
	SMALLMOUTH BUFFALO	S (67)	nd	nd	nd	nd	nd	nd	9.6	nd	nd
	CHANNEL CATFISH	S (42)	nd	nd	nd	nd	nd	nd	0.055	nd	nd
	YELLOW CATFISH	S (42)	nd	nd	nd	nd	nd	nd	nd	nd	nd
	WHITE BASS	C (32,32,37)	nd	nd	nd	nd	nd	nd	nd	nd	nd
	ASIAN CARP	S (64)	nd	nd	nd	nd	nd	nd	nd	nd	nd

[a]composite or single sample type
[b]non-detectable
[c]all units in parts per million

TABLE 2

PCB'S IN FISH TISSUE TAKEN FROM THE DONNA IRRIGATION SYSTEM on Jan 3, 1994

LOCATION	SPECIES	C/S[a] (cm)	AROCLOR								
			1016	1221	1221	1232	1242	1248	1254	1260	1262
Site A DONNA IRRIGATION CANAL 1.5 MILES NORTH OF PUMP STATION	TILAPIA AUREA	S (29)	nd[b]	nd	nd	nd	nd	nd	nd	nd	nd
	COMMON CARP	S (45)	nd	nd	nd	nd	nd	nd	nd	nd	nd
	SMALLMOUTH BUFFALO	S (41)	nd	nd	nd	nd	nd	nd	6.3[c]	nd	nd
	SMALLMOUTH BUFFALO	S (39)	nd	nd	nd	nd	nd	nd	8.8	nd	nd
	SMALLMOUTH BUFFALO	S (39)	nd	nd	nd	nd	nd	nd	4.0	nd	nd
Site B DONNA IRRIGATION CANAL 3.5 MILES NORTH OF PUMP STATION	LARGEMOUTH BASS	S (42)	nd	nd	nd	nd	nd	nd	1.8	nd	nd
	LARGEMOUTH BASS	S (44)	nd	nd	nd	nd	nd	nd	1.5	nd	nd
	COMMON CARP	S (41)	nd	nd	nd	nd	nd	nd	1.1	nd	nd
	COMMON CARP	S (44)	nd	nd	nd	nd	nd	nd	0.34	nd	nd
	COMMON CARP	S (39)	nd	nd	nd	nd	nd	nd	24	nd	nd
Site C DONNA RESERVOIR WEST SIDE	CHANNEL CATFISH	S (43)	nd	nd	nd	nd	nd	nd	nd	nd	nd
	WHITE BASS	C (35,36)	nd	nd	nd	nd	nd	nd	nd	nd	nd
	TILAPIA AUREA	S (27)	nd	nd	nd	nd	nd	nd	nd	nd	nd
	COMMON CARP	C (37,37,35)	nd	nd	nd	nd	nd	nd	nd	nd	nd
	COMMON CARP	S (43)	nd	nd	nd	nd	nd	nd	0.08	nd	nd
Site D DONNA RESERVOIR EAST SIDE	COMMON CARP	S (54)	nd	nd	nd	nd	nd	nd	nd	nd	nd
	COMMON CARP	S (66)	nd	nd	nd	nd	nd	nd	nd	nd	nd
	COMMON CARP	S (43)	nd	nd	nd	nd	nd	nd	nd	nd	nd
	WHITE BASS	C (37,37)	nd	nd	nd	nd	nd	nd	nd	nd	nd
	WHITE BASS	C (36,33,34)	nd	nd	nd	nd	nd	nd	nd	nd	nd

[a]composite or single sample type
[b]non-detectable
[c]all units in parts per million

TOXICOLOGICAL EFFECTS

NON-CARCINOGENIC

Toxic effects of PCB's include immunosuppression, developmental delay in infants exposed prenatally, nervous system disorders, renal effects, male reproductive effects, chloracne, and red blood cell rupture. EPA designates a reference dose (RfD) for non-carcinogenic effects as an estimate of the daily exposure for the human population, including sensitive subpopulations, that is likely to be without an appreciable risk of deleterious effects during a lifetime. The EPA is currently developing RfD's for the noncarcinogenic toxicological effects of various commercial mixtures of PCB's.

CARCINOGENIC EFFECTS

Animal Systems

A great deal of attention has been devoted to the possibility that exposure to PCB's may lead to or contribute to cancer. PCB's appear to be at the worst, very weak genotoxicants (cancer causing agents through reaction with DNA); or weak initiators of carcinogensis in animal systems. Their well established activity at moderately high levels depends on their ability to act as promoters of hepatocarcinogenisis in rodents. Many studies in laboratory rodents previously initiated with various genotoxic carcinogens have clearly established that subsequent exposure to PCB's promotes carcinogenesis in the liver. PCB's increase the numbers of phenotypically altered populations of hepatocytes and accelerates their rate of development into persistent hepatomas.

Cancer promotion by PCB's is dose dependent and there appears to be a threshold dose below which promotion of preneoplastic liver lesions are not observed. This threshold for promotion may be well above the levels encountered in humans exposed to PCB's. The promoting influence of PCB's on carcinogenicity in rodents appears to be specific for the liver. EPA has classified PCB's as probable human carcinogens based on a combination of sufficient evidence in animals and inadequate data in humans (B2).

THEORETICAL HUMAN CARCINOGENIC EFFECTS

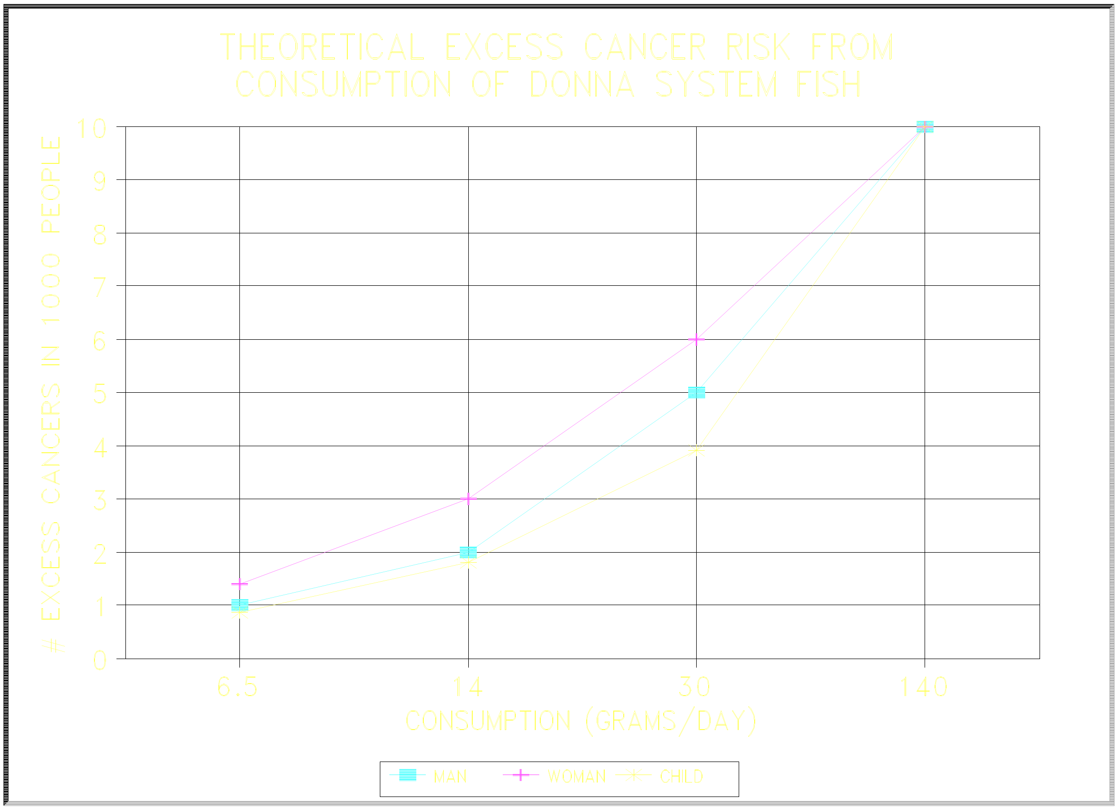
Humans are constantly exposed in their environment to a vast array of chemicals that are foreign to their body (xenobiotics). In general, compounds which are polar or hydrophilic are rapidly excreted and compounds which are nonpolar or lipophilic are rapidly absorbed into the body and slowly metabolized and excreted. PCB's (being lipophilic) are distributed to the liver and muscle tissue initially and are then ultimately stored in adipose tissue.

Fortunately, animal systems have developed a number of biochemical processes that convert lipophilic compounds to more hydrophilic metabolites. This biotransformation is enzymatic in nature and can result either in detoxification and rapid elimination of a chemical, or in some cases, enhanced toxicity of a chemical through its biotransformation to more toxic metabolites. The enzyme systems that catalyze these biotransformations are located primarily in the liver and are collectively termed the cytochrome P-450 system or the mixed function oxygenase system. **It has been well documented in humans that PCB's are capable of inducing the cytochrome P-450 system in the liver.** At this point it is not well known whether active metabolites are responsible for hepatocarcinogenisis or if PCB's themselves cause cell injury and death. PCB's are capable of being oxidized to dioxins and furans, which have been well established as potent carcinogens. This gives rise to the argument that PCB symptoms can be explained by the presence of dioxins and furans, not PCB's

THEORETICAL EXCESS CANCER RISK FROM CONSUMPTION OF FISH TAKEN FROM THE DONNA IRRIGATION SYSTEM*

CONSUMPTION GRAMS/DAY	EXCESS CARCINOGENIC RISK				
	CHILD	WOMAN		MAN	
	10 YEAR EXPOSURE	70 YEAR EXPOSURE	30 YEAR EXPOSURE	70 YEAR EXPOSURE	30 YEAR EXPOSURE
6.5	8×10^{-4}	3×10^{-3}	1×10^{-3}	3×10^{-3}	1×10^{-3}
14	2×10^{-3}	7×10^{-3}	3×10^{-3}	5×10^{-3}	2×10^{-3}
30	4×10^{-3}	10^{-2}	6×10^{-3}	10^{-2}	5×10^{-3}
140	10^{-2}	10^{-2}	10^{-2}	10^{-2}	10^{-2}

*** CONCENTRATION DETERMINED BY CALCULATING THE UPPER 95TH PERCENTILE LEVEL OF EACH CARCINOGENIC CONTAMINANT SCREENED IN ALL SPECIES OF FISH TAKEN FROM THE DONNA IRRIGATION SYSTEM. CANCER RISK IS ADDITIVE TO INCLUDE ALL CARCINOGENIC CONTAMINANTS FOUND. RISK LEVELS WILL NOT EXCEED 10^{-2}, SINCE THE CARCINOGENIC SLOPE FACTOR BECOMES NONLINEAR AT THIS LEVEL.**



The theoretical cancer risk for consumption of fish from the Donna Irrigation System includes the additive carcinogenic potential of PCB's and pesticides detected. The exposure times to the chemicals are assumed to be 30 years for adult males and females and 10 years for children. Body weights are assumed to be 78kg for males, 65kg for females, and 36kg for children.

EPA RISK GUIDANCE

The EPA basis for decision making concerning risk associated with consumption of fish contaminated with carcinogenic contaminants is assessed in the following manner:

* EPA recommends that a risk level of 10^{-5} be used to provide adequate protection to the general public.

* When the 10^{-4} fish tissue criterion is exceeded, the state should consider issuing a fish consumption advisory for the species of concern, and when it is exceeded by more than one species, an advisory for the entire fishery.

* If the 10^{-3} criterion is exceeded, the state should consider issuing a fish consumption ban for that species, and when it is exceeded by more than one species, a ban for the entire fishery.

The state may establish other criteria, possibly through the use of alternate risk estimation procedures or policy to address allowable risk in edible fish tissue.

Screening values are defined as the target analyte concentrations of contaminants in edible fish tissue associated with a specified lifetime cancer risk. Screening values for carcinogens are derived from a carcinogenicity potency factor, or slope factor (q1*) which is the plausible upper bound estimate of the probability of a response per unit intake of a chemical over a lifetime. **In order to maintain the "adequate risk level" of 10^{-5} recommended by EPA, the concentration of fish contaminated with PCB's should not exceed 0.014 ppm* for a 70 kg adult consuming 6.5g/d over a 70 year lifetime (EPA, 1993).**

It is not possible to know the "average concentration" of a contaminant at a particular site, due to limited sampling and extreme variability in contaminant concentration in a population of fish. To address the problem of modelling long term exposure to a contaminant based on limited sampling and natural variability in concentration in a population, a 95% upper confidence limit of the arithmetic mean concentration should be calculated for the pesticides and PCB's detected in the Donna Irrigation System (EPA, 1992). This estimate is based on a true set of site sampling results and provides reasonable confidence that the true site average will not be underestimated. For the PCB data collected at Donna Reservoir and Irrigation Canals, this **95% upper confidence limit of the mean concentration was determined to be 4.2 ppm** for the 31 samples collected**. This data set should be considered a normal distribution since the population has an equal potential for exposure to the contaminant.

* SV= [(RL/SF)*BW] / CR where SV=screening value for a carcinogen; RL=maximum acceptable risk level; SF=slope factor (7.7 mg/kg/day) BW=body weight (70 kg adult); and CR=consumption rate (6.5 g/day)

TABLE 3

PCB contaminated fish consumptions (grams per day) that result in a 10^{-3} risk level (closure advised by EPA) for persons of various body weights and for various levels of PCB in fish tissue*

Body Weight		Level of PCB in fish tissue (ppm)												
kg	lb	1	2	4	6	8	10	12	14	16	18	20	22	24
		Consumption Level of Concern (grams/day) for 10^{-3} Risk Level												
10	22	1	1	0	0	0	0	0	0	0	0	0	0	0
15	33	2	1	0	0	0	0	0	0	0	0	0	0	0
20	44	3	1	1	0	0	0	0	0	0	0	0	0	0
25	55	3	2	1	1	0	0	0	0	0	0	0	0	0
30	66	4	2	1	1	0	0	0	0	0	0	0	0	0
40	88	5	3	1	1	1	1	0	0	0	0	0	0	0
50	110	7	3	2	1	1	1	1	0	0	0	0	0	0
60	132	8	4	2	1	1	1	1	1	0	0	0	0	0
70	154	9	5	2	2	1	1	1	1	1	1	0	0	0
80	176	10	5	3	2	1	1	1	1	1	1	1	0	0
90	198	12	6	3	2	1	1	1	1	1	1	1	1	0
100	220	13	7	3	2	2	1	1	1	1	1	1	1	1

***CR = [RL/SF * BW]/CONC where CR=fish consumption rate; RL=risk level of 10^{-3}; SF=slope factor for PCB's of 7.7 mg/kg/day; BW=body weight; and CONC=concentration of contaminant**

The states may establish other criteria for decision making concerning issuing a fish consumption ban:

To adjust the consumption figures for decreasing risk levels, one would need to divide the consumption by ten for a 10^{-4} risk level and divide the consumption by 100 for a 10^{-5} risk level. These calculations assume a 70 year lifetime exposure to the contaminant.

CONCLUSION

On the basis of the information reviewed, the Texas Department of Health concludes that the Donna Irrigation System is of potential public health concern and that the fish in this system should be banned for public consumption. The fish are contaminated with PCB's, which have been proven to increase the incidence of hepatic tumors in laboratory animals and are considered probable human carcinogens. Long term ingestion of relatively small amounts of contaminated fish from this site will significantly increase the theoretical excess risk of developing cancer of the liver over a lifetime.

The FDA tolerance level for fish and shellfish was exceeded in 26% of the samples collected. The more conservative, yet more appropriate EPA recommended screening value of 1.4 ppm for a closure advisory for a person consuming only one meal per month of contaminated fish was exceeded in 39% of the samples collected.

The contamination is heaviest in the Donna irrigation canal. It appears that the contaminant is localized to Donna Reservoir and Irrigation Canals in the Rio Grande Valley, since subsequent sampling east and west of the area did not reveal PCB levels above detection limits. The source of the contamination is unknown at this time.

At the 95th percentile upper confidence limit on the mean concentration level, a 70 kg adult consuming a 2 gram per day serving (or 2 oz per month) of fish from this area would exceed the risk level at which the state should consider a fish consumption ban. Since this represents only about 1/4 of a typical fish meal per month, it is impractical and hazardous to consider the Donna Irrigation System as a source of any amount of fish for human consumption.

REFERENCES

U.S. Environmental Protection Agency. 1991. Risk Assessment Guidance for Superfund, Volume 1: Human Health Evaluation Manual. Supplemental Guidance. "Standard Default Exposure Factors".

U.S. Environmental Protection Agency. 1992. Risk Assessment Guidance for Superfund, Volume 1: Human Health Evaluation Manual. Supplemental Guidance. "Calculating the Concentration Term".

U.S. Environmental Protection Agency. 1993. Fish Sampling and Analysis: A Guidance Document for Issuing Fish Advisories

U.S. Environmental Protection Agency. 1994. Integrated Risk Information System (IRIS). National Institutes of Health. National Library of Medicine network system used for PCB toxicology and regulatory information.

ATTACHMENTS

TABLE 4

PESTICIDES IN FISH TISSUE TAKEN FROM THE DONNA IRRIGATION SYSTEM ON May 26, 1993

	SAMPLE #									
PESTICIDE	1	2	3	4	6	7	8	9	10	11
DDT	nd[a]	nd	nd	nd	nd	nd	nd	nd	nd	nd
DDD	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
DDE	280[b]	140	460	110	50	380	66	44	200	61
ALDRIN	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
DEILDRIN	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
ENDRIN	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
CHLORDANE	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
HEPTACHLOR	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
HEPTACHLOR EPOX	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
METHOXYCHLOR	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
TOXAPHENE	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
HEXACHLOROBENZENE	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
MALATHION	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
ETHYL PARATHION	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
METHYL PARATHION	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
DIAZINON	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
CHLOROPYRIFOS	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
ENDOSULFAN	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
ENDOSULFAN SULFATE	nd	nd	nd	nd	nd	11	nd	nd	nd	nd
ALACHLOR	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
DACTHAL	nd	nd	nd	nd	nd	30	nd	nd	nd	nd
ALPHA BHC	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
BETA BHC	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
DELTA BHC	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
LINDANE	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd

[a]non-detectable
[b]units given in ug/kg (parts per billion) wet weight

SAMPLE	**SPECIES (SAMPLE TYPE, LENGTH (cm))**	**LOCATION**
#1	Largemouth Bass (single; 44)	Donna Irrigation Canal
#2	Channel Cafish (composite; 48,44)	Donna Irrigation Canal
#3	Smallmouth Buffalo (composite; 44,43,42)	Donna Irrigation Canal
#4	Smallmouth Buffalo (composite; 44,48,48)	Donna Irrigation Canal
#6	Common Carp (composite; 50,51,52)	Donna Reservoir (East)
#7	Smallmouth Buffalo (single; 67)	Donna Reservoir (East)
#8	Channel Catfish (single; 42)	Donna Reservoir (East)
#9	Yellow Catfish (single; 42)	Donna Reservoir (East)

#10	White Bass (composite; 32,32,37)	Donna Reservoir (East)
#11	Asian Carp (single; 64)	Donna Reservoir (East)

TABLE 5

PESTICIDES IN FISH TISSUE TAKEN FROM THE DONNA IRRIGATION SYSTEM on Jan. 3, 1994

SPECIES C/S[a];cm	tilipia aurea S;29	common carp S;45	buffalo S;41	buffalo S;39	buffalo S;39	largemouth bass S;42	largemouth bass S;44	common carp S;41	common carp S;44	common carp S;39
LOCATION	Site A DONNA IRRIGATION CANAL 1.5 MILES NORTH OF RIVER PUMP STATION					Site B DONNA IRRIGATION CANAL 3.5 MILES NORTH OF RIVER PUMP STATION				
PESTICIDES										
ALDRIN	nd	nd	0.058	nd	nd	0.011	0.01	nd	nd	0.38
ALPHA-BHC	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
BETA-BHC	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
DELTA-BHC	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
GAMMA-BHC	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
CHLORDANE	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
DDD	nd	nd	nd	nd	nd	0.054	nd	0.023	nd	nd
DDE	0.041[c]	0.033	0.9	1.3	0.75	0.49	0.36	0.350	0.11	nd
DDT	nd	nd	nd	0.17	nd	0.037	nd	nd	nd	nd
DIELDRIN	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
ENDOSULFAN I	nd	nd	nd	0.32	0.16	nd	nd	nd	nd	nd
ENDOSULFAN II	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
ENDOSULFAN SULFATE	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
ENDRIN	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
METHOXYCHLOR	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
HEPTACHLOR	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
HEPTACHLOR EPOXIDE	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
TOXAPHENE	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
HCB	nd	nd	nd	0.002	0.002	nd	nd	nd	nd	nd
DIAZINON	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
METHYL PARATHION	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
ALACHLOR	nd	nd	nd	nd	nd	nd	nd	nd	nd	0.0095
MALATHION	nd	nd	0.075	nd	0.130	nd	nd	nd	nd	nd
CHLOROPYRIFOS	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
ETHYL PARATHION	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd

DACTHAL	nd	nd	0.053	nd	nd	0.0049	0.0046	0.014	0.0061	nd

[a]composite or single sample type
[b]non-detectable
[c]all units in ug/g (parts per million)

TABLE 5

PESTICIDES IN FISH TISSUE TAKEN FROM THE DONNA IRRIGATION SYSTEM on Jan. 3, 1994 (cont.)

SPECIES	channel catfish	white bass	tilapia aurea	common carp	common carp	common carp	common carp	common carp	white bass	white bass
C/S[a];cm	S;43	C;36,35	S;27	C;37,37,35	S;43	S;54	S;66	S;43	C;37,37	C;36,33,34
LOCATION	Site C DONNA RESERVOIR (WEST SIDE)					Site D DONNA RESERVOIR (EAST SIDE)				
PESTICIDES										
ALDRIN	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
ALPHA-BHC	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
BETA-BHC	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
DELTA-BHC	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
GAMMA-BHC	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
CHLORDANE	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
DDD	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
DDE	0.16[c]	0.016	0.011	0.06	0.13	0.05	0.1	0.043	0.46	0.036
DDT	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
DIELDRIN	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
ENDOSULFAN I	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
ENDOSULFAN II	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
ENDOSULFAN SULFATE	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
ENDRIN	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
METHOXYCHLOR	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
HEPTACHLOR	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
HEPTACHLOR EPOXIDE	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
TOXAPHENE	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
HCB	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
DIAZINON	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
METHYL PARATHION	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
ALACHLOR	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
MALATHION	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
CHLOROPYRIFOS	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd

ETHYL PARATHION	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
DACTHAL	nd	nd	nd	nd	nd	0.0037	0.0066	nd	0.0069	nd

[a]composite or single sample type
[b]non-detectable
[c]all units in ug/g (parts per million)

TABLE 6

METALS IN FISH TISSUE TAKEN FROM THE DONNA IRRIGATION SYSTEM on May 26, 1993

LOCATION	SPECIES	C/S[a] (cm)	METALS					
			As	Cd	Cu	Pb	Hg	Zn
DONNA IRRIGATION CANAL	LARGEMOUTH BASS	S (44)	nd[b]	nd	nd	nd	0.47	3.84
	CHANNEL CATFISH	C (48,44)	nd	nd	nd	nd	0.38	4.05
	SMALLMOUTH BUFFALO	C (44,43,42)	nd	nd	nd	0.37[c]	0.26	3.48
	SMALLMOUTH BUFFALO	C (48,44,48)	nd	nd	nd	nd	0.16	2.91
DONNA RESERVOIR (EAST SIDE)	COMMON CARP	C (50,51,52)	nd	nd	nd	nd	nd	5.83
	SMALLMOUTH BUFFALO	S (67)	nd	nd	nd	nd	0.16	2.69
	CHANNEL CATFISH	S (42)	nd	nd	nd	0.39	nd	3.49
	YELLOW CATFISH	S (42)	nd	nd	nd	nd	nd	3.57
	WHITE BASS	C (32,32,37)	nd	nd	nd	nd	0.34	2.74
	ASIAN CARP	S (64)	nd	nd	nd	nd	0.14	4.73

[a]composite or single sample type
[b]non-detectable
[c]all units in parts per million

EPA RECOMMENDED RISK ASSUMPTIONS

In assessing the risk that may be present to a population ingesting fish containing various levels of PCB's, several assumptions are made and several scenarios are provided. This risk assessment presents estimates of theoretical risk of excess number of cancers above the baseline level of 250 in 1000 people. The estimates assume that a person is ingesting the contaminated fish for a period of 30 years or 70 years (EPA, 1991). The person consuming the fish is assumed to be a 78kg male, a 65kg female, or a 36kg child (EPA, 1993). The following levels of fish consumption are EPA recommeded values for selected subpopulations (EPA, 1993):

6.5 g/d Estimate of the average consumption of fish and shellfish from estuarine and fresh waters by the **general U.S. population**.

14 g/d Estimate of the average consumption of fish and shellfish from marine, estuarine, and fresh waters by the **general U.S. population.**

30 g/d Estimate of the average consumption of fish and shellfish from marine, estuarine, and fresh water by the **50th percentile of recreational fishermen.**

140 g/d Estimate of the average consumption of fish and shellfish from marine, estuarine, and fresh waters by the **90th percentile of recreational fishermen (i.e. subsistence fishermen)**.

Number of meals represented by the above estimates:

6.5 g/d = one 7 ounce meal per month
14 g/d = two 7.5 ounce meals per month
30 g/d = one 8 ounce meal per week
140 g/d = four to five 8 ounce meals per week

TABLE 7

PCB'S IN FISH TISSUE TAKEN FROM THE DONNA IRRIGATION CANAL on March 3, 1994

LOCATION	SPECIES	C/S[a] (cm)	AROCLOR								
			1016	1221	1221	1232	1242	1248	1254	1260	12
DONNA IRRIGATION CANAL 1/4 MILE NORTH OF PUMP STATION	LARGEMOUTH BASS	C (39,38)	nd[b]	nd	nd	nd	nd	nd	nd	nd	n
	CHANNEL CATFISH	S (43)	nd	nd	nd	nd	nd	nd	nd	nd	n
	CHANNEL CATFISH (SKIN ON FILLET)	S (45)	nd	nd	nd	nd	nd	nd	nd	nd	n
	COMMON CARP	S (58)	nd	nd	nd	nd	nd	nd	nd	nd	n
	COMMON CARP	C (47,46,45)	nd	nd	nd	nd	nd	nd	nd	nd	n
	SMALLMOUTH BUFFALO	C (42,43)	nd	nd	nd	nd	nd	nd	nd	nd	n
DONNA IRRIGATION CANAL 3.5 MILES NORTH OF PUMP STATION	LARGEMOUTH BASS	S (51)	nd	nd	nd	nd	nd	nd	nd	nd	n
	SMALLMOUTH BUFFALO	S (38)	nd	nd	nd	nd	nd	nd	nd	nd	n
	COMMON CARP	S (46)	nd	nd	nd	nd	nd	nd	nd	nd	n
	COMMON CARP	S (43)	nd	nd	nd	nd	nd	nd	nd	nd	n

[a]composite or single sample type
[b]non-detectable

TABLE 8

PESTICIDES IN FISH TISSUE TAKEN FROM THE DONNA IRRIGATION CANAL on March 3, 1994

SPECIES C/S[a];cm	largemouth bass C;39,38	channel catfish S;43	channel catfish S;45	common carp S;58	common carp C;47,46,45	smallmouth buffalo C;42,43	largemouth bass S;51	smallmouth buffalo S;38	common carp S;46	common carp S;43
LOCATION	DONNA IRRIGATION CANAL 1/4 MILE NORTH OF PUMP STATION					DONNA IRRIGATION CANAL 3.5 MILES NORTH OF PUMP STATION				
PESTICIDE										
ALDRIN	nd	nd	0.0044	nd	nd	nd	nd	nd	nd	nd
ALPHA-BHC	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
BETA-BHC	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
DELTA-BHC	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
GAMMA-BHC	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
CHLORDANE	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
DDD	0.024[c]	nd	nd	nd	nd	nd	nd	nd	nd	nd
DDE	0.58	0.079	0.14	nd	0.013	0.067	0.077	0.11	0.017	0.05
DDT	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
DIELDRIN	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
ENDOSULFAN I	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
ENDOSULFAN II	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
ENDOSULFAN SULFATE	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
ENDRIN	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
METHOXYCHLOR	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
HEPTACHLOR	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
HEPTACHLOR EPOXIDE	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
TOXAPHENE	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
HCB	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
DIAZINON	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
METHYL PARATHION	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
ALACHLOR	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
MALATHION	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
CHLOROPYRIFOS	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
ETHYL PARATHION	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
DACTHAL	0.092	nd	0.0032	nd	nd	0.018	0.0054	0.016	nd	0.0054

[a]composite or single sample type
[b]non-detectable
[c]all units in ug/g (parts per million)