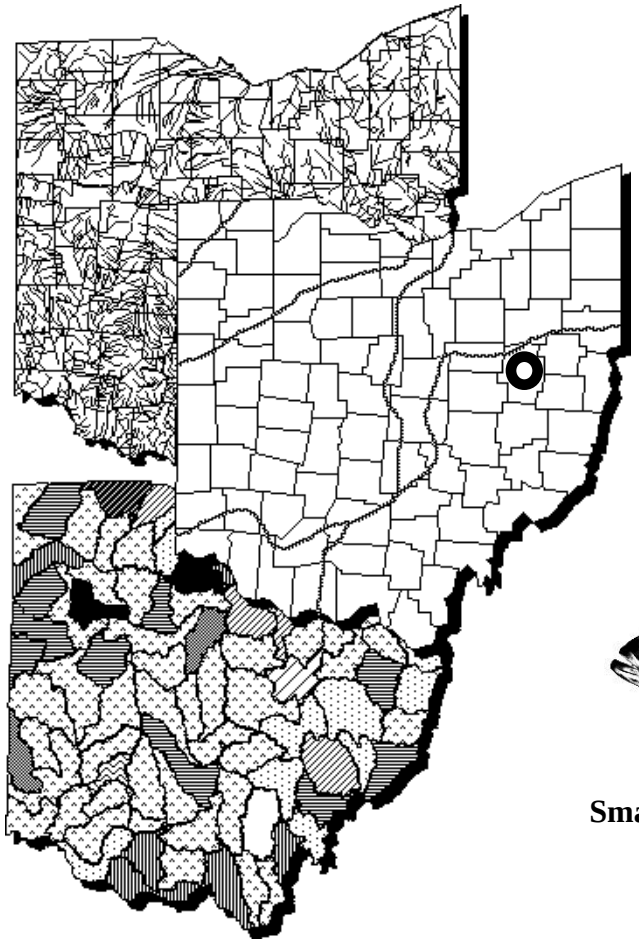
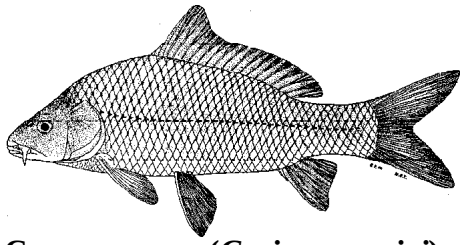
State of Ohio
Environmental Protection Agency

Monitoring and Assessment Section
Division of Surface Water

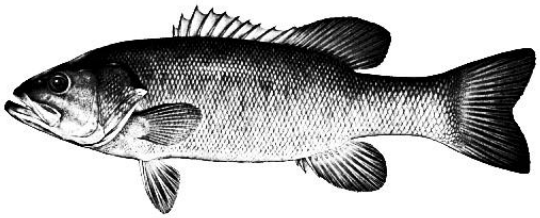
Fish Tissue Study of the Tuscarawas River and Sugar Creek

Tuscarawas County, Ohio





Common carp (*Cypinus carpioi*)



Smallmouth Bass (*Micropterus dolomieui*)

March 22, 1995

P.O. Box 1049, 1800 WaterMark Dr., Columbus, Ohio 43216-1049

Errata Sheet (dated 2/5/96)

Fish Tissue Study of the Tuscarawas River and Sugar Creek, March 22, 1995

The revised fish tissue PCB data presented below are based on revised results provided by the Ohio EPA Division of Emergency and Remedial Response contract lab. The initial results presented in the original report were determined to be improperly produced by the lab and therefore are unacceptable data.

Table 2. Pesticides, PCBs, selected metals, and lipid analyses of fish tissue collected from the Tuscarawas River and Sugar Creek study area, 1994.

	Sampling Location - by River Mile (RM)				
	Tuscarawas River				
	RM 58.5	**RM 58.5**	**RM 57.8**	**RM 57.8**	**RM 57.8**
	Common carp	Smallmouth bass	Common carp	Flathead catfish	Channel catfish
Parameter	SOFC[a]	SOFC	SOFC	SFF[b]	SFF
PCBs (ug/kg)					
PCB-1254	**800J**	**110J**	**130J**	**400J**	**210J**
PCB-1260	**300J**	**43J**	**34J**	**140J**	**79J**

	RM 55.0	**RM 55.0**	**RM 55.0**	**RM 39.6**	**RM 39.6**
	Common carp	Smallmouth bass	Channel catfish	Common carp	Smallmouth bass
Parameter	SOFC	SOFC	SFF	SOFC	SOFC
PCBs (ug/kg)					
PCB-1254	**420J**	**75J**	**160J**	**2100J**	**50J**
PCB-1260	**92J**	**23J**	**50J**	**570J**	**23J**

	RM 39.6	**RM 38.7**	**RM 38.7**	**RM 38.7**	**RM 38.7D**
	Channel catfish	Common carp	Smallmouth bass	Channel catfish	Channel catfish
Parameter	SFF	SOFC	SOF[c]	SFF	SFF
PCBs (ug/kg)					
PCB-1254	**100J**	**94J**	**60J**	**140J**	**81J**
PCB-1260	**53J**	**60J**	**21J**	**66J**	**63J**

	Tuscarawas River			Sugar Creek	
	RM 37.4	**RM 37.4**	**RM 37.4**	**RM 3.7**	**RM 3.7**
	Common carp	Freshwater drum	Channel catfish	Common carp	Smallmouth bass
Parameter	SOFC	SOF	SFF	SOFC	SOFC
PCBs (ug/kg)					
PCB-1254	**1700J**	**130J**	**83J**	**21J**	
PCB-1260	**710J**	**42J**	**62J**		

	Sugar Creek	
	RM 0.6	**RM 0.6**
	Common carp	Smallmouth bass
Parameter	SOFC	SOFC
PCBs (ug/kg)		
PCB-1254	**130J**	**<16J**
PCB-1260	**42J**	**25J**

Fish Tissue Study of the Tuscarawas River and Sugar Creek

Tuscarawas County

Dover Chemical
(Dover, Ohio)

Alsco Anaconda
(Gnadenhutten, Ohio)

March 22, 1995

OEPA Technical Report MAS/1995-3-5

prepared for

State of Ohio Environmental Protection Agency
Division of Emergency and Remedial Response

prepared by

State of Ohio Environmental Protection Agency
Division of Surface Water
Monitoring and Assessment Section
Ecological Assessment Unit
1685 Westbelt Dr.
Columbus, Ohio 43228

Introduction and Methods

The study area for this project included the Tuscarawas River from river mile (RM) 58.5 to RM 55.0 (Dover area) and RM 39.6 to RM 37.4 (Gnadenhutten area), and the lower 3.7 miles of Sugar Creek (Figure 1). Specific objectives of the project included determining the level of potential site contaminants in fish tissue from top predator and bottom dwelling fish in the Tuscarawas River and Sugar Creek in the vicinity of Dover Chemical and Alsco Anaconda, and providing results to the Ohio Department of Health Bureau of Epidemiology and Toxicology for use in determining human health concerns associated with consuming fish taken from the Tuscarawas River.

Fish tissue samples were collected from the Tuscarawas River at six locations and from Sugar Creek at two locations within the study area by the Ohio EPA during October, 1994 (Table 1). Fillet composite and individual fish samples representing five species were analyzed for organochlorine pesticides (method 8080), PCBs (method 8080), dioxin and dibenzofuran congeners (method 8290), cadmium (method 213.2/7131A, GFAA), chromium (method 218.2/7191, GFAA), lead (method 239.2/7421, GFAA), mercury (method 245.5/7471, CVAA) and percent lipid.

Fish collections were made at each site using pulsed DC electrofishing gear: boat electrofishing in the Tuscarawas River and lower Sugar Creek (RM 0.6) and wading electrofishing in Sugar Creek at RM 3.7. Fish collected for tissue analysis were filleted in the field, and the fillets were wrapped in decontaminated aluminum foil and placed in plastic bags. Fillet samples were stored in coolers on dry ice while in the field. Fish tissue sampling and processing procedures are detailed in the Manual of Ohio EPA Surveillance Methods and Quality Assurance Practices (Ohio EPA 1989). Chemical analysis of the fillet samples was provided by an Ohio EPA contract laboratory.

Summary and Conclusions

(Based on Ohio EPA 1994 sampling)

- 2,3,7,8-Tetrachlorodibenzo-*p*-dioxin (2,3,7,8-TCDD), 2,3,7,8-tetrachlorodibenzofuran (2,3,7,8-TCDF) and other dioxin and furan congeners were analyzed in fish collected from the Tuscarawas River at Dover and from Sugar Creek. All 2,3,7,8-TCDD results were far below the U.S. Food and Drug Administration (FDA) Action Level (50 parts per trillion, ppt), as well as being less than the FDA reduced consumption level of 25-50 ppt. The highest 2,3,7,8-TCDD and 2,3,7,8-TCDD total toxicity equivalent in the study area occurred in Sugar Creek at RM 0.6, where a common carp fillet composite sample measured 2.7 ppt and 8.7 ppt, respectively. The Dover Chemical Company discharges process wastewater and treated groundwater into Sugar Creek 1.5 miles upstream from RM 0.6.

- Two PCB mixtures, Aroclors 1254 and 1260, were identified and quantified. Seventeen fillet composite or individual samples were collected from the Tuscarawas River during 1994 within the study area and four fillet composite samples were collected from Sugar Creek during 1994 (Figure 2). All but two of the twenty-one samples had detectable levels of PCBs, with detected values for Aroclor-1254 ranging from 24 ug/kg to 1900 ug/kg and detected values for Aroclor-1260 ranging from 18 ug/kg to 290 ug/kg. One of the samples (RM 37.4, common carp) was considered extremely elevated (Vandermeer 1994), based on a comparison to Ohio Department of Health PCB consumption guidelines. Using additional PCB descriptive guidelines

(Vandermeer 1994), one sample was highly elevated, three samples were moderately elevated, 13 samples were slightly elevated and three samples were considered not elevated. Three samples exceeded the Ohio Water Quality Standards (WQS) criterion for PCBs (any whole sample of any representative organism shall not exceed 640 ug/kg PCBs). The two samples where PCBs were not detected occurred in Sugar Creek at RM 3.7. Elevated levels of PCBs in Tuscarawas River fish occurred at locations both upstream and downstream from the Sugar Creek confluence (Dover Chemical) and Alsco Anaconda. The highest PCB levels in the study area were reported from common carp.

° Hexachlorobenzene, a compound which bioconcentrates extensively in a number of fish and invertebrates (Howard 1989), was detected in all Tuscarawas River and Sugar Creek fish tissue samples. Except for the two fish samples from Sugar Creek upstream from Dover Chemical (RM 3.7), all hexachlorobenzene concentrations were above 79 ug/kg (Figure 2). The two samples in Sugar Creek upstream from Dover Chemical had hexachlorobenzene values of 2.6 ug/kg and 3.1 ug/kg. Concentrations of hexachlorobenzene in fish tissue from the Tuscarawas River ranged from 96.2 ug/kg to 2740 ug/kg. Five of the fish tissue samples were considered slightly elevated (810 ug/kg - 3500 ug/kg hexachlorobenzene), based on a comparison to Ohio Department of Health hexachlorobenzene consumption guidelines (Vandermeer 1994). All other samples were considered not elevated. Elevated levels of hexachlorobenzene in Tuscarawas River fish occurred at locations both upstream and downstream from Dover Chemical. No significant increase in fish tissue levels of hexachlorobenzene was observed in the Tuscarawas River downstream from Sugar Creek. As with PCBs, the highest hexachlorobenzene levels in the study area were reported from common carp.

° Chromium levels were measured in fish tissue samples collected from the Tuscarawas River upstream, adjacent to, and downstream from Alsco Anaconda. Results showed no appreciable difference between all three sampling locations, with concentrations varying between not detected (<0.04 mg/kg) and 0.08 mg/kg. Detected levels of chromium were below tissue levels (4.0 mg/kg) viewed as presumptive evidence of chromium contamination (Eisler 1986).

° Monitoring of various chlorinated pesticides in fish tissue at all sampling sites revealed concentrations less than FDA Action Levels. One common carp fish tissue sample collected at RM 39.6 (upstream Alsco Anaconda, at US 36) revealed elevated concentrations of alpha-BHC (63 ug/kg), gamma-BHC (lindane) (25 ug/kg), delta-BHC (38 ug/kg), heptachlor epoxide (270 ug/kg), endosulfan I (20 ug/kg), 4,4'-DDD (140 ug/kg), and methoxychlor (320 ug/kg). This particular sample had the highest percent lipid content (7.2%) of all the samples collected in the study area and thus associates well with the fact that organochlorine pesticides are not readily metabolized or excreted from the body and are readily stored in fatty tissues.

Table 1. Fish tissue sampling locations in the Tuscarawas River and Sugar Creek study area, 1994.

Stream/ River Mile	Latitude	Longitude	Landmark	County	USGS 7.5 min. Quad. Map
Tuscarawas River					
58.5	40°30'38"	81°28'39"	Adj. Dover WWTP	Tuscarawas	Dover, OH
57.8	40°30'24"	81°28'38"	Dst. Sugar Creek	Tuscarawas	Dover, OH
55.0	40°28'52"	81°27'03"	State Route 416	Tuscarawas	New Philadelphia, OH
39.6	40°22'07"	81°27'03"	Upst. U.S. 36	Tuscarawas	Gnadenhutten, OH
38.7	40°21'31"	81°26'30"	Adj. Alsco Anaconda	Tuscarawas	Gnadenhutten, OH
37.4	40°20'38"	81°26'27"	Dst. Gnadenhutten	Tuscarawas	Gnadenhutten, OH
Sugar Creek					
3.7	40°33'03"	81°30'23"	Crossing Rd.	Tuscarawas	Strasburg, OH
0.6	40°30'45"	81°29'19"	State Route 39	Tuscarawas	Dover, OH

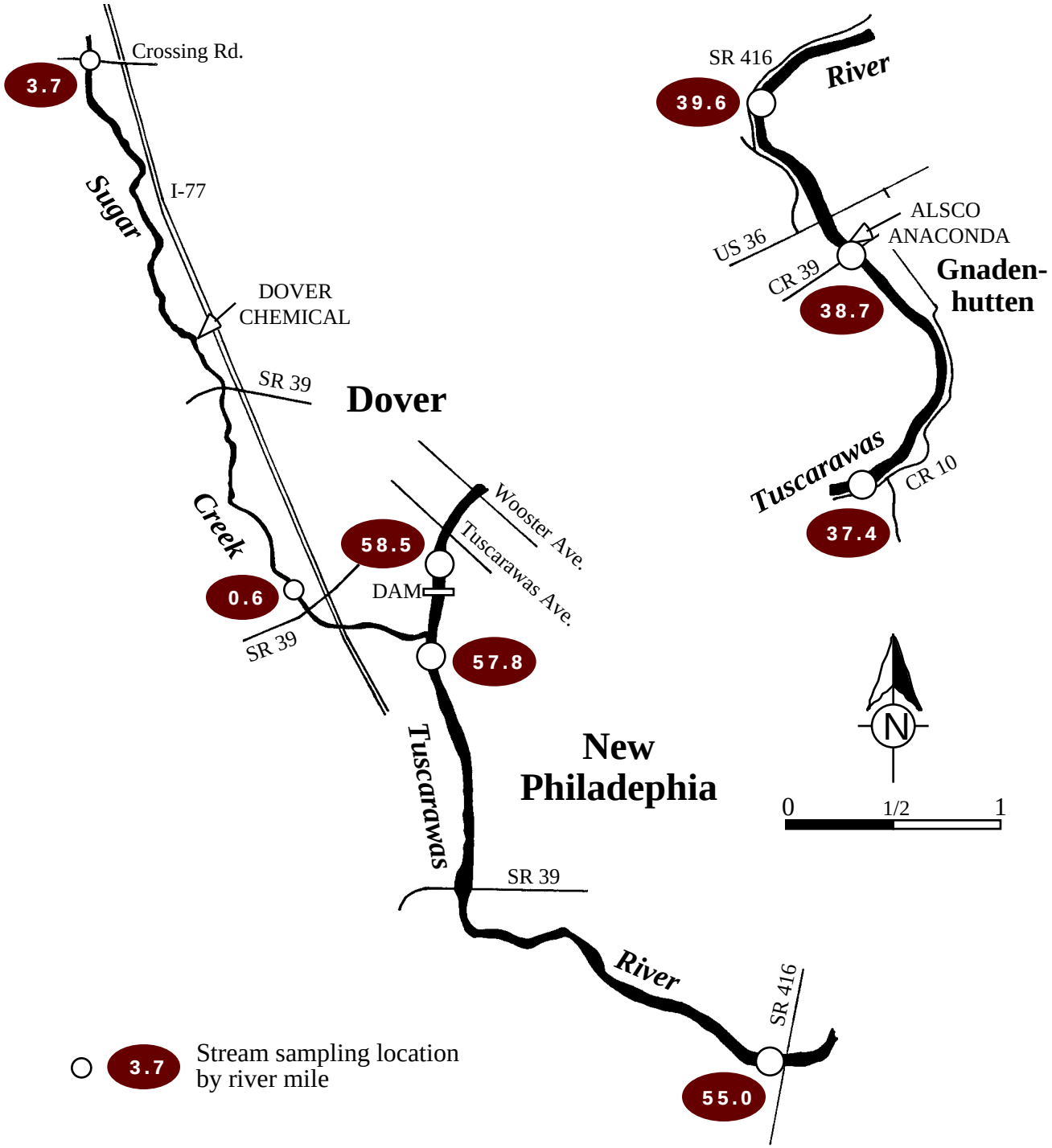


Figure 1. Map of the Tuscarawas River and Sugar Creek study area showing principal streams, landmarks, and Ohio EPA sampling locations.

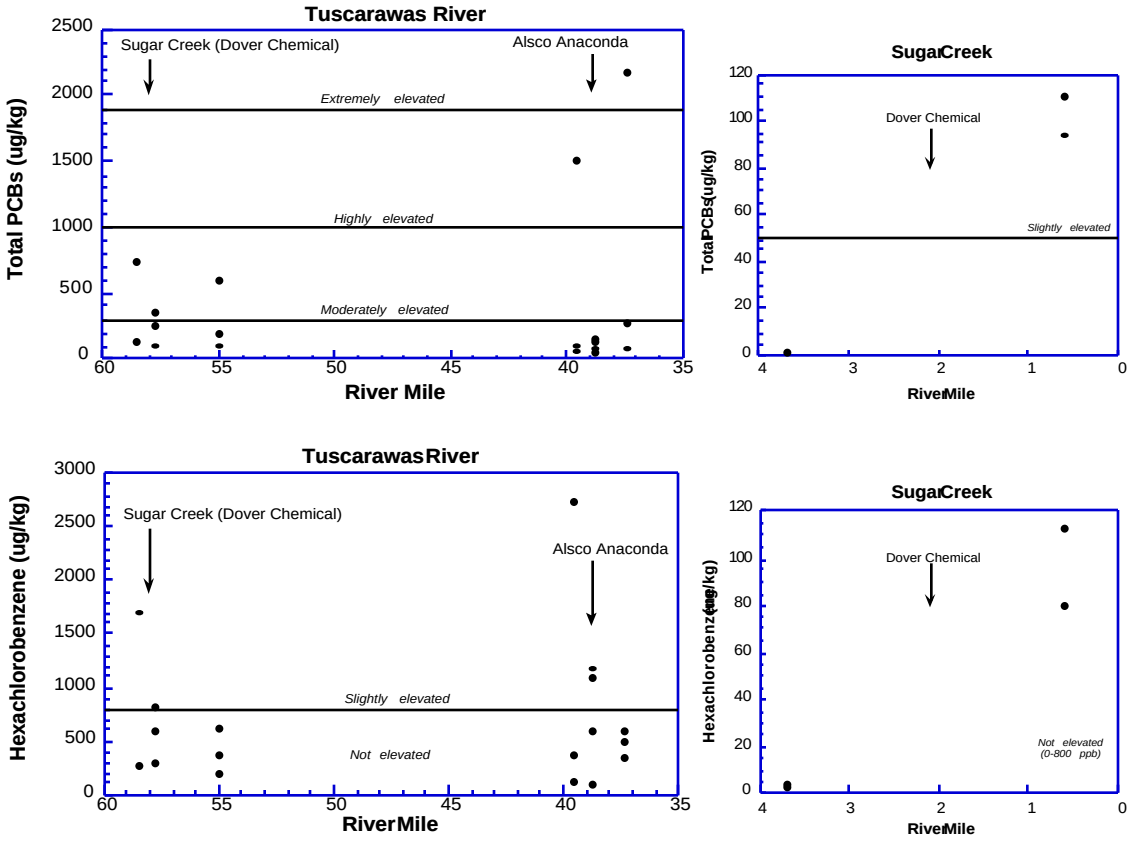


Figure 2. Scatter plots of PCBs and hexachlorobenzene concentrations in fish fillet samples from the Tuscarawas River and Sugar Creek collected during 1994 by Ohio EPA. Levels of concern are noted on each graph.

Table 2. Pesticides, PCBs, selected metals, and lipid analyses of fish tissue collected from the Tuscarawas River and Sugar Creek study area, 1994. **Bold** numbers indicate detected values.

	Sampling Location - by River Mile (RM)				
	Tuscarawas River				
	RM 58.5	**RM 58.5**	**RM 57.8**	**RM 57.8**	**RM 57.8**
	Common carp	Smallmouth bass	Common carp	Flathead catfish	Channel catfish
Parameter	SOFC[a]	SOFC	SOFC	SFF[b]	SFF
Pesticides (ug/kg)					
alpha-BHC	<1.7	<1.7	**5.2**	<1.7	**7.5**
gamma-BHC (Lindane)	<1.7	<1.7	<1.7	**1.8**	**2.7**
beta-BHC	<1.7	<1.7	<1.7	<1.7	<1.7
Heptachlor	<1.7	<1.7	<1.7	<1.7	<1.7
delta-BHC	<1.7	**2.5**	<1.7	<1.7	<1.7
Aldrin	<1.7	<1.7	<1.7	<1.7	<1.7
Heptachlor epoxide	**20**	**2.9**	**5.5**	**27**	**9.5**
Endosulfan I	<1.7	<1.7	<1.7	<1.7	<1.7
4,4'-DDE	**7.3**	<3.3	**3.7**	**16**	<3.3
Dieldrin	**18**	<3.3	**3.6**	**21**	**8.0**
Endrin	**11**	<3.3	**3.6**	**9.9**	**4.0**
4,4'-DDD	<3.3	<3.3	<3.3	<3.3	<3.3
Endosulfan II	**21**	<3.3	**5.6**	**41**	**12**
4,4'-DDT	<3.3	<3.3	<3.3	<3.3	<3.3
Endrin aldehyde	<3.3	**4.6**	<3.3	<3.3	<3.3
Endosulfan sulfate	<3.3	<3.3	<3.3	<3.3	<3.3
Methoxychlor	<17	<17	<17	<17	<17
Chlordane (technical)	<83	<83	<83	<83	<83
Toxaphene	<83	<83	<83	<83	<83
Hexachlorobenzene	**1700**	**270**	**310**	**820**	**590**
PCBs (ug/kg)					
PCB-1016	<17	<17	<17	<17	<17
PCB-1221	<33	<33	<33	<33	<33
PCB-1232	<17	<17	<17	<17	<17
PCB-1242	<17	<17	<17	<17	<17
PCB-1248	<17	<17	<17	<17	<17
PCB-1254	**600**	**78**	**68**	**180**	**170**
PCB-1260	**130**	**54**	**37**	**180**	**92**
Metals (mg/kg)					
Cadmium	<0.004	<0.004	<0.004	<0.004	0.0045
Chromium	-	-	-	-	-
Lead	<0.1	<0.1	<0.1	<0.1	<0.1
Mercury	<0.08	<0.08	**0.15**	**0.29**	<0.08
Lipids (Percent)	**1.9**	**0.42**	**1.6**	**1.2**	**3.3**

Table 2. Continued.

	Sampling Location - by River Mile (RM)				
	Tuscarawas River				
Parameter	**RM 55.0** Common carp SOFC	**RM 55.0** Smallmouth bass SOFC	**RM 55.0** Channel catfish SFF	**RM 39.6** Common carp SOFC	**RM 39.6** Smallmouth bass SOFC
Pesticides (ug/kg)					
alpha-BHC	**3.3**	**1.7**	**4.6**	**63**	<1.7
gamma-BHC (Lindane)	<1.6	<1.7	**1.5**	**25**	<1.7
beta-BHC	<1.6	<1.7	<1.7	<16	<1.7
Heptachlor	<1.6	<1.7	<1.7	<16	<1.7
delta-BHC	<1.6	<1.7	**1.9**	**38**	<1.7
Aldrin	**1.6**	<1.7	<1.7	<16	<1.7
Heptachlor epoxide	<1.6	**2.3**	<1.7	**270**	<1.7
Endosulfan I	<1.6	<1.7	<1.7	**20**	<1.7
4,4'-DDE	**8.7**	**3.8**	<3.3	<33	<3.3
Dieldrin	<3.3	<3.3	**8.1**	<33	<3.3
Endrin	<3.3	<3.3	<3.3	<33	<3.3
4,4'-DDD	**3.6**	<3.3	**4.9**	**140**	<3.3
Endosulfan II	<3.3	<3.3	<3.3	<33	<3.3
4,4'-DDT	<3.3	<3.3	<3.3	<33	<3.3
Endrin aldehyde	**4.6**	<3.3	**5.2**	<33	<3.3
Endosulfan sulfate	<3.3	<3.3	<3.3	<33	<3.3
Methoxychlor	<16	<17	**6.2**	**320**	<17
Chlordane (technical)	<82	<83	<83	<820	<83
Toxaphene	<82	<83	<83	<820	<83
Hexachlorobenzene	**380**	**210**	**620**	**2740**	**114**
PCBs (ug/kg)					
PCB-1016	<16	<17	<17	<16	<17
PCB-1221	<33	<33	<33	<33	<33
PCB-1232	<16	<17	<17	<16	<17
PCB-1242	<16	<17	<17	<16	<17
PCB-1248	<16	<17	<17	<16	<17
PCB-1254	**510**	**56**	**150**	**1500**	**44**
PCB-1260	**92**	**49**	**55**	<16	**21**
Metals (mg/kg)					
Cadmium	<0.004	**0.0083**	<0.004	<0.04	<0.04
Chromium	-	-	-	**0.08**	<0.04
Lead	<0.1	<0.1	<0.1	<0.1	<0.1
Mercury	<0.08	<0.08	<0.08	**0.12**	<0.08
Lipids (Percent)	**1.1**	**0.80**	**2.2**	**7.2**	**0.66**

Table 2. Continued.

	Sampling Location - by River Mile (RM)				
	Tuscarawas River				
	RM 39.6	**RM 38.7**	**RM 38.7**	**RM 38.7**	**RM 38.7D**
	Channel catfish	Common carp	Smallmouth bass	Channel catfish	Channel catfish
Parameter	SFF	SOFC	SOF[c]	SFF	SFF
Pesticides (ug/kg)					
alpha-BHC	**2.5**	**4.9**	<1.7	**3.7**	**3.9**
gamma-BHC (Lindane)	<1.7	**1.8**	<1.7	<1.7	**2.5**
beta-BHC	<1.7	<1.7	<1.7	<1.7	<1.7
Heptachlor	<1.7	<1.7	<1.7	<1.7	<1.7
delta-BHC	<1.7	**2.9**	<1.7	<1.7	**2.0**
Aldrin	<1.7	<1.7	<1.7	<1.7	<1.7
Heptachlor epoxide	**3.6**	**12**	**1.8**	**22**	<1.7
Endosulfan I	<1.7	<1.7	<1.7	<1.7	<1.7
4,4'-DDE	**7.9**	**42**	<3.3	**7.2**	**13**
Dieldrin	**4.6**	<3.3	<3.3	<3.3	**7.4**
Endrin	<3.3	<3.3	<3.3	**4.8**	<3.3
4,4'-DDD	<3.3	**9.9**	<3.3	<3.3	**4.5**
Endosulfan II	<3.3	<3.3	<3.3	**17**	<3.3
4,4'-DDT	<3.3	<3.3	<3.3	<3.3	<3.3
Endrin aldehyde	<3.3	<3.3	<3.3	<3.3	<3.3
Endosulfan sulfate	<3.3	**7.1**	<3.3	<3.3	<3.3
Methoxychlor	<17	<17	<17	<17	<17
Chlordane (technical)	<83	<83	<83	<83	<83
Toxaphene	<83	<83	<83	<83	<83
Hexachlorobenzene	**373**	**1180**	**96.2**	**1080**	**574**
PCBs (ug/kg)					
PCB-1016	<17	<17	<17	<17	<17
PCB-1221	<33	<33	<33	<33	<33
PCB-1232	<17	<17	<17	<17	<17
PCB-1242	<17	<17	<17	<17	<17
PCB-1248	<17	<17	<17	<17	<17
PCB-1254	**71**	**43**	**24**	**88**	**45**
PCB-1260	**30**	**42**	**18**	**65**	**88**
Metals (mg/kg)					
Cadmium	<0.04	<0.04	<0.04	<0.04	<0.04
Chromium	**0.06**	**0.05**	**0.04**	**0.04**	**0.05**
Lead	<0.1	<0.1	<0.1	<0.1	<0.1
Mercury	<0.08	**0.12**	<0.08	<0.08	**0.08**
Lipids (Percent)	**3.7**	**3.7**	**0.39**	**1.4**	**2.5**

Table 2. Continued.

Parameter	Sampling Location - by River Mile (RM)				
	Tuscarawas River			Sugar Creek	
	RM 37.4 Common carp SOFC	**RM 37.4** Freshwater drum SOF	**RM 37.4** Channel catfish SFF	**RM 3.7** Common carp SOFC	**RM 3.7** Smallmouth bass SOFC
Pesticides (ug/kg)					
alpha-BHC	**3.1**	**1.9**	**3.4**	<1.6	<1.7
gamma-BHC (Lindane)	<1.6	<1.6	**2.1**	<1.6	<1.7
beta-BHC	<1.6	<1.6	<1.7	<1.6	<1.7
Heptachlor	<1.6	<1.6	<1.7	<1.6	<1.7
delta-BHC	**1.9**	<1.6	<1.7	<1.6	<1.7
Aldrin	<1.6	<1.6	<1.7	<1.6	<1.7
Heptachlor epoxide	**16**	**3.8**	**4.2**	<1.6	<1.7
Endosulfan I	<1.6	<1.6	<1.7	<1.6	<1.7
4,4'-DDE	**160**	**4.9**	**9.1**	**5.3**	<3.3
Dieldrin	<3.3	<3.3	**5.6**	<3.3	<3.3
Endrin	<3.3	<3.3	<3.3	<3.3	<3.3
4,4'-DDD	**6.8**	<3.3	<3.3	<3.3	<3.3
Endosulfan II	<3.3	<3.3	<3.3	<3.3	<3.3
4,4'-DDT	<3.3	<3.3	<3.3	<3.3	<3.3
Endrin aldehyde	**9.1**	<3.3	<3.3	<3.3	<3.3
Endosulfan sulfate	<3.3	<3.3	<3.3	<3.3	<3.3
Methoxychlor	**26**	<16	<17	<16	<17
Chlordane (technical)	<82	<82	<83	<82	<83
Toxaphene	<82	<82	<83	<82	<83
Hexachlorobenzene	**591**	**348**	**482**	**2.6**	**3.1**
PCBs (ug/kg)					
PCB-1016	<16	<16	<17	<16	<17
PCB-1221	<33	<33	<33	<33	<33
PCB-1232	<16	<16	<17	<16	<17
PCB-1242	<16	<16	<17	<16	<17
PCB-1248	<16	<16	<17	<16	<17
PCB-1254	**1900**	**78**	**200**	<16	<17
PCB-1260	**290**	<16	**83**	<16	<17
Metals (mg/kg)					
Cadmium	<0.04	<0.04	<0.04	**0.408**	**0.396**
Chromium	**0.04**	<0.04	<0.04	-	-
Lead	<0.1	<0.1	<0.1	<0.1	<0.1
Mercury	**0.10**	<0.08	**0.09**	<0.08	**0.18**
Lipids (Percent)	**1.0**	**1.3**	**2.7**	**0.49**	**0.95**

Table 2. Continued.

	Sampling Location - by River Mile (RM)	
	Sugar Creek	
	RM 0.6	**RM 0.6**
Parameter	Common carp SOFC	Smallmouth bass SOFC
Pesticides (ug/kg)		
alpha-BHC	**46**	**14**
gamma-BHC (Lindane)	**4.9**	**1.8**
beta-BHC	**4.9**	**2.0**
Heptachlor	<1.7	<1.6
delta-BHC	<1.7	<1.6
Aldrin	<1.7	<1.6
Heptachlor epoxide	<1.7	**2.7**
Endosulfan I	<1.7	**1.9**
4,4'-DDE	**23**	**7.8**
Dieldrin	<3.3	**3.8**
Endrin	**15**	<3.3
4,4'-DDD	<3.3	<3.3
Endosulfan II	<3.3	**6.5**
4,4'-DDT	<3.3	<3.3
Endrin aldehyde	**8.2**	**3.5**
Endosulfan sulfate	<3.3	<3.3
Methoxychlor	<17	<16
Chlordane (technical)	<83	<82
Toxaphene	<83	<82
Hexachlorobenzene	**113**	**80**
PCBs (ug/kg)		
PCB-1016	<17	<16
PCB-1221	<33	<33
PCB-1232	<17	<16
PCB-1242	<17	<16
PCB-1248	<17	<16
PCB-1254	**110**	**52**
PCB-1260	<17	**42**
Metals (mg/kg)		
Cadmium	**0.013**	<0.004
Chromium	-	-
Lead	**0.25**	<0.10
Mercury	<0.08	<0.08
Lipids (Percent)	**1.2**	**0.51**

[a] SOFC = skin on fillet composite; [b] SFF = skin off fillet; [c] SOF = skin on fillet.

Table 3. Dioxins and dibenzofurans measured in fish tissue samples collected from the Tuscarawas River and Sugar Creek by Ohio EPA during 1994.

	Sampling Location - by River Mile (RM)							
	Tuscarawas River							
	RM 58.5 Common carp SOFC[a]		**RM 58.5** Smallmouth bass SOFC		**RM 57.8** Common carp SOFC		**RM 57.8** Flathead catfish SFF[b]	
Parameter	Concen-tration	Toxic. Equival.[c]	Concen-tration	Toxic. Equival.	Concen-tration	Toxic. Equival.	Concen-tration	Toxic. Equival.
Dioxins (ppt)								
2,3,7,8-TCDD	0.43E	0.43	ND	0.1	0.92	0.92	0.95	0.95
1,2,3,7,8-PeCDD	0.70	0.35	ND	0.05	0.43	0.215	0.75	0.375
1,2,3,4,7,8-HxCDD	0.49	0.049	ND	0.015	0.16E	0.016	0.23E	0.023
1,2,3,6,7,8-HxCDD	1.6	0.16	ND	0.015	0.57E	0.057	0.73E	0.073
1,2,3,7,8,9-HxCDD	0.25	0.025	ND	0.015	ND	0.015	0.20	0.02
1,2,3,4,6,7,8-HpCDD	2.2	0.022	ND	0.001	0.74	0.007	1.3	0.013
1,2,3,4,6,7,8,9-OCDD	2.3B	0.002	ND	0	1.7EB	0	2.4B	0
Total TCDD	0.43E		ND		0.92		0.95	
Total PeCDD	0.70		ND		0.43		0.75	
Total HxCDD	2.3		ND		0.59E		0.20	
Total HpCDD	2.2		ND		0.74		1.3	
Dibenzofurans (ppt)								
2,3,7,8-TCDF	0.78E	0.078	0.22E	0.022	0.91	0.045	0.46E	0.046
1,2,3,7,8-PeCDF	0.38	0.019	ND	0.005	0.71	0.035	0.24E	0.012
2,3,4,7,8-PeCDF	1.2	0.6	0.23	0.115	2.5	1.25	2.0	1.0
1,2,3,4,7,8-HxCDF	0.79	0.079	ND	0.01	1.9	0.19	0.31E	0.031
1,2,3,6,7,8-HxCDF	0.49	0.049	ND	0.005	0.52E	0.052	0.18	0.018
2,3,4,6,7,8-HxCDF	0.32B	0	ND	0.005	0.33B	0	0.32B	0
1,2,3,7,8,9-HxCDF	ND	0.009	ND	0.01	ND	0.01	ND	0.01
1,2,3,4,6,7,8-HpCDF	0.79E	0.008	ND	0.001	1.1	0.011	0.45	0.004
1,2,3,4,7,8,9-HpCDF	0.16E	0.002	ND	0.001	ND	0.001	ND	0.001
1,2,3,4,6,7,8,9-OCDF	ND	0	ND	0	ND	0	ND	0
Total TCDF	0.96E		0.22E		1.1E		0.46E	
Total PeCDF	1.9		0.23		3.9		2.0	
Total HxCDF	1.6		ND		2.4		0.49	
Total HpCDF	0.95E		ND		1.1		0.45	
2,3,7,8-TCDD Total Toxicity Equivalent (TTE)		1.882		0.37		2.824		2.576

Table 3. Continued.

	Sampling Location - by River Mile (RM)							
	Tuscarawas River						Sugar Creek	
	RM 55.0 Common carp SOFC		**RM 55.0** Smallmouth bass SOFC		**RM 55.0** Channel catfish SFF		**RM 3.7** Common carp SOFC	
Parameter	Concen-tration	Toxic. Equival.	Concen-tration	Toxic. Equival.	Concen-tration	Toxic. Equival.	Concen-tration	Toxic. Equival.
Dioxins (ppt)								
2,3,7,8-TCDD	0.71	0.71	0.11	0.11	0.59	0.59	ND	0.05
1,2,3,7,8-PeCDD	0.62E	0.31	0.06E	0.03	0.61	0.305	ND	0.05
1,2,3,4,7,8-HxCDD	0.30E	0.03	ND	0.005	ND	0.015	ND	0.01
1,2,3,6,7,8-HxCDD	1.6	0.16	ND	0.004	0.63	0.063	ND	0.01
1,2,3,7,8,9-HxCDD	0.23E	0.023	ND	0.004	ND	0.015	ND	0.01
1,2,3,4,6,7,8-HpCDD	2.2	0.022	ND	0	0.31E	0.003	0.11	0.001
1,2,3,4,6,7,8,9-OCDD	2.3EB	0	0.77B	0	0.84EB	0	0.79B	0
Total TCDD	0.71		0.11		0.59		ND	
Total PeCDD	0.62E		0.06E		0.61		ND	
Total HxCDD	1.6		ND		0.63		ND	
Total HpCDD	2.2		ND		0.31E		0.11	
Dibenzofurans (ppt)								
2,3,7,8-TCDF	1.1	0.11	0.80	0.08	0.26E	0.026	ND	0.004
1,2,3,7,8-PeCDF	0.30	0.015	0.06E	0.003	0.20	0.01	ND	0.002
2,3,4,7,8-PeCDF	2.1	1.05	0.16E	0.08	1.1E	0.55	ND	0.025
1,2,3,4,7,8-HxCDF	1.1	0.11	ND	0.002	0.37	0.037	ND	0.005
1,2,3,6,7,8-HxCDF	0.52E	0.052	ND	0.002	ND	0.005	ND	0.004
2,3,4,6,7,8-HxCDF	ND	0.015	0.18EB	0	0.25EB	0	0.12EB	0
1,2,3,7,8,9-HxCDF	ND	0.015	ND	0.003	ND	0.01	ND	0.005
1,2,3,4,6,7,8-HpCDF	0.98	0.01	ND	0	0.15E	0.001	ND	0
1,2,3,4,7,8,9-HpCDF	ND	0.003	ND	0	ND	0.001	ND	0.001
1,2,3,4,6,7,8,9-OCDF	ND	0.001	ND	0	ND	0	ND	0
Total TCDF	1.1E		0.80E		0.84E		ND	
Total PeCDF	2.4E		0.46E		0.20		ND	
Total HxCDF	1.5		0.18E		0.37		0.12E	
Total HpCDF	0.98		ND		0.15E		ND	
2,3,7,8-TCDD Total Toxicity Equivalent (TTE)		2.636		0.323		1.631		0.177

Table 3. Continued.

	Sampling Location - by River Mile (RM)					
	Sugar Creek					
	RM 3.7 Smallmouth bass SOFC		**RM 0.6** Common carp SOFC		**RM 0.6** Smallmouth bass SOFC	
Parameter	Concen-tration	Toxic. Equival.	Concen-tration	Toxic. Equival.	Concen-tration	Toxic. Equival.
Dioxins (ppt)						
2,3,7,8-TCDD	ND	0.05	2.7	2.7	0.85	0.85
1,2,3,7,8-PeCDD	ND	0.05	0.88E	0.44	0.16E	0.08
1,2,3,4,7,8-HxCDD	ND	0.01	ND	0.025	ND	0.005
1,2,3,6,7,8-HxCDD	ND	0.01	0.93	0.093	ND	0.004
1,2,3,7,8,9-HxCDD	ND	0.01	ND	0.025	ND	0.004
1,2,3,4,6,7,8-HpCDD	ND	0.001	1.5	0.015	ND	0
1,2,3,4,6,7,8,9-OCDD	0.54B	0	2.1EB	0	0.74EB	0
Total TCDD	ND		2.7		0.93	
Total PeCDD	ND		0.88E		0.16E	
Total HxCDD	ND		0.93		ND	
Total HpCDD	ND		1.5		ND	
Dibenzofurans (ppt)						
2,3,7,8-TCDF	ND	0.004	1.6	0.16	1.6	0.16
1,2,3,7,8-PeCDF	ND	0.002	1.5	0.075	0.62	0.031
2,3,4,7,8-PeCDF	ND	0.025	9.0	4.5	1.8	0.9
1,2,3,4,7,8-HxCDF	ND	0.005	4.8	0.48	0.27E	0.027
1,2,3,6,7,8-HxCDF	ND	0.004	1.8	0.18	ND	0.002
2,3,4,6,7,8-HxCDF	0.20B	0	0.84B	0	0.17EB	0
1,2,3,7,8,9-HxCDF	ND	0.02	ND	0.015	ND	0.003
1,2,3,4,6,7,8-HpCDF	ND	0	2.7	0.027	ND	0
1,2,3,4,7,8,9-HpCDF	ND	0.001	ND	0.002	ND	0
1,2,3,4,6,7,8,9-OCDF	ND	0	ND	0	ND	0
Total TCDF	ND		2.2		5.4	
Total PeCDF	ND		10.5		3.3	
Total HxCDF	0.20		7.5		0.10	
Total HpCDF	ND		2.7		ND	
2,3,7,8-TCDD Total Toxicity Equivalent (TTE)		0.192		8.737		2.066

a SOFC = skin on fillet composite
b SFF = skin off fillet.
c 2,3,7,8 TCDD toxicity equivalents.
B Analyte was detected in the laboratory method blank as well as in the field sample.
E Estimated maximum possible concentration.
ND Analyte not detected at or above the sample specific detection limit.
TTE Calculation of TTEs for non-detect values was based on using one-half the detection limit and USEPA's 1989 methodology.

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