

Sediment and Fish Tissue Study of the Erie-Ohio Canal

B & E Landfill

Pickaway County

1998

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INTRODUCTION

The B&E Landfill is an inactive landfill located four miles southwest of Circleville, in Pickaway County, Ohio, just east of the intersection of Route 104 and Kinderhook Road. The site is 35 acres in size. The site is bordered to the north by an open field, on the east by a portion of the abandoned Erie-Ohio canal which runs parallel to the Scioto River, and on the south by a wooded ravine. State Route 104 border the landfill on the west side.

The site was used for waste disposal from the early 1950's to 1979. Early in its operation, the site was used as an open dump. In 1968, the site began operating as a landfill after Pickaway County issued a solid waste disposal license. Wastes were apparently deposited above ground in and around the reaches of the unnamed tributary in the ravine south of the landfill. Portions of the canal were also filled during site operations, dividing the canal into two segments, referred to as the northern and southern canal segments. After 1968, wastes were primarily disposed of using the trench and cover method. The landfill does not have a liner. The landfill closed in 1979 and was covered with two feet of clay. Solid wastes are visible and protruding from the clay and soil cover material. Leachate has been observed along the southern and eastern slopes of the landfill. Currently, the land owner uses the site to graze cattle.

In September 1998, US EPA issued a unilateral administrative order to a group of potentially responsible parties (PRPs). This PRP Group has agreed to conduct a removal action whereby a new cap, long-term monitoring, and operation & maintenance activities will be completed at the landfill. Construction activities are scheduled to commence during the spring/summer of 1999.

Specific objectives of this study were to:

- 1) determine the levels of hazardous chemical constituents in the Erie-Ohio canal adjacent to the B & E landfill by sampling and evaluating sediment, fish tissue, and turtle tissue, and;
- 2) Establish the concentration of bioaccumulative chemicals in edible portions of turtles and upper and lower trophic level fish from the Erie-Ohio canal.

METHODS

All chemical, physical, and biological field, laboratory, data processing, and data analysis methodologies and procedures adhere to those specified in the Manual of Ohio EPA Surveillance Methods and Quality Assurance Practices (Ohio Environmental Protection Agency 1989), the Ohio EPA Sediment Sampling Guide and Methodologies (Ohio EPA 1996a) and Ohio EPA Fish Tissue Guidance Manual (Ohio EPA 1994). All sediment and fish tissue sampling locations are listed in Table 1.

Sediment

Fine grain sediment samples were collected in the upper 6 inches of bottom material at all locations using either a decontaminated stainless steel scoop or CAB (cellulose acetate butyrate polymer) coring tube. Decontamination of sediment sampling equipment followed the procedures outlined in FSOP 10.01, DERR Sampling Guidance, Vol. III (Ohio EPA 1992). Collected sediment (grab samples) was homogenized in stainless steel pans, transferred into clear glass jars with teflon lined lids, placed on ice (to maintain 4^o C) in a cooler, and shipped to an Ohio EPA contract lab. Sediment evaluations were conducted using guidelines established by the Ontario Ministry of the Environment (Persaud *et al.* 1993).

Fish Tissue

Fish were sampled using boat mounted pulsed DC electrofishing gear. The north canal section was sampled for over one hour using electrofishing gear. Water depth in the south canal section was insufficient for supporting a fish community or conducting electrofishing. One whole body fish sample (goldfish) was collected for tissue analysis. Fish tissue sampling procedures are detailed in the Manual of Ohio EPA Surveillance Methods and Quality Assurance Practices (Ohio EPA 1989) and the Fish Tissue Guidance Manual (Ohio EPA 1994).

Turtle Tissue

Turtles were sampled using boat mounted pulsed DC electrofishing gear and a hoop net. The north canal section was sampled for over one hour using electrofishing gear and a hoop net was set over a three-day period. The hoop net was baited with chicken parts and liver and the open end was set in approximately three feet of water, about 20 feet from the shoreline.

SUMMARY/CONCLUSIONS

- Sediment samples were collected at three locations in the north canal section and two locations in the south canal section of the Erie-Ohio Canal adjacent to the B & E landfill. All sampling locations are indicated by sample number in Figure 1 and Table 1. Sample depth varied between 0 and 6 inches; however, one sample at BES1 was also collected at the 8"-36" depth. Samples were analyzed for total analyte list metals, cyanide, organochlorinated pesticides, polychlorinated biphenyls (PCBs), total organic carbon, pH, and grain size. Specific chemical parameters measured and their concentrations at each sample location are listed in Tables 2 - 4.
- Sediment samples were evaluated in part using guidelines established by the Ontario Ministry of the Environment (Persaud *et al.* 1993). The guidelines define two levels of ecotoxic effects and are based on the chronic, long term effects of contaminants on benthic organisms. A *Lowest Effect Level* is a level of sediment contamination that can be tolerated by the majority of benthic organisms, and a *Severe Effect Level* indicates a level at which pronounced disturbance of the sediment-dwelling community can be expected. The Severe Effect Level is the sediment concentration of a compound that would be detrimental to the majority of benthic species. When any parameters are at or above the Severe Effect Level guideline, the material tested is considered highly contaminated and will likely have a significant effect on benthic biological resources. Based on the guidelines noted above, arsenic exceeded the Severe Effect Level in the north section of the canal and mercury exceeded the Severe Effect Level in the south section of the canal (Table 2). The highest mercury value documented in the sediment (20 mg/kg) exceeded the level reported (13.1 mg/kg) to cause significant mortality in the marine amphipod *Phepoxyinius abronius* during a sediment bioassay test (Swartz *et al.* 1988). The guidelines detailed in Persaud *et al.* (1993) do not include evaluations of numerous metals, pesticides and specific PCB congeners.
- One goldfish (*Carassius auratus*) was collected from the north section of the canal during the October 1998 sampling period. The entire fish (whole body) was analyzed for organochlorinated pesticides, PCBs, mercury, and percent lipid (Table 5). All PCB congeners, and most of the pesticides were not detected in the goldfish sample. Of the three organic pesticides detected in the fish tissue sample, two (methoxychlor, delta-BHC) were flagged with a percent difference qualifier (greater than 50% difference between original and confirmation analyses). Heptachlor epoxide was measured at 1.7 ug/kg in the goldfish, far below the USEPA (1993) screening value (concentrations of target analytes in fish that are of potential public health concern). A mercury value of 0.14 mg/kg was measured in the goldfish. This mercury value is considered slightly elevated (for human consumption) using the guidelines listed in the 1996 Ohio Water Resource Inventory (Ohio EPA 1996b).
- One objective of the study was to evaluate contaminant levels in turtles of edible size collected in the north section of the canal. Traps set over a three day period, as well as electrofishing, failed to produce any turtles of edible size. One turtle was collected, but because of its small size and type (painted turtle, *Chrysemys picta*), was released. Our sampling during early October 1998 did not provide any snapping turtles, which is the turtle species typically eaten by people.

Table 1. Sediment sampling locations in the Erie-Ohio Canal adjacent to B & E Landfill, 1998.

Sample Location	Sample Depth	Latitude	Longitude	Landmark	County	USGS 7.5 min. Quad. Map
<i>North Canal Section</i>						
BES1	0-6"/ 8"-36"	39°31'23"	83°00'43"	100 Meters from outlet	Pickaway	Williamsport, OH
BES2	0-6"	39°31'21"	83°00'42"	Middle of canal	Pickaway	Williamsport, OH
BES3	0-6"	39°31'18"	83°00'41"	50 Meters from southern end	Pickaway	Williamsport, OH
<i>South Canal Section</i>						
BES4	0-6"	39°31'08"	83°00'36"	Near north end	Pickaway	Williamsport, OH
BES5	0-6"	39°31'06"	83°00'35"	75 meters from northern end	Pickaway	Williamsport, OH
BES5 (D)	Field Duplicate of BES5					

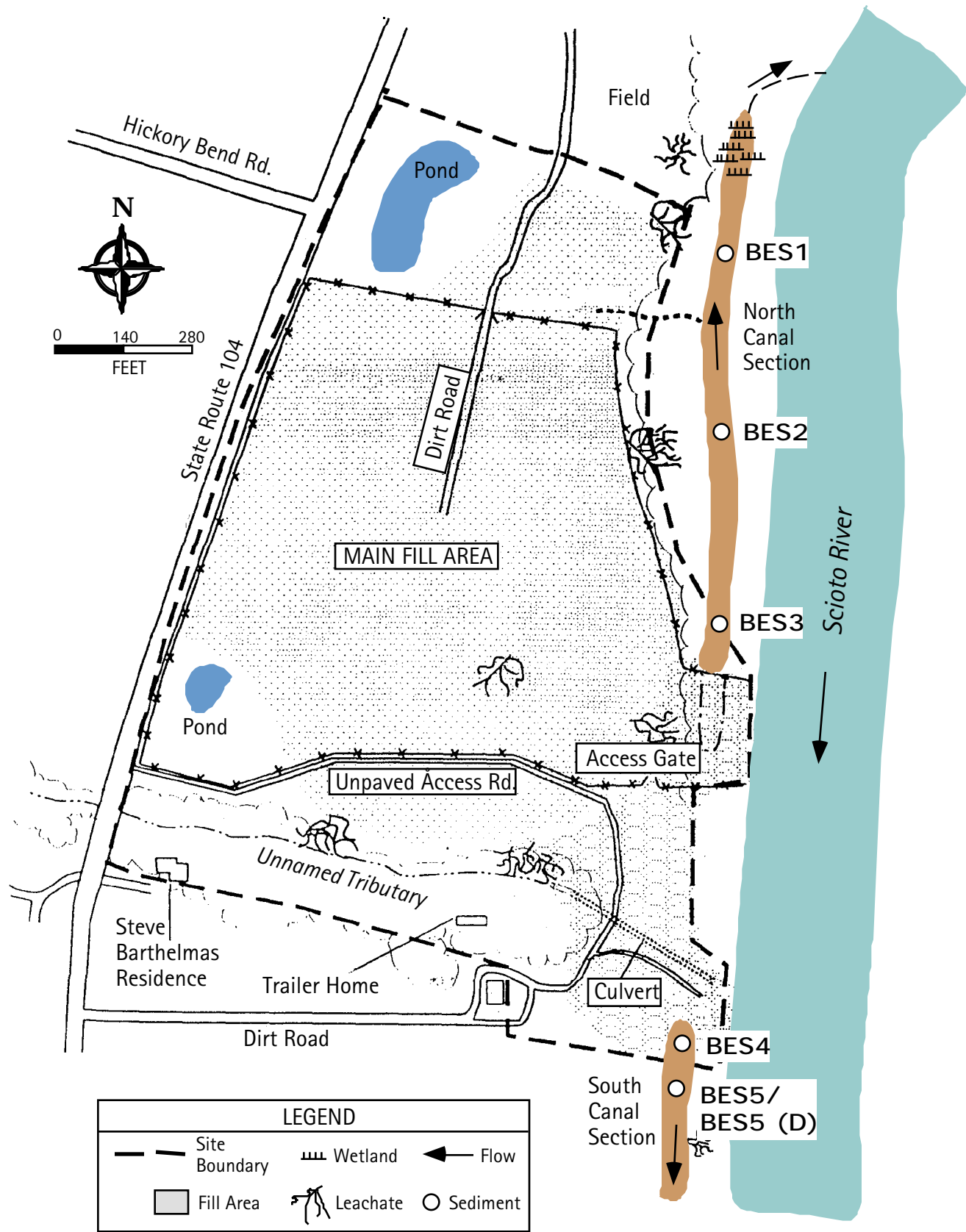


Figure 1. Map of the B & E landfill, Erie-Ohio Canal, and Ohio EPA sediment sampling locations, October 1998.

Table 2. Target analyte list (TAL) metals and cyanide measured in sediment collected from the Erie-Ohio Canal study area adjacent to the B & E Landfill, 1998 by Ohio EPA. Measurements in yellow exceed the Lowest Effect Level and measurements in red exceed the Severe Effect Level as detailed in Persaud *et al.* 1993.

METALS / CYANIDE (SEDIMENT)

Sample Number	MEBKB7	MEBJZ1	MEBPA8	MEBKB2	MEBJZ2	MEBPA9	MEBPA7
Sample Location	BES1	BES1	BES2	BES3	BES4	BES5	BES5 (D)
Sample Depth	0-6"	8"-36"	0-6"	0-6"	0-6"	0-6"	0-6"
Date Sampled	10/6/98	10/6/98	10/6/98	10/6/98	10/6/98	10/6/98	10/6/98
Analyte	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
Aluminum	7,240	9,730	9,730	11,800	10,900	12,300	10,700
Antimony	2.8 UJ	1.4 UJ	3.1 UJ	3.0 UJ	8.9 J	1.9 UJ	1.9 UJ
Arsenic*	34.0	11.8	50.1	64.8	20.6	8.8	8.9
Barium	571	136	755	534	178	170	162
Beryllium	0.80 J	0.80 J	0.70 J	1.1 J	1.1 J	1.0 J	0.90 J
Cadmium*	0.30 U	0.10 U	0.30 U	0.70	9.6	1.3	1.1
Calcium	139,000	30,500	125,000	92,200	45,200	30,900	32,800
Chromium*	11.2	13.5	13.9	17.8	18.2	24.2	22.9
Cobalt	8.8	9.8	9.5	10.9	10.3	10.8	9.7
Copper*	22.7	21.8	29.8	35.4	65.2	38.6	35.5
Iron*	31,900	22,200	38,100	33,200	27,500	23,100	21,000
Lead*	20.1	22.5	26.8	37.1	133	41.9	38.8
Magnesium	29,300	11,800	15,000	17,800	11,400	14,800	14,500
Manganese*	774	619	597	443	925	343	334
Mercury*	0.90	0.10	1.7	0.90	20.0	1.7	2.2
Nickel*	22.1	21.5	30.5	39.4	52.9	36.4	31.8
Potassium	2,140	1,370	2,520	3,050	2,080	2,140	1,900
Selenium	1.4 U	0.70 J	1.5 U	2.3 J	1.7 J	1.0 J	1.4 J
Silver	0.80 U	0.60	0.80 U	0.80 U	1.1	0.60	0.80
Sodium	1,190	420	1,280	1,240	718	372	349
Thallium	2.6 U	1.3 U	2.8 U	2.7 U	2.9 U	1.7 U	1.7 U
Vanadium	17.3	25.9	24.3	29.4	27.2	29.8	27.2
Zinc*	89.9 J	80.2 J	102 J	141 J	214 J	164 J	155 J
Cyanide	0.90 J	0.80 J	0.30 J	0.30 J	0.70 J	0.90 J	0.40 J

U -The analyte was analyzed for, but was not detected above the reported sample quantitation limit.

J - The analyte was positively identified; the associated numerical value is an approximate concentration of the analyte in the sample

UJ-The analyte was not detected above the reported sample quantitation limit. However, the reported quantitation limit is approximate and may or may not represent the action limit of quantitation necessary to accurately and precisely measure the analyte in the sample.

* - Parameters with sediment guidelines listed in Persaud *et al.* (1993).

Table 3. Organochlorinated pesticides and PCBs measured in sediment collected from the Erie-Ohio Canal study area adjacent to the B & E Landfill, 1998 by Ohio EPA. Measurements in yellow exceed the Lowest Effect Level as detailed in Persaud *et al.* 1993.

PESTICIDES / PCBs (SEDIMENT)

Sample Number	ECGL7	EAJM1	ETR43	ECGL2	EAJM2	ETR44	ETR42
Sample Location	BES1	BES1	BES2	BES3	BES4	BES5	BES5 (D)
Sample Depth	0-6"	8"-36"	0-6"	0-6"	0-6"	0-6"	0-6"
Date Sampled	10/6/98	10/6/98	10/6/98	10/6/98	10/6/98	10/6/98	10/6/98
Analyte	ug/kg	ug/kg	ug/kg	ug/kg	ug/kg	ug/kg	ug/kg
alpha-BHC*	5.9 U	2.8 U	6.1 U	6.1 U	5.9 U	3.9 U	3.9 U
beta-BHC*	5.9 U	2.8 U	6.1 U	6.1 U	7.1 J	3.9 U	3.9 U
delta-BHC	5.9 U	2.8 U	6.1 U	6.1 U	5.9 U	3.9 U	3.9 U
gamma-BHC (Lindane)*	5.9 U	2.8 U	6.1 U	6.1 U	5.9 U	3.9 U	3.9 U
Heptachlor*	5.9 U	2.8 U	6.1 U	6.1 U	5.9 U	3.9 U	3.9 U
Aldrin*	5.9 U	2.8 U	6.1 U	6.1 U	5.9 U	3.9 U	3.9 U
Heptachlor Epoxide*	5.9 U	2.8 U	6.1 U	6.1 U	5.9 U	3.9 U	3.9 U
Endosulfan I	5.9 U	2.8 U	6.1 U	6.1 U	5.9 U	3.9 U	3.9 U
Dieldrin*	11 U	5.5 U	12 U	12 U	33 J	7.5 U	5.4 J
4,4'-DDE*	11 U	5.5 U	12 U	9.8 J	47	12 J	9.0
Endrin*	11 U	5.5 U	12 U	12 U	11 U	7.5 U	7.5 U
Endosulfan II	11 U	5.5 U	12 U	12 U	11 U	7.5 U	7.5 U
4,4'-DDD*	11 U	5.5 U	12 U	12 U	11 U	10	7.5 U
Endosulfan Sulfate	11 U	5.5 U	12 U	12 U	11 U	5.4 J	7.5 U
4,4'-DDT*	11 U	5.5 U	12 U	12 U	11 U	7.5 U	7.5 U
Methoxychlor	59 U	28 U	61 U	61 U	59 U	39 U	39 U
Endrin Ketone	11 U	5.5 U	12 U	12 U	11 U	7.5 U	7.5 U
Endrin Aldehyde	11 U	5.5 U	12 U	12 U	9.9 J	7.5 U	7.5 U
alpha-Chlordane*	5.9 U	2.8 U	6.1 U	6.1 U	5.9 U	3.9 U	3.9 U
gamma-Chlordane*	5.9 U	2.8 U	6.1 U	6.1 U	14 J	3.9 U	3.9 U
Toxaphene	590 U	280 U	610 U	610 U	590 U	390 U	390 U
Aroclor-1016*	110 U	55 U	120 U	120 U	110 U	75 U	75 U
Aroclor-1221	230 U	110 U	240 U	240 U	230 U	150 U	150 U
Aroclor-1232	110 U	55 U	120 U	120 U	110 U	75 U	75 U
Aroclor-1242	110 U	55 U	120 U	120 U	110 U	75 U	75 U
Aroclor-1248*	110 U	55 U	120 U	416J	1456	194	126
Aroclor-1254*	110 U	55 U	120 U	120 U	110 U	75 U	75 U
Aroclor-1260*	110 U	55 U	120 U	120 U	110 U	75 U	75 U

U- The analyte was analyzed for, but was not detected above the reported sample quantitation limit.

J- The analyte was positively identified; the associated numerical value is an approximate concentration of the analyte in the sample.

*- Parameters with sediment guidelines listed in Persaud *et al.* (1993).

Table 4. Total organic carbon, pH, and grain size measured in sediment collected from the Erie-Ohio Canal study area adjacent to the B & E Landfill, 1998 by Ohio EPA.

Sample Number	NCNS	NCND	NCMS	NCSS	SCNS	SCSS	SCMS
Sample Location	BES1	BES1	BES2	BES3	BES4	BES5	BES5 (D)
Sample Depth	0-6"	8"-36"	0-6"	0-6"	0-6"	0-6"	0-6"
Date Sampled	10/6/98	10/6/98	10/6/98	10/6/98	10/6/98	10/6/98	10/6/98
Analyte							
TOC (mg/kg)	>54,400	>24,900	>60,300	48,800	>60,900	>37,700	>37,400
pH (S.U.)	7.7	7.7	7.7	7.4	7.4	7.7	7.6
Grain size:							
% Gravel	-	-	3.4	-	2.2	-	-
% Sand	-	-	3.7	-	6.7	-	-
% Silt/Clay	-	-	92.9	-	91.1	-	-
Percent Solids	28.8	63.0	26.3	24.8	25.5	42.0	41.5

Table 5. Organochlorinated pesticides, PCBs, mercury, and percent lipid measured in fish tissue collected from the Erie-Ohio Canal study area adjacent to the B & E Landfill, 1998 by Ohio EPA.

PESTICIDES / PCBs / MERCURY (FISH TISSUE)		
Sample Number	BE265-98	
Sample Location	Ohio Canal	
Date Sampled	10/6/98	
Analyte	ug/kg	Reporting Limit
alpha-BHC	ND	1.7 ug/kg
beta-BHC	ND	1.7 ug/kg
delta-BHC	4.2 PF	1.7 ug/kg
gamma-BHC (Lindane)	ND	1.7 ug/kg
Heptachlor	ND	1.7 ug/kg
Aldrin	ND	1.7 ug/kg
Heptachlor Epoxide	1.7	1.7 ug/kg
Endosulfan I	ND	1.7 ug/kg
Dieldrin	ND	3.3 ug/kg
4,4'-DDE	ND	3.3 ug/kg
Endrin	ND	3.3 ug/kg
Endosulfan II	ND	3.3 ug/kg
4,4'-DDD	ND	3.3 ug/kg
Endosulfan Sulfate	ND	3.3 ug/kg
4,4'-DDT	ND	3.3 ug/kg
Methoxychlor	29PF	17 ug/kg
Endrin Ketone	ND	3.3 ug/kg
Endrin Aldehyde	ND	3.3 ug/kg
Chlordane	ND	8.3 ug/kg
Toxaphene	ND	83 ug/kg
Aroclor-1016	ND	33 ug/kg
Aroclor-1221	ND	33 ug/kg
Aroclor-1232	ND	33 ug/kg
Aroclor-1242	ND	33 ug/kg
Aroclor-1248	ND	33 ug/kg
Aroclor-1254	ND	33 ug/kg
Aroclor-1260	ND	33 ug/kg
Mercury	0.14	0.1 mg/kg
Percent Lipid	1.1	-

ND -Results were not detected at or above the stated limit.

PF -The percent difference between the original and confirmation analyses is greater than 50%.

REFERENCES

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