Fish Tissue Study of the Little Miami River

Peters Cartridge Company

Warren County

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INTRODUCTION

The Peters Cartridge Company site is a partially abandoned manufacturing facility located along the Little Miami River near Kings Mills, Ohio. The site covers about 10 acres in the floodplain and along the south valley wall of the Little Miami River.

The Peters Cartridge facility began operations around 1880. The facility produced shotgun shells, and rifle and pistol cartridges. Shotgun pellets were made in the 220 foot tall shot tower. Mercury fulminate, used as a primer in cartridges and shells, was produced in a building at the west end of the site. Production of munitions continued at the facility until 1944. Various businesses unrelated to ammunitions production have occupied the facility since 1944.

A site evaluation of the property conducted in 1987 revealed widespread lead contamination in soils and groundwater. In addition, an expanded site inspection in 1996 detected lead in soil and sediment at highly elevated levels. Testing for mercury confirmed highly elevated levels in soils and sediments on and adjacent to the site.

The specific objective of this study was to:

1) Establish the concentration of mercury and lead, and other bioaccumulative chemicals, in edible portions of upper and lower trophic level fish from the Little Miami River adjacent to the Peters Cartridge facility.

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), and Ohio EPA Fish Tissue Guidance Manual (Ohio EPA 1994). Fish tissue sampling locations are listed in Table 1.

Fish were sampled using boat mounted pulsed DC electrofishing gear. Two sample locations were established in the Little Miami River upstream from Peters Cartridge, one location was adjacent to the facility, and one location was situated downstream from the facility. Fillet samples (skin-on or skin-off) were collected in the field from five different fish species - common carp, flathead catfish, channel catfish, spotted bass, and smallmouth bass. Fish samples were placed on dry ice, and transported back to the Ecological Assessment Unit field facility for storage in freezers. 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).

SUMMARY/CONCLUSIONS

Fish tissue was analyzed from four Little Miami River locations in 1999 in the vicinity of the Peters Cartridge facility. All samples were evaluated for mercury, lead, cadmium, arsenic, selenium, organochlorinated pesticides, PCBs, and lipids. Results are reported in Table 2.

Mercury, a site contaminant, was measured in all fish samples collected in the Little Miami River during this survey. Mercury values ranged from 128 ug/kg to 385 ug/kg, with no apparent relationship to the Peters Cartridge site. Guidance for mercury assessment in fish tissue in Ohio has been derived by the Ohio Department of Health (Ohio EPA 1996). Mercury consumption levels are directed at quantifying human health risks. Based on this framework, six of the samples exceeded 200 ug/kg and were considered moderately elevated, and the other six samples exceeded 51 ug/kg and were slightly elevated (Ohio EPA 1996). The U.S. Fish and Wildlife Service has found that mercury contamination levels should not exceed 100 ug/kg to protect piscivorous birds and 1,100 ug/kg to protect piscivorous mammals against bioaccumulation (Eisler 1987). Previous studies of mercury in fish fillets from throughout the Little Miami River documented elevated levels, with no association with any obvious pollution sources in the watershed.

Lead, a site contaminant, was measured in all fish tissue samples and was not detected above the laboratory detection limit.

Based on 1999 fish tissue sampling results, Peters Cartridge site related contaminants (mercury and lead) were not adversely influencing the fish communities of the Little Miami River.

Table 1. Fish tissue sampling locations in the Little Miami River, 1999.

River Mile Sample Location	Fish Species	Latitude	Longitude	Landmark	County	USGS 7.5 min. Quad. Map
Little Miami River						
32.5	Flathead catfish Channel catfish Spotted bass Common carp	39°21'58"	84°13'57"	Downstream State Route 48/ Upstream Muddy Creek	Warren	S. Lebanon,OH
30.8	Smallmouth bass Spotted bass Common carp	39°21'09"	84°14'25"	Upstream Grandin Road	Warren	S. Lebanon,OH
30.4	Channel catfish Flathead catfish Common carp	39°21'02"	84°14'55"	Adjacent Peters Cartridge	Warren	S. Lebanon,OH
29.0	Channel catfish Common carp	39°19'54"	84°15'12"	Upstream Simpson Creek	Warren	Mason,OH

Table 2. Mercury, lead, select metals, organochlorinated pesticides, PCBs, and percent lipids measured in fish tissue collected from the Little Miami River, May 11, 1999 by Ohio EPA.

Sample Location	RM 32.5	RM 32.5	RM 32.5	RM 32.5	RM 30.8	RM 30.8
Fish Species	Flathead catfish	Channel catfish	Spotted bass	Common carp	Common carp	Spotted bass
Analyte	ug/kg	ug/kg	ug/kg	ug/kg	ug/kg	ug/kg
Mercury	178	368	385	173	128	341
Lead	ND (<178)	ND (<182)	ND (<182)	ND (<189)	ND (<175)	ND (<185)
Arsenic	ND (<178)	ND (<182)	ND (<182)	ND (<189)	ND (<175)	ND (<185)
Cadmium	ND (<17.8)	ND (<18.2)	ND (<18.2)	ND (<18.9)	ND (<17.5)	ND (<18.5)
Selenium	ND (<178)	ND (<182)	227	283	289	194
Aldrin	ND (<9.97)	ND (<9.86)	ND (<9.86)	ND (<9.76)	ND (<9.94)	ND (<9.85)
alpha-BHC	ND (<9.97)	ND (<9.86)	ND (<9.86)	ND (<9.76)	ND (<9.94)	ND (<9.85)
beta-BHC	ND (<9.97)	ND (<9.86)	ND (<9.86)	ND (<9.76)	ND (<9.94)	ND (<9.85)
delta-BHC	ND (<9.97)	ND (<9.86)	ND (<9.86)	ND (<9.76)	ND (<9.94)	ND (<9.85)
gamma-BHC	ND (<9.97)	ND (<9.86)	ND (<9.86)	ND (<9.76)	ND (<9.94)	ND (<9.85)
4,4'-DDD	ND (<9.97)	ND (<9.86)	ND (<9.86)	ND (<9.76)	ND (<9.94)	ND (<9.85)
4,4'-DDE	ND (<9.97)	32.1	ND (<9.86)	13.7	ND (<9.94)	ND (<9.85)
4,4'-DDT	ND (<9.97)	ND (<9.86)	ND (<9.86)	ND (<9.76)	ND (<9.94)	ND (<9.85)
Dieldrin	17.4	36.4	ND (<9.86)	10.8	ND (<9.94)	ND (<9.85)
Endosulfan I	ND (<9.97)	ND (<9.86)	ND (<9.86)	ND (<9.76)	ND (<9.94)	ND (<9.85)
Endosulfan II	ND (<9.97)	ND (<9.86)	ND (<9.86)	ND (<9.76)	ND (<9.94)	ND (<9.85)
Endosulfan sulfate	ND (<9.97)	ND (<9.86)	ND (<9.86)	ND (<9.76)	ND (<9.94)	ND (<9.85)
Endrin	ND (<9.97)	ND (<9.86)	ND (<9.86)	ND (<9.76)	ND (<9.94)	ND (<9.85)
Heptachlor	ND (<9.97)	ND (<9.86)	ND (<9.86)	ND (<9.76)	ND (<9.94)	ND (<9.85)
Heptachlor epoxide	ND (<9.97)	ND (<9.86)	ND (<9.86)	ND (<9.76)	ND (<9.94)	ND (<9.85)
Methoxychlor	ND (<9.97)	ND (<9.86)	ND (<9.86)	ND (<9.76)	ND (<9.94)	ND (<9.85)
Mirex	ND (<9.97)	ND (<9.86)	ND (<9.86)	ND (<9.76)	ND (<9.94)	ND (<9.85)
Hexachlorobenzene	ND (<9.97)	ND (<9.86)	ND (<9.86)	ND (<9.76)	ND (<9.94)	ND (<9.85)
alpha-Chlordane	ND (<9.97)	30.4	ND (<9.86)	ND (<9.76)	ND (<9.94)	ND (<9.85)
gamma-Chlordane	ND (<9.97)	11.7	ND (<9.86)	ND (<9.76)	ND (<9.94)	ND (<9.85)
Oxychlordane	ND (<9.97)	ND (<9.86)	ND (<9.86)	ND (<9.76)	ND (<9.94)	ND (<9.85)
cis-Nonachlor	ND (<9.97)	15.8	ND (<9.86)	ND (<9.76)	ND (<9.94)	ND (<9.85)
trans-Nonachlor	12.2	53	ND (<9.86)	12.4	ND (<9.94)	ND (<9.85)
PCB-1016	ND (<49.8)	ND (<49.3)	ND (<49.3)	ND (<48.8)	ND (<49.7)	ND (<49.3)
PCB-1221	ND (<49.8)	ND (<49.3)	ND (<49.3)	ND (<48.8)	ND (<49.7)	ND (<49.3)
PCB-1232	ND (<49.8)	ND (<49.3)	ND (<49.3)	ND (<48.8)	ND (<49.7)	ND (<49.3)
PCB-1242	ND (<49.8)	ND (<49.3)	ND (<49.3)	ND (<48.8)	ND (<49.7)	ND (<49.3)
PCB-1248	ND (<49.8)	ND (<49.3)	ND (<49.3)	ND (<48.8)	ND (<49.7)	ND (<49.3)
PCB-1254	ND (<49.8)	172	ND (<49.3)	75.4	ND (<49.7)	ND (<49.3)
PCB-1260	ND (<49.8)	148	ND (<49.3)	79	ND (<49.7)	ND (<49.3)
Lipids	1.4 %	4.74 %	0.187 %	1.71 %	1.44 %	0.236 %

Table 2. Continued.

Sample Location	RM 30.8	RM 30.4	RM 30.4	RM 30.4	RM 29.0	RM 29.0
Fish Species	Smallmouth bass	Channel catfish	Common carp	Flathead catfish	Common carp	Channel catfish
Analyte	ug/kg	ug/kg	ug/kg	ug/kg	ug/kg	ug/kg
Mercury	179	168	257	300	216	156
Lead	ND (<172)	ND (<175)	ND (<189)	ND (<175)	ND (<172)	ND (<169)
Arsenic	ND (<172)	ND (<175)	ND (<189)	ND (<175)	ND (<172)	ND (<169)
Cadmium	ND (<17.2)	ND (<17.5)	ND (<18.9)	ND (<17.5)	ND (<17.2)	ND (<16.9)
Selenium	302	ND (<175)	264	ND (<175)	328	ND (<169)
Aldrin	ND (<9.95)	ND (<9.80)	ND (<9.76)	ND (<10.0)	ND (<9.78)	ND (<9.50)
alpha-BHC	ND (<9.95)	ND (<9.80)	ND (<9.76)	ND (<10.0)	ND (<9.78)	ND (<9.50)
beta-BHC	ND (<9.95)	ND (<9.80)	ND (<9.76)	ND (<10.0)	ND (<9.78)	ND (<9.50)
delta-BHC	ND (<9.95)	ND (<9.80)	ND (<9.76)	ND (<10.0)	ND (<9.78)	ND (<9.50)
gamma-BHC	ND (<9.95)	ND (<9.80)	ND (<9.76)	ND (<10.0)	ND (<9.78)	ND (<9.50)
4,4'-DDD	ND (<9.95)	ND (<9.80)	ND (<9.76)	ND (<10.0)	ND (<9.78)	ND (<9.50)
4,4'-DDE	ND (<9.95)	21.3	ND (<9.76)	25.8	ND (<9.78)	10.4
4,4'-DDT	ND (<9.95)	ND (<9.80)	ND (<9.76)	ND (<10.0)	ND (<9.78)	ND (<9.50)
Dieldrin	ND (<9.95)	30.5	ND (<9.76)	29.7	ND (<9.78)	ND (<9.50)
Endosulfan I	ND (<9.95)	ND (<9.80)	ND (<9.76)	ND (<10.0)	ND (<9.78)	ND (<9.50)
Endosulfan II	ND (<9.95)	ND (<9.80)	ND (<9.76)	ND (<10.0)	ND (<9.78)	ND (<9.50)
Endosulfan sulfate	ND (<9.95)	ND (<9.80)	ND (<9.76)	ND (<10.0)	ND (<9.78)	ND (<9.50)
Endrin	ND (<9.95)	ND (<9.80)	ND (<9.76)	ND (<10.0)	ND (<9.78)	ND (<9.50)
Heptachlor	ND (<9.95)	ND (<9.80)	ND (<9.76)	ND (<10.0)	ND (<9.78)	ND (<9.50)
Heptachlor epoxide	ND (<9.95)	ND (<9.80)	ND (<9.76)	ND (<10.0)	ND (<9.78)	ND (<9.50)
Methoxychlor	ND (<9.95)	ND (<9.80)	ND (<9.76)	ND (<10.0)	ND (<9.78)	ND (<9.50)
Mirex	ND (<9.95)	ND (<9.80)	ND (<9.76)	ND (<10.0)	ND (<9.78)	ND (<9.50)
Hexachlorobenzene	ND (<9.95)	ND (<9.80)	ND (<9.76)	ND (<10.0)	ND (<9.78)	ND (<9.50)
alpha-Chlordane	ND (<9.95)	24.8	ND (<9.76)	18.4	ND (<9.78)	ND (<9.50)
gamma-Chlordane	ND (<9.95)	11.3	ND (<9.76)	ND (<10.0)	ND (<9.78)	ND (<9.50)
Oxychlordane	ND (<9.95)	ND (<9.80)	ND (<9.76)	ND (<10.0)	ND (<9.78)	ND (<9.50)
cis-Nonachlor	ND (<9.95)	ND (<9.80)	ND (<9.76)	10.5	ND (<9.78)	ND (<9.50)
trans-Nonachlor	ND (<9.95)	34.6	ND (<9.76)	34.3	ND (<9.78)	16
PCB-1016	ND (<49.8)	ND (<49.0)	ND (<48.8)	ND (<50.0)	ND (<48.9)	ND (<47.5)
PCB-1221	ND (<49.8)	ND (<49.0)	ND (<48.8)	ND (<50.0)	ND (<48.9)	ND (<47.5)
PCB-1232	ND (<49.8)	ND (<49.0)	ND (<48.8)	ND (<50.0)	ND (<48.9)	ND (<47.5)
PCB-1242	ND (<49.8)	ND (<49.0)	ND (<48.8)	ND (<50.0)	ND (<48.9)	ND (<47.5)
PCB-1248	ND (<49.8)	ND (<49.0)	ND (<48.8)	ND (<50.0)	ND (<48.9)	ND (<47.5)
PCB-1254	ND (<49.8)	170	ND (<48.8)	123	ND (<48.9)	ND (<47.5)
PCB-1260	ND (<49.8)	157	ND (<48.8)	69.2	ND (<48.9)	48.2
Lipids	0.368 %	5.3 %	0.889 %	2.31 %	0.724 %	1.22 %

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

REFERENCES

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