

**Polychlorinated Biphenyls (PCBs) and Metals in  
Sediments Cores Collected September 20, 2006  
from the Ohio River Sand Bank at the  
Bayou Creek – Ohio River Confluence**

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**DRAFT REPORT**

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## INTRODUCTION

Stream sediment core samples for PCB and metal analyses were taken from the sand bank at the confluence of Big and Little Bayou creeks with the Ohio River on September 20, 2006. These samples were taken during low-flow stream conditions that exposed the Ohio River sand bank formed from Bayou Creek discharges. A total of 10 core sediment samples were collected. Three Aroclors (*i.e.* 1248, 1254, 1260) and a total of 29 metals [*i.e.* silver (Ag), aluminum (Al), arsenic (As), boron (B), barium (Ba), beryllium (Be), calcium (Ca), cadmium (Cd), cobalt (Co), chromium (Cr), copper (Cu), iron (Fe), potassium (K), lithium (Li), magnesium (Mg), manganese (Mn), molybdenum (Mo), sodium (Na), nickel (Ni), phosphorus (P), lead (Pb), antimony (Sb), selenium (Se), silicon (Si), strontium (Sr), titanium (Ti), thallium (Tl), vanadium (V), and zinc (Zn)] were determined for each sample.

## METHODS

Samples were collected by personnel from Kentucky's Environmental and Public Protection Cabinet (Division of Waste Management), U.S. EPA, and the University of Kentucky. Sediment core samples were taken at 10 locations within the confluence area. The exact locations were not required by University of Kentucky personnel and the cores were treated as blind-samples to eliminate bias. Sediment samples were obtained using stainless steel auger-head core samplers. Core samplers and stainless steel spoons were cleaned and solvent rinsed between locations. All University of Kentucky samples for PCB and metal analyses were collected in chemically cleaned, 250-mL glass jars with Teflon-

lined caps obtained from I-Chem®. In addition, core samples were split with the State's Division of Waste Management. Samples were placed on ice until delivery to the laboratory and maintained under refrigeration (4°C) until extraction.

### **PCB Sediment Extraction**

Wet sediment extractions of PCBs were performed following U.S EPA SW-846 Method 3540C (U.S. EPA, 1997; Erickson, 1997). All solvents used were pesticide grade and were screened for organic contaminants prior to use. Each sample collected was extracted and analyzed in duplicate. Weighed sub-samples (average wet weight  $50.50 \pm 0.11$  g; average dry weight  $40.81 \pm 0.76$  g) were extracted with 300 mL of acetone/methylene chloride (1:1 v:v) in a 500-mL Soxhlet extractor for 15 h. The extract was concentrated to near dryness in a Roto-evaporator (Buchi Model RE121). The reconstituted samples (5.0 mL in iso-octane) were cleaned of interferences as described below and then analyzed by gas chromatography.

### **Sample Cleanup**

Lipid and pesticide cleanup was performed by eluting a 2.0 mL sample through a micro-column of 2.0 g activated 100-200 mesh Florisil® (100 °C/24 h) with 10.0 mL hexane and evaporated to 2.0 mL (Erickson, 1997; U.S EPA, 1997 Method 3620B). Elemental sulfur was removed by shaking 2-propanol (2 mL) and tetrabutylammonium sulfite (2 mL); adding ultra-pure water (8 mL); and reshaking. The organic extract was removed and mixed with 2.0 mL concentrated sulfuric acid (Jensen *et al.*, 1977; U.S EPA, 1997 Method 3660B). A 4 µL sub-sample was analyzed by gas chromatography.

## **PCB Determinations**

Samples were analyzed for Aroclors 1248, 1254, and 1260 according to SW-846 Method 8082 (U.S. EPA, 1997). Analyses were performed using a Hewlett-Packard (HP) Model 5890A gas chromatograph equipped with an electron capture detector and an HP Model 7673A Automatic Sampler. Samples were analyzed using a 60m X 0.53mm ID SPB-5 (0.5 $\mu$ m film) fused silica megabore column (Supelco®, Inc.) with ultra-high purity helium and nitrogen as carrier and makeup gases, respectively. The temperature program was set at 160 °C to 235 °C at 10 °C/min, then 235 °C to 260 °C at 0.9 °C/min and held for 10 min. Injector temperature was 280 °C and detector temperature was 300 °C. PCB peak heights were quantified using an HP Model 3396A integrator. Aroclor levels were calculated from heights of 6 to 9 peaks for Aroclor 1248 and 1260 and 4-6 peaks for Aroclor 1254. Five external standards for each Aroclor were used for calibration curves and for every tenth sample either a solvent blank or a standard was analyzed. Statistical quantitation of peak heights was determined by multiple-peak linear regression analysis, which was performed with Lotus-123® software. The Lotus program regresses data from PCB standards to the sample being analyzed. Each peak selected for each Aroclor class was statistically analyzed (e.g., standard deviation; standard error; relative deviation). Chromatographs and bench records for all PCB assays will be maintained as given below under quality assurance.

## **Sediment Metal Determinations**

A 2.0 g sample was digested and extracted according to procedures described in EPA Method 3050B and ASTM Method D 3974-81 (U.S. EPA, 1997 and ASTM, 1989). Sediment samples were wet-weighed and placed in 50-mL Hot-Block® (Environmental Express) digestion tubes. The samples were digested with 10.0 mL 1:1 TraceMetal grade HNO<sub>3</sub> and heated to 95°C for 10 min in a Hot-Block® digestion unit. The samples were allowed to cool to room temperature and 5.0 mL of conc. HNO<sub>3</sub> was added to each sample, followed by heat-instilling until 5.0 mL were obtained. To each sample, 2.0 mL of nanopure water and 3.0 mL of 30% H<sub>2</sub>O<sub>2</sub> were added and the sample heated. The samples were then reconstituted with 5.0 mL of 0.5% HNO<sub>3</sub> and filtered through certified 2 µm Teflon filters (Environmental Express) to remove suspended particulates. The filtrates were taken to a final volume of 100 mL. Metal analysis was performed using a Varian Vista-MPX simultaneous Inductively Coupled Plasma-Optical Emission Spectrophotometer (ICP-OES) as described by U.S. EPA (1997). Calibration curves were based on at least four standards. Instrument blanks (0.5% HNO<sub>3</sub>) and check standards were processed with all samples. Sample concentrations were then corrected for deviations from the standards and sample weights were factored into the calculations of final values.

## **Quality Assurance**

Permanent bench records were kept of all assays and annotated as required under Good Laboratory Practices (*Federal Register*, 40 CFR, Part 160, August 17, 1989). All printouts and graphic recordings were filed and are open for inspection. These bench records will be archived within two years after the close of the project but retrievable upon request.

## RESULTS

PCB concentrations for individual wet-extracted sediment cores from the confluence area sand bank are given in Table 1. No Aroclor 1248 was found in any of the core samples. Low level Aroclors 1254 and 1260 were detected in the sediment samples, however, except for sample CONF-9B, none of the PCBs detected were above the minimum quantitation limit (MQL). Detections below the MQL were still presented in Table 1 for Aroclors 1254 and 1260, however these values are mainly for qualitative purposes only. Sample CONF-9B had concentrations of 5.34 and 5.24 µg/Kg for Aroclor 1254 and 1260, respectively. Although PCBs were detected in this sample, the values were close to the limit of detection of <5.22 µg/Kg.

Metal concentrations for individual sediment cores from the confluence area are presented in Table 2. Mean metal concentrations for the 10 core samples and for all samples collected are given in Table 3. As indicated in the Methods, the confluence area sediment cores were treated as blind samples and the locations within the Ohio River sand bank were not known. Mean metal sediment values for Big and Little Bayou creeks collected during the same time period are given in Tables 4 and 5, respectively. This data was used to compare values with those found in the confluence area and a separate report on the findings from Bayou Creek will be submitted at a later date. Silver (Ag) was not found in samples 1 through 5 and sample 7; Antimony (Sb) was not found in sample 7; Selenium (Se) was only detected in sample 10; and titanium (Ti) was not found in samples 1 through 4 and sample 7. Overall, mean metal concentrations for Ag, Al, As, B, Be, Cd, Co, Cr, Fe, Li, Mn, Mo, Na, P, Pb, Sb, Se, Si, Sr, Ti, and V were within the range

observed at upstream reference stations in Big Bayou creek (Table 4). Levels for Ba, Ca, Cu, K, Mg, Ni, Tl, and Zn were slightly higher than those found for upstream stations in Big Bayou creek, but were within the range found in samples from Little Bayou creek (Table 5). It is interesting to note that samples 6, 8, 9, and 10 had the highest concentrations of Ag, Al, Ba, Ca, Co, Cu, Fe, K, Li, Mg, Mn, Na, Ni, P, Pb, Sr, V, and Z (Table 3).

## REFERENCES

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Jensen, S., L. Renberg, and L. Reutergardh. 1977. Residue of sediment and sewage sludge for organochlorines in the presence of elemental sulfur. *Anal. Chem.* 49:316-318.

U.S. EPA. 1997. Test methods for evaluating solid wastes, SW-846, Final Update 3. Office of Solid Waste and Emergency Response, Washington, D.C.



Table 1. PCB results for sediment samples from the Bayou creek-Ohio river confluence collected September 20, 2006.

Station	Date	Sample <sup>1</sup>	Sediment Wt.			Aroclor Conc. (µg/Kg) <sup>2</sup>			
			Wet Wt. (g)	Dry Wt. (g)	% Moisture	1248	1254	1260	Total
CONF	09/20/06	1A	50.424	43.024	14.7	<4.65	1.56*	2.24*	3.80*
CONF	09/20/06	1B	50.499	43.369	14.1	<4.61	1.07*	1.73*	2.80*
CONF	09/20/06	2A	50.374	42.204	16.2	<4.74	1.83*	2.22*	4.05*
CONF	09/20/06	2B	50.008	41.728	16.6	<4.79	0.95*	1.86*	2.81*
CONF	09/20/06	3A	50.362	43.062	14.5	<4.64	1.80*	2.05*	3.85*
CONF	09/20/06	3B	50.156	43.466	13.3	<4.60	1.54*	2.03*	3.57*
CONF	09/20/06	4A	50.582	43.972	13.1	<4.55	1.56*	2.19*	3.75*
CONF	09/20/06	4B	50.101	43.651	12.9	<4.58	1.42*	2.21*	3.62*
CONF	09/20/06	5A	50.328	37.478	25.5	<5.34	2.57*	2.93*	5.49*
CONF	09/20/06	5B	50.290	39.210	22.0	<5.10	2.98*	2.86*	5.84*
CONF	09/20/06	6A	50.392	40.442	19.7	<4.95	3.19*	3.04*	6.23*
CONF	09/20/06	6B	50.685	41.965	17.2	<4.77	1.60*	2.87*	4.46*
CONF	09/20/06	7A	50.755	42.495	16.3	<4.71	2.59*	2.71*	5.29*
CONF	09/20/06	7B	50.452	42.182	16.4	<4.74	1.79*	2.54*	4.33*
CONF	09/20/06	8A	51.275	32.245	37.1	<6.20	3.09*	4.89*	7.98*
CONF	09/20/06	8B	50.488	33.648	33.4	<5.94	3.01*	4.05*	7.07*
CONF	09/20/06	9A	52.257	37.307	28.6	<5.36	4.74*	4.30*	9.04*
CONF	09/20/06	9B	50.356	38.286	24.0	<5.22	5.34	5.24	10.58
CONF	09/20/06	10A	50.195	42.955	14.4	<4.66	2.08*	2.80*	4.88*
CONF	09/20/06	10B	50.026	43.436	13.2	<4.60	2.49*	3.02*	5.51*

<sup>1</sup> Samples A and B are duplicate extractions from the same jar for that station.

<sup>2</sup> Asterisk (\*) denotes PCBs detected, however the concentrations were below the minimum quantitation limit (MQL).

Table 2. Metal concentrations in sediments from Ohio River sand bank at the confluence with Bayou Creek collected September 20, 2006.

Station	Date	Sample <sup>1</sup>	Sediment Metal Conc. (µg/g)								
			Ag	Al	As	B	Ba	Be	Ca	Cd	Co
CONF# 1	9/20/2006	F1A	<0.022	1861.1	1.35	19.46	21.14	0.23	760.3	0.18	3.11
CONF# 1	9/20/2006	F1B	<0.022	1465.8	3.33	17.66	13.90	0.21	709.6	0.16	2.99
CONF# 2	9/20/2006	F1A	<0.024	1185.2	1.20	20.07	10.77	0.16	288.5	0.10	2.08
CONF# 2	9/20/2006	F1B	<0.025	1217.3	1.26	19.27	10.08	0.15	296.3	0.13	2.16
CONF# 3	9/20/2006	F1A	<0.024	1574.6	2.12	20.21	14.17	0.18	409.1	0.14	3.18
CONF# 3	9/20/2006	F1B	<0.023	1507.8	1.22	20.21	14.84	0.17	369.7	0.12	2.89
CONF# 4	9/20/2006	F1A	<0.022	1918.0	1.69	18.11	13.83	0.36	397.0	0.29	5.10
CONF# 4	9/20/2006	F1B	<0.023	1558.4	1.70	18.60	13.37	0.24	429.4	0.17	3.28
CONF# 5	9/20/2006	F1A	<0.025	2989.4	2.01	18.77	38.85	0.29	1319.7	0.23	4.45
CONF# 5	9/20/2006	F1B	<0.021	2987.7	1.99	15.77	37.21	0.25	1236.8	0.20	4.09
CONF# 6	9/20/2006	F1A	0.053	5265.5	3.01	18.18	52.73	0.44	1725.0	0.36	7.43
CONF# 6	9/20/2006	F1B	0.076	4771.2	4.26	19.91	63.84	0.59	1532.0	0.44	11.02
CONF# 7	9/20/2006	F1A	<0.022	1685.5	1.96	17.59	33.19	0.15	609.1	0.14	3.12
CONF# 7	9/20/2006	F1B	<0.024	2206.5	1.59	19.64	19.77	0.19	632.3	0.15	4.00
CONF# 8	9/20/2006	F1A	0.042	6586.4	2.22	16.99	60.68	0.40	3894.0	0.33	6.35
CONF# 8	9/20/2006	F1B	0.044	6456.1	2.04	16.03	56.96	0.38	3669.8	0.34	6.15
CONF# 9	9/20/2006	F1A	0.022	6310.9	2.01	16.67	53.74	0.43	4286.2	0.34	6.63
CONF# 9	9/20/2006	F1B	0.038	6602.1	2.60	17.10	57.30	0.41	4416.0	0.37	6.98
CONF# 10	9/20/2006	F1A	0.138	5681.8	5.48	16.65	103.31	0.44	1857.0	0.39	8.73
CONF# 10	9/20/2006	F1B	0.076	5331.0	4.78	20.51	109.05	0.42	1973.3	0.38	8.22

<sup>1</sup> F1A and F1B are duplicates digested from the same sampling site.

Table 2, continued. Metal concentrations in sediments from Ohio River sand bank at the confluence with Bayou Creek collected September 20, 2006.

Station	Date	Sample <sup>1</sup>	Sediment Metal Conc. (µg/g)									
			Cr	Cu	Fe	K	Li	Mg	Mn	Mo	Na	Ni
CONF# 1	9/20/2006	F1A	9.81	2.84	6293.5	237.3	2.89	419.1	117.1	0.24	43.47	4.54
CONF# 1	9/20/2006	F1B	11.07	2.71	7398.1	169.6	1.99	354.4	112.3	0.29	40.65	4.54
CONF# 2	9/20/2006	F1A	9.82	1.97	4832.4	137.3	1.45	227.9	99.0	0.20	39.02	2.91
CONF# 2	9/20/2006	F1B	8.18	1.64	4939.8	137.2	1.67	288.0	98.4	0.22	46.94	3.12
CONF# 3	9/20/2006	F1A	8.44	2.18	6101.7	185.4	2.08	326.6	121.1	0.27	42.81	4.09
CONF# 3	9/20/2006	F1B	7.74	1.93	5372.1	173.1	1.95	328.8	107.0	0.26	40.38	3.46
CONF# 4	9/20/2006	F1A	22.33	4.95	13838.8	194.3	2.40	496.3	146.6	0.31	39.28	6.72
CONF# 4	9/20/2006	F1B	8.31	2.24	8154.3	189.2	2.18	383.1	100.5	0.26	40.60	4.44
CONF# 5	9/20/2006	F1A	8.51	4.67	8543.4	437.4	5.87	904.8	200.6	0.31	56.64	7.03
CONF# 5	9/20/2006	F1B	7.45	4.49	7684.9	434.0	6.00	930.3	187.5	0.29	40.71	6.37
CONF# 6	9/20/2006	F1A	11.33	8.80	14573.3	727.1	10.94	1261.7	779.2	0.44	53.79	11.12
CONF# 6	9/20/2006	F1B	20.45	9.37	16378.0	626.6	9.55	1200.5	1203.2	0.60	46.37	12.68
CONF# 7	9/20/2006	F1A	5.55	1.78	5862.1	180.5	2.15	469.6	168.9	0.22	43.13	4.82
CONF# 7	9/20/2006	F1B	6.24	3.03	7001.1	261.8	3.55	597.8	152.2	0.26	44.70	5.58
CONF# 8	9/20/2006	F1A	10.31	10.01	11824.6	945.7	10.02	2081.0	686.5	0.36	62.22	10.48
CONF# 8	9/20/2006	F1B	11.63	9.44	11599.0	853.6	9.21	1906.8	650.4	0.37	58.66	9.83
CONF# 9	9/20/2006	F1A	13.14	9.44	13063.5	999.9	10.74	2074.6	319.4	0.34	63.14	10.82
CONF# 9	9/20/2006	F1B	10.83	10.09	12915.0	982.3	11.04	2278.6	612.7	0.37	65.31	11.69
CONF# 10	9/20/2006	F1A	14.21	9.91	13741.3	726.2	8.40	1170.3	1744.9	0.67	49.27	12.40
CONF# 10	9/20/2006	F1B	14.60	8.33	14344.8	704.5	10.97	1194.1	1508.7	0.68	51.03	11.47

<sup>1</sup> F1A and F1B are duplicates digested from the same sampling site.

Table 2, continued. Metal concentrations in sediments from Ohio River sand bank at the confluence with Bayou Creek collected September 20, 2006.

Station	Date	Sample <sup>1</sup>	Sediment Metal Conc. (µg/g)					
			P	Pb	Sb	Se	Si	Sr
CONF# 1	9/20/2006	F1A	206.6	3.71	0.29	<0.22	118.0	3.75
CONF# 1	9/20/2006	F1B	203.0	3.44	0.38	<0.22	105.3	2.87
CONF# 2	9/20/2006	F1A	149.7	2.64	0.25	<0.24	114.5	2.39
CONF# 2	9/20/2006	F1B	153.5	2.46	<0.25	<0.25	100.7	1.72
CONF# 3	9/20/2006	F1A	196.7	3.33	0.26	<0.24	121.1	2.40
CONF# 3	9/20/2006	F1B	176.3	3.06	<0.23	<0.23	110.6	2.92
CONF# 4	9/20/2006	F1A	267.7	4.45	0.79	<0.22	114.4	2.23
CONF# 4	9/20/2006	F1B	215.1	3.83	0.32	<0.23	111.7	2.32
CONF# 5	9/20/2006	F1A	261.2	5.59	0.33	<0.25	135.7	5.61
CONF# 5	9/20/2006	F1B	243.1	5.32	0.28	<0.21	120.7	5.75
CONF# 6	9/20/2006	F1A	392.1	8.72	0.55	<0.23	152.1	10.14
CONF# 6	9/20/2006	F1B	477.3	11.08	0.63	<0.24	136.1	8.99
CONF# 7	9/20/2006	F1A	179.6	2.80	<0.22	<0.22	107.7	2.73
CONF# 7	9/20/2006	F1B	228.4	4.01	<0.24	<0.24	125.5	3.49
CONF# 8	9/20/2006	F1A	410.9	9.37	0.45	<0.22	182.5	12.11
CONF# 8	9/20/2006	F1B	399.8	8.87	<0.22	<0.22	153.4	11.23
CONF# 9	9/20/2006	F1A	460.6	8.79	0.53	<0.21	172.8	10.67
CONF# 9	9/20/2006	F1B	421.5	9.52	0.43	<0.22	161.2	16.61
CONF# 10	9/20/2006	F1A	506.6	11.08	0.53	0.48	176.9	12.39
CONF# 10	9/20/2006	F1B	560.9	9.35	0.66	0.35	199.8	11.72

<sup>1</sup> F1A and F1B are duplicates digested from the same sampling site.

Table 2, continued. Metal concentrations in sediments from Ohio River sand bank at the confluence with Bayou Creek collected September 20, 2006.

Station	Date	Sample <sup>1</sup>	Sediment Metal Conc. (µg/g)				
			Ti	Tl	V	Zn	
CONF# 1	9/20/2006	F1A	31.12	<0.22	7.67	17.03	
CONF# 1	9/20/2006	F1B	31.22	<0.22	6.60	13.35	
CONF# 2	9/20/2006	F1A	29.93	<0.24	5.48	9.01	
CONF# 2	9/20/2006	F1B	42.96	<0.25	5.43	9.20	
CONF# 3	9/20/2006	F1A	34.69	<0.24	7.42	12.00	
CONF# 3	9/20/2006	F1B	32.03	<0.23	5.93	10.48	
CONF# 4	9/20/2006	F1A	26.92	<0.22	10.33	18.67	
CONF# 4	9/20/2006	F1B	32.25	<0.23	7.49	12.92	
CONF# 5	9/20/2006	F1A	27.17	<0.25	9.04	24.65	
CONF# 5	9/20/2006	F1B	24.50	0.23	7.69	23.18	
CONF# 6	9/20/2006	F1A	25.30	0.59	13.11	39.45	
CONF# 6	9/20/2006	F1B	22.52	1.01	16.18	42.02	
CONF# 7	9/20/2006	F1A	51.66	<0.22	5.66	11.85	
CONF# 7	9/20/2006	F1B	36.73	<0.24	6.27	16.40	
CONF# 8	9/20/2006	F1A	25.87	0.53	12.63	41.70	
CONF# 8	9/20/2006	F1B	24.80	0.59	12.34	40.16	
CONF# 9	9/20/2006	F1A	20.99	0.41	13.02	41.33	
CONF# 9	9/20/2006	F1B	21.58	0.54	12.82	44.73	
CONF# 10	9/20/2006	F1A	33.81	1.71	13.54	42.96	
CONF# 10	9/20/2006	F1B	34.21	1.34	13.15	38.59	

<sup>1</sup> F1A and F1B are duplicates digested from the same sampling site.

Table 3. Mean metal values in sediments from Ohio River sand bank at the confluence with Bayou Creek collected September 20, 2006.

Station	Sediment Metal Conc. ( $\mu\text{g/g}$ )									
	Ag	Al	As	B	Ba	Be	Ca	Cd	Co	Cr
Confluence 1	N.D.	1663.4	2.34	18.56	17.52	0.22	735.0	0.17	3.05	10.44
Confluence 2	N.D.	1201.2	1.23	19.67	10.42	0.16	292.4	0.12	2.12	9.00
Confluence 3	N.D.	1541.2	1.67	20.21	14.50	0.18	389.4	0.13	3.03	8.09
Confluence 4	N.D.	1738.2	1.70	18.35	13.60	0.30	413.2	0.23	4.19	15.32
Confluence 5	N.D.	2988.5	2.00	17.27	38.03	0.27	1278.2	0.22	4.27	7.98
↻ Confluence 6	0.064	5018.3	3.64	19.04	58.28	0.51	1628.5	0.40	9.22	15.89
Confluence 7	N.D.	1946.0	1.77	18.62	26.48	0.17	620.7	0.14	3.56	5.89
Confluence 8	0.043	6521.2	2.13	16.51	58.82	0.39	3781.9	0.33	6.25	10.97
Confluence 9	0.030	6456.5	2.30	16.89	55.52	0.42	4351.1	0.35	6.80	11.99
Confluence 10	0.107	5506.4	5.13	18.58	106.18	0.43	1915.1	0.39	8.47	14.40
Mean	0.061	3458.1	2.39	18.37	39.93	0.31	1540.5	0.25	5.10	11.00
Std. Dev.	0.034	2172.0	1.16	1.18	30.23	0.13	1444.9	0.11	2.45	3.38

Table 3, continued. Mean metal values in sediments from Ohio River sand bank at the confluence with Bayou Creek collected September 20, 2006.

Station	Sediment Metal Conc. ( $\mu\text{g/g}$ )								
	Cu	Fe	K	Li	Mg	Mn	Mo	Na	Ni
Confluence 1	2.77	6845.8	203.5	2.44	386.8	114.7	0.26	42.06	4.54
Confluence 2	1.80	4886.1	137.3	1.56	258.0	98.7	0.21	42.98	3.02
Confluence 3	2.05	5736.9	179.3	2.02	327.7	114.1	0.27	41.59	3.78
Confluence 4	3.59	10996.6	191.7	2.29	439.7	123.6	0.29	39.94	5.58
Confluence 5	4.58	8114.2	435.7	5.93	917.6	194.1	0.30	48.68	6.70
14 Confluence 6	9.08	15475.7	676.9	10.24	1231.1	991.2	0.52	50.08	11.90
Confluence 7	2.41	6431.6	221.2	2.85	533.7	160.5	0.24	43.92	5.20
Confluence 8	9.72	11711.8	899.6	9.61	1993.9	668.5	0.37	60.44	10.16
Confluence 9	9.77	12989.3	991.1	10.89	2176.6	466.1	0.35	64.23	11.26
Confluence 10	9.12	14043.1	715.4	9.68	1182.2	1626.8	0.68	50.15	11.94
Mean	5.49	9723.1	465.2	5.75	944.7	455.8	0.35	48.41	7.41
Std. Dev.	3.48	3785.7	327.6	3.94	694.8	508.8	0.14	8.23	3.54

Table 3, continued. Mean metal values in sediments from Ohio River sand bank at the confluence with Bayou Creek collected September 20, 2006.

Station	Sediment Metal Conc. ( $\mu\text{g/g}$ )									
	P	Pb	Sb	Se	Si	Sr	Ti	Tl	V	Zn
Confluence 1	204.8	3.57	0.33	N.D.	111.6	3.31	31.17	N.D.	7.14	15.19
Confluence 2	151.6	2.55	0.25	N.D.	107.6	2.06	36.44	N.D.	5.45	9.10
Confluence 3	186.5	3.19	0.26	N.D.	115.9	2.66	33.36	N.D.	6.68	11.24
Confluence 4	241.4	4.14	0.55	N.D.	113.0	2.27	29.59	N.D.	8.91	15.79
Confluence 5	252.1	5.46	0.30	N.D.	128.2	5.68	25.83	0.23	8.37	23.92
51 Confluence 6	434.7	9.90	0.59	N.D.	144.1	9.56	23.91	0.80	14.64	40.74
Confluence 7	204.0	3.40	N.D.	N.D.	116.6	3.11	44.20	N.D.	5.96	14.13
Confluence 8	405.3	9.12	0.45	N.D.	168.0	11.67	25.33	0.56	12.49	40.93
Confluence 9	441.1	9.16	0.48	N.D.	167.0	13.64	21.28	0.47	12.92	43.03
Confluence 10	533.7	10.21	0.59	0.41	188.4	12.06	34.01	1.53	13.35	40.77
Mean	305.5	6.07	0.44	0.41	136.0	6.60	30.51	0.77	9.59	25.48
Std. Dev.	134.3	3.14	0.14	---	29.0	4.63	6.84	0.50	3.43	14.20



Table 4. Mean metal values in sediments from Massac Creek and Big Bayou Creek collected September 18-21, 2006.

Station	Sediment Metal Conc. ( $\mu\text{g/g}$ )									
	Ag	Al	As	B	Ba	Be	Ca	Cd	Co	Cr
MC	0.070	2044.8	4.33	18.93	28.09	0.32	135.0	0.210	4.77	17.43
BB1A	0.052	4568.6	2.75	18.57	20.88	0.29	436.2	0.158	3.63	7.47
BB1	0.070	2587.3	7.76	19.52	39.08	0.64	287.9	0.297	7.00	26.55
BB2A	0.063	3511.6	2.22	20.07	23.10	0.24	470.2	0.126	3.38	8.49
BB2	0.102	3202.3	8.28	18.57	27.43	0.62	260.7	0.430	7.17	39.85
BB3	0.056	2506.0	3.74	18.42	27.17	0.39	313.2	0.182	3.41	13.82
008	N.D.	7113.1	4.87	19.74	61.03	0.32	14205.1	0.228	4.93	9.24
BB4	N.D.	5372.8	2.09	19.56	10.90	0.35	339.5	0.190	2.38	18.59
006	0.035	3223.9	1.51	19.51	9.40	0.46	361.3	0.271	3.46	41.11
BB5	N.D.	11017.2	1.34	18.87	17.67	0.32	635.3	0.202	2.58	11.38
001	0.056	4151.6	3.81	18.08	20.02	0.51	4331.0	0.300	5.01	32.01
BB6	0.050	4763.6	2.12	17.49	23.93	0.29	864.1	0.177	3.28	16.23
BB7	0.040	1719.4	1.01	19.96	11.97	0.13	1966.1	0.084	1.65	6.32
BB8	0.027	1585.5	1.00	21.03	10.74	0.13	178.4	0.074	2.45	6.66
BB9	N.D.	5196.9	1.15	21.84	38.23	0.23	604.3	0.136	3.49	8.06

Table 4, continued. Mean metal values in sediments from Massac Creek (MC) and Big Bayou Creek collected September 18-21, 2006.

Station	Sediment Metal Conc. ( $\mu\text{g/g}$ )								
	Cu	Fe	K	Li	Mg	Mn	Mo	Na	Ni
MC	2.37	11847.4	113.0	0.81	107.0	327.3	0.39	39.17	3.06
BB1A	3.62	9121.1	337.3	3.65	447.2	143.4	0.16	47.24	3.85
BB1	3.48	17591.4	147.3	1.06	163.0	521.3	0.54	47.08	4.75
BB2A	2.57	6996.4	229.5	2.22	273.9	170.3	0.20	53.56	2.90
BB2	3.66	>20180.5	154.1	1.32	168.1	492.5	0.54	51.41	5.70
BB3	2.59	10742.5	147.5	1.32	163.1	126.7	0.34	46.81	2.76
008	5.97	11655.2	550.4	7.65	1226.8	294.7	0.24	73.18	4.96
BB4	2.71	10988.0	210.8	2.71	158.9	95.6	0.23	48.64	2.99
17 006	4.79	16420.5	156.1	1.78	237.3	90.2	0.44	53.70	6.26
BB5	4.03	12155.0	377.5	7.08	311.2	107.8	0.21	65.15	3.73
001	7.83	17187.7	306.2	4.21	649.3	89.8	0.79	94.36	6.88
BB6	3.70	9748.9	244.2	2.93	317.3	126.5	0.27	60.56	3.66
BB7	1.55	4119.0	105.1	1.11	152.0	106.2	0.16	50.90	1.78
BB8	1.53	3778.1	95.4	0.99	125.9	92.5	0.15	51.46	1.53
BB9	4.03	6303.6	411.4	4.96	500.6	225.5	0.14	57.65	4.27

Table 4, continued. Mean metal values in sediments from Massac Creek (MC) and Big Bayou Creek collected September 18-21, 2006.

Station	Sediment Metal Conc. (µg/g)									
	P	Pb	Sb	Se	Si	Sr	Ti	Tl	V	Zn
MC	221.9	6.08	0.63	N.D.	59.7	1.24	40.41	0.25	21.20	7.58
BB1A	193.3	6.03	0.46	N.D.	84.4	4.60	47.98	N.D.	13.50	12.78
BB1	424.5	12.87	0.85	N.D.	68.4	148.24	41.04	0.59	32.04	13.47
BB2A	186.4	5.55	0.35	N.D.	93.6	6.50	37.20	N.D.	13.27	16.58
BB2	394.4	11.74	1.16	N.D.	70.7	2.50	42.25	0.57	42.75	19.16
BB3	225.5	6.27	0.54	N.D.	74.5	4.65	29.14	N.D.	20.33	12.73
008	248.8	9.32	0.56	N.D.	99.9	25.79	38.99	0.38	19.31	24.03
BB4	168.6	4.85	0.48	N.D.	92.9	3.78	19.04	N.D.	21.47	9.40
18 006	271.3	5.93	0.77	N.D.	92.3	1.78	41.15	N.D.	40.03	13.06
BB5	117.6	6.02	0.42	N.D.	109.3	7.48	30.66	N.D.	23.55	10.30
001	277.3	7.75	0.73	N.D.	84.4	9.20	34.64	N.D.	32.83	28.84
BB6	195.6	5.46	0.50	N.D.	93.1	6.33	31.49	N.D.	18.55	16.55
BB7	98.0	2.96	N.D.	N.D.	82.7	5.17	24.92	N.D.	8.13	7.93
BB8	98.4	3.69	N.D.	N.D.	73.8	1.67	33.13	N.D.	8.62	5.36
BB9	237.8	5.51	N.D.	N.D.	108.1	6.60	46.83	0.32	10.18	15.70

Table 5. Mean metal values in sediments from Little Bayou Creek collected September 18-21, 2006.

Station	Sediment Metal Conc. ( $\mu\text{g/g}$ )									
	Ag	Al	As	B	Ba	Be	Ca	Cd	Co	Cr
LB1	0.034	6900.3	7.00	18.38	65.46	0.71	15037.4	0.370	10.16	19.87
LB2A	N.D.	4217.6	1.25	21.33	45.64	0.23	559.2	0.114	2.69	9.74
010+011	0.044	4578.4	1.20	20.08	35.68	0.26	1354.2	0.158	3.16	12.65
LB2	N.D.	2471.0	6.42	20.36	26.29	0.44	315.6	0.217	3.63	18.77
LB3	0.072	3923.4	10.30	20.17	28.91	0.80	985.2	0.345	7.81	112.54
LB4	N.D.	2986.2	0.66	22.15	18.15	0.15	299.5	0.083	1.78	12.90
Station	Cu	Fe	K	Li	Mg	Mn	Mo	Na	Ni	
LB1	7.66	>18144.9	511.6	6.84	958.7	792.2	0.47	53.58	8.53	
LB2A	2.38	6007.6	174.3	2.18	290.6	97.0	0.07	46.35	2.70	
010+011	2.52	9393.0	184.6	2.14	391.8	666.0	0.11	43.97	2.99	
LB2	3.49	12336.2	93.4	1.04	154.5	95.9	0.36	43.50	3.95	
LB3	10.53	19001.9	220.1	2.33	327.1	204.0	0.53	50.70	5.88	
LB4	2.19	4438.2	166.3	1.98	222.7	110.6	0.09	47.32	1.91	
Station	P	Pb	Sb	Se	Si	Sr	Ti	Tl	V	Zn
LB1	524.6	17.21	0.69	N.D.	93.1	21.87	35.63	0.52	36.45	47.68
LB2A	106.0	5.54	N.D.	N.D.	129.6	15.16	18.23	N.D.	11.42	15.14
010+011	164.8	5.55	0.64	N.D.	118.6	9.94	11.61	1.02	12.93	20.03
LB2	211.4	7.95	0.47	N.D.	94.7	4.99	15.15	N.D.	24.81	15.06
LB3	674.7	17.66	1.40	N.D.	97.8	11.94	41.78	N.D.	38.50	59.44
LB4	99.5	3.72	N.D.	N.D.	97.6	5.63	29.06	N.D.	7.98	9.93