Polychlorinated Biphenyl (PCB) Residues in Water, Stream Sediments and Floodplain Soils Collected March 26-28, 2003 from the Bayou Creek System

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DRAFT REPORT

April 29, 2004

Submitted to

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INTRODUCTION

Water, sediments and floodplain soil samples were taken from Big and Little Bayou Creeks on March 26-28, 2003 for PCB analyses. A total of 10 sites were sampled from Big Bayou Creek (stations BB1A through BB9) and 5 sites from Little Bayou Creek (stations LB1 through LB4). In addition, Massac Creek (MC) was sampled (*i.e.* West Fork) and served as a reference station. Water samples also were collected and analyzed for effluents 006 and the combined effluents 010 and 011. Water and sediment samples were collected in duplicate, except for single sediment collections at BB9 and LB1. One floodplain sample was taken at each station. Three Aroclors (*i.e.* 1248, 1254, 1260) were determined for all samples.

METHODS

Water samples for PCB analyses were collected in chemically cleaned, 1-L amber glass jars with Teflon-lined caps. New jars were obtained from I-Chem®. Samples were placed on ice until delivery to the laboratory and maintained under refrigeration (4°C) until extraction. Sediment samples were restricted to the upper 5-10 cm of sediment soil, including depositional areas when found. Floodplain soils were collected within 10 m of the shoreline (5-10 cm deep) in areas were flood debris was present. Any surface vegetation was removed prior to sampling floodplain soils. All sediment and floodplain samples were collected in acetone-rinsed 0.47 L glass jars with Teflon-lined lids. Stainless steel spoons and scoops used for collections were acetone-rinsed between sampling stations.

PCB Extraction and Analysis

Extraction and cleanup of water samples followed procedures described by Birge

and Price (2002), and were completed within 7 days of collection. Wet sediment or floodplain soil extractions of PCB and sample cleanup were performed following U.S EPA SW-846 Method 3540C (U.S. EPA, 1997; Erickson, 1997) as described previously by Birge and Price (2002). Samples were analyzed for Aroclors 1248, 1254, and 1260 according to SW-846 Method 8082 (U.S. EPA, 1997). Analyses also were performed as described by Birge and Price (2002).

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. Chain of Custody was maintained for all samples collected.

RESULTS

Results for PCB analyses of water samples are given in Tables 1 and 2 for Big and Little Bayou Creeks, respectively. No PCBs were quantifiable in any of the water samples collected, observing a detection limit of 0.08 µg PCB/L. PCB concentrations for individual wet-extracted sediments for Massac Creek and Big Bayou Creek are given in Table 3 and in Table 4 for Little Bayou Creek. Mean values for PCB in sediments are given in Table 5 and Figure 1. No PCBs were detected at the reference station on Massac Creek and stations upstream of BB4 in Big Bayou Creek. Aroclor 1248 was detected at stations BB4 and BB8 (5.49 and 7.04 µg/Kg). The highest PCB concentrations were found at BB5, with Aroclors 1254 and 1260 concentrations of 13.49 and 43.77 µg/Kg, respectively. In sediments collected June 3-4, 2002 (Birge and Price, 2003), Aroclor 1254 was detected at stations BB6 and BB7 and Aroclor 1260 had quantifiable levels at stations BB6 and BB8 (5.08 and 5.99 µg/Kg for BB6; 4.53 µg/Kg for BB8).

PCB concentrations for Little Bayou Creek sediments are presented in Table 4. and mean sediment PCB values presented in Table 5 and Figure 2. As in previous observations, PCBs were not detected at reference station LB1, situated upstream of PGDP. At the downstream stations LB2A through LB4, Aroclor 1248 ranged from 9.01 to 100.16 µg/Kg; 1254 ranged from 4.29 to 69.69 µg/Kg; and 1260 ranged from 3.09 to 44.27 µg/Kg (Tables 2 and 5, Figure 2). The highest mean concentrations were observed at station LB3 and the second highest was at LB2A (Table 5).

Results for PCBs in individual floodplain soils from Massac Creek and Big Bayou Creek are presented in Table 6 and Figure 3. As with data from June 2002, Aroclor

1248 was not detected at Massac Creek or at any of the Big Bayou Creek stations. The majority of Aroclor 1254 and 1260 were detected at and downstream of BB4. Station BB4 had the highest concentration of Aroclor 1254 (14.76 µg/Kg) and station BB8 had the highest concentration of Aroclor 1260 (18.07 µg/Kg).

Results for individual floodplain soils from Little Bayou Creek are shown in Table 7 and Figure 4. As with the sediments, no PCBs were detected upstream at station LB1. All three Aroclor concentrations were highest at station LB2A and was followed by a downstream decrease in PCB concentrations (Figure 4). Total PCBs ranged from 42.60 to 412.22 µg/Kg for floodplain soils taken at stations LB2A through LB4.

DISCUSSION

In general, total Aroclor concentrations in sediments were higher during the March 2003 collection (moderately high stream flow) as compared to the June 2002 collection (low flow) (Birge and Price 2003). On the other hand, Aroclor 1254 and/or 1260 were higher at some stations during the June 2002 collection, which may be attributed to runoff from contaminated floodplain soils during the wet months in between the two sampling events. As compared with data for Big Bayou Creek reported in June 2002, total PCB values in sediments were appreciably higher for the March 2003 collections. For example, PCB values found in 2003 for Big Bayou Creek were higher for four of five stations which normally have shown most PCB contamination (*i.e.* BB4-BB8). Using the same comparison, PCB values were much higher in Little Bayou Creek in March 2003. The highest concentration (µg/Kg) was 166 at LB3, while the total PCB concentration reported in June 2002 was 6.5 for this station. This represented a ten-fold increase within about 10

months. The highest total PCB value for sediments reported in June 2002 was 55 µg/Kg at LB2A, whereas it was 124 µg/Kg at this station in March 2003.

Concerning floodplain soil samples collected in March 2003, total PCB values were higher at the stations on Big Bayou Creek in five cases, about the same in one instance, and lower in three comparisons. With respect to floodplain soils collected from Little Bayou Creek in March 2003, the total PCB values (µg/Kg) were 412 and 283 for station LB2A and LB2, respectively. In June 2002, corresponding values were 213 and 254 µg/Kg. However, concerning Little Bayou Creek, total PCB concentrations were less in March 2003 for stations LB3 and LB4. Otherwise, there were appreciable increases in PCB contamination analyzed in March 2003 as compared with findings from June 2002 for sediments and floodplain soils in both stream systems. Fluctuations in PCB concentrations in sediments and soils are not unusual from one sampling period to the next. More time will be required to establish long-term trends.

Table 1. PCB results for water samples from Big Bayou Creek collected March 26-28, 2003.

Station	Date	Sample	Aroclor Concentration (μg/L) 1248	1254	1260
MC	03/27/03	PWS1	<0.08	<0.08	<0.08
MC	03/27/03	PWS2	<0.08	<0.08	<0.08
BB1A	03/26/03	PWS1	<0.08	<0.08	<0.08
BB1A	03/26/03	PWS2	<0.08	<0.08	<0.08
BB1	03/26/03	PWS1	<0.08	<0.08	<0.08
BB1	03/26/03	PWS2	<0.08	<0.08	<0.08
BB2	03/27/03	PWS1	<0.08	<0.08	<0.08
BB2	03/27/03	PWS2	<0.08	<0.08	<0.08
BB3	03/27/03	PWS1	<0.08	<0.08	<0.08
BB3	03/27/03	PWS2	<0.08	<0.08	<0.08
BB4	03/26/03	PWS1	<0.08	<0.08	<0.08
BB4	03/26/03	PWS2	<0.08	<0.08	<0.08
006	03/26/03	PWS1	<0.08	<0.08	<0.08
006	03/26/03	PWS2	<0.08	<0.08	<0.08
BB5	03/27/03	PWS1	<0.08	<0.08	<0.08
BB5	03/27/03	PWS2	<0.08	<0.08	<0.08
BB6	03/27/03	PWS1	<0.08	<0.08	<0.08
BB6	03/27/03	PWS2	<0.08	<0.08	<0.08
BB7	03/27/03	PWS1	<0.08	<0.08	<0.08
BB7	03/27/03	PWS2	<0.08	<0.08	<0.08
BB8	03/28/03	PWS1	<0.08	<0.08	<0.08
BB8	03/28/03	PWS2	<0.08	<0.08	<0.08
BB9	03/28/03	PWS1	<0.08	<0.08	<0.08
BB9	03/28/03	PWS2	<0.09	<0.09	<0.09

Table 2. PCB results for water samples from Little Bayou Creek collected March 26-28, 2003.

			Aroclor Concentration (μg/L)		
Station	Date	Sample	1248	1254	1260
LB1	03/27/03	PWS1	<0.08	<0.08	<0.08
LB1	03/27/03	PWS2	<0.08	<0.08	<0.08
LB2A	03/27/03	PWS1	<0.08	<0.08	<0.08
LB2A	03/27/03	PWS2	<0.08	<0.08	<0.08
010+011	03/27/03	PWS1	<0.08	<0.08	<0.08
010+011	03/27/03	PWS2	<0.08	<0.08	<0.08
LB2	03/27/03	PWS1	<0.08	<0.08	<0.08
LB2	03/27/03	PWS2	<0.09	<0.09	<0.09
LB3	03/27/03	PWS1	<0.08	<0.08	<0.08
LB3	03/27/03	PWS2	<0.08	<0.08	<0.08
LB4	03/26/03	PWS1	<0.08	<0.08	<0.08
LB4	03/26/03	PWS2	<0.08	<0.08	<0.08

Table 3. PCB results for stream sediment samples from Massac Creek and Big Bayou Creek, collected March 26-28, 2003.

Station	Date	Sample[1]	Sample Wet Wt. (g)	Sample Dry Wt. (g)	% Moisture	Aroclor Conc. (µg/Kg) 1248	1254	1260	Total
MC	3/27/03	PSED1	47.12	40.63	13.8	<4.92	<4.92	<4.92	<4.92
MC	3/27/03	PSED2	47.58	42.02	11.7	<4.76	<4.76	<4.76	<4.76
BB1A	3/26/03	PSED1	48.13	43.05	10.5	<4.65	<4.65	<4.65	<4.65
BB1A	3/26/03	PSED2	49.63	45.47	8.4	<4.40	<4.40	<4.40	<4.40
BB1	3/26/03	PSED1	48.66	43.26	11.1	<4.62	<4.62	<4.62	<4.62
BB1	3/26/03	PSED2	48.58	42.48	12.6	<4.71	<4.71	<4.71	<4.71
BB2	3/27/03	PSED1	51.73	45.26	12.5	<4.42	<4.42	<4.42	<4.42
BB2	3/27/03	PSED2	47.72	43.43	9.0	<4.61	<4.61	<4.61	<4.61
BB3	3/26/03	PSED1	49.11	44.88	8.6	<4.46	<4.46	<4.46	<4.46
BB3	3/26/03	PSED2	51.49	47.11	8.5	<4.25	<4.25	<4.25	<4.25
BB4	3/26/03	PSED1	48.38	45.02	6.9	<4.44	<4.44	1.83*	1.83*
BB4	3/26/03	PSED2	50.71	46.92	7.5	5.49	2.55*	1.86*	9.90
BB5	3/27/03	PSED1	49.23	45.85	6.9	<4.36	2.34*	2.70*	5.04
BB5	3/27/03	PSED2	49.70	46.85	5.7	<4.27	13.49	43.77	57.26

[1] PSED1 and PSED2 are separate samples from the station.
* PCBs were detected, however the values were below the Minimum Quantitation Level (MQL).

Table 3, continued. PCB results for stream sediment samples from Massac Creek and Big Bayou Creek, collected March 26-28, 2003.

Station	Date	Sample[1]	Sample Wet Wt. (g)	Sample Dry Wt. (g)	% Moisture	Aroclor Conc. (µg/Kg) 1248	1254	1260	Total
BB6	3/27/03	PSED1	48.81	45.90	6.0	<4.36	<4.36	<4.36	<4.36
BB6	3/27/03	PSED2	47.75	44.13	7.6	<4.53	<4.53	2.18*	2.18*
BB7	3/27/03	PSED1	48.90	44.46	9.1	<4.50	6.13	1.65*	7.79
BB7	3/27/03	PSED2	49.34	46.43	5.9	<4.31	<4.31	<4.31	<4.31
BB8	3/28/03	PSED1	49.78	47.54	4.5	7.04	<4.21	2.99*	10.03
BB8	3/28/03	PSED2	49.62	47.18	4.9	<4.24	<4.24	<4.24	<4.24
BB9	3/28/03	PSED1	47.92	44.56	7.0	<4.49	<4.49	<4.49	<4.49

[1] PSED1 and PSED2 are separate samples from the station.
* PCBs were detected, however the values were below the Minimum Quantitation Level (MQL).

Table 4. PCB results for stream sediment samples from Little Bayou Creek, collected March 26-28, 2003.

Station	Date	Sample[1]	Sample		% Moisture	Aroclor Conc. (µg/Kg)			
			Wet Wt. (g)	Dry Wt. (g)		1248	1254	1260	Total
LB1	3/27/03	PSED1	48.57	46.28	4.7	<4.32	<4.32	<4.32	<4.32
LB2A	3/27/03	PSED1	51.48	50.02	2.8	94.55	69.69	20.48	184.72
LB2A	3/27/03	PSED2	51.16	49.49	3.3	32.48	16.28	14.35	63.11
LB2	3/27/03	PSED1	51.33	48.18	6.1	41.21	23.42	18.75	83.38
LB2	3/27/03	PSED2	48.81	48.60	0.4	<4.12	11.27	16.28	27.55
LB3	3/27/03	PSED1	49.48	46.60	5.8	89.73	31.94	11.67	133.34
LB3	3/27/03	PSED2	49.49	47.52	4.0	100.16	54.22	44.27	198.65
LB4	3/28/03	PSED1	49.28	47.98	2.6	9.18	4.77	6.30	20.26
LB4	3/28/03	PSED2	48.12	46.54	3.3	9.01	4.29	3.09	16.39

[1] PSED1 and PSED2 are separate samples from the station.

Table 5. Mean PCB results for stream sediment samples from Massac Creek (MC) and Bayou Creek system collected March 26-28, 2003.

	Aroclor Conc. (µg/Kg)			
Station	1248	1254	1260	Total
MC	<4.76	<4.76	<4.76	<4.76
BB1A	<4.40	<4.40	<4.40	<4.40
BB1	<4.62	<4.62	<4.62	<4.62
BB2	<4.42	<4.42	<4.42	<4.42
BB3	<4.25	<4.25	<4.25	<4.25
BB4	5.49	2.55*	1.85*	5.87
BB5	<4.27	7.92	23.23	31.15
BB6	<4.53	<4.53	2.18*	2.18*
BB7	<4.31	6.13	1.65*	7.79
BB8	7.04	<4.24	2.99*	10.03
BB9	<4.49	<4.49	<4.49	<4.49
LB1	<4.32	<4.32	<4.32	<4.32
LB2A	63.52	42.98	17.42	123.92
LB2	41.21	17.34	17.52	76.07
LB3	94.95	43.08	27.97	165.99
LB4	9.12	4.53	4.70	18.35

* PCBs were detected, however values were below the Minimum Quantitation Level (MQL).

Table 6. PCB results for floodplain soils from Massac Creek and Big Bayou Creek, collected March 26-28, 2003.

Station	Date	Sample	Sample		% Moisture	Aroclor Conc. (µg/Kg)			
			Wet Wt. (g)	Dry Wt. (g)		1248	1254	1260	Total
BB1A	3/26/03	FP1	51.31	50.04	2.5	<4.00	<4.00	<4.00	<4.00
BB1	3/26/03	FP1	50.40	44.85	11.0	<4.46	2.44	5.44	7.88
BB2	3/27/03	FP1	49.83	45.54	8.6	<4.39	<4.39	4.23*	4.23*
BB3	3/26/03	FP1	50.10	46.85	6.5	<4.27	<4.27	2.10*	2.10*
BB4	3/26/03	FP1	52.48	50.63	3.5	<3.95	14.76	10.48	25.24
BB5	3/27/03	FP1	50.70	48.54	4.3	<4.12	12.59	8.22	20.82
BB6	3/27/03	FP1	51.43	50.80	1.2	<3.94	7.43	4.44	11.86
BB7	3/27/03	FP1	51.34	50.64	1.4	<3.95	8.50	7.69	16.19
BB8	3/28/03	FP1	51.46	51.45	0.0	<3.89	8.29	18.07	26.36
BB9	3/28/03	FP1	51.64	51.64	0.0	<3.87	8.19	6.18	14.37

* PCBs were detected, however the values were below the Minimum Quantitation Level (MQL).

Table 7. PCB results for floodplain soils from Little Bayou Creek, collected March 26-28, 2003.

Station	Date	Sample	Sample		% Moisture	Aroclor Conc. (µg/Kg)			
			Wet Wt. (g)	Dry Wt. (g)		1248	1254	1260	Total
LB1	3/27/03	FP1	50.626	50.270	0.7	<4.32	<4.32	<4.32	<4.32
LB2A	3/27/03	FP1	48.539	46.040	5.1	185.22	138.79	88.21	412.22
LB2	3/27/03	FP1	51.842	50.290	3.0	125.85	93.86	63.15	282.85
LB3	3/27/03	FP1	52.443	50.560	3.6	41.99	33.70	25.81	101.50
LB4	3/28/03	FP1	49.666	48.300	2.8	<4.14	21.36	21.24	42.60

Figure 1. Mean PCB concentrations in sediments from Massac Creek and Big Bayou Creek collected March 26-28, 2003.

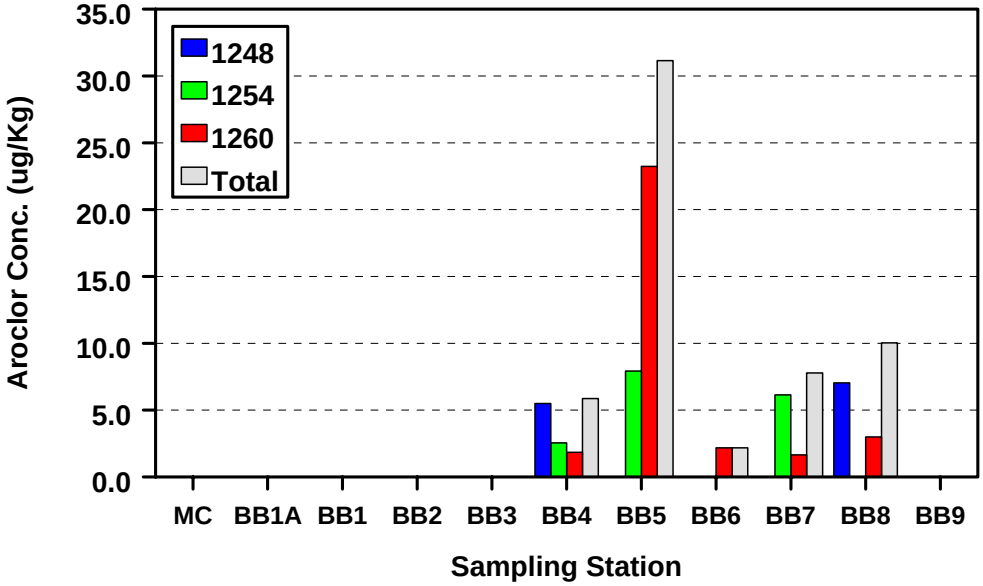


Figure 2. Mean PCB concentrations in sediments from Little Bayou Creek collected March 26-28, 2003.

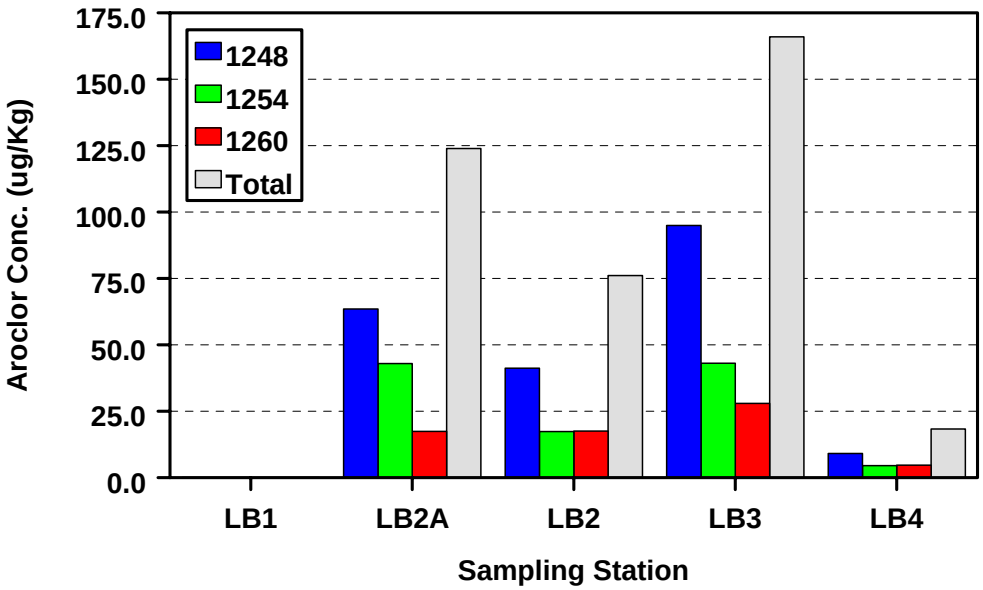


Figure 3. Mean PCB concentrations in floodplain soils from Massac Creek and Big Bayou Creek collected March 26-28, 2003.

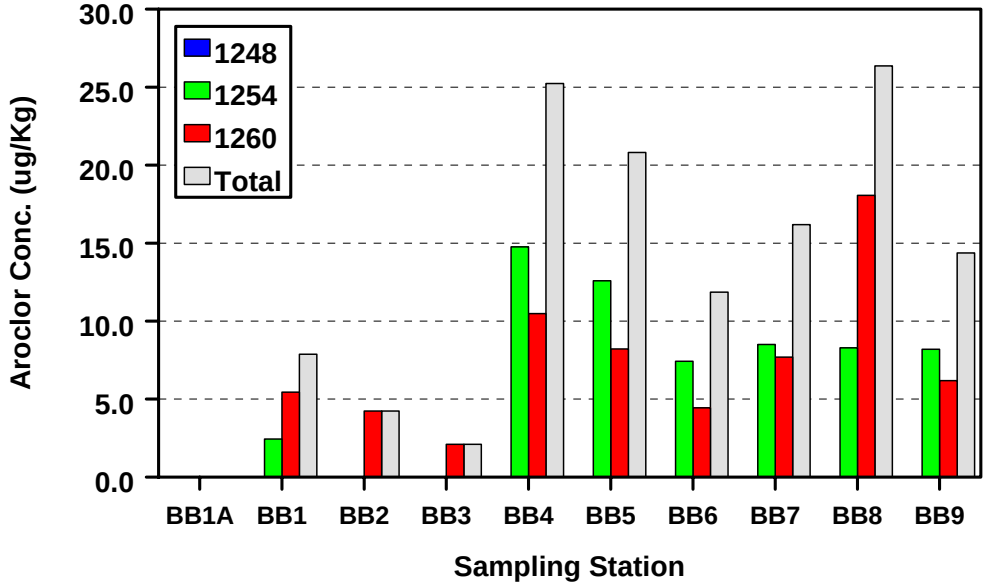
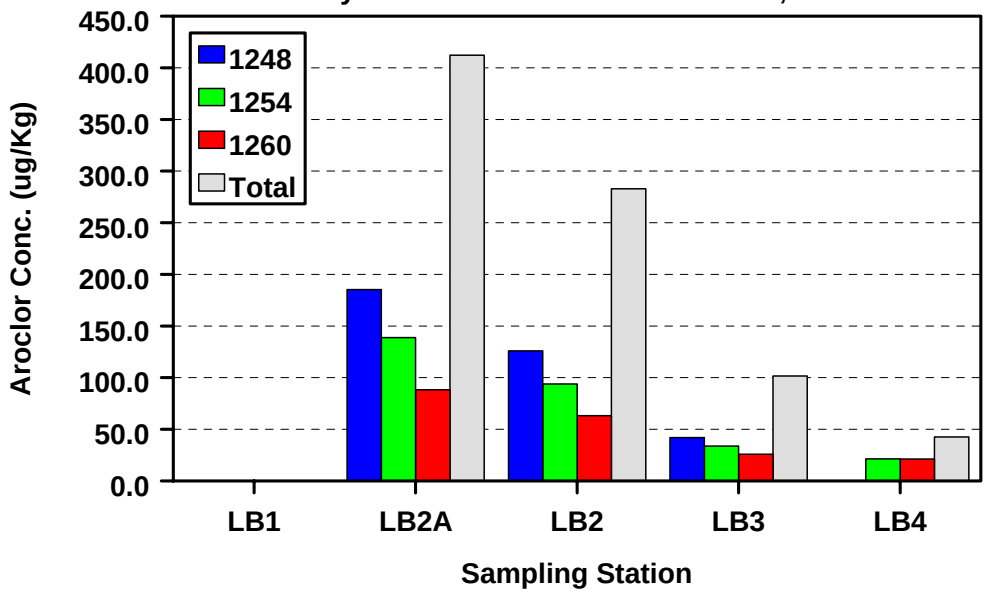


Figure 4. Mean PCB concentrations in floodplain soils from Little Bayou Creek collected March 26-28, 2003.



REFERENCES

Birge, W.J. and D.J. Price. 2002. Analysis of Polychlorinated Biphenyl (PCB) Residues and Metals in Sediment Samples Collected February 19-20, 2001 from the Bayou Creek System. Report submitted February 4, 2002 to Jon Maybriar, Division of Waste Management, Kentucky Department for Environmental Protection.

Birge, W.J. and D.J. Price. 2003. Polychlorinated Biphenyl (PCB) Residues in Stream Sediments and Floodplain Soils Collected June 3-4, 2002 from the Bayou Creek System. Report submitted July 30, 2003 to Jon Maybriar, Division of Waste Management, Kentucky Department for Environmental Protection.

Erickson, M.D. 1997. *Analytical Chemistry of PCBs*, 2nd edition. CRC Press, Boca Raton, FL. pp.667.

Federal Register. 1989. Good Laboratory Practice Standards. 40 CFR Part 160. August 17, 1989. Washington, DC.

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.