

**Analysis of Polychlorinated Biphenyl (PCB) Residues and Metals
in Sediment Samples Collected August 13-14, 2001
from the Bayou Creek System**

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DRAFT REPORT

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INTRODUCTION

Sediment samples (60 samples) were taken for PCB and metal analyses from Big and Little Bayou Creeks on August 13-14, 2001. A total of 10 sites were sampled from Big Bayou Creek (stations BB1 through BB9) and 4 sites from Little Bayou Creek (stations LB1 through LB4). The new reference station, upstream of BB1 and designated BB1A, also was collected. In addition, Massac Creek (MC) was sampled (*i.e.* West Fork) and served as a reference station independent of the Bayou Creek system. Two sediment samples per station were collected for PCB and metal assays. Three Aroclors (*i.e.* 1248, 1254, and 1260) were determined for these samples and 9 metals (*i.e.* Ag, Be, Cd, Cr, Cu, Fe, Ni, Pb and Zn) were analyzed.

METHODS

Sediment samples were restricted to the upper 5-10 cm of sediment soil, including depositional areas when found. All sediment samples were collected in acetone-rinsed 0.47 L glass jars with teflon or aluminum foil-lined lids. Stainless steel spoons and scoops used for collections were acetone-rinsed between sampling stations.

PCB Sediment Extraction and Analysis

Wet sediment extractions of PCBs and sample cleanup were performed following U.S EPA SW-846 Method 3540C (U.S. EPA, 1997; Erickson, 1997) and described 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 were performed as described by Birge and Price (2002).

Sediment Metal Digestions and Analysis

A 2.0 g sample was digested and extracted according to procedures described in U.S. EPA, 1997 (Method 3050B), ASTM, 1989 (Method D 3974-81), and Birge and Price (2002). Nine metals, including silver (Ag), beryllium (Be), cadmium (Cd), chromium (Cr), copper (Cu), iron, (Fe), lead (Pb), nickel (Ni), and zinc (Zn), were determined. Metal analyses were performed by graphite furnace-atomic absorption spectrophotometry (GF-AAS) 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

PCBs in Sediments

PCB concentrations for individual wet-extracted sediments are given in Tables 1 and 2 for Big and Little Bayou Creeks, respectively. No Aroclor 1248 was detected at any of the Big Bayou Creek stations. Aroclors 1254 and 1260 were observed at stations BB7 and BB8, however, only station BB8 had detectable levels of Aroclor 1260 (0.016 µg/g). Concerning Little Bayou Creek, PCBs were not detected at station LB1 situated upstream of PGDP. However, PCBs were detected at all other stations, including LB2,

LB3 and LB4 (Table 2). Aroclors 1248 and 1254 were present in stations LB2 and LB3; and 1260 was detected in LB3. The highest total PCB concentration was 0.258 µg/g (258 ppb) observed at station LB3. Mean values for PCB in sediments are given in Table 3.

Metals in Sediments

Results for metal concentrations of individual sediment samples are given in Table 4, whereas mean metal concentrations are given in Table 5 and in Figures 1 through 9. The high Silver (Ag) value for MC-081401-MSED1 (Table 4) was suspect and therefore removed from the mean calculations. Except for stations BB1 and BB3, Ag was somewhat elevated at all stations when values were compared with those for station MC on Massac Creek. The highest Ag concentration was 0.061 µg/g (*i.e.* 61 ppb) at station BB5 (Table 5, Figure 1). The highest Beryllium (Be) concentrations was 0.75 ± 0.34 µg/g (75 ppb) at station BB6 (Figure 2). Based on mean metal values (Table 5), Be was found at higher concentrations at all stations downstream of BB1A, except for stations BB3 and BB8 (Figure 2).

Cadmium (Cd) concentrations were generally low throughout the system. The highest Cd concentration was 0.02 ± 0.01 µg/g (20 ppb) observed at BB7 (Table 5, Figure 3). Chromium (Cr) was extremely high for sample BB1-081401-MSED1 (121.97 µg/g), which could be suspect. Cr concentrations were most elevated at station BB6 (13.02 ± 8.45 µg/g; Figure 4). Copper (Cu) was most elevated at stations BB5 and BB7, where mean values were 6.89 ± 1.45 and 8.67 ± 1.60 µg/g (Table 5, Figure 5). Iron (Fe) also was elevated at stations BB5 and BB7. The highest mean concentrations were 23.9 ± 8.8 and

31.1 ± 7.5 µg/g.

Lead (Pb) was detected throughout Big Bayou Creek, where values ranged from 2.48 to 7.63 µg/g (Table 5, Figure 7). The highest mean values for Pb were 7.63 ± 3.16 and 7.09 ± 3.45 µg/g at stations BB5 and BB8 as compared with the value of 5.13 ± 0.79 for station MC (Table 5). As compared with upstream stations BB1A and BB1, Nickel (Ni) occurred at higher concentrations at stations BB2, BB5, and BB7 through BB9 (Table 5, Figure 8). The highest mean value for Ni was 7.26 ± 0.92 µg/g at BB7 (Table 5). The highest Ni value at BB2 was 5.73 ± 0.04 µg/g (Table 5). Mean concentrations for Zinc (Zn) are shown in Table 5 and Figure 9.

Metals analyzed in sediment samples from Little Bayou Creek are given in Tables 6 and 7. The latter is based on mean values ± standard deviations. Metal concentrations for Little Bayou Creek also are shown in Figures 1 through 9. Ag and Cd were elevated at station LB2, where the highest mean values were 0.07 and 0.02 µg/g (Table 7). Concentrations for Be, Cr, Fe, Pb, and Zn were highest at station LB3, with values of 1.01, 30.02, 21.9, 8.49, and 10583.4 µg/g, respectively (Table 7, Figures 2, 4, 6, 7 and 9).

Table 1. PCB results for stream sediment samples from Massac Creek and Big Bayou Creek, collected August 14, 2001.

Station	Date	Sample ¹	Sample			Aroclor Conc. (µg/g)			
			Wet Wt. (g)	Dry Wt. (g)	% Moisture	1248	1254	1260	Total
MC	8/14/01	PSED1	50.55	35.98	28.8	<0.006	<0.006	<0.006	<0.006
MC	8/14/01	PSED2	48.63	40.21	17.3	<0.005	<0.005	<0.005	<0.005
BB1A	8/14/01	PSED1	47.47	34.36	27.6	<0.006	<0.006	<0.006	<0.006
BB1A	8/14/01	PSED2	52.81	38.92	26.3	<0.005	<0.005	<0.005	<0.005
BB1	8/14/01	PSED1	49.28	40.73	17.3	<0.005	<0.005	<0.005	<0.005
BB1	8/14/01	PSED2	50.43	40.65	19.4	<0.005	<0.005	<0.005	<0.005
BB2	8/14/01	PSED1	47.91	33.50	30.1	<0.006	<0.006	<0.006	<0.006
BB2	8/14/01	PSED2	50.91	37.64	26.1	<0.005	<0.005	<0.005	<0.005
BB3	8/14/01	PSED1	50.47	40.22	20.3	<0.005	<0.005	<0.005	<0.005
BB3	8/14/01	PSED2	51.28	42.61	16.9	<0.005	<0.005	<0.005	<0.005
BB4	8/14/01	PSED1	48.69	41.10	15.6	<0.005	<0.005	<0.005	<0.005
BB4	8/14/01	PSED2	50.62	36.79	27.3	<0.005	<0.005	<0.005	<0.005
BB5	8/14/01	PSED1	49.07	37.76	23.0	<0.005	<0.005	<0.005	<0.005
BB5	8/14/01	PSED2	49.05	40.72	17.0	<0.005	<0.005	<0.005	<0.005
BB6	8/14/01	PSED1	50.05	41.75	16.6	<0.005	<0.005	<0.005	<0.005
BB6	8/14/01	PSED2	49.48	39.75	19.7	<0.005	<0.005	<0.005	<0.005

¹ PSED1 and PSED2 are two samples collected separately.

* PCBs detected, however value below Minimum Quantitation Limit (MQL).

Table 1, continued. PCB results for stream sediment samples from Massac Creek and Big Bayou Creek, collected August 14, 2001.

Station	Date	Sample ¹	Sample			Aroclor Conc. (µg/g)			
			Wet Wt. (g)	Dry Wt. (g)	% Moisture	1248	1254	1260	Total
BB7	8/14/01	PSED1	50.17	33.41	33.4	<0.006	<0.006	0.001*	0.001*
BB7	8/14/01	PSED2	48.34	38.72	19.9	<0.005	0.002*	<0.005	0.002*
BB8	8/14/01	PSED1	48.91	40.73	16.7	<0.005	<0.005	<0.005	<0.005
BB8	8/14/01	PSED2	48.89	39.80	18.6	<0.005	0.003*	0.016	0.019
BB9	8/14/01	PSED1	49.54	36.81	25.7	<0.005	<0.005	<0.005	<0.005
BB9	8/14/01	PSED2	50.24	40.00	20.4	<0.005	<0.005	<0.005	<0.005

¹ PSED1 and PSED2 are two samples collected separately.

* PCBs detected, however value below Minimum Quantitation Limit (MQL).

Table 2. PCB results for stream sediment samples from Little Bayou Creek, collected August 13, 2001.

Station	Date	Sample ¹	Sample		% Moisture	Aroclor Conc. (µg/g)			
			Wet Wt. (g)	Dry Wt. (g)		1248	1254	1260	Total
LB1	8/13/01	PSED1	53.36	42.40	20.5	<0.005	<0.005	<0.005	<0.005
LB1	8/13/01	PSED2	48.91	38.02	22.3	<0.005	<0.005	<0.005	<0.005
LB2	8/13/01	PSED1	46.76	36.31	22.3	0.028*	<0.055	<0.055	0.028
LB2	8/13/01	PSED2	51.43	39.64	22.9	0.125	0.101	<0.050	0.226
LB3	8/13/01	PSED1	50.14	43.40	13.4	0.059	0.077	0.027*	0.162
LB3	8/13/01	PSED2	50.54	47.03	6.9	0.104	0.100	0.054	0.258
LB4	8/13/01	PSED1	48.51	44.80	7.6	<0.009	<0.009	<0.009	<0.009
LB4	8/13/01	PSED2	48.98	44.79	8.6	<0.009	0.007*	0.003*	0.010

¹ PSED1 and PSED2 are two samples collected separately.

* PCBs detected, however value below Minimum Quantitation Limit (MQL).

Table 3. Mean PCB results for stream sediment samples from Massac Creek and Bayou Creek system collected August 13-14, 2001.

Station	Aroclor Conc. ($\mu\text{g/g}$)			
	1248	1254	1260	Total
MC	<0.005	<0.005	<0.005	<0.005
BB1A	<0.005	<0.005	<0.005	<0.005
BB1	<0.005	<0.005	<0.005	<0.005
BB2	<0.005	<0.005	<0.005	<0.005
BB3	<0.005	<0.005	<0.005	<0.005
BB4	<0.005	<0.005	<0.005	<0.005
BB5	<0.005	<0.005	<0.005	<0.005
BB6	<0.005	<0.005	<0.005	<0.005
BB7	<0.005	0.002	0.001	0.003
BB8	<0.005	0.003	0.016	0.019
BB9	<0.005	<0.005	<0.005	0.000
LB1	<0.005	<0.005	<0.005	<0.005
LB2	0.076	0.101	<0.050	0.178
LB3	0.082	0.088	<0.050	0.170
LB4	<0.009	0.007	<0.050	0.007

Table 4. Metal concentrations in stream sediments from Big Bayou Creek collected August 14, 2001.

Station	Date	Sample	Metal Concentration (µg/g)								
			Ag	Be	Cd	Cr	Cu	Fe	Pb	Ni	Zn
MC	08/14/01	MSED1	0.671	0.558	0.014	5.04	5.28	7432.3	7.74	5.69	15.09
MC	08/14/01	MSED2	0.027	0.557	<0.009	17.78	<18.67	10684.4	3.91	4.57	7.70
BB1A	08/14/01	MSED1	0.052	0.608	<0.012	4.43	3.28	6963.9	5.84	6.45	15.33
BB1A	08/14/01	MSED2	0.045	0.454	<0.012	3.45	2.79	6390.5	4.35	5.45	13.52
BB1	08/14/01	MSED1	0.036	0.993	<0.010	121.97	1.96	14991.3	3.83	5.77	9.94
BB1	08/14/01	MSED2	0.013	0.306	<0.010	5.12	<19.34	5324.4	<3.87	3.37	5.12
BB2	08/14/01	MSED1	0.033	0.847	0.013	7.40	2.98	6829.9	5.76	5.16	20.84
BB2	08/14/01	MSED2	0.045	0.474	<0.011	8.19	3.82	7204.6	5.70	5.56	18.53
BB3	08/14/01	MSED1	0.021	0.247	<0.010	6.85	<19.98	4866.9	<4.00	2.62	6.36
BB3	08/14/01	MSED2	0.017	0.228	<0.011	6.11	<21.29	5379.1	<4.26	2.34	6.77
BB4	08/14/01	MSED1	0.026	0.672	<0.011	11.35	2.22	8554.8	3.58	5.18	14.49
BB4	08/14/01	MSED2	0.047	0.402	0.013	7.82	5.67	6535.0	4.15	5.92	22.15
BB5	08/14/01	MSED1	0.061	0.693	<0.011	8.00	5.87	11141.9	6.48	5.39	17.72
BB5	08/14/01	MSED2	0.050	0.709	0.017	9.45	7.92	9325.9	7.08	9.86	30.14
BB6	08/14/01	MSED1	0.026	0.985	<0.011	19.00	3.19	14041.7	5.35	7.41	14.03
BB6	08/14/01	MSED2	0.045	0.506	<0.010	7.05	<20.78	6369.0	3.84	3.19	11.99

Table 4, continued. Metal concentrations in stream sediments from Big Bayou Creek collected August 14, 2001.

Station	Date	Sample	Metal Concentration ($\mu\text{g/g}$)								
			Ag	Be	Cd	Cr	Cu	Fe	Pb	Ni	Zn
BB7	08/14/01	MSED1	0.052	0.472	0.027	7.70	9.80	6604.3	6.61	5.93	36.42
BB7	08/14/01	MSED2	0.053	0.596	0.017	8.75	7.53	8239.9	7.91	6.08	25.77
BB8	08/14/01	MSED1	0.026	0.264	<0.010	8.41	2.16	5347.6	<4.12	4.65	9.63
BB8	08/14/01	MSED2	0.049	0.721	0.010	5.85	4.75	8282.4	6.87	9.53	15.77
BB9	08/14/01	MSED1	0.044	0.818	<0.010	5.29	4.40	6629.2	6.49	5.52	18.61
BB9	08/14/01	MSED2	0.032	0.409	<0.010	4.86	2.24	6048.3	4.60	4.57	14.37

Table 5. Mean metal concentrations \pm standard deviations¹ in stream sediments from Big Bayou Creek collected August 14, 2001.

Station	Metal Concentration ($\mu\text{g/g}$)								
	Ag	Be	Cd	Cr	Cu	Fe	Pb	Ni	Zn
MC	0.35	0.56	0.01	11.41	5.28	11.4	5.13	5.82	9058.4
	0.46	---	---	9.01	---	5.2	0.79	2.71	2299.6
BB1A	0.05	0.53	<0.01	3.94	3.04	14.4	5.95	5.10	6677.2
	0.01	0.11	---	0.69	0.35	1.3	0.71	1.05	405.4
BB1	0.02	0.65	<0.01	63.54	1.96	7.5	4.57	3.83	10157.8
	0.02	0.49	---	82.63	0.00	3.4	1.70	---	6835.5
BB2	0.04	0.66	0.01	7.79	3.40	19.7	5.36	5.73	7017.3
	0.01	0.26	---	0.56	0.59	1.6	0.28	0.04	264.9
BB3	0.02	0.24	<0.01	6.48	<19.98	6.6	2.48	<4.00	5123.0
	---	0.01	---	0.52	---	0.3	0.20	---	362.2
BB4	0.04	0.54	0.01	9.58	3.95	18.3	5.55	3.87	7544.9
	0.02	0.19	---	2.50	2.44	5.4	0.52	0.40	1428.2
BB5	0.06	0.70	0.02	8.73	6.89	23.9	7.63	6.78	10233.9
	0.01	0.01	---	1.03	1.45	8.8	3.16	0.43	1284.1
BB6	0.04	0.75	<0.01	13.02	3.19	13.0	5.30	4.60	10205.3
	0.01	0.34	---	8.45	---	1.4	2.99	1.07	5425.4

¹ Standard deviations given below the means.

Table 5, continued. Mean metal concentrations \pm standard deviations¹ in stream sediments from Big Bayou Creek collected August 14, 2001.

Station	Metal Concentration ($\mu\text{g/g}$)								
	Ag	Be	Cd	Cr	Cu	Fe	Pb	Ni	Zn
BB7	0.05	0.53	0.02	8.22	8.67	31.1	6.00	7.26	7422.1
	---	0.09	0.01	0.75	1.60	7.5	0.11	0.92	1156.5
BB8	0.04	0.49	0.01	7.13	3.46	12.7	7.09	6.87	6815.0
	0.02	0.32	---	1.81	1.83	4.3	3.45	---	2075.2
BB9	0.04	0.61	<0.01	5.07	3.32	16.5	5.05	5.54	6338.8
	0.01	0.29	---	0.30	1.52	3.0	0.67	1.34	410.8

¹ Standard deviations given below the means.

Table 6. Metal concentrations in stream sediments from Little Bayou Creek collected August 13, 2001.

Station	Date	Sample	Metal Concentration (µg/g)								
			Ag	Be	Cd	Cr	Cu	Fe	Pb	Ni	Zn
LB1	08/13/01	MSED1	0.059	0.533	0.010	7.93	5.27	9870.4	7.72	7.58	25.28
LB1	08/13/01	MSED2	0.054	0.687	<0.011	7.17	4.82	7743.0	6.93	5.98	24.87
LB2	08/13/01	MSED1	0.115	1.214	0.022	9.93	2.61	8346.4	6.16	2.65	14.07
LB2	08/13/01	MSED2	0.020	0.404	<0.009	11.46	<18.53	6626.6	<3.71	7.55	10.06
LB3	08/13/01	MSED1	0.016	1.585	<0.010	46.66	3.42	14774.8	6.42	10.15	24.24
LB3	08/13/01	MSED2	0.027	0.437	<0.011	13.37	2.38	6392.1	<4.23	6.84	19.61
LB4	08/13/01	MSED1	0.021	0.153	<0.011	9.00	<21.14	<4228.3	<4.23	3.80	10.74
LB4	08/13/01	MSED2	0.040	0.316	<0.010	12.90	2.56	5119.6	3.90	5.36	17.56

Table 7. Mean metal concentrations \pm standard deviations¹ in stream sediments from Little Bayou Creek collected August 13, 2001.

Station	Metal Concentration ($\mu\text{g/g}$)								
	Ag	Be	Cd	Cr	Cu	Fe	Pb	Ni	Zn
LB1	0.06	0.61	0.01	7.55	5.05	25.1	6.78	7.33	8806.7
	---	0.11	---	0.53	0.32	0.3	1.13	0.56	1504.2
LB2	0.07	0.81	0.02	10.69	2.61	12.1	5.10	6.16	7486.5
	0.07	0.57	---	1.08	---	2.8	3.46	---	1216.1
LB3	0.02	1.01	<0.01	30.02	2.90	21.9	8.49	6.42	10583.4
	0.01	0.81	---	23.54	0.74	3.3	2.35	---	5927.4
LB4	0.03	0.23	<0.01	10.95	2.56	14.1	4.58	3.90	5119.6
	0.01	0.12	---	2.76	---	4.8	1.10	---	---

¹ Standard deviations given below the means.

Figure 1. Silver concentrations in sediments from Big Bayou Creek, collected August 14, 2001.

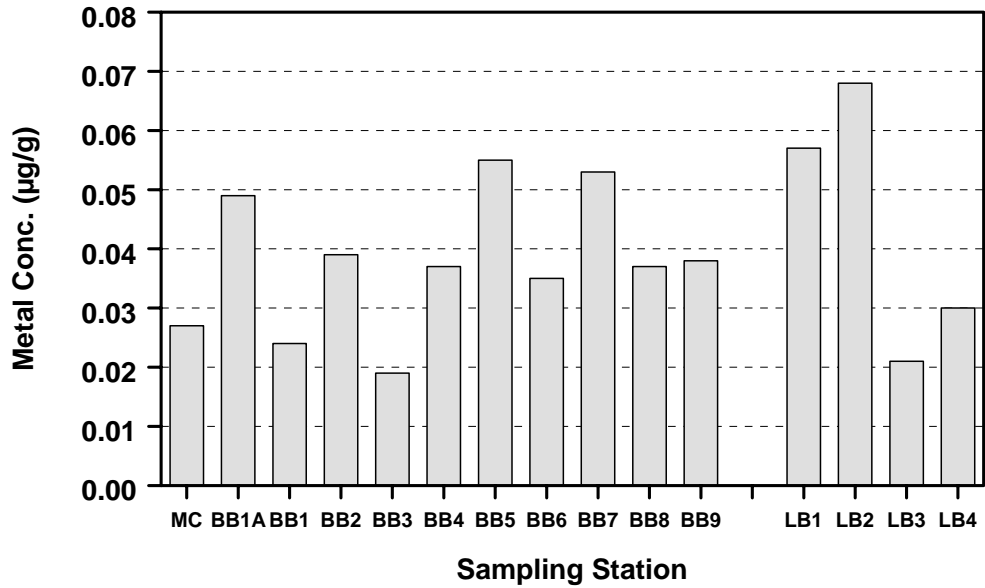


Figure 2. Beryllium concentrations in sediments from Big Bayou Creek, collected August 14, 2001.

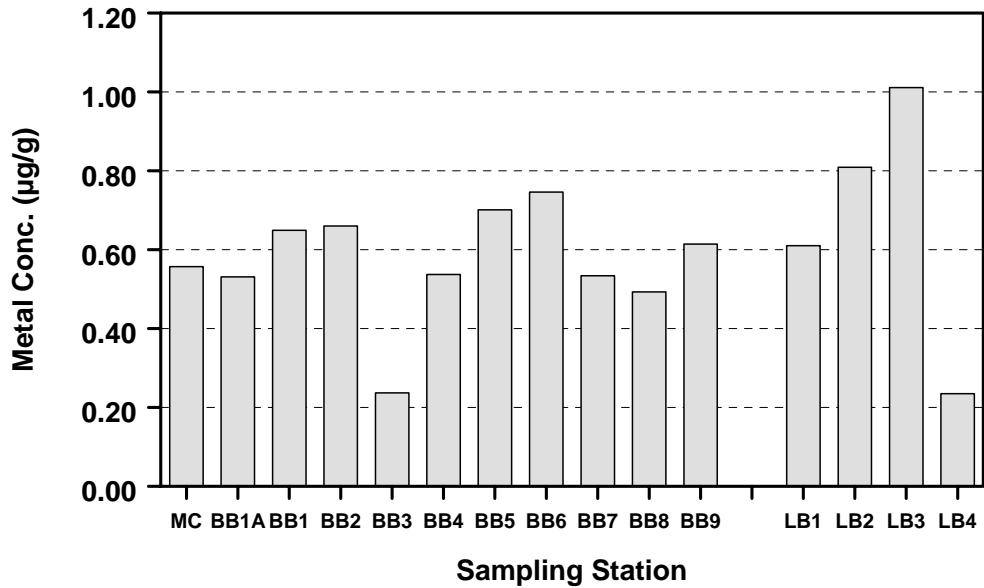


Figure 3. Cadmium concentrations in sediments from Big Bayou Creek, collected August 14, 2001.

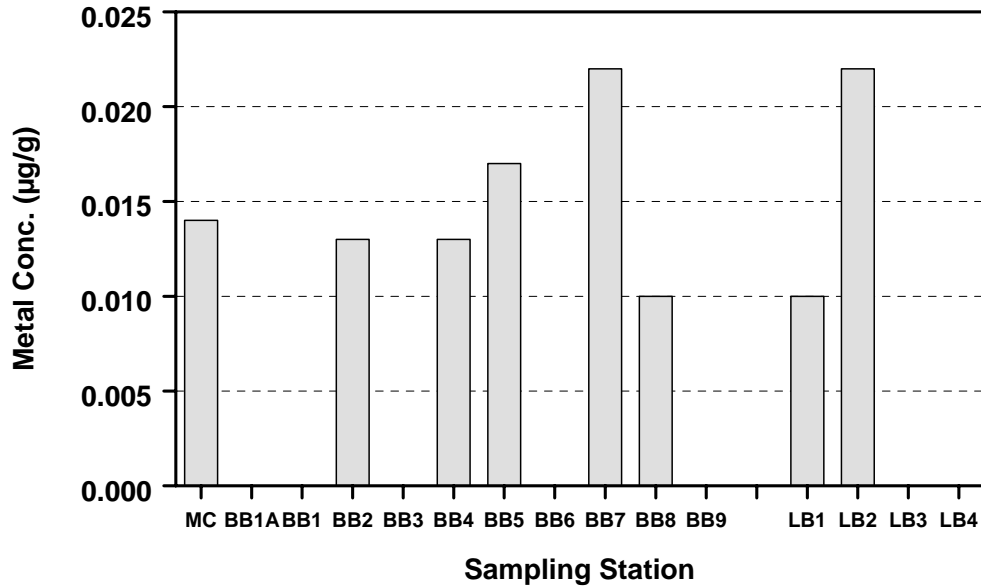


Figure 4. Chromium concentrations in sediments from Big Bayou Creek, collected August 14, 2001.

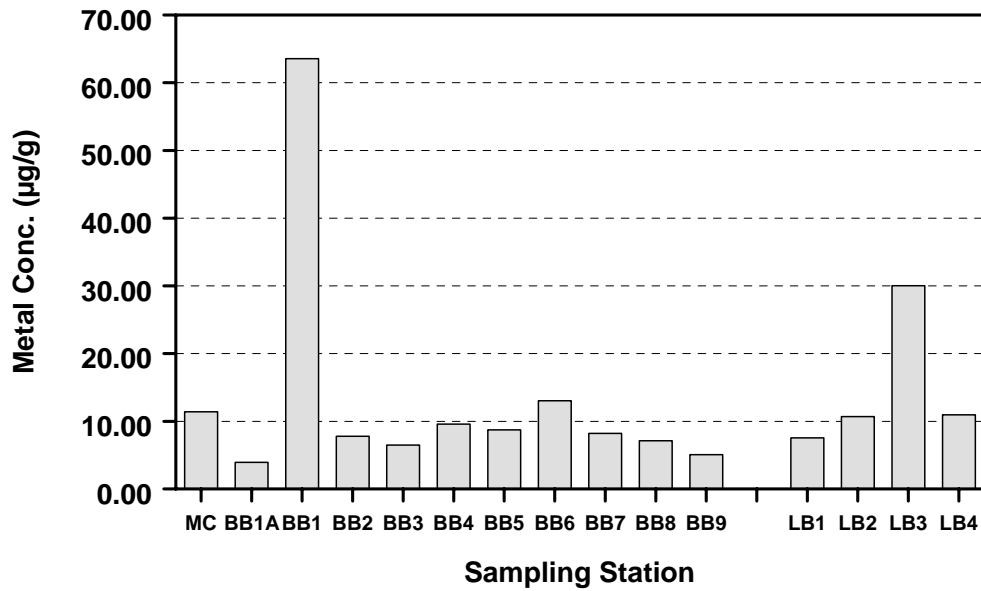


Figure 5. Copper concentrations in sediments from Big Bayou Creek, collected August 14, 2001.

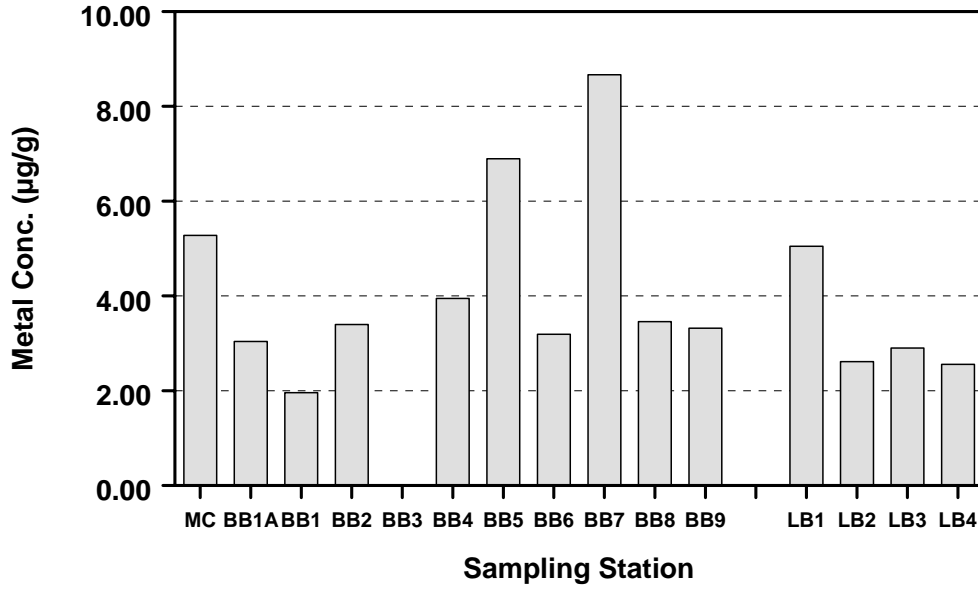


Figure 6. Iron concentrations in sediments from Big Bayou Creek, collected August 14, 2001.

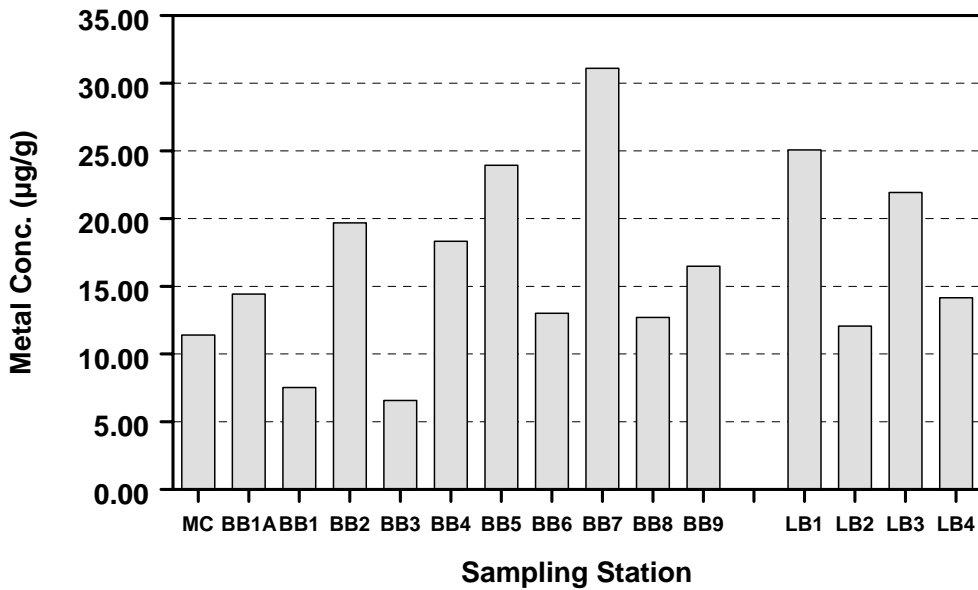


Figure 7. Lead concentrations in sediments from Big Bayou Creek, collected August 14, 2001.

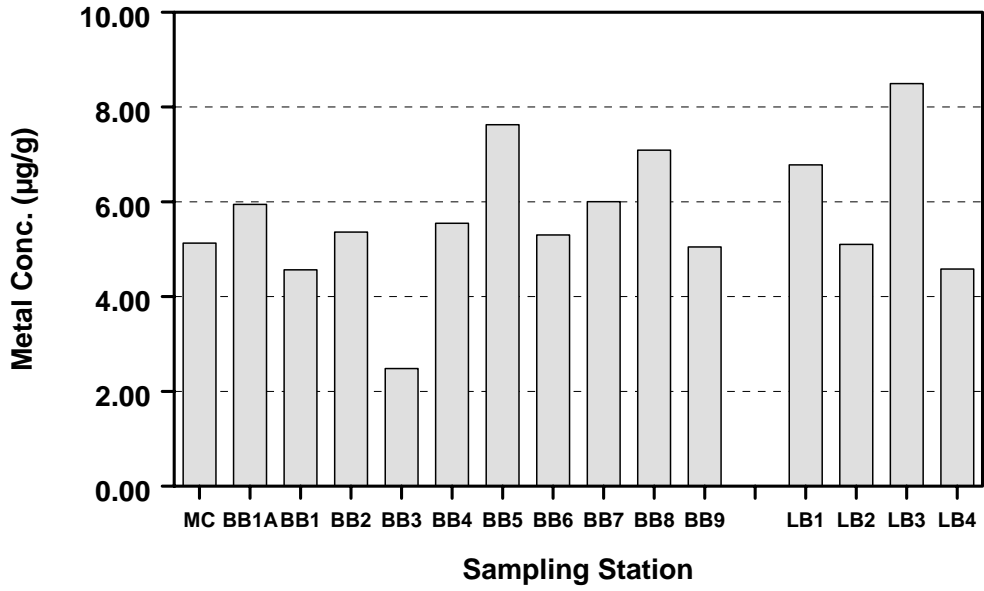


Figure 8. Nickel concentrations in sediments from Big Bayou Creek, collected August 14, 2001.

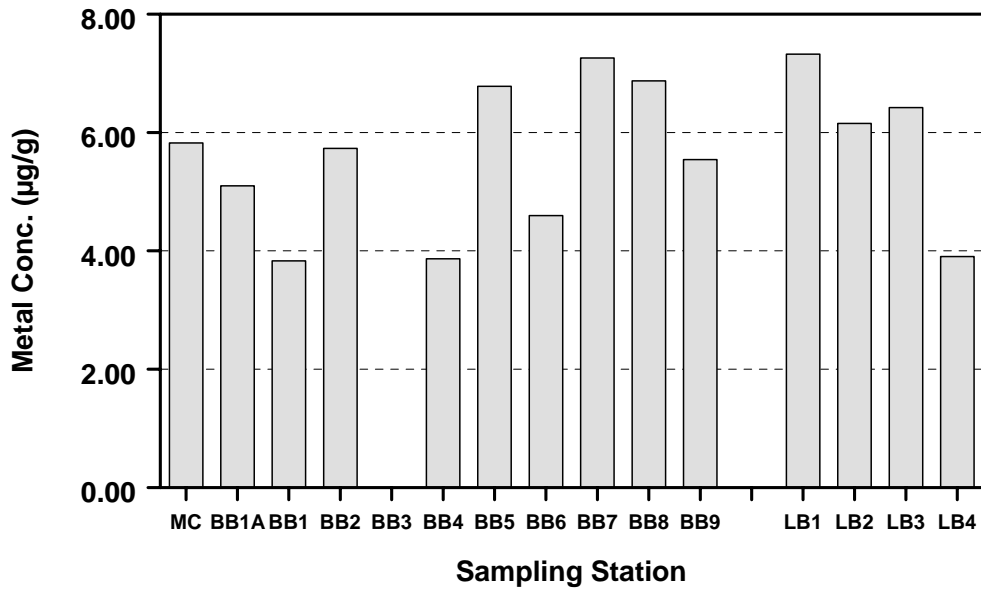
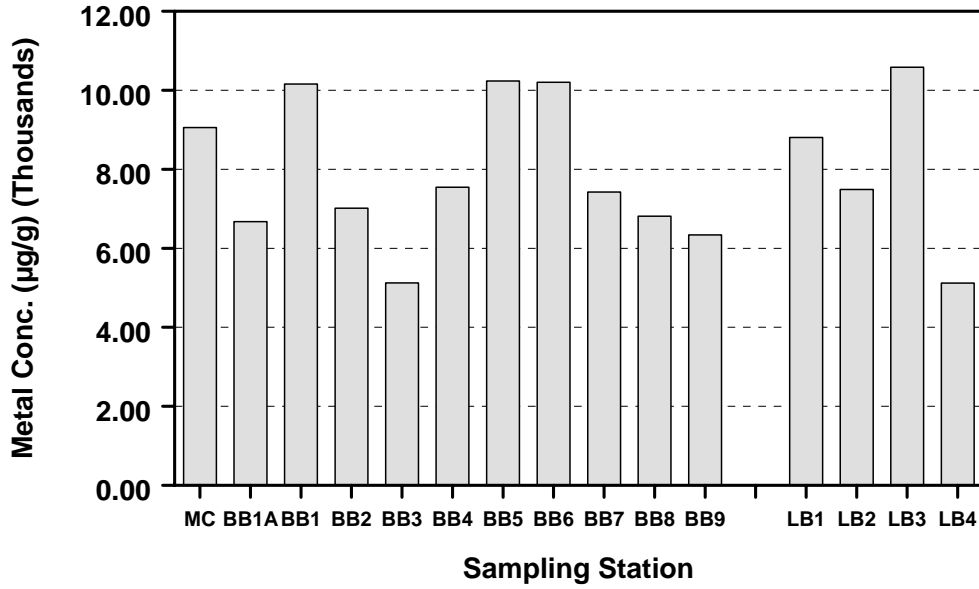


Figure 8. Zinc concentrations in sediments from Big Bayou Creek, collected August 14, 2001.



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