Analysis of Polychlorinated Biphenyl (PCB) Residues and Metals in Sediment Samples Collected February 19-20, 2001 from the Bayou Creek System

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INTRODUCTION

Sediment samples (72 samples) were taken for PCB and metal analyses from Big and Little Bayou Creeks on February 19-20, 2001. A total of 11 sites were sampled from Big Bayou Creek (stations BB1 through BB9) and 5 sites from Little Bayou Creek (stations LB2A 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. During this sampling event, the station used by DOE on Massac Creek (MC-DOE) also was located and sampled. 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

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. Weighed sub-samples (average wet weight 47.4±1.5 g; average dry weight 38.3±2.6 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. PCBs in the dry clay/silt fractions were also analyzed. The sediment sample was air-dried for 7d and sieved (past 180-μm mesh) to obtain the clay/silt fraction. This fraction was then extracted as described above. All sieves and trays were stainless-steel and were solvent cleaned between samples.

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 ^{o}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 (0.5μm 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 Aroclors 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® digestion tubes. The samples were digested with 10.0 mL 1:1 TraceMetal grade HNO_3 and heated to 95^{o}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_3 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_2O_2 were added and the sample heated. The samples were then reconstituted with 5.0 mL of 0.5% HNO_3 and filtered through a Gelman Sciences Type A/E glass fiber filter to remove suspended particulates. The filters were rinsed with 0.5% HNO_3 prior to use and filtrates were taken to a final volume of 15 mL. Metal analysis was performed by atomic absorption spectrophotometry (AAS), using graphite

furnace atomization techniques and a Varian atomic absorption spectrophotometer (Model Spectra AA-20) equipped with a GTA-96 graphite furnace. All gases used were ultra pure carrier grade. Calibration curves were based on five standards. The instrument was programmed to take three readings per sample and average the absorbance. Instrument blanks (0.5 % HNO_3) 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. 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. All three Aroclors were detected at stations BB4 through BB8 on Big Bayou Creek, with station BB6 having the highest total Aroclor level (*i.e.* 0.031 µg/g; 31 ppb). Frequency of detection for the 12 samples taken from station BB4 through BB9 was "92%", as compared with "no" detections (*i.e.* <0.003 µg/g) observed in samples taken in September, 1999 (Birge and Price, March 14, 2000a). These data reflect some increases in PCB contamination.

Concerning Little Bayou Creek, PCBs were not detected at station LB1 situated upstream of PGDP. However, PCBs were detected at all other stations, including LB2A, LB2, LB3 and LB4 (Table 2). Aroclor 1248 was present in all eight samples taken from these stations; 1254 was not detected; and 1260 was detected in 6 of 8 samples. The highest total PCB concentration was 0.131 µg/g (131 ppb) observed at station LB2A. Mean values for PCB in sediments are given in Tables 3 and 4 and illustrated in Figures 1 and 2.

In order to evaluate further the pattern of PCB sediment contamination in the Bayou Creek system, assays also were performed on dried and sieved clay/silt samples (Tables 5, 6). The pattern of PCB contamination did not differ appreciably. However, PCB concentrations generally were somewhat higher. The highest values (µg/g) for stations BB5, BB6 and BB7 were 0.044 (44 ppb), 0.038 (38 ppb) and 0.034 (34 ppb), respectively. Greater differences were noted for Little Bayou Creek. For example, the highest total PCB values (µg/g) for stations LB2, LB3 and LB4 were 0.30, 0.21 and 0.26,

respectively (Table 6). This represented increases of about three to ten times those values given in Table 2. The patterns of PCB contamination in Big and Little Bayou Creeks are illustrated in Figures 1 through 6. Mean concentrations for clay/silt samples are given in Table 7. Maximum values for the clay/silt fractions are shown in Figures 7 and 8. These results support the premise that sediment PCB contamination has increased since March 2000. This is based on the frequency of detection, as well as the PCB concentrations observed.

Considering the PCB residues found in the stoneroller minnow and other fish (Birge and Price, August 2001a; October 2001b), the sediment PCB concentrations appeared lower than expected.

It is recommended that consideration be given to additional work to examine this situation more closely, including:

- Soil particle size characterization at all stations
- Determinations on percent organic carbon
- Evaluations of rates of downstream movement of sediments, especially under high-water conditions.

Metals in Sediments

Results for metal concentrations of individual sediment samples are given in Tables 8 and 10, whereas mean metal concentrations are given in Tables 9 and 11. In reviewing sediment metal contamination in Big Bayou Creek, the Massac Creek site MCDOE was used for comparisons and BB1A was taken as the instream reference. As compared with the former (*i.e.* MCDOE), all nine metals were elevated at and downstream of station BB2.

Stations 4 and/or 5 were the least impacted with metal contamination. Except for station BB5, Ag was somewhat elevated as all stations when values were compared with those for station MCDOE on Massac Creek. The highest Ag concentration was 0.059 µg/g (*i.e.* 59 ppb) at station BB3 (Table 8, Figure 9). The highest Be concentrations was 0.603 µg/g (603 ppb) at station BB3. Based on mean metal values (Table 9), Be was found at higher concentrations at all stations downstream of BB1A, except for stations BB4 and BB5. The mean Be values (µg/g) were 0.45, 0.57, 0.36 and 0.29 at stations BB2, BB3, BB6 and BB9, respectively (Figure 10). Beryllium was not detected at station MCDOE.

Cadmium (Cd) concentrations were generally low throughout the system. The highest Cd concentration was 0.50 µg/g (50 ppb) observed at BB9 (Figure 11). Chromium (Cr) concentrations were most elevated at stations BB2, BB3 and BB7 (Figure 12). The mean value at stations BB3, situated downstream of effluent 009, was 37.2 µg/g (*i.e.* 37.2 ppm). This value was considerably higher that the mean values of 5.76 and 8.71 µg/g observed for station MCDOE and the upstream reference station (BB1A), respectively (Table 9). Copper (Cu) was most elevated at downstream station BB7, BB8, and BB9, where mean values were 4.24, 5.16 and 4.85 µg/g (Table 9, Figure 13). Iron (Fe) was variable throughout the system. The highest mean concentrations were observed at BB2A, BB3 and BB7, where the values were 8210.0, 8580.3 and 8103.8 µg/g. The ash landfill may have affected stations BB2A and BB3.

The highest mean values for Pb were 13.5, 18.9 and 12.5 µg/g at stations BB2A, near the ash landfill, BB8 and BB9. Compared with the value of 2.66 for station MCDOE, Pb was elevated at all stations on Big Bayou Creek, except at BB5 (Table 9). The lowest mean value for Pb was 2.03 µg/g at station BB5 (Figure 14). As compared with upstream

stations BB1A and BB1, Ni occurred at higher concentrations at stations BB2, BB2A, BB3, and BB6 through BB9 (Table 9, Figure 15). The highest mean value for Ni was 15.1 µg/g at BB2 (Table 2). The abandoned bridge on the unnamed tributary is near station BB2 and contamination from the bridge site likely affected this stream station. The highest Ni value at BB2 was 19.4 µg/g (Table 8). As noted above, Cr also was elevated at BB2 (25.3 µg/g, Table 9). Mean concentrations for Zn are shown in Figure 16. The higher mean concentrations (µg/g) were 31.6, 21.9, 21.4 and 25.7 at stations BB2, BB7, BB8 and BB9, respectively (Table 9).

It appears likely that all continuous and intermittent effluents contributed , at least to some extent, to sediment metal pollution in Big Bayou Creek. Effluent 001 most often was implicated. However, other sources of metal contamination included the ash landfill, the abandoned bridge area on the unnamed tributary and, possibly, other areas yet to be determined. As illustrated in Figures 9-16, metals in the water column of Big Bayou Creek displayed profiles that usually differed substantially from the patterns of sediment contamination. Although, affected to some extent by upstream effluents, metal concentrations in the water column of Big Bayou Creek generally increased noticeably at and downstream of station BB6. As noted above, this tends to implicate effluent 001 as a major source of metal pollution. It should be noted that sediment concentrations shown in Figures 9-16 were based on mean values.

Metals analyzed in sediment samples from Little Bayou Creek are given in Tables 10 and 11. The latter is based on mean values ± standard deviations. These data raise the prospect that the upstream station (LB1) has sustained considerable metal pollution (*e.g.* Cr, Pb, Zn) and, therefore, probably is not a reliable reference site

for metals (Tables 10, 11). Downstream stations most impacted by metals included LB2A, LB2, and to a lesser extent LB3. For example, mean Cr values range up to 28.10 µg/g (28.10 ppm) at LB2. As given in Table 11, sediment concentrations of Cu, Pb, Ni and Zn were much lower at LB3 than reported in earlier studies (Birge and Price, March 14, 2000b). This raises questions as to any possible sediment remediation or, alternatively, downstream sediment transport.

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Table 1. PCB results for PGDP stream sediment samples from Big Bayou Creek, collected February 19-20, 2001.

Station	Date	Sample[1]	Sample Wet Wt. (g)	Sample Dry Wt. (g)	% Moisture	Aroclor Conc. (µg/g) 1248	1254	1260	Total
MC[2]	02/19/01	PSED1	45.759	32.950	28.0	<0.006	<0.006	<0.006	N.D.
MC	02/19/01	PSED2	46.153	33.600	27.2	0.008	<0.006	<0.006	0.008
MCDOE[3]	02/20/01	PSED1	46.190	37.230	19.4	<0.005	<0.005	<0.005	N.D.
MCDOE	02/20/01	PSED2	46.933	38.850	17.2	<0.005	<0.005	<0.005	N.D.
BB1A	02/19/01	PSED1	49.073	33.220	32.3	<0.006	<0.006	<0.006	N.D.
BB1A	02/19/01	PSED2	50.740	34.240	32.5	<0.006	<0.006	<0.006	N.D.
BB1	02/19/01	PSED1	47.699	39.230	17.8	<0.005	<0.005	<0.005	N.D.
BB1	02/19/01	PSED2	47.392	37.920	20.0	0.003*	<0.005	<0.005	0.003*
BB2	02/19/01	PSED1	47.375	36.130	23.7	<0.006	<0.006	<0.006	N.D.
BB2	02/19/01	PSED2	47.892	37.590	21.5	0.004*	<0.005	<0.005	0.004*
BB2A	02/19/01	PSED1	47.137	38.520	18.3	0.004*	<0.005	<0.005	0.004*
BB2A	02/19/01	PSED2	45.691	35.490	22.3	0.007	<0.006	<0.006	0.007
BB3	02/19/01	PSED1	46.202	38.460	16.8	0.005	<0.005	<0.005	0.005
BB3	02/19/01	PSED2	48.282	35.820	25.8	0.008	0.003	<0.006	0.011

[1] PSED1 and PSED2 were two samples collected separately.
[2] MC was a new reference site on Massac Creek.
[3] MCDOE was the DOE site on Massac Creek.
* PCBs detected, however the value was below the Minimum Quantitation Limit (MQL).

Table 1, continued. PCB results for PGDP stream sediment samples from Big Bayou Creek, collected February 19-20, 2001.

Station	Date	Sample[1]	Sample Wet Wt. (g)	Sample Dry Wt. (g)	% Moisture	Aroclor Conc. (µg/g) 1248	1254	1260	Total
BB4	02/19/01	PSED1	49.832	41.400	16.9	<0.005	<0.005	<0.005	N.D.
BB4	02/19/01	PSED2	45.857	36.830	19.7	0.005	0.002*	0.004*	0.011
BB5	02/19/01	PSED1	46.261	38.100	17.6	0.009	0.004*	0.006*	0.019
BB5	02/19/01	PSED2	45.960	37.730	17.9	0.009	0.004*	0.008*	0.021
BB6	02/19/01	PSED1	49.677	41.780	15.9	0.004*	<0.005	<0.005	0.004*
BB6	02/19/01	PSED2	45.157	37.270	17.5	0.014	0.006	0.011	0.031
BB7	02/19/01	PSED1	47.806	38.560	19.3	0.006	0.003*	0.005	0.014
BB7	02/19/01	PSED2	47.728	40.420	15.3	0.008	0.003*	0.005	0.016
BB8	02/19/01	PSED1	48.770	38.520	21.0	0.007	0.003*	0.009	0.019
BB8	02/19/01	PSED2	44.690	33.600	24.8	0.005*	<0.006	<0.006	0.005*
BB9	02/19/01	PSED1	47.303	39.550	16.4	0.004*	<0.005	<0.005	0.004*
BB9	02/19/01	PSED2	48.863	40.420	17.3	0.006	<0.005	<0.005	0.006

[1] PSED1 and PSED2 were two samples collected separately.
* PCBs detected, however the value was below the Minimum Quantitation Limit (MQL).

Table 2. PCB results for PGDP stream sediment samples from Little Bayou Creek, collected February 20, 2001.

Station	Date	Sample[1]	Sample Wet Wt. (g)	Sample Dry Wt. (g)	% Moisture	Aroclor Conc. (µg/g) 1248	1254	1260	Total
LB1	02/20/01	PSED1	47.599	41.440	12.9	<0.005	<0.005	<0.005	N.D.
LB1	02/20/01	PSED2	48.132	41.270	14.3	<0.005	<0.005	<0.005	N.D.
LB2A	02/20/01	PSED1	46.803	40.860	12.7	0.131	<0.005	<0.005	0.131
LB2A	02/20/01	PSED2	46.281	39.000	15.7	0.055	<0.005	<0.005	0.055
LB2	02/20/01	PSED1	46.767	39.940	14.6	0.060	0.002*	0.012	0.074
LB2	02/20/01	PSED2	49.734	42.200	15.1	0.030	<0.005	0.005	0.035
LB3	02/20/01	PSED1	47.640	39.290	17.5	0.029	<0.005	0.005	0.034
LB3	02/20/01	PSED2	48.337	40.890	15.4	0.069	<0.005	0.013	0.083
LB4	02/20/01	PSED1	45.713	38.860	15.0	0.018	<0.005	0.007	0.025
LB4	02/20/01	PSED2	49.719	42.020	15.5	0.023	<0.005	0.011	0.033

[a] PSED1 and PSED2 were two samples collected separately.
* PCBs detected, however the value was below the Minimum Quantitation Limit (MQL).

Table 3. Mean PCB results for stream sediment samples from Big Bayou Creek, collected February 19-20, 2001.

	Aroclor Conc. (µg/g)			
Station	1248	1254	1260	Total
MC[1]	0.008	<0.006	<0.006	0.008
MCDOE[2]	<0.005	<0.005	<0.005	<0.005
BB1A	<0.006	<0.006	<0.006	<0.006
BB1	0.003	<0.005	<0.005	0.003
BB2	0.004	<0.005	<0.005	0.004
BB2A	0.006	<0.005	<0.005	0.006
BB3	0.007	0.003	<0.005	0.010
BB4	0.005	0.002	0.004	0.011
BB5	0.009	0.004	0.007	0.020
BB6	0.009	0.006	0.011	0.026
BB7	0.007	0.003	0.005	0.015
BB8	0.006	0.003	0.009	0.018
BB9	0.005	<0.005	<0.005	0.005

[1] MC was a new reference site on Massac Creek.
[2] MCDOE was the DOE site on Massac Creek.

Table 4. Mean PCB results for stream sediment samples from Little Bayou Creek, collected February 19-20, 2001.

	Aroclor Conc. (µg/g)			
Station	1248	1254	1260	Total
LB1	<0.005	<0.005	<0.005	<0.005
LB2A	0.093	<0.005	<0.005	0.093
LB2	0.045	0.002	0.009	0.056
LB3	0.049	<0.005	0.009	0.058
LB4	0.021	<0.005	0.009	0.030

Table 5. PCB results for the clay/silt fraction of stream sediments from Big Bayou Creek, collected February 19-20, 2001.

Station	Date	Sample[1]	Sample Dry Wt. (g)	Aroclor Conc. (µg/g)[2] 1248	1254	1260	Total
MC	2/19/01	PCS1	47.547	<0.004	<0.004	<0.004	<0.004
MCDOE	2/20/01	PCS1	35.942	<0.006	<0.006	<0.006	<0.006
BB1A	2/19/01	PCS1	46.466	<0.004	<0.004	<0.004	<0.004
BB1	2/19/01	PCS1	24.408	<0.008	<0.008	<0.008	<0.008
BB2	2/19/01	PCS1	46.663	<0.004	<0.004	<0.004	<0.004
BB2A	2/19/01	PCS1	46.672	<0.004	0.001*	0.001*	0.002*
BB3	2/19/01	PCS1	26.323	<0.008	<0.008	<0.008	<0.008
BB4	2/19/01	PCS1	16.657	<0.012	0.005*	0.005*	0.009*
BB4	2/19/01	PCS2	21.180	<0.009	0.005*	0.011	0.016
BB5	2/19/01	PCS1	46.849	<0.004	0.027	0.018	0.044
BB5	2/19/01	PCS2	27.095	<0.007	0.006*	0.010	0.016
BB6	2/19/01	PCS1	47.145	<0.004	0.002*	0.002*	0.004*
BB6	2/19/01	PCS2	24.980	<0.008	0.012	0.025	0.038
BB7	2/19/01	PCS1	46.607	<0.004	0.006	0.028	0.034
BB7	2/19/01	PCS2	42.429	<0.005	0.005	0.022	0.028
BB8	2/19/01	PCS1	46.795	<0.004	0.004	0.009	0.013
BB8	2/19/01	PCS2	46.730	<0.004	0.006	0.017	0.022
BB9	2/19/01	PCS1	47.362	<0.004	0.005	0.013	0.018
BB9	2/19/01	PCS2	46.628	<0.004	0.003*	0.010	0.013

[1] PCS1 and PCS2 were two samples collected separately.
[2] Asterisk represent detected PCBs, but the value was below the minimum quantitation limit (MQL).

Table 6. PCB results for the clay/silt fraction of stream sediments from Little Bayou Creek, collected February 20, 2001.

Station	Date	Sample[1]	Sample Dry Wt. (g)	Aroclor Conc. (µg/g)[2] 1248	1254	1260	Total
LB1	2/20/01	PCS1	47.060	<0.004	<0.004	<0.004	<0.004
LB2A	2/20/01	PCS1	47.060	<0.042	0.009*	0.046	0.056
LB2A	2/20/01	PCS2	48.540	<0.041	0.032*	0.053	0.085
LB2	2/20/01	PCS1	46.606	<0.043	0.117	0.187	0.304
LB2	2/20/01	PCS2	47.267	<0.042	0.023*	0.035*	0.057*
LB3	2/20/01	PCS1	40.819	0.117	0.044	0.047	0.208
LB3	2/20/01	PCS2	46.156	<0.009	0.101	0.044	0.145
LB4	2/20/01	PCS1	46.594	0.157	0.077	0.027	0.261
LB4	2/20/01	PCS2	47.043	<0.004	0.009	0.012	0.021

[1] PCS1 and PCS2 were two samples collected separately.
[2] Asterisk represent detected PCBs, but the value was below the minimum quantitation limit (MQL).

Table 7. Mean PCB results for the clay/silt fraction of stream sediments from the Bayou Creek system, collected February 19-20, 2001.

	Mean Aroclor Conc. (µg/g)			
Station	1248	1254	1260	Total
MC	<0.004	<0.004	<0.004	<0.004
MCDOE	<0.006	<0.006	<0.006	<0.006
BB1A	<0.004	<0.004	<0.004	<0.004
BB1	<0.008	<0.008	<0.008	<0.008
BB2	<0.004	<0.004	<0.004	<0.004
BB2A	<0.004	0.001	0.001	0.002
BB3	<0.008	<0.008	<0.008	<0.008
BB4	N.D.	0.005	0.008	0.013
BB5	N.D.	0.016	0.014	0.030
BB6	N.D.	0.007	0.014	0.021
BB7	N.D.	0.006	0.025	0.031
BB8	N.D.	0.005	0.013	0.018
BB9	N.D.	<0.005	<0.005	0.016
LB1	<0.004	<0.004	<0.004	<0.004
LB2A	N.D.	0.021	0.050	0.070
LB2	N.D.	0.070	0.111	0.181
LB3	0.117	0.073	0.046	0.177
LB4	0.157	0.043	0.020	0.141

Cd =1

Cr = 52

Table 8. Metal concentrations in stream sediments from Big Bayou Creek, collected February 19-20, 2001.

			Metal Concentration (µg/g)								
Station	Date	Sample	Ag	Be	Cd	Cr	Cu	Fe	Pb	Ni	Zn
MC	021901	MSED1	0.028	0.602	0.045	12.263	4.621	7668.0	26.718	7.549	21.295
MC	021901	MSED2	0.224	0.365	0.016	8.034	3.355	7850.4	12.573	5.480	14.661
MCDOE	022001	MSED1	0.007	<0.082	<0.010	3.749	0.052	3232.2	2.506	1.074	<10.292
MCDOE	022001	MSED2	0.008	<0.098	<0.012	7.770	0.044	4807.6	2.807	1.015	<12.273
BB1A	021901	MSED1	0.023	0.238	0.016	9.767	2.860	6612.9	11.035	7.323	17.025
BB1A	021901	MSED2	0.020	0.190	0.017	7.653	2.919	6872.1	10.495	6.989	17.241
BB1	021901	MSED1	0.026	0.515	0.014	29.594	2.787	7574.2	14.416	7.146	13.115
BB1	021901	MSED2	0.019	0.156	<0.013	7.624	1.618	6798.9	9.554	4.420	<12.927
BB2	021901	MSED1	0.024	0.358	0.022	12.831	2.884	8036.5	10.131	10.824	14.678
BB2	021901	MSED2	0.033	0.550	0.046	37.777	4.364	7844.0	8.311	19.362	48.473
BB2A	021901	MSED1	0.023	0.399	0.025	19.987	2.117	8803.0	8.791	5.875	15.920
BB2A	021901	MSED2	0.023	0.390	0.027	19.362	3.557	7617.0	18.170	11.376	19.763
BB3	021901	MSED1	0.035	0.532	0.021	38.576	2.350	8729.5	7.268	12.864	12.987
BB3	021901	MSED2	0.059	0.603	0.023	35.910	3.170	8431.2	7.276	10.916	17.265
BB4	021901	MSED1	0.024	0.288	0.020	17.404	1.800	8652.4	4.818	3.691	12.781
BB4	021901	MSED2	0.035	0.096	0.014	7.794	0.898	5523.5	3.628	2.579	<11.176

Table 8, continued. Metal concentrations in stream sediments from Big Bayou Creek, collected February 19-20, 2001.

			Metal Concentration (µg/g)								
Station	Date	Sample	Ag	Be	Cd	Cr	Cu	Fe	Pb	Ni	Zn
BB5	021901	MSED1	0.008	0.139	0.028	7.720	0.792	5819.2	2.250	2.285	<10.535
BB5	021901	MSED2	0.006	<0.102	0.009	7.311	0.320	5251.5	1.802	2.628	<12.781
BB6	021901	MSED1	0.024	0.387	0.024	13.142	2.038	7036.9	4.591	10.833	<11.126
BB6	021901	MSED2	0.028	0.331	0.018	12.151	3.057	7087.9	5.045	8.132	15.632
BB7	021901	MSED1	0.050	0.412	0.042	14.647	6.148	7440.7	7.429	11.798	26.945
BB7	021901	MSED2	0.031	0.359	0.017	27.986	2.334	8767.0	4.761	5.377	16.884
BB8	021901	MSED1	0.034	0.365	0.033	15.352	6.395	6175.6	23.347	12.856	23.835
BB8	021901	MSED2	0.022	0.250	0.027	12.089	3.930	6886.6	14.559	8.461	19.048
BB9	021901	MSED1	0.025	0.266	0.054	21.999	4.079	6298.6	12.683	8.761	22.240
BB9	021901	MSED2	0.032	0.310	0.047	14.294	5.622	7294.9	12.359	11.695	29.131

Table 9. Mean metal concentrations ± standard deviations[1] in stream sediments from Big Bayou Creek, collected February 19-20, 2001.

	Metal Concentration (µg/g)								
Station	Ag	Be	Cd	Cr	Cu	Fe	Pb	Ni	Zn
MC	0.126	0.484	0.030	10.149	3.988	7759.2	19.646	6.515	17.978
	0.138	0.167	0.021	2.990	0.895	129.0	10.002	1.463	4.691
MCDOE	0.008	N.D.	N.D.	5.759	0.048	4019.9	2.656	1.044	N.D.
	0.001	---	---	2.843	0.005	1114.0	0.213	0.041	N.D.
BB1A	0.021	0.214	0.016	8.710	2.889	6742.5	10.765	7.156	17.133
	0.002	0.034	0.000	1.495	0.041	183.3	0.382	0.236	0.153
BB1	0.022	0.335	0.014	18.609	2.202	7186.5	11.985	5.783	13.115
	0.005	0.254	---	15.536	0.827	548.2	3.437	1.928	---
BB2	0.028	0.454	0.034	25.304	3.624	7940.2	9.221	15.093	31.575
	0.007	0.135	0.017	17.639	1.046	136.1	1.287	6.037	23.896
BB2A	0.023	0.394	0.026	19.674	2.837	8210.0	13.480	8.625	17.842
	0.000	0.007	0.001	0.442	1.018	838.6	6.632	3.890	2.717
BB3	0.047	0.567	0.022	37.243	2.760	8580.3	7.272	11.890	15.126
	0.017	0.050	0.002	1.885	0.579	211.0	0.005	1.377	3.025
BB4	0.029	0.192	0.017	12.599	1.349	7087.9	4.223	3.135	12.781
	0.008	0.136	0.004	6.795	0.638	2212.5	0.842	0.786	---

[1] Standard deviations given below the means.

Table 9, continued. Mean metal concentrations ± standard deviations[1] in stream sediments from Big Bayou Creek, collected February 19-20, 2001.

	Metal Concentration (µg/g)								
Station	Ag	Be	Cd	Cr	Cu	Fe	Pb	Ni	Zn
BB5	0.007	0.139	0.019	7.515	0.556	5535.4	2.026	2.456	N.D.
	0.001	---	0.014	0.289	0.333	401.4	0.316	0.242	---
BB6	0.026	0.359	0.021	12.646	2.547	7062.4	4.818	9.483	15.632
	0.002	0.039	0.004	0.701	0.721	36.0	0.321	1.910	---
BB7	0.041	0.385	0.029	21.317	4.241	8103.8	6.095	8.588	21.914
	0.013	0.037	0.018	9.433	2.697	937.9	1.886	4.541	7.114
BB8	0.028	0.308	0.030	13.721	5.163	6531.1	18.953	10.658	21.441
	0.008	0.081	0.004	2.308	1.743	502.7	6.214	3.108	3.385
BB9	0.028	0.288	0.050	18.146	4.850	6796.8	12.521	10.228	25.685
	0.005	0.031	0.005	5.449	1.091	704.5	0.229	2.075	4.873

[1] Standard deviations given below the means.

Figure 1. Mean PCB concentrations in sediment samples from Big Bayou Creek, collected February 19-20, 2001.

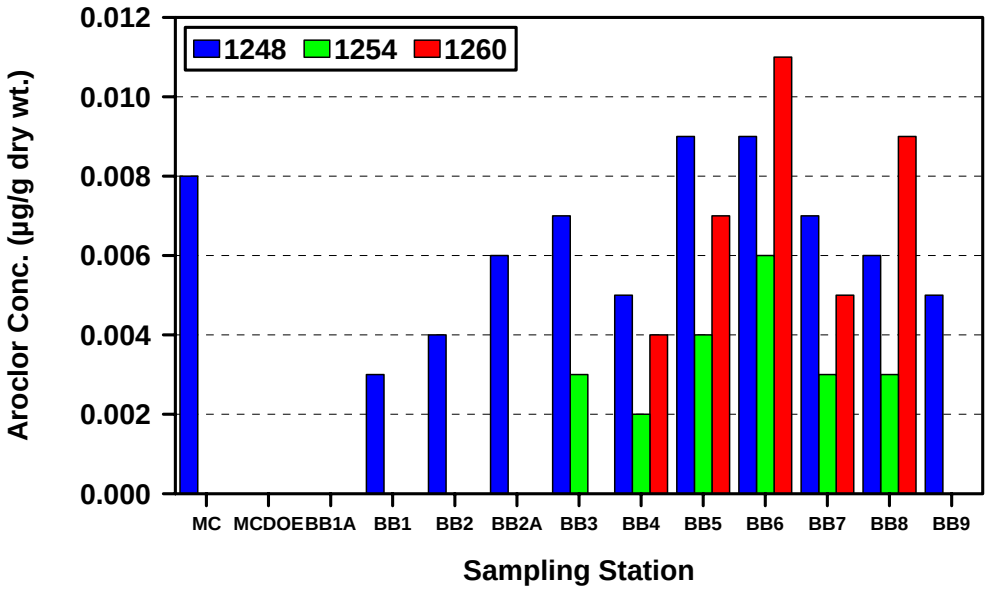

Figure 2. Mean values for total PCB concentrations in sediment samples from Big Bayou Creek, collected February 19-20, 2001.

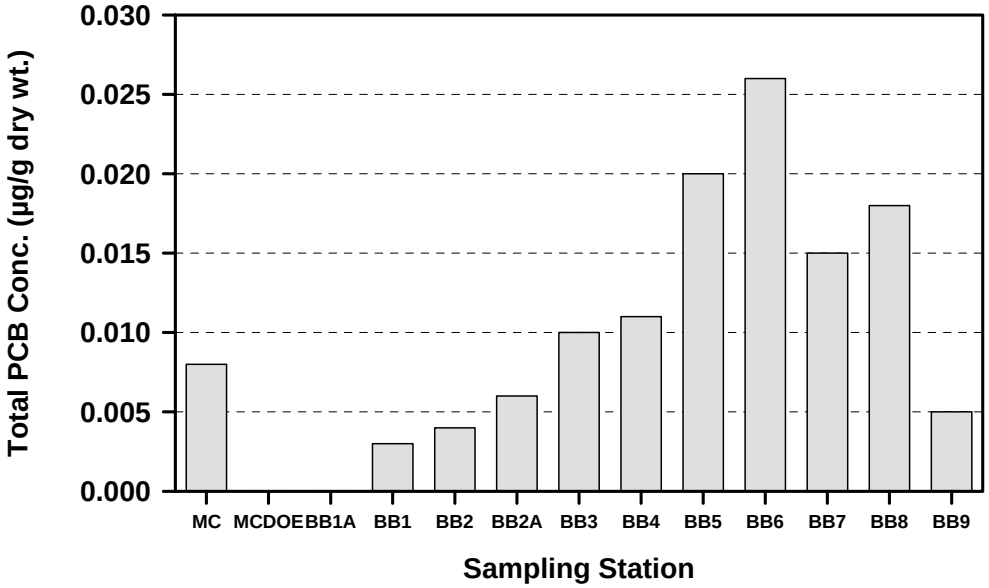

Figure 3. Mean PCB concentrations in sediment samples from Little Bayou Creek, collected February 19-20, 2001.

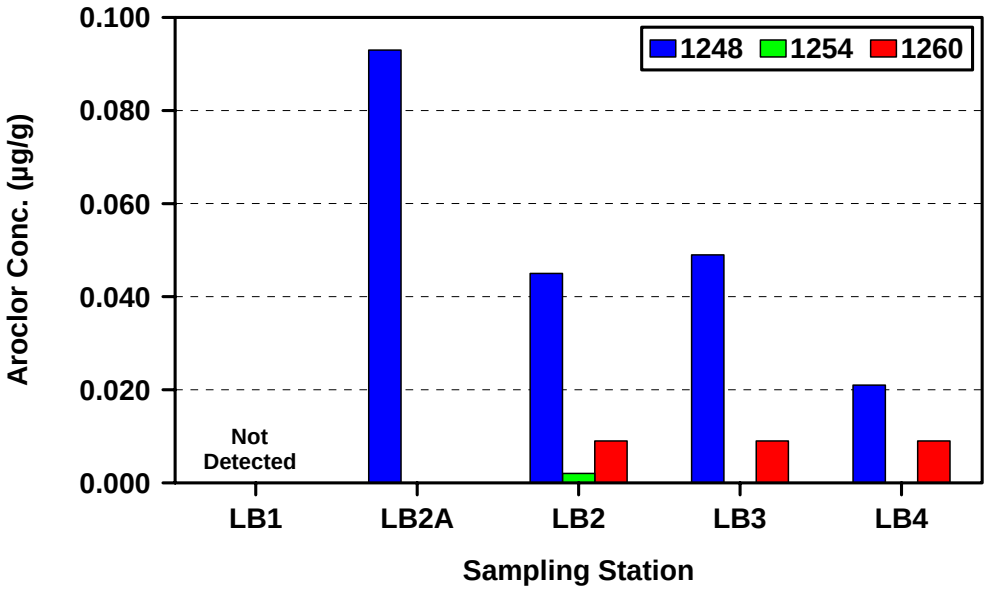

Figure 4. Mean values for total PCB concentrations in sediment samples from Little Bayou Creek, collected February 19-20, 2001.

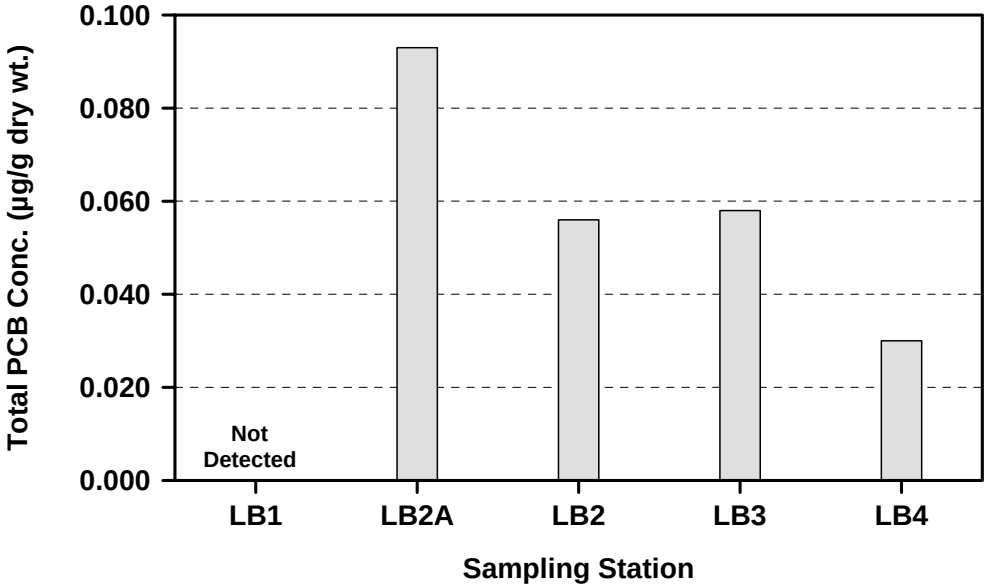

Figure 5. Mean PCB concentrations for the sediment clay/silt fractions from Big Bayou Creek, collected February 19-20, 2001.

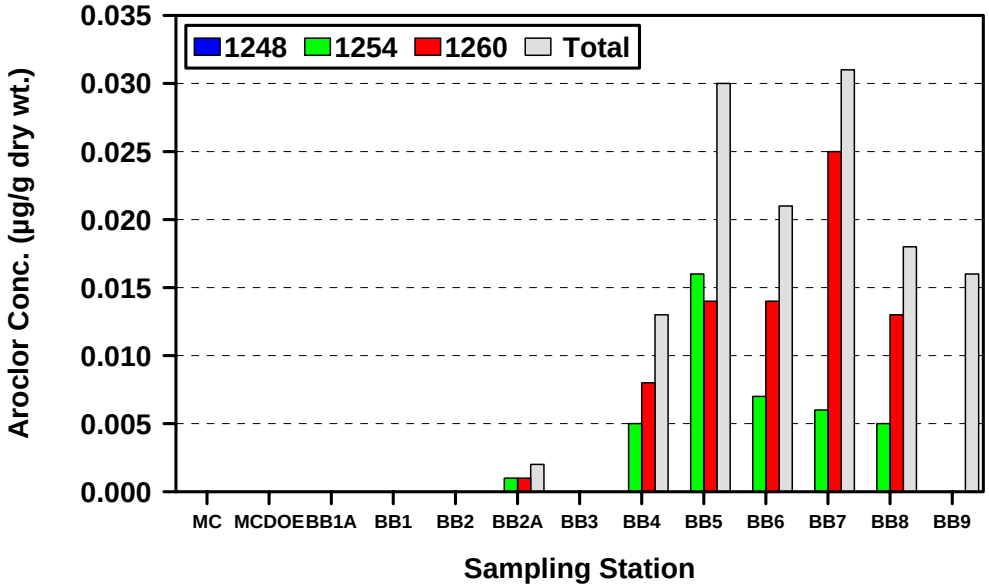

Figure 6. Mean PCB concentrations for the sediment clay/silt fractions from Little Bayou Creek, collected February 19-20, 2001.

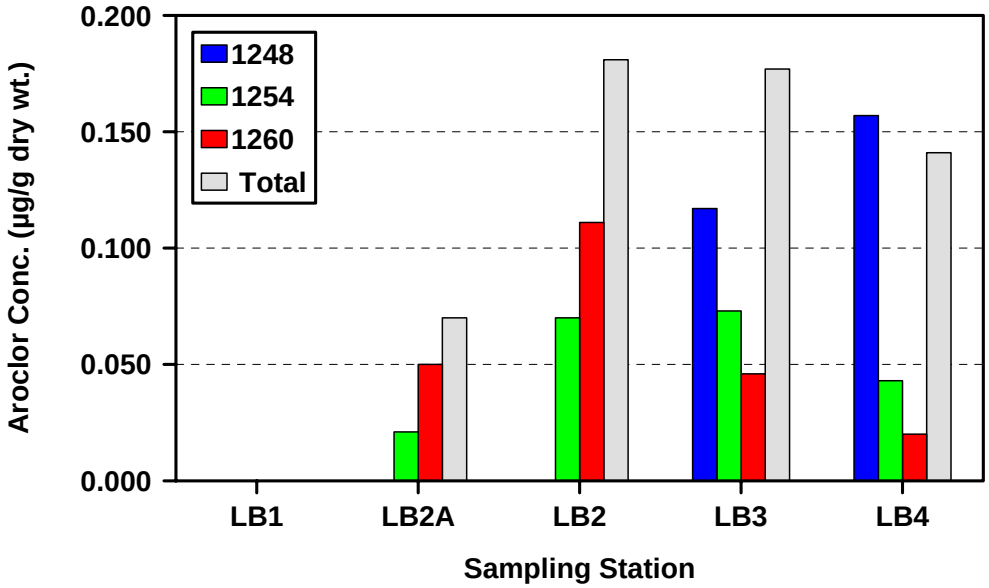

Figure 7. Maximum PCB concentrations for the sediment clay/silt fractions from Big Bayou Creek, collected February 19-20, 2001.

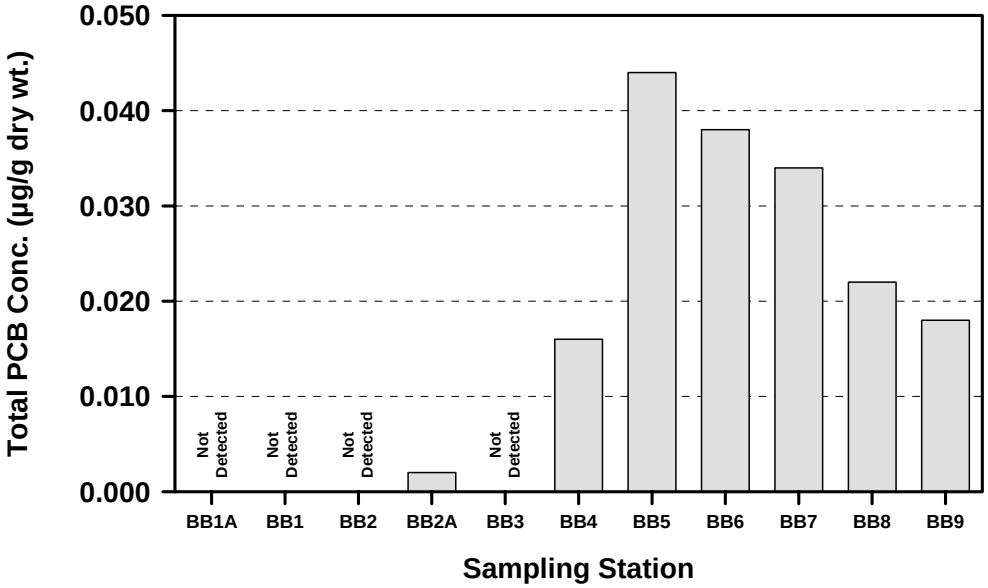

Figure 8. Maximum PCB concentrations for the sediment clay/silt fractions from Little Bayou Creek, collected February 19-20, 2001.

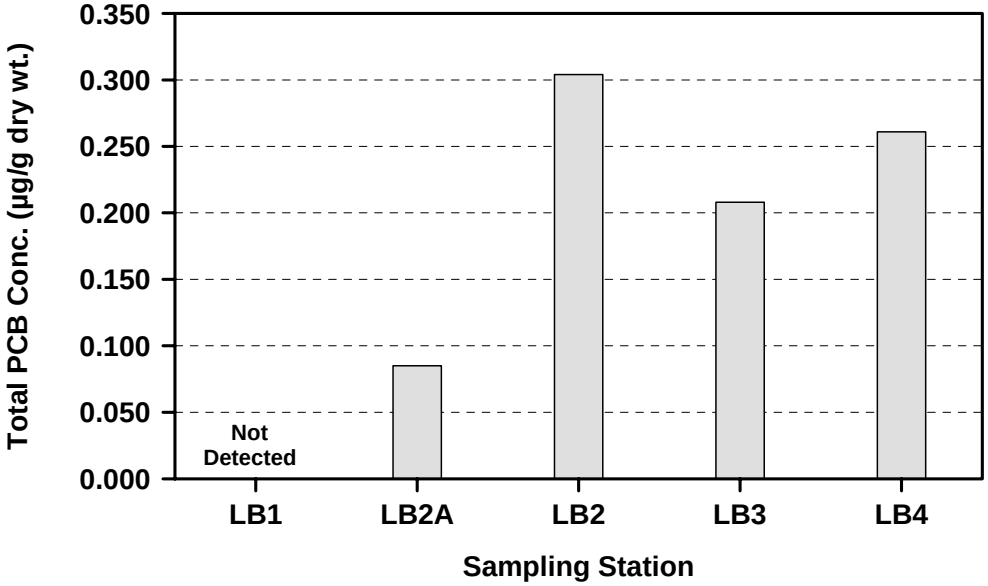

Figure 9. Silver concentrations in water and sediment samples from Big Bayou Creek, collected February 19-20, 2001.

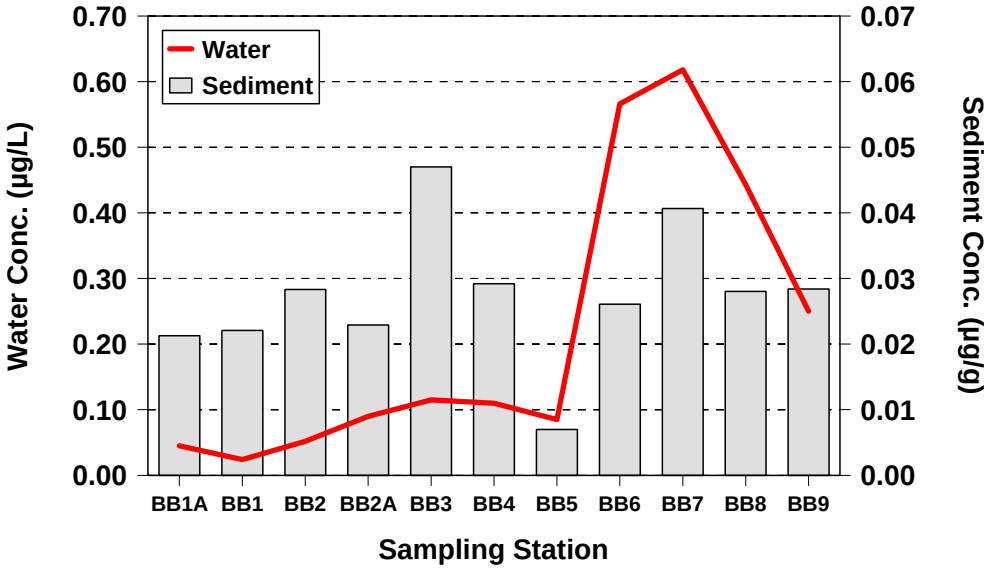

Figure 10. Beryllium concentrations in water and sediment samples from Big Bayou Creek, collected February 19-20, 2001.

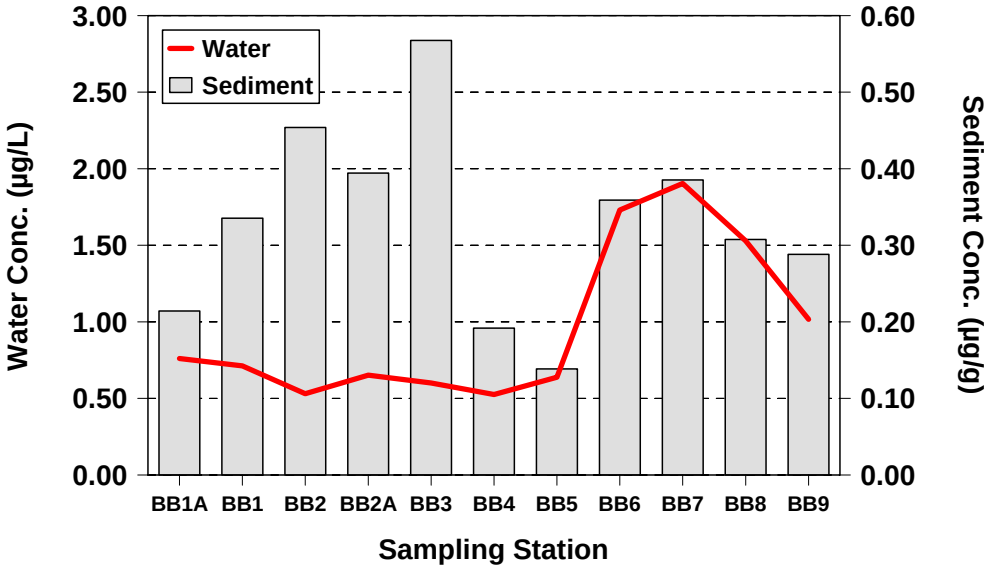

Figure 11. Cadmium concentrations in water and sediment samples from Big Bayou Creek, collected February 19-20, 2001.

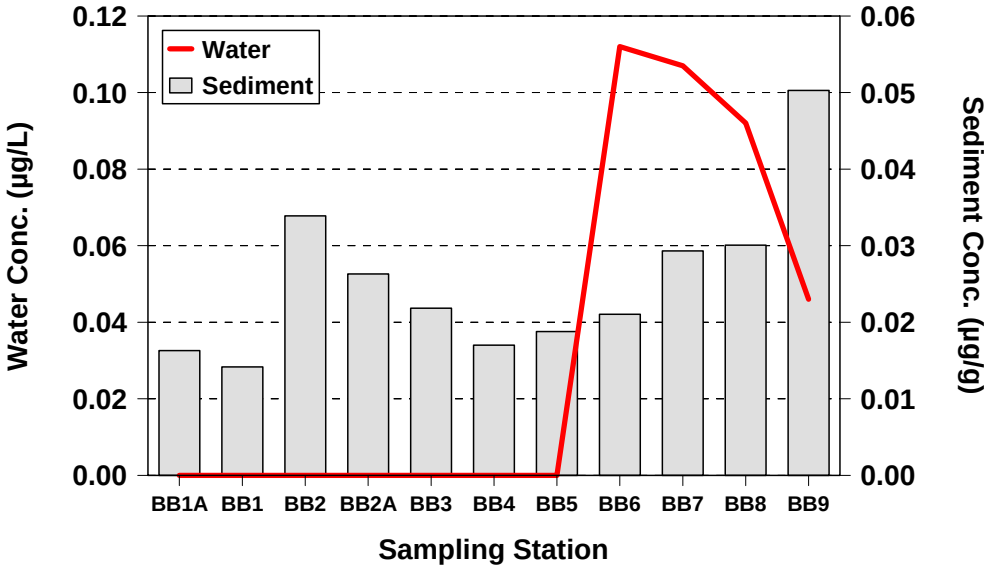

Figure 12. Chromium concentrations in water and sediment samples from Big Bayou Creek, collected February 19-20, 2001.

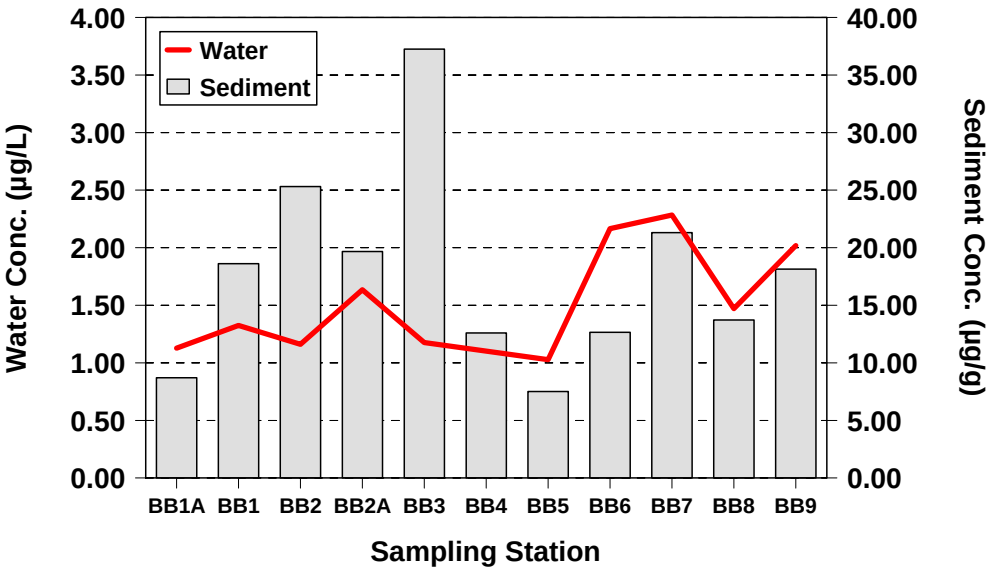

Figure 13. Copper concentrations in water and sediment samples from Big Bayou Creek, collected February 19-20, 2001.

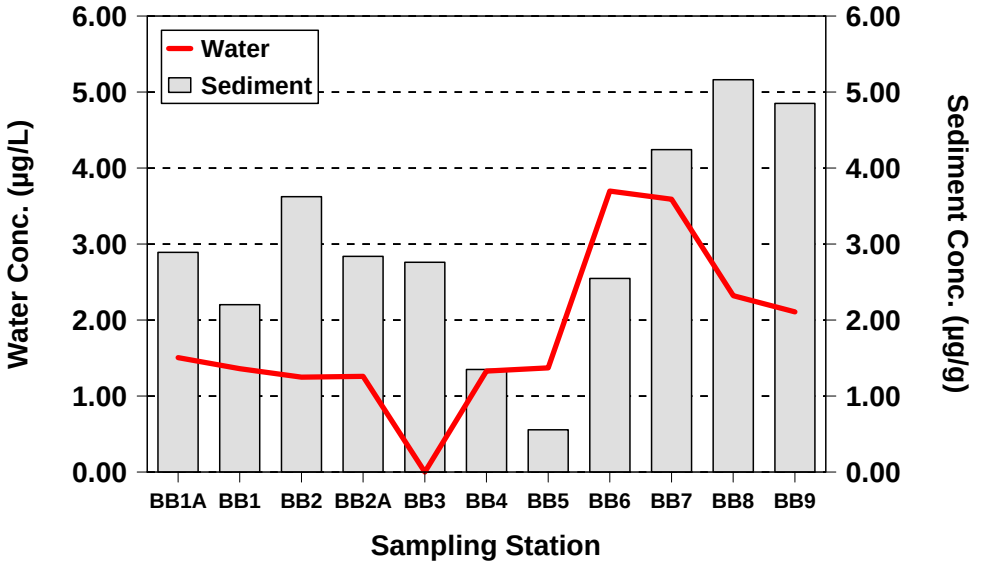

Figure 14. Lead concentrations in water and sediment samples from Big Bayou Creek, collected February 19-20, 2001.

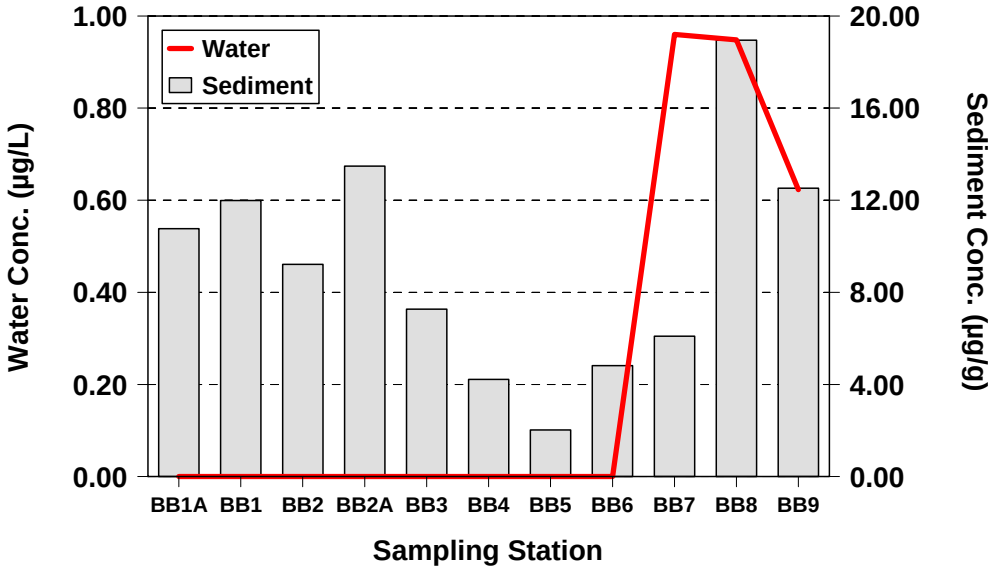

Figure 15. Nickel concentrations in water and sediment samples from Big Bayou Creek, collected February 19-20, 2001.

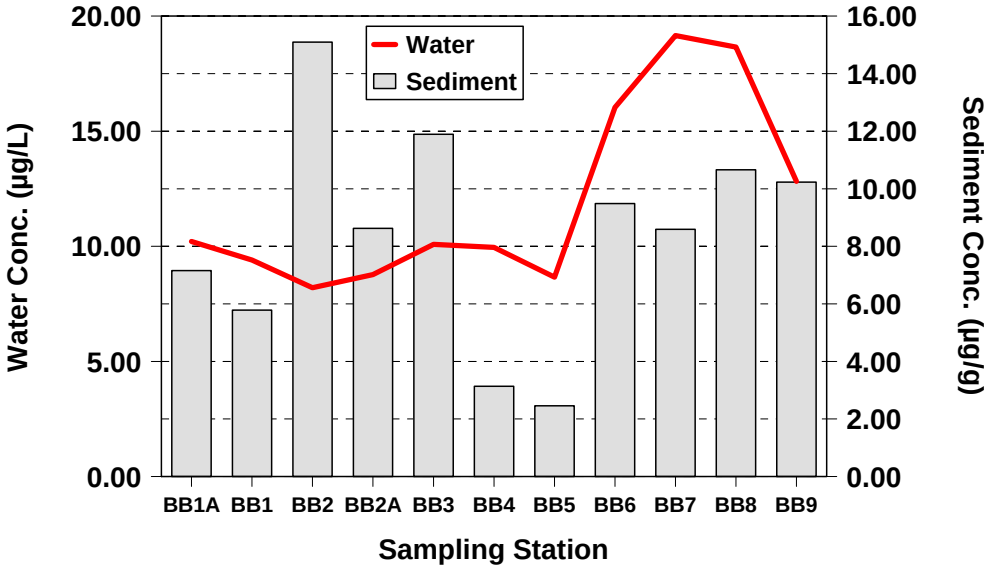

Figure 16. Zinc concentrations in water and sediment samples from Big Bayou Creek, collected February 19-20, 2001.