Polychlorinated Biphenyl (PCB) Residues in Water, Stream Sediments and Floodplain Soils Collected September 18-21, 2006 from the Bayou Creek System

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INTRODUCTION

Water, sediments and floodplain soil samples were taken from Big and Little Bayou creeks on September 18-21, 2006 for PCB analyses. Sampling was conducted following heavy rainfall occurring on September 18, 2006, however, water levels decreased on the following day. A total of 11 sites were sampled from Big Bayou creek (stations BB1A through BB9) and 5 sites from Little Bayou creek (stations LB1, LB2, LB2A, LB3 and LB4). In addition, Massac creek (MC) was sampled (*i.e.* West Fork) and served as a reference station. Samples also were collected near outfalls for effluents 001, 006, 008, and the combined effluents 010 and 011. 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 samples designated FP1 were collected next to the stream bank, while FP2 samples were taken 50-100 yards from the shoreline whenever possible. Both floodplain samples were collected 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.

RESULTS

Stream Water

Results for PCB analyses of water samples are presented in Table 1 for Massac and Big Bayou creeks and in Table 2 for Little Bayou creek and the main effluents. No PCBs were quantifiable in the water samples collected from Massac creek and from stations BB1A through BB5 in Big Bayou Creek, observing a detection limit of 0.08 µg

PCB/L. Aroclor 1254 and 1260 were detected at stations BB6, BB7, and BB8 with mean values of 0.192, 0.170, and 0.140 µg/L for Aroclor 1254 and values of 0.094, 0.089, and 0.097 µg/L for Aroclor 1260. In addition, Aroclor 1254 was detected in sample BB9-PWS2 (0.203 µg/L). No PCBs were detected at any of the Little Bayou creek stations or the four effluents (Table 2). These results indicated that water from the main effluents were not introducing PCBs into the streams. Stations BB6 through BB9 were sampled on September 20-21, 2006 following high-flow conditions, which may have caused the resuspension of sediments within the stream channel and the mobilization of PCBs from the floodplain soils into the stream.

Stream Sediments

PCB concentrations for duplicate wet-extracted sediments for Massac creek and Big Bayou creek are given in Table 3 and for Little Bayou creek in Table 4. Mean values for PCBs in sediments are given in Table 5. As with the water samples, no PCBs were detected at the reference station (MC) or at stations BB1A through BB5 in Big Bayou creek. Low concentrations of Aroclor 1254 were found in stations BB6 through BB9. Aroclor 1260 was found in one sample from station BB8 (Tables 3 and 5). In general most of the detections were close to the minimum quantitation limit.

In Little Bayou creek, Aroclor 1248 was not found in any of the stations or effluents. Highest sediment PCBs were observed for stations LB3 (389.19 µg A1254/Kg; 76.23 µg A1260/Kg) and station LB2A (44.37 µg A1254/Kg; 38.84 µg A1260/Kg). In the May 2006 collection, Aroclors 1254 and 1260 were also elevated at station LB3, with mean concentrations of 140.58 and 89.43 µg/Kg, respectively (Price 2007). During this spring

collection Aroclor 1254 also was detected in sediments from effluent 010+011 (5.95 µg/Kg), whereas in March 2005, sediment Aroclor 1254 from effluent 010+011 was 3.54 µg/Kg (Birge and Price, 2005). Background interferences were observed in effluent sediment samples collected in September 2006, therefore, the samples will be extracted once again with additional cleanup. Results for these samples will be presented in a later report.

Floodplain Soils

Results for PCBs in individual floodplain soils from Massac creek and Big Bayou creek are presented in Table 6. Mean Aroclor concentrations are given in Table 8. No Aroclor 1248 was detected in any of the floodplain soils samples. Similar results were obtained during the March 2005 collection (Birge and Price, 2005). Higher chlorinated PCBs were more prevalent in floodplain soils with Aroclors 1254 and 1260 being detected in stations BB1 and BB5 through BB9. Aroclor 1254 was highest at station BB6 and Aroclor 1260 was highest at station BB5 (Table 8).

Results for individual floodplain soils from Little Bayou creek are shown in Table 7, and mean Aroclor values are given in Table 8. As with the sediments, no PCBs were detected upstream at the LB1 reference station. Highest PCB concentrations in floodplain soils were found at stations LB2A and LB3. Mean floodplain soil Aroclor 1254 and 1260 concentrations for LB2A were 104.80 and 78.68 µg/Kg, respectively. In May 2006 station LB2A also had the highest concentrations of 1254 and 1260, with mean values of 110.42 and 76.39 µg/Kg, respectively (Price 2007). At station LB3, Aroclor 1254 and 1260 concentrations were 108.76 and 59.27 µg/Kg, whereas in May 2006 the values were

46.37 and 56.85 µg/Kg. These results indicated that PCBs in floodplain soils remained somewhat unchanged over time and that the floodplain soils were acting as reservoirs for the higher chlorinated PCBs. As with sediments collected in September 2006, floodplain soils from the main effluents will be reanalyzed and the results presented in a later report.

SUMMARY

In the past, PCB contamination was rarely observed in water from the Bayou creek system. Results from the latest sampling event indicated that the main effluents were not contributing additional PCBs into the Bayou system. Detections of PCBs in water from Big Bayou creek stations BB6 through BB9 may have been due to the high-flow event prior to sampling, which resuspended sediments within the stream channel and/or mobilized PCBs from the floodplain soils into the streams. As observed in the past, sediment PCB levels in Big Bayou creek were low, with most of the impact occurring downstream of the effluents at stations BB6 through BB9. PCBs in Little Bayou creek have remained somewhat constant over time. Station LB3 had the greatest impact due to Aroclors 1254 and 1260. Detection of PCBs at LB2A, located above effluent 010+011, indicated that contamination in Little Bayou creek is mainly from historical PCBs remaining in the stream. The lack of Aroclor 1248 in floodplain soils indicated that no recent deposition of PCB contaminated sediments has occurred. However, significant concentrations of Aroclors 1254, and 1260 were still being observed in floodplain soils, thus having the potential of reintroducing PCBs back into the streams due to runoff and high-flow events.

REFERENCES

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Table 1. PCBs in water samples from Massac and Big Bayou creeks collected September 18-21, 2006.

Station [1]	Date	Sample	Aroclor Concentration (μg/L) 1248	1254	1260
MC	9/21/2006	PWS1	<0.080	<0.080	<0.080
MC	9/21/2006	PWS2	<0.080	<0.080	<0.080
BB1A	9/19/2006	PWS1	<0.080	<0.080	<0.080
BB1A	9/19/2006	PWS2	<0.080	<0.080	<0.080
BB1	9/19/2006	PWS1	<0.081	<0.081	<0.081
BB1	9/19/2006	PWS2	<0.081	<0.081	<0.081
BB2	9/18/2006	PWS1	<0.080	<0.080	<0.080
BB2	9/18/2006	PWS2	<0.080	<0.080	<0.080
BB2A	9/18/2006	PWS1	<0.080	<0.080	<0.080
BB2A	9/18/2006	PWS2	<0.080	<0.080	<0.080
BB3	9/18/2006	PWS1	<0.080	<0.080	<0.080
BB3	9/18/2006	PWS2	<0.080	<0.080	<0.080
BB4	9/18/2006	PWS1	<0.080	<0.080	<0.080
BB4	9/18/2006	PWS2	<0.080	<0.080	<0.080
BB5	9/18/2006	PWS1	<0.080	<0.080	<0.080
BB5	9/18/2006	PWS2	<0.080	<0.080	<0.080
BB6	9/21/2006	PWS1	<0.080	0.234	0.070*
BB6	9/21/2006	PWS2	<0.080	0.150	0.094
BB7	9/20/2006	PWS1	<0.080	0.188	0.081
BB7	9/20/2006	PWS2	<0.080	0.151	0.096
BB8	9/20/2006	PWS1	<0.080	0.081	0.097
BB8	9/20/2006	PWS2	<0.080	0.198	<0.080
BB9	9/21/2006	PWS1	<0.080	<0.080	<0.080
BB9	9/21/2006	PWS2	<0.080	0.203	<0.080

* PCBs detected, however below minimum quantitation limit (MQL).
[1] Results for stations BB6 through BB9 are based on duplicate injections.

Table 2. PCB results for water samples from Little Bayou creek and main effluents collected September 18-21, 2006.

Station	Date	Sample	Aroclor Concentration (μg/L) 1248	1254	1260
LB1	9/18/2006	PWS1	<0.080	<0.080	<0.080
LB1	9/18/2006	PWS2	<0.080	<0.080	<0.080
LB2A	9/19/2006	PWS1	<0.080	<0.080	<0.080
LB2A	9/19/2006	PWS2	<0.080	<0.080	<0.080
LB2	9/19/2006	PWS1	<0.080	<0.080	<0.080
LB2	9/19/2006	PWS2	<0.080	<0.080	<0.080
LB3	9/19/2006	PWS1	<0.080	<0.080	<0.080
LB3	9/19/2006	PWS2	<0.080	<0.080	<0.080
LB4	9/21/2006	PWS1	<0.080	<0.080	<0.080
LB4	9/21/2006	PWS2	<0.080	<0.080	<0.080
001	9/18/2006	PWS1	<0.162	<0.162	<0.162
001	9/18/2006	PWS2	<0.162	<0.162	<0.162
006	9/18/2006	PWS1	<0.081	<0.081	<0.081
006	9/18/2006	PWS2	<0.081	<0.081	<0.081
008	9/18/2006	PWS1	<0.080	<0.080	<0.080
008	9/18/2006	PWS2	<0.081	<0.081	<0.081
010+011	9/19/2006	PWS1	<0.101	<0.101	<0.101
010+011	9/19/2006	PWS2	<0.166	<0.166	<0.166

Table 3. PCB results for stream sediment samples from Big Bayou creek, collected September 18-21, 2006.

Station	Date	Sample[1]	Sample		% Moisture	Aroclor Conc. (µg/Kg)			
			Wet Wt. (g)	Dry Wt. (g)		1248	1254	1260	Total
MC	9/21/2006	PSED1A	51.26	42.37	17.3	<4.720	<4.720	<4.720	<4.720
MC	9/21/2006	PSED1B	50.91	42.36	16.8	<4.722	<4.722	<4.722	<4.722
BB1A	9/19/2006	PSED1A	50.08	38.66	22.8	<5.173	<5.173	<5.173	<5.173
BB1A	9/19/2006	PSED1B	50.88	40.00	21.4	<5.001	<5.001	<5.001	<5.001
BB1	9/19/2006	PSED1A	50.57	37.68	25.5	<5.308	<5.308	<5.308	<5.308
BB1	9/19/2006	PSED1B	50.11	40.40	19.4	<4.951	<4.951	<4.951	<4.951
BB2A	9/18/2006	PSED1A	50.92	39.58	22.3	<5.053	<5.053	<5.053	<5.053
BB2A	9/18/2006	PSED1B	50.03	39.60	20.8	<5.050	<5.050	<5.050	<5.050
BB2	9/19/2006	PSED1A	50.03	40.33	19.4	<4.959	<4.959	<4.959	<4.959
BB2	9/19/2006	PSED1B	50.47	40.70	19.4	<4.914	<4.914	<4.914	<4.914
BB3	9/18/2006	PSED1A	50.59	38.39	24.1	<5.209	<5.209	<5.209	<5.209
BB3	9/18/2006	PSED1B	50.14	40.51	19.2	<4.937	<4.937	<4.937	<4.937
BB4	9/18/2006	PSED1A	50.73	40.37	20.4	<4.954	<4.954	<4.954	<4.954
BB4	9/18/2006	PSED1B	50.16	41.17	17.9	<4.858	<4.858	<4.858	<4.858

[1] PSED1A and 1B are duplicate samples.

Table 3, continued. PCB results for stream sediment samples from Big Bayou creek, collected September 18-21, 2006.

Station	Date	Sample[1]	Sample Wet Wt. (g)	Sample Dry Wt. (g)	% Moisture	Aroclor Conc. (µg/Kg) 1248	1254	1260	Total
BB5	9/18/2006	PSED1A	50.13	37.73	24.7	<5.300	<5.300	<5.300	<5.300
BB5	9/18/2006	PSED1B	50.40	38.50	23.6	<5.195	<5.195	<5.195	<5.195
BB6	9/21/2006	PSED1A	50.28	35.66	29.1	<5.608	<5.608	<5.608	<5.608
BB6	9/21/2006	PSED1B	50.86	36.81	27.6	<5.434	7.436	<5.434	7.436
BB7	9/20/2006	PSED1A	50.69	38.69	23.7	<5.169	5.509	<5.169	5.509
BB7	9/20/2006	PSED1B	50.18	39.07	22.1	<5.119	<5.119	<5.119	<5.119
BB8	9/20/2006	PSED1A	50.52	40.37	20.1	<4.954	5.019	<4.954	5.019
BB8	9/20/2006	PSED1B	50.11	39.93	20.3	<5.009	<5.009	5.190	5.190
BB9	9/21/2006	PSED1A	50.24	35.51	29.3	<5.633	8.153	<5.633	8.153
BB9	9/21/2006	PSED1B	50.93	35.29	30.7	<5.667	<5.667	<5.667	<5.667

[1] PSED1A and 1B are duplicate samples.

Table 4. PCB results for stream sediment samples from Little Bayou creek, collected September 18-21, 2006.

Station	Date	Sample[1]	Sample		% Moisture	Aroclor Conc. (µg/Kg)			
			Wet Wt. (g)	Dry Wt. (g)		1248	1254	1260	Total
LB1	9/18/2006	PSED1A	50.17	33.66	32.9	<5.942	<5.942	<5.942	<5.942
LB1	9/18/2006	PSED1B	50.34	35.79	28.9	<5.588	6.323	<5.588	6.323
LB2A	9/19/2006	PSED1A	50.92	37.50	26.4	<5.333	51.397	40.528	91.925
LB2A	9/19/2006	PSED1B	50.61	38.61	23.7	<5.180	37.337	37.151	74.487
LB2	9/19/2006	PSED1A	50.30	39.42	21.6	<5.073	31.802	10.175	41.977
LB2	9/19/2006	PSED1B	50.01	39.51	21.0	<5.062	26.519	10.144	36.662
LB3	9/19/2006	PSED1A	50.06	38.16	23.8	<5.242	314.150	72.064	386.214
LB3	9/19/2006	PSED1B	50.10	37.37	25.4	<5.353	464.227	80.403	544.630
LB4	9/21/2006	PSED1A	50.33	41.16	18.2	<4.859	<4.859	<4.859	<4.859
LB4	9/21/2006	PSED1B	50.10	40.63	18.9	<4.923	20.728	<4.923	20.728

[1] PSED1A and 1B are duplicate samples.

Table 5. Mean PCB results for stream sediment samples from the Bayou Creek system collected September 18-21, 2006.

	Aroclor Conc. (µg/Kg)			
Station	1248	1254	1260	Total
MC	N.D.	N.D.	N.D.	N.D.
BB1A	N.D.	N.D.	N.D.	N.D.
BB1	N.D.	N.D.	N.D.	N.D.
BB2A	N.D.	N.D.	N.D.	N.D.
BB2	N.D.	N.D.	N.D.	N.D.
BB3	N.D.	N.D.	N.D.	N.D.
BB4	N.D.	N.D.	N.D.	N.D.
BB5	N.D.	N.D.	N.D.	N.D.
BB6	N.D.	7.44	N.D.	7.44
BB7	N.D.	5.51	N.D.	5.51
BB8	N.D.	5.02	5.19	5.10
BB9	N.D.	8.15	N.D.	8.15
LB1	N.D.	6.32	N.D.	6.32
LB2A	N.D.	44.37	38.84	83.21
LB2	N.D.	29.16	10.16	39.32
LB3	N.D.	389.19	76.23	465.42
LB4	N.D.	20.73	N.D.	20.73

Table 6. PCB results for floodplain soils from Big Bayou creek, collected September 18-21, 2006.

Station	Date	Sample	Sample: Wet Wt. (g)	Sample: Dry Wt. (g)	% Moisture	Aroclor Conc. (µg/Kg): 1248	1254	1260	Total
MC	9/21/2006	FP1	50.17	42.86	14.6	<4.666	<4.666	<4.666	<4.666
MC	9/21/2006	FP2	50.02	37.51	25.0	<5.332	<5.332	<5.332	<5.332
BB1A	9/19/2006	FP1	50.25	40.38	19.6	<4.954	<4.954	<4.954	<4.954
BB1A	9/19/2006	FP2	50.03	36.64	26.8	<5.458	<5.458	<5.458	<5.458
BB1	9/19/2006	FP1	50.08	40.41	19.3	<4.949	<4.949	<4.949	<4.949
BB1	9/19/2006	FP2	50.31	40.46	19.6	<4.944	8.923	8.938	17.861
BB2A	9/18/2006	FP1	50.26	38.01	24.4	<5.262	<5.262	<5.262	<5.262
BB2A	9/18/2006	FP2	50.10	37.34	25.5	<5.356	6.560	<5.356	6.560
BB2	9/19/2006	FP1	50.16	37.60	25.0	<5.319	<5.319	<5.319	<5.319
BB2	9/19/2006	FP2	50.15	39.10	22.0	<5.115	<5.115	<5.115	<5.115
BB3	9/18/2006	FP1	50.00	41.08	17.8	<4.868	<4.868	<4.868	<4.868
BB3	9/18/2006	FP2	50.26	33.79	32.8	<5.919	7.547	<5.919	7.547
BB4	9/18/2006	FP1	50.50	41.43	18.0	<4.828	<4.828	6.462	6.462
BB4	9/18/2006	FP2	50.05	40.52	19.0	<4.936	<4.936	5.499	5.499

[1] PFP1 and PFP2 are separate samples from each of the stations.

Table 6, continued. PCB results for floodplain soils from Big Bayou creek, collected September 18-21, 2006.

Station	Date	Sample	Sample Wet Wt. (g)	Sample Dry Wt. (g)	% Moisture	Aroclor Conc. (µg/Kg) 1248	1254	1260	Total
BB5	9/18/2006	FP1	50.29	39.97	20.5	<5.004	23.437	65.968	89.405
BB5	9/18/2006	FP2	50.12	39.31	21.6	<5.088	6.488	<5.088	6.488
BB6	9/21/2006	FP1	50.09	38.98	22.2	<5.131	6.026	10.467	16.493
BB6	9/21/2006	FP2	50.13	30.15	39.9	<6.633	28.454	9.817	33.365
BB7	9/20/2006	FP1	50.03	43.38	13.3	<4.610	<4.610	5.809	5.809
BB7	9/20/2006	FP2	50.02	40.98	18.1	<4.881	6.387	7.126	13.513
BB8	9/20/2006	FP1	53.28	42.89	19.5	<4.663	5.711	7.181	12.892
BB8	9/20/2006	FP2	50.05	41.39	17.3	<4.833	10.988	19.598	30.585
BB9	9/21/2006	FP1	50.07	45.16	9.8	<4.429	8.069	8.856	16.925
BB9	9/21/2006	FP2	50.05	37.81	24.5	<5.289	11.083	12.669	23.753

[1] PFP1 and PFP2 are separate samples from each of the stations.

Table 7. PCB results for floodplain soils from Little Bayou creek, collected September 18-21, 2006.

Station	Date	Sample	Sample: Wet Wt. (g)	Sample: Dry Wt. (g)	% Moisture	Aroclor Conc. (µg/Kg): 1248	1254	1260	Total
LB1	9/18/2006	FP1	50.13	34.84	30.5	<5.741	<5.741	<5.741	<5.741
LB1	9/18/2006	FP2	50.09	39.75	20.6	<5.032	<5.032	5.131	5.131
LB2A	9/19/2006	FP1	50.07	38.35	23.4	<5.215	102.697	62.998	165.695
LB2A	9/19/2006	FP2	50.08	29.41	41.3	<6.801	106.905	94.356	201.262
LB2	9/19/2006	FP1	50.02	30.89	38.2	<6.474	10.415	10.942	21.357
LB2	9/19/2006	FP2	50.25	34.72	30.9	<5.760	19.861	18.395	38.256
LB3	9/19/2006	FP1	50.21	38.98	22.4	<5.131	204.268	101.742	306.010
LB3	9/19/2006	FP2	50.10	30.81	38.5	<6.491	13.255	16.806	30.061
LB4	9/21/2006	FP1	50.10	43.71	12.8	<4.575	26.680	51.462	78.142
LB4	9/21/2006	FP2	50.08	37.20	25.7	<5.376	25.882	67.745	93.626

[1] PFP1 and PFP2 are separate samples from each of the stations.

Table 8. Mean PCB results for floodplain soil samples from Bayou Creek system collected September 18-21, 2006.

	Aroclor Conc. (µg/Kg)			
Station	1248	1254	1260	Total
MC	N.D.	N.D.	N.D.	N.D.
BB1A	N.D.	N.D.	N.D.	N.D.
BB1	N.D.	8.92	8.94	17.86
BB2A	N.D.	6.56	N.D.	6.56
BB2	N.D.	N.D.	N.D.	N.D.
BB3	N.D.	7.55	N.D.	7.55
BB4	N.D.	N.D.	5.98	5.98
BB5	N.D.	14.96	65.97	47.95
BB6	N.D.	17.24	10.14	24.93
BB7	N.D.	6.39	6.47	9.66
BB8	N.D.	8.35	13.39	21.74
BB9	N.D.	9.58	10.76	20.34
LB1	N.D.	N.D.	5.13	5.13
LB2A	N.D.	104.80	78.68	183.48
LB2	N.D.	15.14	14.67	29.81
LB3	N.D.	108.76	59.27	168.04
LB4	N.D.	26.28	59.60	85.88