

**Analysis of Mercury in Stream Sediment from PGDP**

**Andrew J. Wigginton and Wesley J. Birge**

**School of Biological Sciences**

**University of Kentucky**

**April 30, 1998**

In July of 1997, sediment samples were collected from Big Bayou Creek (July 15) and Little Bayou Creek (July 16). This report to FFOU includes the results of assays for eight metals in 26 sediment samples.

## **METHODS**

### **Sediment Preparation and Extraction**

The sediment samples were returned to the lab and air-dried in a fume hood. The samples were then sieved (>250  $\mu\text{m}$ ) to obtain the clay/silt fraction. The digestion procedure used was a modification of EPA Method 7471A (U.S. EPA, 1997). A 2.00-g sediment sample was digested with 2.0 mL concentrated nitric acid and 5.0 mL concentrated sulfuric acid in a BOD bottle. The samples were heated in a water bath (70°C/3 min.) and allowed to cool to room temperature. Fifty mL of deionized water and 15.0 mL 5% potassium permanganate solution were added to each bottle, the bottles were heated to 95°C for 30 minutes, and allowed to cool. Deionized water was added to each bottle to obtain a total volume of 100 mL, followed by an addition of 12% hydroxylamine hydrochloride solution (6.0 mL), to reduce unused potassium permanganate. Five mL 10% stannous chloride solution were added and the mercury aerator was placed on the BOD bottle immediately thereafter. All acids used were TraceMetal grade and all chemicals were "Baker Analyzed" grade, or better.

### **Metal Analysis**

Sediment mercury determinations were performed by cold vapor atomic absorption spectrophotometry (CVAAS) using a Coleman MAS-50B Mercury Analyzer System. Calibration curves were based on eight standards. Check standards and reagent blanks were also analyzed.

### **Quality Assurance**

Copies of all chain of custody forms and permanent records are maintained in active files and are available for review by FFOU or the Cabinet for Natural Resources and Environmental Protection. Quality assurance for mercury assays included blanks and check standards (U.S. EPA 1997).

## RESULTS

The results for total mercury (Hg) in sediment samples are given in Table 1 for Big Bayou Creek and Table 2 for Little Bayou Creek. Sediment Hg appeared somewhat elevated at the upstream reference station (BB1) on Big Bayou Creek, as was the case for silver and certain other chemicals (Birge *et al.*, February, 1998). As suggested in earlier reports, a new upstream reference site should be identified. In this report, station BB3 will be taken as the “reference”. By comparison, sediment Hg was elevated at stations BB4, BB5, BB7, BB8, and BB9. The highest Hg concentration was observed at BB7, where the mean value was 144 µg/Kg. This is illustrated in Figure 1. The majority of mercury action-level fish collected in 1991 were from stations BB4-BB7 (Birge *et al.*, 1992). As noted for other sediment metals (Birge *et al.*, February, 1998), sediment Hg contamination appears to have extended downstream to the last monitoring station, which was situated only 2.8 Km from the Ohio River confluence. Sediment Hg concentrations were less elevated in Little Bayou Creek and no “hot spots” were evident. Further monitoring of Hg in Big Bayou Creek is recommended.

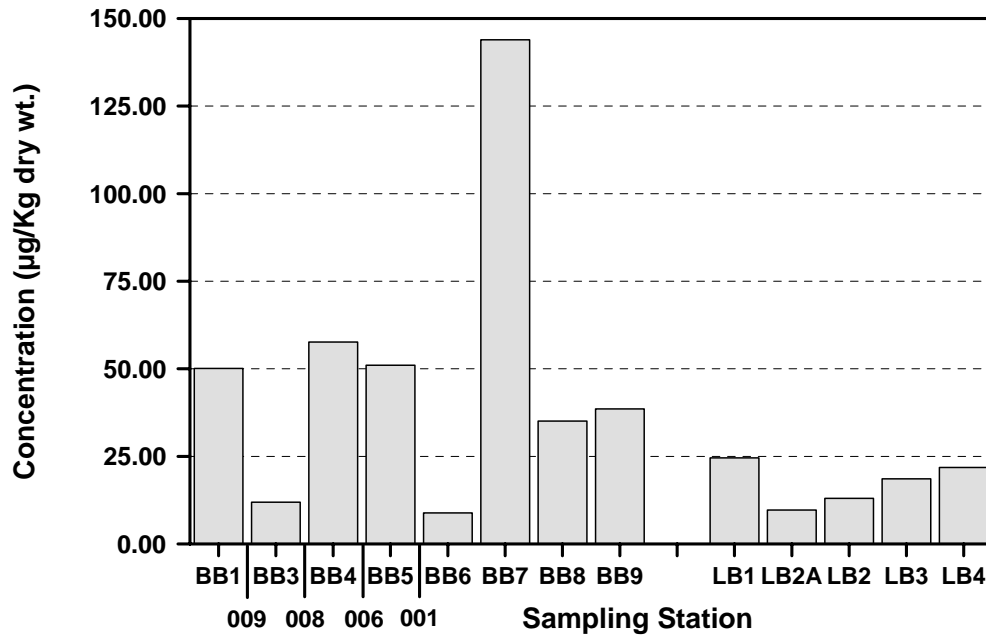
Table 1. Mercury Concentrations in Stream Sediments  
from Big Bayou Creek Collected July 15, 1997.

Sample Number	µg Hg/Kg dry wt.
BB1071597HSED1A	18.96
BB1071597HSED2A	81.24
Average	50.10
Standard Dev.	31.14
BB3071597HSED1A	6.13
BB3071597HSED2A	17.71
Average	11.92
Standard Dev.	5.79
BB4071597HSED1A	8.06
BB4071597HSED2A	107.18
Average	57.62
Standard Dev.	49.56
BB5071597HSED1A	69.19
BB5071597HSED2A	32.84
Average	51.01
Standard Dev.	18.17
BB6071597HSED1A	3.11
BB6071597HSED2A	14.60
Average	8.85
Standard Dev.	5.75
BB7071597HSED1A	206.30
BB7071597HSED2A	81.57
Average	143.94
Standard Dev.	62.37
BB8071597HSED1A	27.61
BB8071597HSED2A	42.54
Average	35.08
Standard Dev.	7.47
BB9071597HSED1A	49.36
BB9071597HSED2A	27.75
Average	38.55
Standard Dev.	10.81

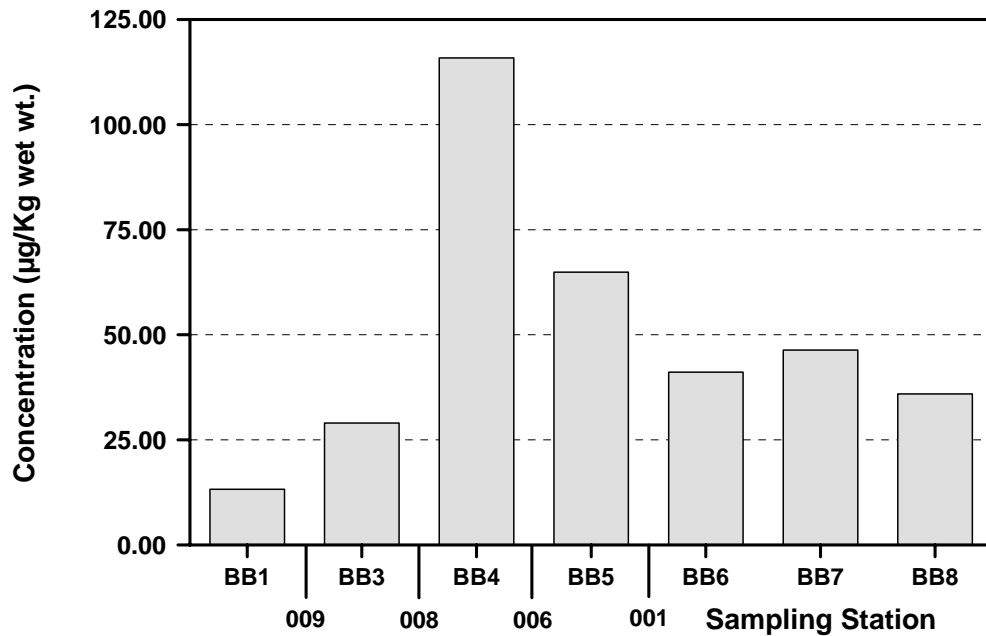
Table 2. Mercury Concentrations in Stream Sediments  
from Little Bayou Creek Collected July 16, 1997.

Sample Number	µg Hg/Kg dry wt.
LB1071697HSED1A	21.28
LB1071697HSED2A	27.89
Average	24.58
Standard Dev.	3.30
LB2071697HSED1A	11.37
LB2071697HSED2A	8.02
Average	9.69
Standard Dev.	1.67
LB2A071697HSED1A	13.02
LB2A071697HSED2A	13.02
Average	13.02
Standard Dev.	0.00
LB3071697HSED1A	20.86
LB3071697HSED2A	16.32
Average	18.59
Standard Dev.	2.27
LB4071697HSED1A	13.02
LB4071697HSED2A	30.58
Average	21.80
Standard Dev.	8.78

**Figure 1. Mean Mercury Concentrations in Stream Sediments from Bayou Creek Collected July 15-16, 1997.**



**Figure 2. Mean Mercury Concentrations in Stoneroller Minnows from Big Bayou Creek Collected September 30, 1997.**



## REFERENCES

Birge, W.J., D.J. Price, and M.D. Kercher. 1998. Analysis of Metals in Sediments from the Bayou Creek System. Report submitted to FFOU February 11, 1998. 16 pp.

Birge, W.J., D.J. Price, D.P. Keogh, J.A. Zuiderveen, and M.D. Kercher. 1992. *Biological Monitoring Program for the Paducah Gaseous Diffusion Plant*. Annual Report for Study Period October, 1990 through March, 1992. University of Kentucky, Lexington, KY.

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