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FINAL REPORT

PADUCAH GASEOUS DIFFUSION PLANT
PCB SEDIMENT SURVEY
BIG BAYOU CREEK AND LITTLE BAYOU CREEK
PADUCAH, KENTUCKY

Prepared for:

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1.0 INTRODUCTION

1.1 General Information. This report presents findings pertaining to the Paducah Gaseous Diffusion Plant (PGDP) PCB (polychlorinated biphenyls) sediment sampling survey. This work was performed by the US Army Corps of Engineers (COE) under the direction of the PGDP site operator, Martin Marietta Energy Systems, Inc. (MMES). Field activities for this investigation were conducted during May 1994. The execution of field work and the interpretation of findings were the responsibility of the Nashville District COE. Analytical services, both on-site and off-site, were provided by the PGDP Laboratory. The remainder of this chapter describes project background information and the scope of this investigation. Details of the field sampling effort are discussed in Chapter 2. Analytical results, including those from the quality assurance program, are compiled in Chapter 3. Chapter 4 includes a review of relevant data generated by previous studies and compliance monitoring administered by PGDP. A Preliminary Risk Evaluation which identifies the major pathways of PCB contaminant migration and discusses the risks to human and ecological receptors is included in Chapter 5. Chapter 6 presents conclusions based on information generated during this investigation and historical PCB sediment data.

1.2 Background. The PGDP facility, a 3400 acre tract in McCracken County, Kentucky, falls within the drainage areas of both Big Bayou Creek and Little Bayou Creek. Effluents from PGDP operations constitute about 85 percent of the average dry-weather flow in Big Bayou Creek and almost 100 percent of the average dry-weather flow in Little Bayou Creek. PCB levels above the Food and Drug Administration limit of 2 ppm have been observed in fish samples collected from these creeks. Both creeks were identified on the Clean Water Act 304(L) list as streams impacted by PCBs from PGDP. The Kentucky Division of Water has posted Little Bayou Creek with a fish advisory for PCBs. PCB spills and leaks have occurred in the past at locations throughout the facility. Although PGDP has an active PCB management and spill cleanup program, the cumulative effect of occasional spills and past waste management activities warranted further investigation to establish locations within Big and Little Bayou Creeks containing elevated levels of PCBs.

1.3 Purpose and Scope. The purpose of this sediment sampling survey was to identify PCB contaminated areas within Big Bayou Creek and Little Bayou Creek. The sampling plan designed to accomplish this task included collection of 21 sediment samples from Big Bayou Creek and 16 samples from Little Bayou Creek. Sediment sampling locations along these

two creeks were selected both upstream and downstream of each outfall confluence to determine their impact on the creeks. In addition, all major PGDP KPDES (Kentucky Pollutant Discharge Elimination System) outfalls were included in the sediment sample collection plan due to the documentation of PCB contamination in water samples collected from these sites during the previous PCB Source Identification Study. Descriptions of sediment sample locations for the KPDES outfalls, Big Bayou Creek, and Little Bayou Creek are presented in Tables 1-1 through 1-3. The locations of these sampling points are indicated in Figure 1-1. All field activities were conducted in accordance with the Sampling and Quality Assurance Project Plan. Sediment samples were collected once from each location. Laboratory analysis on these samples was limited to identification of PCBs by specific Aroclors, as detailed in the scope of services. The results presented in this report were used along with relevant sediment PCB data from previous investigations to prepare a preliminary risk evaluation. This evaluation considered potential pathways of PCB contaminant migration and risks to human and ecological receptors.

TABLE 1-1

**PADUCAH GASEOUS DIFFUSION PLANT
PCB SEDIMENT SAMPLING SURVEY
OUTFALL SEDIMENT SAMPLING STATIONS**

Sample Point	Location
001	C-335 Ditch (West), KPDES 001
335	C-335 Ditch (West)
002	C-337 Ditch (East), KPDES 002
003	Diversion Ditch (North), KPDES 003
008	West Ditch, KPDES 008
009	Southwest Ditch, KPDES 009
010	C-331 Ditch (East), KPDES 010
011	C-340 Ditch, KPDES 011
012	C-333 Ditch (East), KPDES 012
013	Southeast Ditch, KPDES 013
015	West Central Ditch, KPDES 015
016	Southwest Ditch, KPDES 016
017	Extreme Southwest Ditch, KPDES 017
018	North Ditch, KPDES 018

TABLE 1-2

**PADUCAH GASEOUS DIFFUSION PLANT
PCB SEDIMENT SAMPLING SURVEY
BIG BAYOU CREEK SEDIMENT SAMPLING STATIONS**

Sample Point	Location
BBUP1	Background sample at Highway 60
BBUP2	Background sample near railroad crossing on BBC between Old Hobbs Rd and 995
BBUP3	Background sample near Woodville Rd
BBUP4	Big Bayou at L1 bridge
BBUP5	Big Bayou at Highway 995
BBU17	Big Bayou above confluence of KPDES 017
BBD17	Big Bayou below confluence of KPDES 017
BBU09	Big Bayou above confluence of KPDES 009
BBD09	Big Bayou below confluence of KPDES 009
BBU16	Big Bayou above confluence of KPDES 016
BBD16	Big Bayou below confluence of KPDES 016
BBU08	Big Bayou above confluence of KPDES 008
BBD08	Big Bayou below confluence of KPDES 008
BBU15	Big Bayou above confluence of KPDES 015
BBD15	Big Bayou below confluence of KPDES 015
BBU01	Big Bayou above confluence of KPDES 001
BBD01	Big Bayou below confluence of KPDES 001
BBONW	Big Bayou near northwest corner of PGDP
BBUBC	Big Bayou above Brushy Creek
BBBCI	Brushy Creek inflow to Big Bayou Creek
BBDN1	Big Bayou most downstream station (one mile above confluence with Ohio River)

TABLE 1-3

**PADUCAH GASEOUS DIFFUSION PLANT
PCB SEDIMENT SAMPLING SURVEY
LITTLE BAYOU CREEK SEDIMENT SAMPLING STATIONS**

Sample Point	Location
LBUP1	Background sample of Little Bayou Creek
LBUP2	Background above McCaw Rd on main tributary of Little Bayou Creek
LBU13	LB above Outfall 013 confluence
LBD13	LB below Outfall 013 confluence
LBU12	LB above Outfall 012 confluence
LBD12	LB below Outfall 012 confluence
LBU11	LB above Outfall 011 confluence
LBD11	LB below Outfall 011 confluence
LBU10	LB above Outfall 010 confluence
LBD10	LB below Outfall 010 confluence
LBU02	LB above Outfall 002 confluence
LBD02	LB below Outfall 002 confluence
LBU18	LB above Outfall 018 confluence
LBD18	LB below Outfall 018 confluence
LBDN1	Little Bayou Creek at Anderson Road
LBDN2	Little Bayou near Shawnee Steam Plant

2.0 SEDIMENT SAMPLING ACTIVITY

2.1 Field Methodology. This chapter describes field collection procedures for sediment sampling of Big Bayou Creek, Little Bayou Creek, and the KPDES outfalls. All necessary field work was completed during a two week period in May, 1994. Sediment sampling conducted on Big Bayou Creek was performed May 10-12, 1994. During this same sampling trip sediments from two upstream and two downstream stations on Little Bayou Creek were collected. The remaining stations on Little Bayou Creek and the KPDES outfall locations were sampled May 16-18, 1994. All field work was performed by Nashville District COE personnel. The MMES Project Manager, Mr. David Ashburn, was present during all field activities. The sediment sample from Outfall 016, located within the secured plant area, was collected by Mr. Ashburn.

2.2 KPDES Outfall Samples. The PCB source identification study completed in July 1992 identified several outfall ditches with detectable levels of PCBs in water. The outfall ditches were sampled in the current study to document which had detectable PCB levels in the sediment, and may be contributing to the PCBs observed in the sediment and aquatic life of the receiving streams. All sediment sampling activity within the outfall ditches was performed in accordance with the Sampling - Quality Assurance Project Plan. The sampling points within these outfall ditches are displayed in Appendix A via Figures A-1 through A-14. Sample collection methods varied depending on the nature of the sediment present and the physical structure of the ditch itself. Sampling methods included the use of a spoon, shovel, or hand auger. Regardless of the method employed samples were collected from the low point of the channel in areas of sediment accumulation (whenever possible). Most of the rill area is covered with vegetation at all outfall locations. Samples were obtained from the top 2-6 inches of sediment either as a grab or composite depending on the location and variability of sediment. Sediment was thoroughly mixed in a stainless steel bowl; thus eliminating gravel, leaves, and twigs before filling the sample container. Sediments from outfalls were a mixture of clay, sand, gravel, and decaying organic material. See Table 2-1. This table also identifies the sampling device used at each location as well as the type and nature of the sample.

2.3 Big Bayou Creek Samples. A total of 21 locations were sampled on Big Bayou Creek. Appendix A presents the locations of these sampling points via Figures A-15 through A-35. Five sampling points were located upstream of the plant area to provide background data for the creek.

TABLE 2-1

**PADUCAH GASEOUS DIFFUSION PLANT
PCB SEDIMENT SAMPLING SURVEY
KPDES OUTFALLS - FIELD OBSERVATIONS**

Sampling Point	Sediment Description/Sampling Device/Notes
OF001	mostly fine black sediment with some sand, gravel, clay, and organic matter; sampled with shovel
OF335	black sediment layer below with clay and organic material on top; low flow; sampled with shovel
OF002	Predominantly clay with some sand; sampled with shovel from a stagnant pool
OF003	sampled upstream and downstream of the weir with shovel; composited sample from these two sites; mostly organic material with some clay
OF008	sampled with auger; black organic material mixed in sand and gravel as top layer with underlying clay material
OF009	sampled with shovel right below a beaver dam and downstream of the weir; steady flow; gray clay underneath with sand and gravel mixed on top at both sites; sample composited; split sample site
OF010	sampled with auger upstream of the culvert from a stagnant pool with high concentrations of algae; sediment mostly organic material with some underlying clay
OF011	sampled upstream of the culvert with auger; low flow; high concentrations of algae present at the site; thick layer of decaying organic material as sediment; duplicate site
OF012	sampled immediately downstream of culvert with shovel; low flow; fine gravel and sand with some organic material and very little clay as sediment

TABLE 2-1

PADUCAH GASEOUS DIFFUSION PLANT
PCB SEDIMENT SAMPLING SURVEY
KPDES OUTFALLS - FIELD OBSERVATIONS
(CONTINUED)

Sampling Point	Sediment Description/Sampling Device/Notes
OF013	sampled with shovel from a stagnant pool below the culvert; sediment mostly clay with some sand
OF015	noticed strong decaying organic material odor; no flow; buildup of sand in flume; sampled with shovel below culvert and upstream of weir; composited sample; coal fines on very top, sand layer in the middle with underlying clay as sediment
OF016	sample collected from two sites above and below weir with spoon and composited; sediment mostly clay with some sand; no ditch outside fenced area; sample collected by Mr. David Ashburn/MMES
OF017	very little flow; sampled with shovel at three points along the ditch - one site below culvert, another below weir, and the third near confluence; composited; clay with thin layer of silt and sand on top as sediment
OF018	sampled from a stagnant pool located upstream of weir with shovel; sand and gravel over clay as sediment

In addition, sediment was collected from a site on Brushy Creek, a significant tributary which enters Big Bayou Creek downstream of the plant area. Sediment samples were collected both upstream and downstream of each KPDES outfall (001, 008, 009, 015, 016, and 017) discharging to the creek. The most downstream sampling point on Big Bayou is located about one mile above its confluence with the Ohio River. Sediment samples were collected from low flow areas such as pools using either a shovel or a spoon. Samples were composited at stations BBUP2, BBUP3, and BBU01. The remaining sediment samples from Big Bayou Creek were grab samples. Sediments were collected from the top six inches at each sampling location. However, at sampling site BBONW the sample was collected from a three inch layer of clay underlying ten inches of gravel. Table 2-2 describes the sediments found at each sampling location. Generally, Big Bayou Creek sediments are predominantly sandy in the upstream stations and transition to areas of accumulated gravel and exposed clay in the middle and lower reaches. The extreme lower portion of the stream is impacted by backwater from the Ohio River and tends to have a significant portion of organic material.

2.4 Little Bayou Creek Samples. Sediment samples were collected from 16 sites within Little Bayou Creek. The location of these sampling points along with the sediment description and other pertinent information is presented in Table 2-3. In addition, a display of all sampling points for each site is provided in Appendix A via Figures A-36 through A-51. Samples were collected from two stations located upstream of the PGDP facility and from two points downstream of the plant discharges. The creek segments immediately upgradient and downgradient of each outfall (002, 010, 011, 012, 013, and 018) were also sampled. Table 2-3 presents the location of these sampling points along with the corresponding sediment description. Several beaver dams which obstruct the natural flow in the creek were observed during sampling activities on this creek. Sediments were collected from the top six inches at all sampling sites either with a shovel or an auger. Sediment samples appeared to be similar to those collected from Big Bayou Creek with a combination of sand, gravel, organic material, and clay.

2.5 Quality Assurance/Quality Control Samples. The QA/QC samples consisted of duplicate, split, rinsate, and field blanks for each sampling trip. Field duplicate samples were collected at sampling points OF008 and OF011 during outfall sampling activity. Sediments from sites BBD08, LBDN1, LBU11, and LBD12 were used for field duplicate sample analysis from Big Bayou Creek and Little Bayou Creek sampling operations. Sampling locations BBU15, OF009,

TABLE 2-2

**PADUCAH GASEOUS DIFFUSION PLANT
PCB SEDIMENT SAMPLING SURVEY
BIG BAYOU CREEK - FIELD OBSERVATIONS**

Sampling Point	Sediment Description/Sampling Device/Notes
BBUP1	sample collected with spoon; extremely low flow; mostly sand with very little organic material in sediment
BBUP2	sample collected from both upstream and downstream of railroad tracks with spoon; composited; sandy sediment with no organic material and clay
BBUP3	sampled above and below the bridge with spoon; unable to collect core sample due to sandy sediment; good flow; observed 2 to 3 inch sunfish with unusual growth on head and tail
BBUP4	sampled with shovel below L1 bridge where a surface drainage ditch comes into Big Bayou; sediment is a mixture of sand, gravel, organic material, and clay
BBUP5	sample collected below Highway 995 bridge with shovel; sediment is mostly decaying organic material and sand
BBU17	sampled exposed clay with shovel from a low flow pool; catfish, bass, and bream observed in pool; sediment is mostly sand with gravel and clay
BBD17	sampled exposed clay with shovel; bass observed in pool; sand and gravel in sediment
BBU09	mostly gravel in the stream bed; sandy sediment in limited areas; sampled one of these spots with shovel
BBD09	mostly sand and gravel in the creek; sample collected from exposed clay layer with shovel; sediment is gray color with orange tint

TABLE 2-2

**PADUCAH GASEOUS DIFFUSION PLANT
PCB SEDIMENT SAMPLING SURVEY
BIG BAYOU CREEK - FIELD OBSERVATIONS
(CONTINUED)**

Sampling Point	Sediment Description/Sampling Device/Notes
BBU16	mostly gravel in the creek; sample collected with shovel; sediment is predominantly gravel with thin layer of sand on top
BBD16	sampled with shovel; top 4 inches is sandy sediment with clay underneath; submitted one sample (BBD16S) from sandy sediment and another (BBD16C) from clay layer
BBU08	sampled the deepest part of the channel with shovel; sediment is a mixture of clay and sand with orange color indicating the presence of iron
BBD08	noticed sand and gravel type sediment on left side of the creek and clay on right side; sampled with shovel in the middle of the channel to find sediment with a combination of sand, gravel, and clay
BBU15	sampled with shovel from a low flow pool; clay sediment under gravel; several bass observed in the pool; split sample site
BBD15	sand and gravel over exposed clay present at this location; sediment sample was clay from deepest part of channel; collected with shovel
BBU01	used shovel to collect composited sample from two sites; sand and gravel interlaced with exposed clay layer as sediment at both sites
BBD01	sampled deepest part of a pool in mid-channel with shovel to find sand and gravel sediment interlaced with clay layer
BBONW	removed 10 inches of gravel to get to sediment with shovel; sampled clay in a pool located 50 ft upstream of the weir; top of the sediment is dusted with sand

TABLE 2-2

PADUCAH GASEOUS DIFFUSION PLANT
PCB SEDIMENT SAMPLING SURVEY
BIG BAYOU CREEK - FIELD OBSERVATIONS
(CONTINUED)

Sampling Point	Sediment Description/Sampling Device/Notes
BBUBC	used soil probe to find clay sediment; went down as much as 4 ft to find only sand with some gravel
BBBCI	very little flow in creek; sample collected with spoon, sandy sediment with no clay
BBDN1	ground surrounding creek banks saturated from flooding on Ohio River; sample collected with shovel; sediment is sandy, silty clay with a lot of decaying organic material

TABLE 2-3

**PADUCAH GASEOUS DIFFUSION PLANT
PCB SEDIMENT SAMPLING SURVEY
LITTLE BAYOU CREEK - FIELD OBSERVATIONS**

Sampling Point	Sediment Description/Sampling Device/Notes
LBUP1	no flow; sample collected from a stagnant pool with shovel; a combination of silty material and underlaying clay as sediment
LBUP2	sample collected with shovel from stagnant/low flow pool 25 ft downstream of concrete bridge; small layer of gravel on top of clay
LBU13	low flow; four beaver dams present on this section of Little Bayou Creek; sample collected with shovel from a beaver dam pool; sediment is mostly organic material with lots of leaves and twigs
LBD13	sample collected with shovel from a pool below beaver dam located 50 ft downstream of Outfall 013; no flow; clay with sand and gravel with a top layer of organic material as sediment
LBU12	sampled with shovel; gray sediment with black organic material mixed with little sand and gravel
LBD12	sample collected 30 ft downstream of Outfall 012 with auger; clay sediment; duplicate sample site
LBU11	sample collected with shovel below a beaver dam; sediment is a mixture of sand, small gravel, roots and sticks with underlaying clay; duplicate sample station
LBD11	sample collected 150 ft downstream of Outfall 011 confluence with auger; sediment is mostly clay with some sand, gravel, and organic material
LBU10	sampled 15 ft above confluence of Outfall 010 with shovel; low flow; sediment is sand and gravel with underlying clay

TABLE 2-3

PADUCAH GASEOUS DIFFUSION PLANT
PCB SEDIMENT SAMPLING SURVEY
LITTLE BAYOU CREEK - FIELD OBSERVATIONS
(CONTINUED)

Sampling Point	Sediment Description/Sampling Device/Notes
LBD10	sample collected 50 ft downstream of outfall confluence with shovel; low flow; sediment mostly clay with very little sand, gravel, and organic material; split sample site
LBU02	no flow; sample collected with shovel from a pool of beaver dam located 120 ft upstream of Outfall 002 confluence; sediment mostly clay with sand and gravel as top layer
LBD02	sample collected with shovel 200 ft downstream of outfall confluence and upstream of culvert; predominantly clay sediment; split sample station
LBU18	low flow; sample collected 15 ft above confluence with shovel; sediment is clay with little sand
LBD18	low flow; clay sediment with some sand; collected with shovel 50 ft downstream of Outfall 018
LBDN1	noticed lot of fallen trees, logs, and brush at this location; sampled 50 ft downstream of bridge at midchannel with shovel; clay sediment; duplicate sample point
LBDN2	creek was very turbid with little flow; mostly sand with gravel in the creek bed; collected clay sediment lying underneath sand and gravel with shovel

LBD02, LBU10, LBD10, and LBD11 were selected for split sample analysis. Rinsate samples were taken on the sampling devices used to collect sediment. They were collected by spraying deionized water over the bowls, spoons, and sample collection equipment following decontamination procedures. This water was collected and subsequently analyzed for PCBs. Five of these rinsate samples were submitted to the PGDP Laboratory. Five sample containers were filled with deionized water during sampling activities to evaluate potential contamination of sampling equipment in the field. These were identified as field blank samples and submitted along with program samples for PCB analysis.

2.6 Sample Management. A total of 78 samples were collected during sediment sampling for this project. This included six each of duplicate and split samples for sediment PCB analysis. Water matrix samples of five each for rinsates and field blanks were collected as part of the QA/QC program. In addition, four control samples with known PCB levels were submitted. All sediments were labeled with the appropriate sample number, project name, date, time, analysis to be performed, and sampling team member initials. Samples were placed under chain of custody forms at the time of collection and stored on ice until delivered to the PGDP Laboratory for PCB analysis.

2.7 Investigation Derived Wastes. Sampling equipment decontamination included devices such as a hand auger, shovel, spoons, and mixing bowls. Equipment was decontaminated between sampling locations and at the end of each sampling day. Decontamination wastewater was containerized and submitted to the Project Manager/MMES for proper disposal. No sediment waste was generated during field sampling activities. All solid waste was separated and contaminated waste (Tyvek Coveralls, Nitrile Latex Gloves, and Kimtex Wipes used to clean sampling equipment) was disposed as specified in the PGDP Waste Classification and Management Plan.

3.0 ANALYTICAL RESULTS

3.1 Introduction. This chapter presents information obtained from laboratory analyses of samples collected during May 1994 for the Paducah Gaseous Diffusion Plant PCBs in Sediment Survey of Big Bayou and Little Bayou Creeks. The sampling plan and associated field activities were discussed in the previous chapter. Sediment samples were collected once from several sampling points along both creeks. In addition, all major KPDES outfalls discharging to these creeks were sampled. Sediment and associated QA/QC samples were submitted to the PGDP Laboratory at the conclusion of the sampling activity. The samples were analyzed by the PGDP Laboratory for PCBs, identified by specific Aroclor. All PCB analyses were performed in accordance with USEPA Method 8081 given in "Test Methods for Evaluating Solid Waste". The lowest concentration reported (LCR) for PCB in sediment analysis is 0.1 ug/g. The analytical results on samples collected from the KPDES outfall ditches, Big Bayou Creek, and Little Bayou Creek are presented in Tables 3-1, 3-2, and 3-3 respectively. The following sections include a discussion of these results.

3.2 KPDES Outfalls. Sediment samples were collected from 13 KPDES discharge ditches in accordance with the established Quality Assurance Project Plan. In addition, another sample was taken at the old Outfall 001 (referenced as OF335 in this investigation). A summary of the PCB results with accompanying sample location information is presented in Table 3-1. PCB analyses above the detection limit of 0.1 ug/g were reported for eight sites. The sample from Outfall 001 was found to contain PCB Aroclor 1254 at a concentration of 0.4 ug/g. PCB Aroclor 1260 was identified at a concentration of 0.3 ug/g at Outfall 002. The sample from Outfall 008 had PCB Aroclor 1254 at a concentration of 0.4 ug/g. PCB Aroclor 1242 at a concentration of 0.7 ug/g was identified in the sample collected from Outfall 009. The sediment sample from Outfall 011 was reported to contain PCB Aroclor 1242 at a concentration of 1.0 ug/g. A PCB Aroclor 1254 concentration of 0.5 ug/g was observed for Outfall 012. A PCB concentration of 0.4 ug/g (Aroclor 1260) was reported for Outfall 015. The sediment sample from Outfall 018 was found to contain PCB Aroclor 1254 at a concentration of 0.2 ug/g.

3.3 Big Bayou Creek. Sediment samples were collected from 21 sites within Big Bayou Creek. The location of these sampling points along with the PCB results is presented in Table 3-2. PCB analyses resulted in values less than the LCR of 0.1 ug/g for all sediment samples except the one from

TABLE 3-1

**PADUCAH GASEOUS DIFFUSION PLANT
PCB SEDIMENT SAMPLING SURVEY
ANALYTICAL RESULTS - KPDES OUTFALLS**

Sample Point	Location	PCBs (ug/g)
OF001	C-335 Ditch (West), KPDES 001	0.4 (A-1254)
OF335	C-335 Ditch (West)	< 0.1
OF002	C-337 Ditch (East), KPDES 002	0.3 (A-1260)
OF003	Diversion Ditch (North)	< 0.1
OF008	West Ditch, KPDES 008	0.4 (A-1254)
OF009	Southwest Ditch, KPDES 009	0.7 (A-1242)
OF010	C-331 Ditch (East), KPDES 010	< 0.1
OF011	C-340 Ditch, KPDES 011	1.0 (A-1242)
OF012	C-333 Ditch (East), KPDES 012	0.5 (A-1254)
OF013	Southeast Ditch, KPDES 013	< 0.1
OF015	West Central Ditch, KPDES 015	0.4 (A-1260)
OF016	Southwest Ditch, KPDES 016	< 0.1
OF017	Southwest Ditch, KPDES 017	< 0.1
OF018	North Ditch, KPDES 018	0.2 (A-1254)

TABLE 3-2

**PADUCAH GASEOUS DIFFUSION PLANT
PCB SEDIMENT SURVEY
ANALYTICAL RESULTS - BIG BAYOU CREEK**

Sample Point	Location	PCBs (ug/g)
BBUP1	Big Bayou background at Highway 60	< 0.1
BBUP2	Big Bayou background sample near railroad track crossing on BBC between Old Hobbs Rd and Highway 995	< 0.1
BBUP3	BB Background sample near Woodville Rd	< 0.1
BBUP4	Big Bayou at L1 bridge	0.2
BBUP5	Big Bayou at Highway 995	< 0.1
BBU17	Big Bayou above confluence of OF017	< 0.1
BBD17	Big Bayou below confluence of OF017	< 0.1
BBU09	Big Bayou above confluence of OF009	< 0.1
BBD09	Big Bayou below confluence of OF009	< 0.1
BBU16	Big Bayou above confluence of OF016	< 0.1
BBD16S	Big Bayou below confluence of OF016	< 0.1
BBD16C	Big Bayou below confluence of OF016	< 0.1
BBU08	Big Bayou above confluence of OF008	< 0.1
BBD08	Big Bayou below confluence of OF008	< 0.1
BBU15	Big Bayou above confluence of OF015	< 0.1
BBD15	Big Bayou below confluence of OF015	< 0.1
BBU01	Big Bayou above confluence of OF001	< 0.1
BBD01	Big Bayou below confluence of OF001	< 0.1
BBONW	BB near northwest corner of PGDP	< 0.1
BBUBC	Big Bayou above Brushy Creek	< 0.1
BBBCI	Brushy Creek inflow to Big Bayou	< 0.1
BBDN1	Big Bayou most downstream station (one mile above confluence with Ohio River)	< 0.1

TABLE 3-3

**PADUCAH GASEOUS DIFFUSION PLANT
PCB SEDIMENT SAMPLING SURVEY
ANALYTICAL RESULTS - LITTLE BAYOU CREEK**

Sample Point	Location	PCBs (ug/g)
LBUP1	Little Bayou background sample (upstream of PGDP)	< 0.1
LBUP2	Background near McCaw Rd on main tributary of Little Bayou Creek	< 0.1
LBU13	Little Bayou above confluence of OF013	< 0.1
LBD13	Little Bayou below confluence of OF013	< 0.1
LBU12	Little Bayou above confluence of OF012	< 0.1
LBD12	Little Bayou below confluence of OF012	< 0.1
LBU11	Little Bayou above confluence of OF011	< 0.1
LBD11	Little Bayou below confluence of OF011	5.4
LBU10	Little Bayou above confluence of OF010	< 0.1
LBD10	Little Bayou below confluence of OF010	< 0.1
LBU02	Little Bayou above confluence of OF002	< 0.1
LBD02	Little Bayou below confluence of OF002	< 0.1
LBU18	Little Bayou above confluence of OF018	< 0.1
LBD18	Little Bayou below confluence of OF018	< 0.1
LBDN1	Little Bayou at Anderson Road	< 0.1
LBDN2	Little Bayou near Shawnee Steam Plant	< 0.1

the upstream station, UP4, on Big Bayou Creek. This sample contained PCB Aroclor 1254 at a concentration of 0.2 ug/g.

3.4 Little Bayou Creek. A total of 16 sediment samples were collected from Little Bayou Creek. A summary of the analytical results for these samples is presented in Table 3-3. The sample from a site located downstream of outfall ditch 011 on Little Bayou Creek was found to contain PCBs at a concentration of 5.4 ug/g. This sample had PCB Aroclors 1260 and 1254 at concentrations of 3.2 and 2.2 ug/g, respectively. PCBs were below the LCR for the remaining 15 samples.

3.5 Quality Assurance/Quality Control Samples. The QA/QC sample collection program included duplicate, split, rinsate, and field blanks during field activities for this project. In addition, control samples were submitted to the PGDP Laboratory as part of the QA/QC program. A discussion of PCB results for each type of QA/QC sample is presented in the following subsections.

3.5.1 Duplicate Samples. Field duplicate samples were collected from the same sampling location at the same time and submitted to the PGDP Laboratory as separate samples. This permits evaluation of the variability of sediment from one sampling point to another at the same location and also PCB analysis procedures. Duplicate samples were collected at outfall ditches 008 and 011; Big Bayou Creek sampling point BBD08; Little Bayou Creek sites LBDN1, LBU11, and LBD12. The analytical results of these duplicate samples along with a brief site description are presented in Table 3-4. PCB analyses of samples collected from Big Bayou and Little Bayou Creeks resulted in levels below detection limits. The duplicate samples from Outfall 011 were found to contain PCB Aroclor 1242 at concentrations of 1.0 and 0.6 ug/g, respectively. The original sample from Outfall 008 was found to contain PCB Aroclor 1254 at a concentration of 0.4 ug/g. PCBs were not detected in the duplicate sample from that outfall. This variability between duplicate samples is not unusual for sediment samples.

3.5.2 Split Samples. A sediment sample was thoroughly mixed and divided into two parts after collection and submitted to the PGDP and offsite QA laboratories for subsequent analysis. These samples were identified as split samples and served as external quality assurance for this investigation. Sampling locations BBU15, OF009, LBD02, LBU10, LBD10, and LBD11 were chosen for split sample analysis. All values determined by the PGDP and offsite laboratories from these samples are compiled in Table 3-5. Both laboratories reported values below the detection limits at four of the six split sample sites. A discrepancy was

TABLE 3-4

PADUCAH GASEOUS DIFFUSION PLANT
PCB SEDIMENT SURVEY
PCB RESULTS - FIELD DUPLICATE SAMPLES

Location	Sample Point	PCBs (ug/g)
West Ditch, KPDES 008	OF008 of008	0.4 (A-1254) <0.1
C-340 Ditch, KPDES 011	OF011 of011	1.0 (A-1242) 0.6 (A-1242)
Big Bayou Creek below confluence of OF008	BBD08 bbd08	< 0.1 < 0.1
Little Bayou Creek at Anderson Road	LBDN1 lbdn1	< 0.1 < 0.1
Little Bayou Creek below confluence of OF012	LBD12 lbd12	< 0.1 < 0.1
Little Bayou Creek above confluence of OF011	LBU11 lbu11	< 0.1 < 0.1

TABLE 3-5

PADUCAH GASEOUS DIFFUSION PLANT
PCB SEDIMENT SURVEY
PCB RESULTS - SPLIT SAMPLES

Location	PGDP Lab (ug/g)	Lionville Lab (ug/g)
Big Bayou Creek above OF015 (BBU15)	< 0.1	< 0.1
Southwest Ditch, KPDES 009 (OF009)	0.7 (A-1242)*	< 0.1
Little Bayou Creek below OF002 (LBD02)	< 0.1	< 0.1
Little Bayou Creek above OF010 (LBU10)	< 0.1	< 0.1
Little Bayou Creek below OF010 (LBD10)	< 0.1	< 0.1
Little Bayou Creek below OF011 (LBD11)	3.2 (A-1260) 2.2 (A-1254)	2.9 (A-1260) 1.6 (A-1254) 1.5 (A-1016)

Notes:

1. Locations are shown in Figure 1-1.
2. Lionville Analytical Laboratory is the offsite QA Lab.
3. * PGDP Lab performed PCB analysis on a separate sample collected from the same location. This sample was submitted for the qualitative determination of radioactivity. PCBs were below the detection limit for this sample.

noted in the split sample for Outfall 009. The PGDP Laboratory reported a PCB concentration of 0.7 ug/g (Aroclor 1242), while the result from the offsite laboratory was < 0.1 ug/g. However, PCB analysis performed by the PGDP Laboratory on a separate sediment sample collected from the same location for radioactivity screening revealed a concentration below the detection limit. Total PCBs were reported in the sediment sample collected from downstream of Outfall 011 on Little Bayou Creek as 5.4 ug/g by the PGDP Laboratory and 6.0 ug/g by the offsite laboratory.

3.5.3 Control Samples. QA/QC sample collection included submitting four control samples of known concentration to the PGDP Laboratory along with the program samples. The control samples used in this project were obtained from the Corps of Engineers Waterways Experiment Station and provided an indication of the quality of analytical results. Two control samples were reported to contain Aroclor 1248 at 2.3 ug/g and 1.9 ug/g. The acceptance range is 1.0 - 2.5 ug/g for these low level control samples. PCB analysis on the other two control samples, from the high concentration range, revealed levels of Aroclor 1248 at 38 and 39 ug/g which are within the acceptable range of 35 to 75 ug/g.

3.5.4 Rinsate Samples. Rinsates are samples of deionized water passed through decontaminated sampling equipment prior to sample collection. They are used to determine the effectiveness of the decontamination process. Five rinsate samples were submitted to the PGDP Laboratory during this investigation. All rinsate samples exhibited PCB levels below the detection limit of 0.1 ug/l.

3.5.5 Field Blank Samples. Five sample containers were filled with deionized water during field operations and submitted to the PGDP Laboratory. The purpose was to evaluate potential contamination of either sampling equipment or sample containers in the field. PCB analyses of field blanks resulted in concentrations below detection limits, thus indicating no measurable contamination from field operations.

4.0 REVIEW OF PCB DATA FROM PREVIOUS INVESTIGATIONS

4.1 Introduction. Sediment PCB data is available from three main environmental monitoring programs that are being conducted by the PGDP; the Environmental Surveillance Network, Biological Monitoring Program, and Environmental Restoration Program. A brief description of each program and the relevant PCB data are presented in the following sections. These data are provided to show any trends in PCB contamination.

4.2 Environmental Surveillance Network. Routine monitoring and sampling are used to quantify potential increases in contaminant concentrations and to maintain compliance with applicable regulations under this environmental monitoring program by the PGDP. As part of this program, annual sediment samples were collected from several sites in the outfall ditches, Big Bayou Creek, and Little Bayou Creek. These sediment sampling locations are shown in Figure 4-1. A sampling scoop was used to collect sediment from the bottom of the outfall ditch or creek. Samples were collected with as few gravel/rocks as possible and obtained from quiet pools where only minimum scouring is expected. The results of PCB analyses of sediment samples collected from 1987 through 1992 are listed in Tables 4-1 and 4-2. The sediment sampling locations were changed in 1992 due to the initiation of portions of the PGDP Environmental Monitoring Plan. This plan calls for sediment sample collection for PCBs at two sites on Big Bayou Creek and three sites on Little Bayou Creek annually and eliminates sample collection from the outfall ditches.

4.2.1 KPDES Outfalls. Thirteen outfalls were sampled annually and analyzed for PCBs. As indicated in Table 4-1, there are no definite trends for any of the outfall sample locations. However, PCB levels above the detection limit of 0.1 ug/g were reported more than once at ten of the thirteen outfall locations. The highest PCB concentration of 16 ug/g was reported for a sample collected from Outfall 011 in 1988. The only location with PCBs levels below the detection limit every year is Outfall 013. Sediment samples from Outfall 018 were consistently found to contain PCBs in concentrations varying from 0.2 to 0.4 ug/g.

4.2.2 Big Bayou and Little Bayou Creeks. Annual sediment collection included three sites on Big Bayou Creek and two sites on Little Bayou Creek. PCB concentrations of 0.1 ug/g were reported for two samples collected in 1989 and 1991 from the upstream station on Big Bayou Creek. See Table 4-2. A sediment sample collected from the downstream monitoring point on Big Bayou Creek in 1991 was found to contain PCBs

TABLE 4-1

PADUCAH GASEOUS DIFFUSION PLANT
PCB SEDIMENT SAMPLING SURVEY
KPDES OUTFALL PCB DATA FROM PGDP ANNUAL
SEDIMENT SAMPLING PROGRAM

Location	1987	1988	1989	1990	1991
Outfall 001	<0.1	<1.0	0.1	<0.1	0.5
Outfall 002	<0.1	<0.1	<0.1	0.2	0.4
Outfall 003	<0.1	0.2	0.5	<0.1	0.3
Outfall 008	<0.1	<0.1	1.1	<0.1	<0.1
Outfall 009	1.5	2.8	<0.1	<0.1	<0.1
Outfall 010	<0.1	<1.0	0.1	<0.5	0.6
Outfall 011	<0.1	16	5.1	<0.1	1.9
Outfall 012	<0.1	<1.0	<0.1	<0.5	0.8
Outfall 013	NS	NS	<0.1	<0.1	<0.1
Outfall 015	1.1	<1.0	<0.1	<0.1	<0.1
Outfall 016	NS	NS	0.2	<0.1	0.4
Outfall 017	NS	NS	<0.1	<0.5	<0.1
Outfall 018	NS	NS	0.2	0.4	0.2

Notes:

1. Sample locations are shown in Figure 4-1.
2. PCB results are reported in ug/g.
3. NS indicates no sample was collected at that site in that year.

TABLE 4-2

PADUCAH GASEOUS DIFFUSION PLANT
PCB SEDIMENT SAMPLING SURVEY
BIG BAYOU AND LITTLE BAYOU CREEK PCB DATA FROM
PGDP ANNUAL SEDIMENT SAMPLING PROGRAM

Location	1987	1988	1989	1990	1991	1992
SS20 Big Bayou Creek - Upstream	<0.1	<1.0	0.1	<0.5	<0.1	<0.1
SS19 Big Bayou @ Wooden Bridge	<0.1	<1.0	<0.1	<0.1	0.1	NS
SS1 Big Bayou Ck Downstream	<0.1	<3.0	<1.0	<0.1	0.3	<0.1
SS21 Little Bayou Creek - upstream	<0.1	<3.0	<0.1	<0.6	<0.1	<0.1
SS2 Little Bayou Ck - downstream	2.2	<1.0	0.4	0.2	0.2	0.7

Notes:

1. Sample locations are shown in Figure 4-1.
2. PCB results are reported in ug/g.
3. NS indicates no sample was collected at that site that year.

at 0.3 ug/g. None of the samples collected from the upstream Little Bayou Creek locations were found to contain PCBs above the detection limits. However, samples collected from the Little Bayou Creek locations downstream of the plant area were found to contain PCBs ranging from 0.2 to 2.2 ug/g, with one exception. The sediment sample obtained in 1988 was reported to have PCBs below the detection limit of 1.0 ug/g.

4.3 Biological Monitoring Program. Discharges from the PGDP are regulated by the Kentucky Division of Water through the KPDES permitting program. As part of this permit, a Biological Monitoring Program was conducted from 1987 through 1991 by the University of Kentucky in collaboration with the Oak Ridge National Laboratory. The objective of this program was to determine the effects of plant effluents on aquatic life in the receiving streams, Big Bayou and Little Bayou Creeks. Sediment samples were collected by the University of Kentucky during 1988 from four outfall ditches, one location on Big Bayou Creek, and two locations on Little Bayou Creek. Sediments were collected from four stations at each sampling location and twice at Outfall 011 and the upstream Little Bayou Creek location.

4.3.1 KPDES Outfalls. PCBs were detected in all samples collected from Outfall 011 with concentrations ranging from 1.24 to 17.17 ug/g, as presented in Table 4-3. PCB analyses revealed concentrations ranging from 0.02 to 0.12 ug/g in Outfall 006, 0.32 to 1.33 ug/g in Outfall 008, and 0.06 to 0.15 in Outfall 010.

4.3.2 Big Bayou and Little Bayou Creeks. Sediment samples collected from upstream stations on Big Bayou and Little Bayou Creeks were not found to contain significant levels of PCBs. All four sediment samples collected from downstream of the Outfall 011 confluence on Little Bayou Creek were found to contain PCBs, PCB concentrations ranged from 3.32 to 8.76 ug/g. See Table 4-3.

4.4 Environmental Restoration Program. This program was originally designed to determine the extent of existing contamination at the plant and to develop corrective actions. As part of this program and also in response to the discovery of offsite groundwater contamination in 1988, PGDP initiated a two-phased site investigation to identify the nature and extent of offsite contamination. Phase I of the site investigation was conducted by CH2M Hill in 1989 and 1990 to evaluate the contamination at PGDP through extensive groundwater monitoring and surface water sampling. Phase II of the site investigation, which was initiated in 1990 and extended through 1991, focused on further assessment of the nature, extent, and risk of offsite

TABLE 4-3

PADUCAH GASEOUS DIFFUSION PLANT
PCB SEDIMENT SAMPLING SURVEY
PCB SEDIMENT DATA FROM BIOLOGICAL MONITORING PROGRAM

Location (Sampling Date)	Sample 1	Sample 2	Sample 3	Sample 4
Outfall 006 (8/26/88)	0.04	0.02	0.06	0.12
Outfall 008 (8/26/88)	0.37	1.33	0.53	0.32
Outfall 010 (8/26/88)	0.06	0.10	0.15	0.14
Outfall 011 (8/26/88)	4.68	17.17	6.28	13.60
Outfall 011 (10/9/88)	1.24	3.08	2.58	3.25
BB1 (8/26/88)	<0.03	<0.05	0.02	0.06
LB1 (8/26/88)	0.02	<0.02	0.03	0.05
LB1 (10/9/88)	0.10	0.12	0.06	0.05
LB2A (10/9/88)	4.16	3.32	8.76	5.57

Notes:

1. Sample locations are shown in Figure 4-1.
2. PCB results are reported in ug/g.
3. BB1 - Upstream Big Bayou Creek.
4. LB1 - Upstream Little Bayou Creek.
5. LB2A was located approximately 200 m downstream of the confluence of Outfall 011 and Little Bayou Creek.

contamination. KPDES outfall ditches, Big Bayou Creek, and Little Bayou Creek were investigated during these activities and sediment samples from several locations on both creeks and the outfall ditches were analyzed for PCBs. Sampling locations are shown in Figure 4-2. Samples were collected from the top six inches of sediment at three or more random locations at each sampling station.

4.4.1 KPDES Outfalls. The Phase I site investigation included collection of three sediment samples from Outfall 003 (LB21, LB23, and LB24) and one from Outfall 018 (LB26). Sediment samples were collected from four stations at Outfall 003 (NS1, NS2, NS3, and NS4), one station at the old Outfall 003 (NS5), two stations each at Outfalls 011 (OF011A and OF011B) and 015 (OF015A and OF015B), and one station each at Outfalls 001 (OF001), 002 (OF002), 008 (OF008), and 010 (OF010) during the Phase II site investigation. PCBs were found in five of the ten samples collected from Outfall 003 with a maximum concentration of 11 ug/g at LB21, as shown in Table 4-4. PCBs were also detected in both samples collected from Outfall 011. In addition, two soil samples collected from stream banks during the Phase I Site Investigation were analyzed for PCBs. The location of these sampling points is indicated in Figure 4-2. A PCB concentration of 58.7 ug/g was reported on a sample collected near the confluence of Outfall 010 and Little Bayou Creek. PCBs were also detected in the stream bank sample collected in Outfall 003 near Ogden Landing Road at 35.1 ug/g.

4.4.2 Big Bayou and Little Bayou Creeks. Fifteen stations from each creek were sampled for sediment during Phase I and Phase II site investigation activities. No PCBs were detected in the sediment samples collected from Big Bayou Creek. PCB detection limits ranged between 0.1 and 0.22 ug/g for these sediment samples. None of the fifteen samples collected from Little Bayou Creek were found to contain PCBs above the detection limit. PCB detection limits varied between 0.1 and 0.25 ug/g for the Little Bayou Creek sediment samples.

FIGURE 4 - 2

PHASE I & II SITE INVESTIGATION
SEDIMENT SAMPLING LOCATIONS
PADUCAH GASEOUS DIFFUSION PLANT
PCB SEDIMENT SAMPLING SURVEY

LEGEND

- BB - Big Bayou Stations
- LB - Little Bayou Stations
- SB - Stream Bank Soil Samples
- OF & NS - Outfalls

TABLE 4-4

**PADUCAH GASEOUS DIFFUSION PLANT
PCB SEDIMENT SAMPLING SURVEY
PCB RESULTS FROM PHASE I & II SITE INVESTIGATION**

Location	PCBs (ug/g)
SB 1	58.7
SB 9	35.1
SB 9 (Field Duplicate)	21.0
LB 21	4.3
LB 21 (Field Duplicate)	11.0
NS 2	1.5
NS 2 (Field Duplicate)	1.14
LB 24	1.1
Outfall 011A	2.4
Outfall 011B	0.98

Notes:

1. Sample locations are shown in Figure 4-2.
2. SB 1 - Stream bank soil sample collected near the confluence of Little Bayou Creek and Outfall 010.
3. SB 9 - Stream bank soil sample collected in KPDES Outfall 003 near Ogden Landing Road.

5.0 PRELIMINARY RISK EVALUATION

5.1 Introduction. This chapter presents results of a preliminary risk calculation conducted at the Paducah Gaseous Diffusion Plant (PGDP), in Paducah, Kentucky to evaluate the impacts to human health and the environment associated with PCB contamination at the site. This chapter was prepared by the Fuller, Mossbarger, Scott, & May Engineers, Inc. (FMSM) under contract to COE. The Preliminary Risk Calculation includes a quantitative human health risk and a qualitative ecological risk assessment.

The calculation formulas for human health risk were based on the Risk Assessment Guidance for Superfund (RAGS), Volume I, Human Health Evaluation Manual, 1989. The RAGS manual was developed to provide guidance for evaluating health risk information at Superfund sites. However, the RAGS outline may be modified and scaled down to provide preliminary risk calculations for other potentially contaminated sites.

The human health risk assessment organization may be briefly summarized as follows:

- * Hazard Identification
- * Exposure Assessment
- * Toxicity Assessment
- * Risk Characterization

Two methods were used to quantify risk to human health. The methods differed in the choice of exposure parameters to be used within each risk calculation. Each method did, however, develop raw data in similar manners. The data was assumed to follow a log normal distribution. A 95% Upper Confidence Level (UCL) was used to calculate a representative exposure concentration. The two methods of developing exposure parameters are presented in the following sections.

1) The first calculation method utilizes default values for exposure established by the United States Environmental Protection Agency (USEPA) and Kentucky Department for Environmental Protection (KYDEP). Analytical data is summarized through statistical methods to establish a conservative estimate of representative PCB environmental concentrations.

2) The second calculation method uses modified values for exposure provided through correspondence with the Kentucky Department of Fish and Wildlife Resources (KDFWR). KDFWR maintains various information concerning the

recreational use of land and water bodies throughout Kentucky. The modified exposure values represent figures which are considered more realistic for the site.

Risk calculations for Big Bayou and Little Bayou Creeks are quantified separately using each of the two referenced calculation methods. A summary of risk calculations is presented in Appendix D.

The qualitative ecological risk discussion compares PGDP exposure concentrations with toxicological benchmarks provided by the Oak Ridge National Laboratory (ORNL).

5.2 Hazard Identification. The objective of the hazard identification is to determine the chemicals of concern through data collection and evaluation. Although various chemicals have been determined to be present at the site, this report analyzes only the potential risk of exposure to PCBs. Aroclors 1248, 1254, and 1260 were detected at the site, and are the focus of the Preliminary Risk Calculation. Table 5-1 summarizes PCB testing performed at Big Bayou and Little Bayou Creeks.

PCBs are man-made organic compounds composed of chlorine atoms attached to biphenyl rings. PCBs are commonly known by their trade name Aroclor. Over 200 individual PCB compounds have been manufactured. The Aroclors are distinguished by a four number code. The first two numbers represent the number of carbon atoms; the last two numbers represent the percent by weight of chlorine. Seven of these PCB compounds account for 98% of PCBs sold in the United States since 1970. Aroclors 1248, 1254 and 1260 are the subjects of this Preliminary Risk Calculation.

PCBs are oily liquids and solids with no known smell or taste. PCBs have predominantly been used as coolants or lubricants in capacitors, transformers and other electrical equipment. The use of PCBs was discontinued in 1977 due to evidence that PCBs do not easily decompose and can cause harmful environmental and health effects. Exposure to PCBs is generally the result of contact with electrical equipment containing PCB-dielectric fluids or from exposure to soil, sediments, and water in which spills or leaks of dielectric fluids have taken place. PCBs typically enter the body through inhalation, ingestion, or dermal absorption. A brief discussion on each exposure route is included below.

Inhalation - Air can contain PCBs as solid or liquid aerosols and as a vapor. Inhalation of PCB vapors allows PCBs to be absorbed through the lungs and into the bloodstream. Absorption rates in the lungs are unknown. PCBs in air are typically transferred to other media due to

TABLE 5-1

**PADUCAH GASEOUS DIFFUSION PLANT
PCB SEDIMENT SAMPLING SURVEY
PCB Detection in Media at Paducah Gaseous Diffusion Plant**

Matrix	Analytes	Detected Analytes
Surface Water	Aroclors 1248, 1254, 1260	Aroclors 1248, 1254, 1260
Fish Tissue	Aroclors 1248, 1254, 1260	Aroclors 1248, 1254, 1260
Surface Soil	Aroclors 1016, 1221, 1232, 1242, 1248, 1254, 1260	Aroclors 1248, 1260
Sediment	Aroclors 1242, 1254, 1260	Aroclors 1254, 1260

their low volatility and tendency to adsorb to particles.

Ingestion - The ingestion of PCB contaminated fish and shellfish provides a means through which PCBs can enter the bloodstream. Data on the absorption rates indicate absorption of PCBs through the stomach occurs in minutes. Absorption of PCBs in the stomach from drinking water can also occur, but is uncommon. The solubility of PCBs in water is quite low and PCBs do not generally remain in water, but are attracted to suspended sediment particles in water. Sediments containing PCB can act as a reservoir, releasing small amounts of PCBs into water over an extended period of time.

Dermal Absorption - PCBs can be absorbed by the body through skin contact with PCB contaminated soil, and dermal contact with water. The absorption efficiency and rate has not been documented.

PCB exposure concentrations have been determined from data supplied by the Nashville District Corps of Engineers (COE) and the ORNL. No effort has been made to review the sampling or analytical methods used in the collection of analytical data.

The Paducah Gaseous Diffusion Plant lies south of the Ohio River. Big Bayou and Little Bayou Creeks lie east and west of the PGDP, respectively, and feed into the Ohio River. PCBs have been detected in surface water, fish tissue, surface soil, and sediment from both Big Bayou and Little Bayou Creeks. Assessments have been determined for exposure to each of the referenced matrices.

5.2.1 Surface Water. Surface water data was obtained from the following document:

Birge, W. J., Short T. M., and Lauth J. R., 1990.
Biological Monitoring Program for the Paducah Gaseous Diffusion Plant, Three-Year Draft Report, December 1990.
Submitted to Dr. Barbara Walton, Project Officer,
Environmental Sciences Division, Oak Ridge National
Laboratory, Oak Ridge, Tennessee.

Surface water analytical data and a reference map are included in Appendix B. The data includes sample locations and dates, detectable concentrations, and quantification limits. Further, the data identifies replicate samples. For the purpose of the assessment, replicate samples are assumed to represent additional samples taken from a given location. The replicates are not considered duplicate samples collected for quality assessment or quality control purposes.

Eight stations located along Big Bayou Creek and five stations located along Little Bayou Creek which were used to collect surface water samples are utilized in the risk assessment. Three additional sampling locations at the confluence of Big Bayou and Little Bayou Creeks were not included in the risk calculation because they are within one-quarter mile of the Ohio River. Due to the frequency of backflow of Ohio River water into Big Bayou and Little Bayou Creeks, it was determined by W.J. Birge that surface water samples collected at this confluence would not be representative of PCB concentrations in Big and Little Bayou Creeks. The surface water samples would represent conditions in the Ohio River, which are not the subject of this risk calculation.

Surface water samples were collected during the period from August 1988 to June 1990. Aroclors 1248, 1254, and 1260 were detected at both Big Bayou and Little Bayou Creeks during the sampling period. Because each of the Aroclors were detected in surface water samples collected from Big Bayou and Little Bayou Creeks, it was deemed necessary to include concentrations reported as below the quantification limit (i.e., non-detects) in the risk assessment.

Justification for the inclusion of non-detected sample concentrations in the risk assessment is derived from the fact that sampling and analysis has shown that PCBs are present in surface water. Thus, PCBs could theoretically be present in non-detected samples, but at very low concentrations. The non-detected samples have been used to develop representative exposure concentrations by assuming the actual concentration in the sample is one-half the quantification limit, and including these concentrations in the calculation of the 95% UCL.

Surface water concentrations utilized in the risk assessment calculations are included within example calculations found in Appendix D. By including non-detected samples in the assessment, a conservative exposure level, which will not underestimate associated risks, can be maintained.

5.2.2 Fish Tissue. Fish tissue data was obtained from Mr. Danny R. Guminski (Environmental Management - Lockheed Martin) and the Nashville District COE on 12 September 1995. The data represents information collected by ORNL for inclusion in the PGDP Biomonitoring Program. According to Mr. Mark J. Peterson, a representative of ORNL, the data should be considered preliminary due to the fact that the data has not been evaluated for quality assurance. A letter from Mr. Peterson further explaining fish tissue considerations is included in Appendix B, along with

analytical data and a sampling point reference map. Analytical data includes various information, including sample points and dates, fish species, and Aroclor concentrations.

Five stations located along both Big Bayou and Little Bayou Creeks which were used to collect fish tissue samples are included in the risk assessment. Samples were collected between October 1992 and October 1994. Aroclors 1248, 1254, and 1260 were detected in fish tissue collected from both Big and Little Bayou Creeks during the sampling period.

To maintain the conservative approach in the risk assessment, both non-detected and estimated concentration values, identified by data qualifiers, are included in the assessment calculations. Non-detected concentrations are used by assuming an actual concentration in the sample of one-half the quantitation limit, and including the data in the calculation of the 95% UCL. Estimated fish tissue concentrations are included by assuming an actual concentration equal to the estimated value. Analytical data used in the risk assessment calculations are included within example calculations found in Appendix D.

5.2.3 Surface Soil. Surface soil data was obtained from Mr. David Ashburn (Lockheed-Martin Energy Systems) in the form of a diskette. The diskette included analytical information only. The data was reportedly obtained from the following document:

CH2MHILL. 1991. Results of the Site Investigation at the Paducah Gaseous Diffusion Plant, Paducah, KY U.S. Department of Energy. Document No. KY/ER-4.

A copy of the referenced report was not submitted. The surface soil data includes sample locations and dates, data qualifications, and Aroclor concentrations. Detection and quantification limits are not clearly identified. Results reported as estimated quantities are assumed to be based upon quantification limits. Analytical data and a sampling point reference map are included in Appendix B.

Two stations along Big Bayou Creek and three stations along Little Bayou Creek were used to collect surface soil samples. The samples were collected during August and September of 1990. Each sample was analyzed for seven Aroclors. Aroclors 1248 and 1260 were detected during analysis. Of the remaining five Aroclors, only Aroclor 1254 has been detected by analysis of a separate matrix (fish tissue and surface water) at the site. Because Aroclor 1254 has been detected at the site, estimated concentrations of Aroclor 1254 in surface soil have been included in the risk

assessment calculations. The four additional Arochlors which have not been detected in other media at the site, and were not detected in soil samples collected at the site, are not included in the risk assessment calculations.

Estimated Aroclor concentrations, identified by data qualifiers, were included in the risk calculation by assuming a concentration of one-half the quantification limit. An exception occurs in the consideration of analytical data for Little Bayou Creek. Due to the limited number of samples from Little Bayou Creek and the variability of the concentrations within the sample set, statistical analysis produces a concentration which is above the maximum PCB concentration measured at the site. Because the statistical value exceeded maximum PCB concentrations measured in surface soil at the site, the value was deemed unrepresentative of conditions at PGDP. To correct this situation, yet maintain the conservatism of the risk assessment, the statistical approach outlined in the calculation plan was abandoned. Alternatively, the highest detected concentrations, at any surface soil sample point for Aroclor 1248 (SB001-3) and 1260 (SB009-1), have been summed to provide a representative concentration. Analytical data used in the risk assessment calculations are included within example calculations found in Appendix D.

5.2.4 Sediment. Sediment data was obtained through testing conducted by the U.S. Army Corps of Engineers, Nashville District, for this study. Twenty-two locations at Big Bayou Creek and sixteen locations at Little Bayou Creek were used to collect sediment data. Three of the sampling points along Big Bayou Creek, and two of the sampling points along Little Bayou Creek were designated as background samples by the COE. These samples, while being located along sections of each creek, are upstream of the PGDP and are a sufficient distance from the PGDP to be considered representative background samples.

Reported sediment concentrations represent total PCBs. PCBs were detected in one sample each for Big Bayou and Little Bayou Creeks. The remaining samples were found to contain PCB concentrations below the quantification limits. The samples with concentrations below the quantification limits have been included, however, in the risk assessment calculation. The non-detected samples have been used to develop representative exposure concentrations by assuming the actual concentration in the sample is one-half the quantification limit, and including these concentrations in the calculation of the 95% UCL. The inclusion of the non-detected samples serves to keep the assessment conservative in nature. Analytical data used in the risk assessment calculations are included within example calculations found

in Appendix D.

5.2.5 Statistical Analysis. Representative concentrations at the site have been determined by assuming a log normal distribution of the data, and performing an upper 95% confidence interval analysis. The following equation has been used to evaluate the upper 95% confidence interval:

$$UCL(95\%) = e^{(x + 0.5 * s * s + s * H / [n-1])}$$

UCL(95%) = upper (95%) confidence limit
e = constant (base of the natural log, equal to 2.718)
x = mean of the transformed data
s = standard deviation of the transformed data
H = H-statistic (e.g., from table published in Gilbert 1987)
n = number of samples

A UCL is a statistical method which accounts for sample size and variance to develop a representative average for a sample population with some form of confidence. An interval generated by the 95% confidence interval essentially maintains that within the interval surrounding the sample set average, the mean of the sample population is within that interval 95% of the time. For this risk calculation, the upper 95% confidence limit, which is the upper limit of confidence interval, was used as the representative PCB concentrations.

Statistical analysis is included for each matrix within the example calculations found in Appendix D.

5.3 Exposure Assessment. The objective of the exposure assessment is to estimate the type and magnitude of exposures to chemicals of concern present at, or migrating from a site. The results of the exposure assessment are integrated with the chemical-specific toxicity information in order to characterize human health risks associated with the site.

Exposure pathways describe the movement of chemicals from sources (e.g. contaminated soil) to exposure points (locations) where receptors (exposed populations) may come in contact with chemicals. Table 5-2 identifies exposure pathways addressed in the risk calculation. Exposed populations will include the adult and child recreational user.

TABLE 5-2

**PADUCAH GASEOUS DIFFUSION PLANT
PCB SEDIMENT SAMPLING SURVEY
PCB Exposure Pathways Addressed at PGDP**

Matrix	Exposure Pathway
Sediment	Exposure to PCB contaminated sediment at banks of Big Bayou and Little Bayou Creeks through dermal contact.
Surface Water	Exposure to contaminated surface water in Big Bayou and Little Bayou Creeks through dermal contact.
Fish Tissue	Exposure to PCB contaminated fish caught from Big Bayou and Little Bayou Creeks through ingestion.
Soil	Exposure to PCB contaminated soil near banks of Big Bayou and Little Bayou Creeks through incidental ingestion and dermal contact. Exposure to PCB vapors from PCB contaminated soil near banks of Big Bayou and Little Bayou Creeks through inhalation.

Pathway-specific intake formulas, assumed input variables, associated references, and relevant comments are presented in tabular form within the Revised Final Calculation Plan developed for the risk assessment. A copy of the Revised Final Calculation Plan is presented in Appendix E. Default values listed in the Revised Final Calculation Plan represent values established by the USEPA/KYDEP and values developed from correspondence with the KDFWR, respectively. The USEPA/KYDEP defaults are standard defaults not specific to a site, but considered a conservative representation of exposure at sites in general. To ascertain values which would be more indicative of exposure at Big Bayou and Little Bayou Creeks, Mr. Charlie Logsdon, WMA Supervisor of the KDFWR, was contacted and a series of questions were developed to quantify exposure at the two locations. Correspondence with Mr. Logsdon is presented in Appendix C. Mr. Logsdon's comments have specifically been used to modify the USEPA/KYDEP default values for exposure frequencies and exposure time at the site. These modifications are discussed below.

5.3.1 KDFWR Summaries. A questionnaire was submitted to KDFWR to obtain site specific information on Big Bayou and Little Bayou Creeks. The questions posed to KDFWR were designed to determine intake parameters for the exposure assessment. Input from KDFWR is summarized in the following paragraphs.

Big Bayou

The average number of visits specifically made to Big Bayou Creek by an individual is less than 10 per year. The visiting population mainly consists of fishermen and hunters. Wade fishing has not been observed, but fishermen do fish from the bank. A harvestable fish population is present at Big Bayou, and a catch of 0.284 kgs of fish, the USEPA default value for ingestion rate, could be caught on a regular basis assuming no fish were returned to the Creek. The Creek could not, however, support this catch 128 times per year which is the USEPA default value for exposure frequency, unless a major influx of fish from the Ohio River occurred. Further, while a large catch of fish can occur during these periods of backflow, the fish would not originate in Big Bayou Creek, but the Ohio River. While hunters do come in contact with Big Bayou Creek, their contact is typically limited to crossing the Creek using culverts or logs. Hunters do not specifically visit Big Bayou Creek, but do visit land in the general vicinity.

Little Bayou

The average number of visits to Little Bayou Creek is less than 10 per year. The visitors are limited to PGDP personnel and fishermen and reportedly are all adults. Fishermen typically fish near a beaver pond above the plant outfalls for periods of approximately 2 hours. Wade fishing has not been observed at the beaver pond. A harvestable fish population does not exist at Little Bayou Creek with the exception of the beaver pond. The beaver pond could support a catch of 0.284 kgs of fish on an intermittent basis. The creek could not, however, consistently support a significant portion of an individual diet.

5.3.2 Derivation of KDFWR Defaults. Based on the information obtained from Mr. Logsdon, an adult and child exposure frequency of 10 events per year was deemed representative of Big Bayou and Little Bayou Creeks for contact with surface water, surface soil, and sediment. An adult and child exposure frequency of 64 meals per year was regarded as representative of exposure to fish from Big Bayou Creek. While the Creek could support 128 meals per year given an influx of fish from the Ohio River, exposure to fish potentially affected by the PGDP would be limited to fish originating in Big Bayou Creek. Fish originating from the Ohio River would not be considered potentially affected by PGDP and would pose no risk to an individual. It was further determined that an individual would not be exposed to potentially affected fish from Little Bayou Creek. Fish caught from the beaver pond above the plant outfalls is not likely to have been affected by the downstream PGDP. Thus, the exposure frequency is 0 events per year.

Exposure times at Big and Little Bayou Creeks have been based upon both fishing and hunting to various degrees. The exposure time for dermal contact with surface water is primarily based upon fishing times. Fisherman come in contact with surface water through bank fishing, but hunters are unlikely to be exposed to this matrix. Fishing times at Little Bayou Creek are approximately two hours. The value represents typical bank fishing time at the beaver pond. The value has also, however, been used to represent fishing times at Big Bayou Creek. In assessing exposure to surface soil, it was concluded that individuals at Big Bayou Creek are exposed to surface soil through both hunting and fishing activities equally, while individuals at Little Bayou Creek are exposed to surface soil predominantly through fishing at the beaver pond. Hunting times in the area of Big Bayou Creek reportedly vary from two to four hours. Thus, the exposure to surface soil has been determined to be four hours per day. Fishing times at Little Bayou Creek are approximately two hours per day, and this figure has been

judged to be representative of exposure to surface soil at Little Bayou Creek.

5.3.3 Identification of Exposure Uncertainties.

Uncertainties in the exposure assessment arise from the utilization of analytical data, professional judgments, and statistical methods. Throughout the risk assessment, non-detected concentrations have been included in risk calculations. Each non-detected sample point has been assessed by assuming an actual concentration equal to one-half the quantification limit. Also, because of the minimal number of surface soil samples collected from Little Bayou Creek, a statistical analysis could not accurately calculate conditions at the site. Therefore, the highest concentration of each Aroclor has been assumed to be representative of the conditions throughout surface soil at Little Bayou Creek. Thus, a portion of the risk generated from each exposure is derived from matrix samples which have not shown PCB contamination.

Additional uncertainty in the exposure assessment is due to professional judgments associated with default values generated by the USEPA/KYDEP and modified values developed from correspondence with the KDFWR. Activities in the vicinity of Big Bayou and Little Bayou Creeks may not be accurately represented by the USEPA/KYDEP figures. Modified default values have been developed using site-specific data provided by KDFWR. The data should provide a more accurate representation of exposure parameters at Big Bayou and Little Bayou Creeks.

Another factor attributing to the uncertainty in the exposure assessment is the assumptions regarding fish consumption. The exposure assessment assumes all fish caught from Big Bayou and Little Bayou Creeks are consumed. Realistically, a large portion, if not the majority of fish caught are too small to be eaten and are released. Further, the assessment also assumes that the entire catch of fish is consumed. It does not account for the fact that typically only a small portion of fish which can be filleted is eaten.

The lack of toxicological data available for PCBs also contributed to the uncertainty in the risk calculation. In the risk calculations, an oral slope factor and oral reference dose were used for each exposure pathway. The oral slope factor and reference dose are representative of the oral route of exposure. Although the data did not indicate whether the two toxicological factors were based upon administered or absorbed doses, the assumption was made in the calculations that the oral factors were based on absorbed doses. In contrast, the oral slope factor and reference dose are not representative of the absorptive

route of exposure. Due to the lack of toxicological data, however, and the preliminary nature of the risk assessment, the data was judged to be adequate.

Finally, statistical methods introduce uncertainty into the risk assessment. Analytical data has been assumed to follow a log normal distribution. An upper 95% confidence interval has been performed on each data set, with the exception of surface soil data from Little Bayou Creek, to determine a conservative representative concentration at the site. While an upper 95% confidence interval is an accepted statistical method, values can be skewed by small sample sizes and variability within the data.

While uncertainties in the exposure assessment do exist, the cumulative effect should act to produce risk values which are greater than that actually associated with conditions at the site. Thus, risks are not minimized by uncertainties within the exposure assessment.

5.4 Quantitative Toxicity Assessment. The objectives of the toxicity assessment are to evaluate the available information regarding the potential for particular contaminants to cause adverse effects in exposed individuals, and to provide the analytical framework for the characterization of human health impacts. For the purpose of evaluating the causal relationships between the extent of exposure to a contaminant and the increased likelihood and/or severity of adverse effects, toxicological information used to support the risk assessment is generally divided into the categories of carcinogenic and systemic (non-carcinogenic).

5.4.1 Carcinogenic Toxicity Information. For the purpose of assessing risks associated with potential carcinogenic chemicals, the USEPA has adopted the science policy of "no-threshold", i.e. there is essentially no level of exposure to a carcinogen which will not result in some finite possibility of tumor formation.

The USEPA utilizes a slope factor to directly convert estimated daily intakes averaged over a lifetime of exposure to incremental risk of an individual developing cancer. A linear low-dose response relationship is assumed at sites in which relatively low intakes by individuals are expected.

5.4.2 Non-carcinogenic Toxicity Information. For the purpose of assessing risk associated with non-carcinogenic effects, the USEPA has adopted the position that protective mechanisms must be overcome before an adverse health effect is manifested. Therefore, a range of exposures exists from zero to some finite value that can be tolerated by the organism with essentially no chance of expressing adverse effects. The approach used by the USEPA to gauge potential

non-carcinogenic effects is to identify the upper boundary of the tolerance range (threshold) for each chemical and to derive an estimate of the exposure below which adverse effects are not expected to occur. For oral routes of exposure this is referred to as an oral reference dose (RfD). The RfD is generally considered to have uncertainty spanning an order of magnitude or more, and therefore the RfD should not be viewed as a strict scientific demarcation between what level is toxic and non-toxic.

5.4.3 Identification of Toxicological Uncertainties.

Uncertainties in the quantitative toxicity assessment are typically due to limitations in quantitative toxicological information. Inherent in the toxicological assessment are uncertainties associated with using animal data to generate slope factors and reference doses to be used in calculating human health risks. The relationship between animal responses and human health impact is not direct. Thus, the accuracy of slope factors and reference doses is limited. Further, slope factors and reference doses for PCBs are available only for the oral pathway. Slope factors and reference doses are not available for the dermal absorption or inhalation pathway. The accuracy of risks associated with these pathways is uncertain.

5.4.4 Toxicological Criteria. The source for the toxicological criteria used in the toxicity assessment is the Integrated Risk Information System (IRIS). Toxicological criteria is presented within the Final Calculation Plan presented in Appendix E.

5.5 Risk Characterization. Risk assessment involves using exposure and toxicity assessment data to characterize potential risk posed by chemicals at a site. Daily intakes calculated within the exposure assessment are used in conjunction with dose-related health effect factors (i.e., slope factor and reference dose) determined from the toxicity assessment to obtain a quantitative expression of the potential risks an individual is subject to at a site.

Risk assessment categorizes risk in carcinogenic and non-carcinogenic categories. Carcinogenic risks are calculated by assuming a direct relationship between risk and both chronic daily intakes and the slope factor. To obtain an overall carcinogenic risk posed to an individual, carcinogenic risks are summed for each pathway through which exposure can occur.

Non-carcinogenic risks are quantified through a hazard quotient. A hazard quotient represents a comparison of an exposure level over a specified time period with a reference dose derived for a similar exposure period. The ratio of

the exposure level to a reference dose is considered a measure of the hazard quotient. Hazard quotients are summed across an individual's potential exposure pathways to obtain a hazard index. The hazard index is considered an evaluation of the total risk for the manifestation of non-carcinogenic effects in an individual. In general, if the hazard index reference dose exceeds one, a concern may exist for potential non-carcinogenic effects. Risk assessment calculations are included in Appendix D.

5.6. Carcinogenic Risk and Hazard Index Summary. The Environmental Protection Agency has determined through review of animal testing data that PCBs are probable human carcinogens. Animals ingesting large amounts of PCBs in food have experienced many serious health effects, including stomach, liver, and thyroid gland injuries. Rats which ingested PCB mixtures over their lifetime have developed liver cancer. Exposure in animals to PCBs through skin contact or breathing has resulted in kidney, liver, and skin damage. Studies of humans exposed to PCBs do not provide adequate information to verify that PCBs cause cancer in humans. PCBs are classified by the Integrated Risk Information System as B2, a probable human carcinogen.

Carcinogenic risks and non-carcinogenic hazard indices have been evaluated separately for Big Bayou and Little Bayou Creeks. The following sections detail the results of the risk calculations.

5.6.1 Risk Calculation Results for Big Bayou Creek

Carcinogenic Risk

Calculated carcinogenic risks associated with exposure to Big Bayou Creek are presented in Table 5-3. The total carcinogenic risk, which is a summation of risks due to individual exposure pathways, is included. Using defaults established by the USEPA/KYDEP, the total carcinogenic risk is $5.63\text{E-}03$. According to modified defaults established by consultation with KDFWR, the total carcinogenic risk is $2.79\text{E-}03$. The total carcinogenic risk is predominantly due to exposure to PCBs in fish tissue.

Non-Carcinogenic (Systemic) Risks

Non-carcinogenic hazard indices associated with Big Bayou Creek are identified in Table 5-4. The non-carcinogenic hazard index exceeds unity, a condition regulations suggest introduces concern for individuals, for an adult and child using Big Bayou Creek under both USEPA/KYDEP and KDFWR default values. The values are due to the ingestion of PCBs in fish from Big Bayou Creek. Dermal

TABLE 5-3

**PADUCAH GASEOUS DIFFUSION PLANT
PCB SEDIMENT SAMPLING SURVEY
Carcinogenic Risks Associated with Recreational
Use of Big Bayou Creek**

Exposure Pathway	USEPA/KYDEP Defaults	KDFWR Defaults
Dermal Absorption of PCBs in Sediment	8.65E-07	9.78E-08
Dermal Absorption of PCBs in Soil	1.97E-06	1.94E-07
Incidental Ingestion of PCBs in Soil	2.91E-07	3.11E-08
Dermal Absorption of PCBs in Surface Water	6.13E-05	5.55E-06
Inhalation of PCB Vapor from Soil	2.94E-07	2.35E-08
Ingestion of PCB in Fish Tissue	5.57E-03	2.78E-03
Total Carcinogenic Risk	5.63E-03	2.79E-03

Note: Total carcinogenic risk accounts for exposure as child and adult to each of the exposure pathways.

TABLE 5-4

**PADUCAH GASEOUS DIFFUSION PLANT
PCB SEDIMENT SAMPLING SURVEY
Non-Carcinogenic Hazard Indices Associated with Recreational
Use of Big Bayou Creek**

Exposure Pathway	USEPA/KYDEP Defaults		KDFWR Defaults	
	Adult	Child	Adult	Child
Dermal Absorption of PCBs in Sediment	6.16E-03	2.15E-02	1.18E-03	1.53E-03
Dermal Absorption of PCBs in Soil	9.19E-03	5.75E-02	1.77E-03	4.10E-03
Incidental Ingestion of PCBs in Soil	1.77E-03	7.76E-03	3.41E-04	5.55E-04
Dermal Absorption of PCBs in Surface Water	4.37E-01	1.52	6.72E-02	8.70E-02
Inhalation of PCBs Vapor from Soil	1.43E-03	8.51E-03	2.21E-04	4.86E-04
Ingestion of PCBs in Fish Tissue	60.9	99.2	30.5	49.6
Total Non-Carcinogenic Hazard Index	61.4	101.0	30.6	49.7

absorption of PCBs from surface water by a child, under USEPA/KYDEP defaults, is the only other pathway which contributes significantly to the hazard index.

Big Bayou Creek Risk Summary

Carcinogenic risks and non-carcinogenic hazard indices are presented in Tables 5-3 and 5-4. Although dermal absorption of PCBs in surface water and soil contributes to the calculated risk, the total risk is mainly due to the ingestion of PCBs from fish caught at Big Bayou Creek. The risk estimates generated from the fish ingestion pathway may be overestimated, however, due to uncertainties in default values used in the exposure assessment.

Exposure frequency defaults presented by the USEPA/KYDEP differ greatly from those presented through correspondence with Mr. Charlie Logsdon of the KDFWR. According to Mr. Logsdon, Big Bayou Creek could not sustain the fish exposure frequency designated by USEPA/KYDEP unless a major influx of fish from the Ohio River occurred. Fish originating in the Ohio River would not likely be affected by the PDGP. Thus, risk and hazard indices generated from parameters provided through cooperation with the KDFWR are more representative of the site than the those figures generated from USEPA/KYDEP defaults.

An additional factor which may cause an overestimation of the risk due to fish is the ingestion rate. Mr. Logsdon did state the suggested fish ingestion rate could be met by Big Bayou Creek, but the figure likely represents the amount of fish actually caught, and not the actual edible portion of the fish (i.e., fish fillets).

Risk figures associated with dermal absorption of surface water are considered an accurate reflection of conditions at the site. The limited number of soil samples should be considered when evaluating the risks associated with the dermal absorption of soil pathway.

5.6.2 Risk Calculation Results for Little Bayou Creek

Carcinogenic Risks

Carcinogenic risks associated with exposure to Little Bayou Creek are presented in Table 5-5. The total carcinogenic risk, which is a summation of risks due to the individual exposure pathways, is included. Using defaults established by the USEPA/KYDEP, the total carcinogenic risk is $7.85\text{E-}03$. According to the modified defaults established by consultation with KDFWR, the total carcinogenic risk is $8.50\text{E-}05$. The total carcinogenic risk is due largely to exposure to PCBs in fish tissue, however, exposure to PCBs through dermal absorption from soil is also a contributor.

Non-Carcinogenic (Systemic) Risks

Non-carcinogenic hazard indices representative of Little Bayou Creek are presented in Table 5-6. The hazard indices exceed unity for adult and child users of Little Bayou Creek according to defaults developed by the USEPA/KYDEP. For an adult recreational user, the pathways of PCBs ingestion from fish and dermal absorption of PCBs in soil have hazard indices above one. A child recreational user is subject to non-carcinogenic risks, however, due to all exposure pathways except dermal absorption of PCBs in sediment. The indices exceed unity mainly due to ingestion of fish originating in Little Bayou Creek. Dermal absorption of PCBs in soil, however, also contributes substantially to the hazard index in adults and children. The non-carcinogenic hazard indices generated from default values provided by the KDFWR indicate only a child is subject to non-carcinogenic risks. The risk is due to the dermal absorption of PCBs in soil.

Little Bayou Creek Risk Summary

Carcinogenic and non-carcinogenic hazard indices are presented in Tables 5-5 and 5-6. These values are considered representative of the site, with the possible exception of the fish ingestion and dermal absorption of soil pathways. According to correspondence with the KDFWR, Little Bayou Creek does not have a harvestable fish population. While fishing does occur at a beaver pond located at Little Bayou Creek, the pond lies upstream from the PGDP and is not likely affected by PCBs generated by the plant. Thus, the fish ingestion pathway may not need to be considered a potential exposure pathway.

Carcinogenic risks and hazard indices are considered representative of the site, with the possible exception of the fish ingestion and dermal absorption of soil pathways. According to correspondence with the KDFWR, Little Bayou Creek fishing does occur at a beaver pond located at Little Bayou Creek, the pond lies upstream from the PGDP and is not likely affected by PCBs generated by the plant. Thus, the fish ingestion pathway may not need to be considered a potential exposure pathway.

Finally, because of the limited number of surface soil samples taken from Little Bayou Creek, a truly representative carcinogenic risk or non-carcinogenic hazard index can not be determined. The reported values are considered to have a high degree of uncertainty.

TABLE 5-5

**PADUCAH GASEOUS DIFFUSION PLANT
PCB SEDIMENT SAMPLING SURVEY
Carcinogenic Risks Associated with Recreational
Use of Little Bayou Creek**

Exposure Pathway	USEPA/KYDEP Defaults	KDFWR Defaults
Dermal Absorption of PCBs in Sediment	6.45E-06	7.29E-07
Dermal Absorption of PCBs in Soil	6.66E-04	6.59E-05
Incidental Ingestion of PCBs in Soil	9.87E-05	1.06E-05
Dermal Absorption of PCBs in Surface Water	8.45E-05	3.82E-06
Inhalation of PCB Vapor from Soil	9.98E-05	3.99E-06
Ingestion of PCB in Fish Tissue	6.89E-03	Non Valid Pathway
Total Carcinogenic Risk	7.85E-03	8.50E-05

Note: Total carcinogenic risk accounts for exposure as child and adult to each of the exposure pathways.

TABLE 5-6

**PADUCAH GASEOUS DIFFUSION PLANT
PCB SEDIMENT SAMPLING SURVEY
Non-Carcinogenic Hazard Indices Associated with Recreational
Use of Little Bayou Creek**

Exposure Pathway	USEPA/KYDEP Defaults		KDFWR Defaults	
	Adult	Child	Adult	Child
Dermal Absorption of PCBs in Sediment	4.59E-02	1.60E-01	8.83E-03	1.14E-02
Dermal Absorption of PCBs in Soil	3.12	19.5	6.00E-01	1.39
Incidental Ingestion of PCBs in Soil	6.01E-01	2.64	1.16E-01	1.88E-01
Dermal Absorption of PCBs in Surface Water	6.02E-01	2.10	4.63E-02	6.00E-02
Inhalation of PCBs Vapor from Soil	4.87E-01	2.89	3.74E-02	8.25E-02
Ingestion of PCBs in Fish Tissue	7.55E+01	123.00	Non Valid Pathway	Non Valid Pathway
Total Non-Carcinogenic Hazard Index	80.4	150.0	0.81	1.73

5.7 Ecological Risk Statement. Although an extensive literature review and ecological risk assessment is beyond the intended scope of this project, an effort was made to select toxicological endpoint species from the following reports received from the ORNL in order to compare applicable PCB contamination at the PGDP.

Martin Marietta Energy Systems. 1994. Toxicological Benchmarks for Wildlife: 1994 Revision. ES/ER/TM-86/R1, September.

Martin Marietta Energy Systems. 1994. Toxicological Benchmarks for Screening Contaminants of Potential Concern for Effects on Sediment-Associated Biota: 1994 Revision. ES/ER/TM-95R1. June.

Martin Marietta Energy Systems. 1994. Toxicological Benchmarks for Screening Potential Contaminants for Effects on Aquatic Biota: 1994. July.

Martin Marietta Energy Systems. 1994. Estimating Exposure of Terrestrial Wildlife to Contaminants. ES/ER/TM-125. September

5.7.1. Toxicological Benchmarks. Benchmarks may be combinations of various test endpoints. A test endpoint is a statistically derived numeric summary of the results of a toxicity test that results in an adverse effect to the test species. Also, benchmarks may be combinations of multiple test endpoints. Finally, benchmarks may be derived by using mathematical models to simulate an assessment endpoint for a specific environmental characteristic that is valued and is at risk due to the contamination or disturbance that is being assessed. Further information on the estimation of toxicological benchmarks and determinations of intake values through diet and water can be found in the above references.

5.7.2 Water Quality Benchmarks. Table 5-7 summarizes water quality benchmark data obtained from ORNL. The table identifies PCB concentrations which illicit acute and chronic effects. Acute concentrations of Aroclor 1254 in water are listed for the scud, damselfly, and flathead minnow. Aroclor 1254 concentrations in neither Big Bayou nor Little Bayou Creeks exceed the benchmark values for these organisms. An acute concentration in water of Aroclor 1260 is provided for the cutthroat trout. The benchmark value is above these encountered in both Big Bayou and Little Bayou Creeks. Chronic values for Aroclor 1248 and Aroclor 1254 are listed for daphnids and non-daphnid invertebrates. The benchmark concentrations are not exceeded in Big Bayou or Little Bayou Creeks.

TABLE 5-7

**PADUCAH GASEOUS DIFFUSION PLANT
PCB SEDIMENT SAMPLING SURVEY
Summary of Selected Benchmarks from ORNL Literature**

Aquatic Species		Acute values in Water (ug/l)
Arochlor	Endpoint Species	
Aroclor 1254	Scud	2400
Aroclor 1254	Damselfly	200
Aroclor 1254	Fathead Minnow	7.7
Aroclor 1260	Cutthroat Trout	60,900
Lowest Chronic Values in Water (ug/l)		
Arochlor	Daphnids	Non-daphnid Invertebrates
Aroclor 1248	4.3	3.3
Aroclor 1254	2.1	0.8

5.7.3 Sediment Quality Benchmarks. Sediment Quality Benchmarks are based on the equilibrium partitioning (EqP) favored by the USEPA. A bulk sediment concentration benchmark is calculated using water quality benchmarks together with corrections for the effects of organic carbon. The EqP approach makes three assumptions: 1) the sensitivities of benthic species and water column species to derive the water quality benchmarks are similar; 2) the levels of protection placed by water quality benchmarks are appropriate for benthic organisms; and 3) exposures are similar. For this review, the following Aroclor benchmarks are applicable:

Aroclor 1248	1.05 mg/kg
Aroclor 1254	0.17 mg/kg
Aroclor 1260	1099 mg/kg

Sediment Quality Benchmarks were obtained from the following source:

Martin Marietta Energy Systems. Hill, R.N., Suter, G.W., 1994 Toxicological Benchmarks for Screening Contaminants of Potential Concern for Effects on Sediment - Associated Biota: 1994 Revision.

PCBs were detected at one sample point location from Little Bayou Creek at a total concentration of 5.4 mg/kg. This measured value consisted of Aroclor 1254 at 2.2 mg/kg and Aroclor 1260 at 3.2 mg/kg. The measured Aroclor 1254 concentration, at the detected sample location, is above the Sediment Quality Benchmark for benthic organisms.

PCBs were also detected at one sample location from Big Bayou Creek sediments at a total concentration of 0.2 mg/kg. Aroclor 1254 was the only PCB detected at this concentration, which is above the Sediment Quality Benchmark for benthic organisms.

5.7.4 Regulatory PCB Concentrations in Aquatic Habitats. The Chronic National Ambient Water Quality Criteria (NAWQC) for the protection of aquatic life are based on thresholds for statistically significant effects on individual responses of fish and aquatic invertebrates. This threshold is derived from at least eight Lethal concentrations (LC50) and three Chronic Values. The Kentucky Warm Water Habitat Criteria are based on protecting aquatic life from acute and chronic toxicity. These benchmarks are as follows:

National Ambient Water Quality Criteria (Total PCBs)	2.0 ug/L
KY Warm Water Aquatic Habitat Criteria	0.0014 µg/L

A representative surface water PCB concentration was calculated using a log normal distribution and a 95 percent upper confidence interval using all detected values, and one-half the quantification limits for non-detected samples. The representative values for Little Bayou and Big Bayou Creeks were 0.19 $\mu\text{g/L}$ and 0.142 $\mu\text{g/L}$, respectively. These concentrations exceed the Kentucky Warm Water Aquatic Habitat criteria in both creeks, but are below the National Ambient Water Quality Criteria.

Analytical results for each individual sample point were above the Kentucky Warm Water Aquatic Habitat criteria because the quantification limits were above the listed criteria. However, none of the analytical results from individual sample points in Big Bayou or Little Bayou Creeks exceeded the National Ambient Water Quality Criteria.

6.0 SUMMARY AND CONCLUSIONS

6.1 Project Overview. The Paducah Gaseous Diffusion Plant (PGDP), a Department of Energy/ United States Enrichment Corporation facility operated by Martin Marietta Energy Systems, Inc., is an active uranium enrichment plant located on a 3400 acre tract a short distance west of Paducah, Kentucky. Surface runoff from PGDP is to the west and northwest toward Big Bayou Creek and to the east and northeast toward Little Bayou Creek. Process water from PGDP is discharged via several KPDES permitted outfalls to both of these creeks. These effluents constitute about 85 percent of the average dry-weather flow in Big Bayou Creek and almost 100 percent in Little Bayou Creek. Both creeks were identified by the Kentucky Division of Water as streams impacted by PCBs from PGDP operations. The objective of the investigation detailed in this report was to identify the PCB contaminated areas within these creeks. This was accomplished through sediment sample collection at multiple locations within the surface drainage network. Sampling points were established at locations along these creeks receiving effluent from KPDES outfalls with a history of PCB contamination. Sampling locations were also established at all major KPDES outfall ditches to determine the extent of suspect PCB sediment contamination. Sediment samples were collected once from each location. The samples were analyzed for PCBs, identified by specific Aroclor.

6.2 Project Results. No evidence from the sediment data collected in this investigation was found to indicate that Big Bayou Creek has any PCB contaminated areas above the detection limit of 0.1 ug/g. However, the KPDES permitted outfalls (001, 008, 009, and 015) that discharge process water and surface runoff from PGDP to Big Bayou Creek were found to contain sediments with PCB concentrations varying from 0.4 to 0.7 ug/g. PCB contamination detected in the sediment collected from BBUP4 can not be attributed to PGDP since this location is upstream of all plant discharges. The detection of PCBs in the sediment sample collected downstream of the confluence of Outfall 011 with Little Bayou Creek suggests that PCBs are being transported offsite through this creek. The presence of PCBs in the sample collected from Outfall 011 indicates that PCBs from the plant area are migrating to Little Bayou Creek through this outfall. PCBs were not detected in the sediment sample collected from Little Bayou Creek upstream of Outfall 011. Even though PCBs were detected in sediment samples collected from outfalls 002, 012, and 018, Little Bayou Creek samples collected from downstream of these outfalls were not found to contain any PCBs. Table 6-1 presents the PCB data for all sediment samples with a value greater than the detection

TABLE 6-1

**PADUCAH GASEOUS DIFFUSION PLANT
PCB SEDIMENT SAMPLING SURVEY
SAMPLING POINTS WITH PCB VALUES ABOVE THE LCR OF 0.1 ug/g**

Sample Point	Location	PCBs (ug/g)
OF001	C-335 Ditch (West), KPDES 001	0.4 (A-1254)
OF008	West Ditch, KPDES 008	0.4 (A-1254)
OF009	Southwest Ditch, KPDES 009	0.7 (A-1242)
OF015	West Central Ditch, KPDES 015	0.4 (A-1260)
BBUP4	Big Bayou Creek at L1 bridge	0.2 (A-1254)
OF002	C-337 Ditch (East), KPDES 002	0.3 (A-1260)
OF011	C-340 Ditch, KPDES 011	1.0 (A-1242)
OF012	C-333 Ditch (East), KPDES 012	0.5 (A-1254)
OF018	North Ditch, KPDES 018	0.2 (A-1254)
LBD11	Little Bayou below confluence of OF011	3.2 (A-1260) 2.2 (A-1254)

limit of 0.1 ug/g from Big Bayou Creek, Little Bayou Creek, and the KPDES outfalls. Figure 6-1 indicates the location of these sampling points.

6.2.1 Big Bayou Creek. As indicated in Table 6-1, only one sediment sample collected from Big Bayou Creek during this study exhibited a PCB value greater than the lowest concentration reported (LCR) of 0.1 ug/g. A concentration of PCB Aroclor 1254 of 0.2 ug/g was recorded for sampling site BBUP4, located upstream of PGDP. PCB concentrations greater than the LCR were not observed for the remaining 20 samples collected from Big Bayou Creek. However, PCB concentrations of 0.1 and 0.3 ug/g were reported for samples collected in 1991 from sites SS19 (referred as BBD09 in this investigation) and SS1 (referred as BBONW in this investigation) as part of PGDP Annual Sediment Sampling Program (see Chapter 4).

6.2.2 Little Bayou Creek. As presented in Table 6-1, the highest concentration observed in this investigation came from a site located downstream of the Outfall 011 confluence on Little Bayou Creek and is the only site out of 16 stations sampled on this creek with a PCB value greater than the LCR. PCB Aroclors 1260 and 1254 at concentrations of 3.2 and 2.2 ug/g, respectively, were reported for this site. A cursory review of available PCB sediment data from previous investigations indicated the presence of PCBs at levels varying from 3.32 to 8.76 ug/g on sediment samples collected in 1988 at roughly the same location on this creek (Biological Monitoring Program - see Chapter 4). A stream bank soil sample obtained near the confluence of Outfall 010 on Little Bayou Creek had a reported PCB concentration of 58.7 ug/g. This sample was collected during Phase I Site Investigation activities in August 1990. In addition, PCBs were found consistently in samples collected annually from Little Bayou Creek location SS2 from 1987 through 1992 as part of PGDP Annual Sediment Sampling Program. This sediment sampling point is located downstream of all outfalls discharging to Little Bayou Creek except Outfall 018. See Figure 4-1. The reported concentrations varied from 0.2 to 2.2 ug/g, as presented in Table 4-2 of Chapter 4.

6.2.3 KPDES Outfalls. Eight of the 13 outfalls sampled during this investigation were reported to contain PCBs above the detection limit. See Table 6-1. The outfall sites with reportable PCB concentrations were 001, 002, 008, 009, 011, 012, 015, and 018. Outfall ditches 001 (0.4 ug/g), 008 (0.4 ug/g), 009 (0.7 ug/g), and 015 (0.4 ug/g) all discharge into Big Bayou Creek. However, PCBs were not detected in the corresponding Big Bayou Creek stations located downstream of their respective discharge points.

FIGURE 6-1

SEDIMENT SAMPLING LOCATIONS

PCB VALUES $> 0.1 \mu\text{g/g}$

PADUCAH GASEOUS DIFFUSION PLANT

PCB SEDIMENT SAMPLING SURVEY

LEGEND

- - Big Bayou Stations
- △ - Little Bayou Stations
- - KPDES Outfalls

Little Bayou Creek also receives discharge from four outfalls which had PCB concentrations above the LCR. They are 002 (0.3 ug/g), 011 (1.0 ug/g), 012 (0.5 ug/g), and 018 (0.2 ug/g). The Little Bayou Creek station located just downstream of Outfall 011 reported PCB concentrations for Aroclors 1254 and 1260 of 2.2 and 3.2 ug/g. The Little Bayou Creek stations downstream of outfalls 002, 012, and 018 all reported PCB concentrations below the LCR.

Sediment PCB data for KPDES outfalls derived from this investigation and other environmental programs at the PGDP are summarized in Table 6-2. This table displays only those outfall locations found to contain sediments with PCB levels above the detection limits on more than one occasion over the period of record. The information presented includes the year the sample was collected along with the location. Data for outfalls 001, 002, 003, 008, 009, 010, 011, 012, 015, 016, and 018 compiled between 1987 and 1991 originated from the PGDP Annual Sediment Sampling Program. Data for samples 003-LB21 through NS2, 011A, and 011B were from the Phase I and II Site Investigation Study. Maximum PCB concentrations observed for samples (008-BMP, 010-BMP, and 011-BMP) from the Biological Monitoring Program are also included in this table under the appropriate year. Data from the current investigation is presented under 1994.

The significance of an individual data point is small in the case of sediment samples, even when sampling procedures are designed to minimize the well known variability inherent in sediments. However, the frequency of PCB contamination observed at the outfalls identified in Table 6-2 indicates that low level PCB contamination exists in these ditches. Outfalls 003 and 011 appear to contain pockets of areas with higher concentration of PCBs. The PCB Source Identification study, completed by the Nashville District Corps of Engineers in July 1992, also revealed low level PCB contamination in water matrix samples from the same outfall sites. This study included the collection of water matrix grab samples from all of the PGDP KPDES outfalls and several storm sewer locations with effluent discharges to these ditches. The sampling period for this study extended from August 1991 through April 1992 and involved collecting samples twice a month from these locations. See Figure 6-2 for the location of sampling points with PCB concentrations in water above the LCR of 0.1 ug/l observed during that study. As indicated in Table 6-3, samples from sites discharging to Outfalls 001, 008, 009, and 015 located within the Big Bayou Creek drainage area were reported to contain PCBs. These sites coincide with those found to contain contaminated sediments during this PGDP PCB Sediment Sampling Survey. Within the eastern part of the plant area which drains toward Little Bayou Creek,

TABLE 6-2

PADUCAH GASEOUS DIFFUSION PLANT
PCB SEDIMENT SAMPLING SURVEY
KPDES OUTFALL SEDIMENT PCB DATA

KPDES Outfall	1987	1988	1989	1990	1991	1994
001	<0.1	<1.0	0.1	<0.1	0.5	0.4
002	<0.1	<0.1	<0.1	0.2	0.4	0.3
003 003-LB21 003-LB24 003-SB9 003-NS2	<0.1	0.2	0.5	<0.1 11.0 1.1 35.1	0.3 1.5	<0.1
008 008-BMP	<0.1	<0.1 1.33	1.1	<0.1	<0.1	0.4
009	1.5	2.8	<0.1	<0.1	<0.1	0.7
010 010-BMP	<0.1	<1.0 0.15	0.1	<0.5	0.6	<0.1
011 011-BMP 011A 011B	<0.1	16.0 17.2	5.1	<0.1	1.9 2.4 0.98	1.0
012	<0.1	<1.0	<0.1	<0.5	0.8	0.5
015	1.1	<1.0	<0.1	<0.1	<0.1	0.4
016	NS	NS	0.2	<0.1	0.4	<0.1
018	NS	NS	0.2	0.4	0.2	0.2

Notes:

1. PCB results are reported in ug/g.
2. LB21, LB24, & NS2: Phase I & II Site Investigation data, locations shown in Figure 4-2.
3. SB9: Stream bank soil sample from Outfall 003, location shown in Figure 4-2 (Phase I Site Investigation).
4. 008-BMP, 010-BMP & 011-BMP: Maximum PCB concentration reported from Biological Monitoring Program.
5. 011A & 011B: Data from Phase II Site Investigation.
6. NS indicates site not sampled during that year.

TABLE 6-3

**PADUCAH GASEOUS DIFFUSION PLANT
PCB SEDIMENT SAMPLING SURVEY
KPDES OUTFALL & STORM SEWER WATER MATRIX PCB DATA**

Sample Point	Location	Sampling Date	PCBs (ug/l)
009A	C-720 Sewer to OF009	09-30-91	3.2 (A-1254)
009B	C-333 Sewer to OF009	11-13-91	0.2 (A-1254)
008A	(S)E-W Ditch to OF008	08-07-91	0.1 (A-1260)
008B	C-420 Sewer to OF008	01-22-92	0.6 (A-1260)
015	KPDES Outfall 015	10-30-91	0.1 (A-1254)
		11-21-91	0.4 (A-1254)
		02-24-92	0.2 (A-1254)
S-1B	C-535 Sewer to OF001	10-16-91	0.2 (A-1254)
S-1B-2	C-337 Sewer to OF001	04-07-92	0.3 (A-1260)
001D	(N)E-W Ditch to OF001	12-03-91	0.2 (A-1260)
S-12B	C-333 Sewer to OF012	11-13-91	0.1 (A-1260)
S-11B	C-331 Sewer to OF011	11-13-91	0.1 (A-1260)
		03-24-92	30.8 (A-1254)
S-11A	C-340 Sewer to OF011	09-04-91	0.4 (A-1248)
		02-24-92	23.0 (A-1254)
011	KPDES Outfall 011	12-03-91	0.3 (A-1254)
S-10A	C-331 Sewer to OF010	11-13-91	0.3 (A-1260)
010	KPDES Outfall 010	09-04-91	0.3 (A-1260)
003	KPDES Outfall 003	10-29-91	0.1 (A-1260)

Reference: USACE, "Paducah Gaseous Diffusion Plant PCB Source Identification Project Paducah, Kentucky Final Report" July 1992

NOTES:

1. SAMPLE POINTS MARKED IN BLACK DID NOT HAVE ANY PCB VALUES $>0.1 \mu\text{g/l}$.
2. SAMPLE POINTS MARKED IN GREEN HAD ONE PCB VALUE $>0.1 \mu\text{g/l}$.
3. SAMPLE POINTS MARKED IN MAGENTA HAD TWO PCB VALUES $>0.1 \mu\text{g/l}$.
4. SAMPLE POINTS MARKED IN BLUE HAD THREE PCB VALUES $>0.1 \mu\text{g/l}$.
5. NO SAMPLE LOCATIONS HAD MORE THAN THREE PCB VALUES $>0.1 \mu\text{g/l}$.
6. STORM SEWER SITE S-11A HAD PCB LEVELS >0.1 THE ONLY TWO TIMES IT COULD BE SAMPLED.

samples (water) from sites discharging to outfalls 003, 010, 011, and 012 were reported with PCBs above the detection limit of 0.1 ug/l. As discussed before, this investigation reported PCB sediment contamination at outfalls 002, 011, 012, and 018. It should be noted that data from other environmental programs indicated the presence of contaminated sediments in outfall ditches 002, 003, 010, and 018.

6.3 Conclusions. As discussed in section 6.2 the data from outfalls 001, 008, 009, and 015 document the presence of low levels of PCBs within these ditches. These outfalls all receive surface drainage and process water discharge from the plant area enroute to Big Bayou Creek. PCBs were not detected in any of the Big Bayou Creek sampling points corresponding to these or any other KPDES outfalls. The absence of PCB values above the detection limit in sediments collected from Big Bayou Creek during this study coupled with the detection of PCBs in outfalls and fish tissues (Biological Monitoring Program) indicate that PCBs may be present in Big Bayou Creek at levels below detection limits. However, it should be noted that data are limited to snapshot sampling and results may not be representative of other factors including spatial variability and dynamic hydrographic conditions. In addition, the significance of an individual data point corresponding to one time sampling is small. PCB contamination was also detected in outfalls 002, 011, 012, and 018 during this investigation. Little Bayou Creek receives effluents from these outfalls. The detection of PCBs in Little Bayou Creek at the sampling point downstream of the confluence of Outfall 011 confirms past studies in which PCBs had been reported in this area, resulting in the posting of this creek to warn of PCB contamination. This supports the theory that Little Bayou Creek is a pathway for the transport of PCBs originating within the PGDP facility. The source of this contamination includes permitted KPDES outfalls and surface runoff from the plant area.

REFERENCES

USACE, "Sampling and Quality Assurance Project Plan Paducah Gaseous Diffusion Plant PCB in Sediment. Survey Big Bayou Creek and Little Bayou Creek Paducah, Kentucky" February 1994.

USACE, "Site Safety Plan Paducah Gaseous Diffusion Plant PCB in Sediment Survey Big Bayou Creek and Little Bayou Creek Paducah, Kentucky" May 1994.

USACE, "Paducah Gaseous Diffusion Plant PCB Source Identification Project Paducah, Kentucky Final Report" July 1992.

MMES, "Paducah Gaseous Diffusion Plant PCB Sediment Sampling" May 1992.

MMES, "Sediment Monitoring in Little Bayou Creek for PCBs" January 1992.

MMES, "Paducah Gaseous Diffusion Plant Environmental Reports for 1989, 1990, 1991, and 1992".

CH2M HILL, "Results of the Site Investigation, Phase II at the Paducah Gaseous Diffusion Plant Paducah, Kentucky" April 1992.

APPENDIX A

**Sample Locations
PADUCAH GASEOUS DIFFUSION PLANT
PCB SEDIMENT SAMPLING SURVEY**

FIGURE A - 1

OUTFALL SAMPLE LOCATION - OF001
PADUCAH GASEOUS DIFFUSION PLANT
PCB SEDIMENT SAMPLING SURVEY

FIGURE A - 2

OUTFALL SAMPLE LOCATION - OF335
PADUCAH GASEOUS DIFFUSION PLANT
PCB SEDIMENT SAMPLING SURVEY

FIGURE A - 3

OUTFALL SAMPLE LOCATION - OF002
PADUCAH GASEOUS DIFFUSION PLANT
PCB SEDIMENT SAMPLING SURVEY

FIGURE A - 4

OUTFALL SAMPLE LOCATION - OF003
PADUCAH GASEOUS DIFFUSION PLANT
PCB SEDIMENT SAMPLING SURVEY

FIGURE A - 5

OUTFALL SAMPLE LOCATION - OF008
PADUCAH GASEOUS DIFFUSION PLANT
PCB SEDIMENT SAMPLING SURVEY

FIGURE A - 6

OUTFALL SAMPLE LOCATION - OF009
 PADUCAH GASEOUS DIFFUSION PLANT
 PCB SEDIMENT SAMPLING SURVEY

FIGURE A - 7

OUTFALL SAMPLE LOCATION - OF010
 PADUCAH GASEOUS DIFFUSION PLANT
 PCB SEDIMENT SAMPLING SURVEY

FIGURE A - 8

OUTFALL SAMPLE LOCATION - OF011
PADUCAH GASEOUS DIFFUSION PLANT
PCB SEDIMENT SAMPLING SURVEY

FIGURE A - 9

OUTFALL SAMPLE LOCATION - OF012
PADUCAH GASEOUS DIFFUSION PLANT
PCB SEDIMENT SAMPLING SURVEY

FIGURE A - 10

OUTFALL SAMPLE LOCATION - OF013
PADUCAH GASEOUS DIFFUSION PLANT
PCB SEDIMENT SAMPLING SURVEY

FIGURE A - 11

OUTFALL SAMPLE LOCATION - OF015
PADUCAH GASEOUS DIFFUSION PLANT
PCB SEDIMENT SAMPLING SURVEY

FIGURE A - 12

OUTFALL SAMPLE LOCATION - OF016
 PADUCAH GASEOUS DIFFUSION PLANT
 PCB SEDIMENT SAMPLING SURVEY

FIGURE A - 13

OUTFALL SAMPLE LOCATION - OF017
PADUCAH GASEOUS DIFFUSION PLANT
PCB SEDIMENT SAMPLING SURVEY

FIGURE A - 14

OUTFALL SAMPLE LOCATION - QF018
 PADUCAH GASEOUS DIFFUSION PLANT
 PCB SEDIMENT SAMPLING SURVEY

FIGURE A - 15

BIG BAYOU CREEK SAMPLE LOCATION - BBUP1
PADUCAH GASEOUS DIFFUSION PLANT
PCB SEDIMENT SAMPLING SURVEY

FIGURE A - 16

BIG BAYOU CREEK SAMPLE LOCATION - BBUP2
PADUCAH GASEOUS DIFFUSION PLANT
PCB SEDIMENT SAMPLING SURVEY

FIGURE A - 17

BIG BAYOU CREEK SAMPLE LOCATION - BBUP3
PADUCAH GASEOUS DIFFUSION PLANT
PCB SEDIMENT SAMPLING SURVEY

FIGURE A - 18

BIG BAYOU CREEK SAMPLE LOCATION - BBUP4
PADUCAH GASEOUS DIFFUSION PLANT
PCB SEDIMENT SAMPLING SURVEY

FIGURE A - 19

BIG BAYOU CREEK SAMPLE LOCATION - BBUP5
PADUCAH GASEOUS DIFFUSION PLANT
PCB SEDIMENT SAMPLING SURVEY

FIGURE A - 20

BIG BAYOU CREEK SAMPLE LOCATION - BBU17
PADUCAH GASEOUS DIFFUSION PLANT
PCB SEDIMENT SAMPLING SURVEY

FIGURE A - 21

BIG BAYOU CREEK SAMPLE LOCATION - BBD17
PADUCAH GASEOUS DIFFUSION PLANT
PCB SEDIMENT SAMPLING SURVEY

FIGURE A - 22

BIG BAYOU CREEK SAMPLE LOCATION - BBU09
PADUCAH GASEOUS DIFFUSION PLANT
PCB SEDIMENT SAMPLING SURVEY

FIGURE A - 23

BIG BAYOU CREEK SAMPLE LOCATION - BBD09
PADUCAH GASEOUS DIFFUSION PLANT
PCB SEDIMENT SAMPLING SURVEY

FIGURE A - 24

BIG BAYOU CREEK SAMPLE LOCATION - BBU16
PADUCAH GASEOUS DIFFUSION PLANT
PCB SEDIMENT SAMPLING SURVEY

FIGURE A - 25

BIG BAYOU CREEK SAMPLE LOCATION - BBD16
PADUCAH GASEOUS DIFFUSION PLANT
PCB SEDIMENT SAMPLING SURVEY

FIGURE A - 26

BIG BAYOU CREEK SAMPLE LOCATION - BBU08
PADUCAH GASEOUS DIFFUSION PLANT
PCB SEDIMENT SAMPLING SURVEY

FIGURE A - 27

BIG BAYOU CREEK SAMPLE LOCATION - BBD08
PADUCAH GASEOUS DIFFUSION PLANT
PCB SEDIMENT SAMPLING SURVEY

FIGURE A - 28

BIG BAYOU CREEK SAMPLE LOCATION - BBU15
PADUCAH GASEOUS DIFFUSION PLANT
PCB SEDIMENT SAMPLING SURVEY

FIGURE A - 29

BIG BAYOU CREEK SAMPLE LOCATION - BBD15
PADUCAH GASEOUS DIFFUSION PLANT
PCB SEDIMENT SAMPLING SURVEY

FIGURE A - 30

BIG BAYOU CREEK SAMPLE LOCATION - BBU01
PADUCAH GASEOUS DIFFUSION PLANT
PCB SEDIMENT SAMPLING SURVEY

FIGURE A - 31

BIG BAYOU CREEK SAMPLE LOCATION - BBD01
PADUCAH GASEOUS DIFFUSION PLANT
PCB SEDIMENT SAMPLING SURVEY

FIGURE A - 32

BIG BAYOU CREEK SAMPLE LOCATION - BBONW
PADUCAH GASEOUS DIFFUSION PLANT
PCB SEDIMENT SAMPLING SURVEY

FIGURE A - 33

BIG BAYOU CREEK SAMPLE LOCATION - BBUBC
PADUCAH GASEOUS DIFFUSION PLANT
PCB SEDIMENT SAMPLING SURVEY

FIGURE A - 34

BRUSHY CREEK INFLOW SAMPLE LOCATION - BBBCI
 PADUCAH GASEOUS DIFFUSION PLANT
 PCB SEDIMENT SAMPLING SURVEY

FIGURE A - 35

BIG BAYOU CREEK SAMPLE LOCATION - BBDN1
PADUCAH GASEOUS DIFFUSION PLANT
PCB SEDIMENT SAMPLING SURVEY

FIGURE A - 36

LITTLE BAYOU CREEK SAMPLE LOCATION - LBUP1
PADUCAH GASEOUS DIFFUSION PLANT
PCB SEDIMENT SAMPLING SURVEY

FIGURE A - 37

LITTLE BAYOU CREEK SAMPLE LOCATION - LBUP2
PADUCAH GASEOUS DIFFUSION PLANT
PCB SEDIMENT SAMPLING SURVEY

FIGURE A - 38

LITTLE BAYOU CREEK SAMPLE LOCATION - LBU13
PADUCAH GASEOUS DIFFUSION PLANT
PCB SEDIMENT SAMPLING SURVEY

FIGURE A - 39

LITTLE BAYOU CREEK SAMPLE LOCATION - LBD13
PADUCAH GASEOUS DIFFUSION PLANT
PCB SEDIMENT SAMPLING SURVEY

FIGURE A - 40

LITTLE BAYOU CREEK SAMPLE LOCATION - LBU12
PADUCAH GASEOUS DIFFUSION PLANT
PCB SEDIMENT SAMPLING SURVEY

FIGURE A - 41

LITTLE BAYOU CREEK SAMPLE LOCATION - LBD12
PADUCAH GASEOUS DIFFUSION PLANT
PCB SEDIMENT SAMPLING SURVEY

FIGURE A - 42

LITTLE BAYOU CREEK SAMPLE LOCATION - LBU11
PADUCAH GASEOUS DIFFUSION PLANT
PCB SEDIMENT SAMPLING SURVEY

FIGURE A - 43

LITTLE BAYOU CREEK SAMPLE LOCATION - LBD11
PADUCAH GASEOUS DIFFUSION PLANT
PCB SEDIMENT SAMPLING SURVEY

FIGURE A - 44

LITTLE BAYOU CREEK SAMPLE LOCATION - LBU10
PADUCAH GASEOUS DIFFUSION PLANT
PCB SEDIMENT SAMPLING SURVEY

FIGURE A - 45

LITTLE BAYOU CREEK SAMPLE LOCATION - LBD10
PADUCAH GASEOUS DIFFUSION PLANT
PCB SEDIMENT SAMPLING SURVEY

FIGURE A - 46

LITTLE BAYOU CREEK SAMPLE LOCATION - LBU02
 PADUCAH GASEOUS DIFFUSION PLANT
 PCB SEDIMENT SAMPLING SURVEY

FIGURE A - 47

LITTLE BAYOU CREEK SAMPLE LOCATION - LBD02
PADUCAH GASEOUS DIFFUSION PLANT
PCB SEDIMENT SAMPLING SURVEY

FIGURE A - 48

LITTLE BAYOU CREEK SAMPLE LOCATION - LBU18
PADUCAH GASEOUS DIFFUSION PLANT
PCB SEDIMENT SAMPLING SURVEY

FIGURE A - 49

LITTLE BAYOU CREEK SAMPLE LOCATION - LBD18
PADUCAH GASEOUS DIFFUSION PLANT
PCB SEDIMENT SAMPLING SURVEY

FIGURE A - 50

LITTLE BAYOU CREEK SAMPLE LOCATION - LBDN1
PADUCAH GASEOUS DIFFUSION PLANT
PCB SEDIMENT SAMPLING SURVEY

FIGURE A - 51

LITTLE BAYOU CREEK SAMPLE LOCATION - LBDN2
 PADUCAH GASEOUS DIFFUSION PLANT
 PCB SEDIMENT SAMPLING SURVEY

APPENDIX B

**Analytical Data
PADUCAH GASEOUS DIFFUSION PLANT
PCB SEDIMENT SAMPLING SURVEY**

Surface Water

Reference: Birge, W.J., Short T.M., and Lauth J.R. 1990 Biological Monitoring Program for the Paducah Gaseous Diffusion Plant, Three-Year Draft Report, December 1990. Submitted to Dr. Barbara Walton, Project Officer, Environmental Sciences Division, Oak Ridge National Laboratory, Oak Ridge, Tennessee

BIOLOGICAL MONITORING PROGRAM FOR THE
PADUCAH GASEOUS DIFFUSION PLANT

THREE-YEAR DRAFT REPORT
December 1990

Submitted to:

Dr. Barbara Walton, Project Officer
Environmental Sciences Division
Oak Ridge National Laboratory
Oak Ridge, Tennessee

Submitted by:

W.J. Birge, T.M. Short, J.R. Lauth
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Lexington, KY

Table 5-11. PCB Analysis of Water Samples Collected
August 26, 1988 to June 25, 1990 from
Big Bayou Creek

Station	Collection Date	Replicate	Aroclor Conc. ($\mu\text{g/L}$)		
			1248	1254	1260
BB1	8/26/88	1	<0.02	<0.02	<0.03
		2	<0.01	<0.01	<0.01
BB1	1/23/90	1	<0.081	<0.081	<0.081
		2	<0.081	<0.081	<0.081
BB1	3/2/90	1	<0.081	<0.081	<0.081
			<0.081	<0.081	<0.081
		2	<0.081	<0.081	<0.081
			<0.081	<0.081	<0.081
BB1	4/24/90	1	<0.081	<0.081	<0.081
			<0.081	<0.081	<0.081
		2	<0.081	<0.081	<0.081
			<0.081	<0.081	<0.081
BB2A	2/8/90	1	<0.082	<0.082	<0.082
		2	<0.084	<0.084	<0.084
BB3	1/23/90	1	<0.080	<0.080	<0.080
		2	---	---	---
BB3	2/8/90	1	<0.080	<0.080	<0.080
		2	<0.081	0.091	0.057 ^a
BB3	3/2/90	1	<0.080	<0.080	<0.080
			<0.080	<0.080	<0.080
		2	<0.081	<0.081	<0.081
			<0.081	<0.081	<0.081
BB3	4/24/90	1	<0.081	<0.081	<0.081
			<0.081	<0.081	<0.081
		2	<0.081	<0.081	<0.081
			<0.081	<0.081	<0.081

^a Value given is an estimated number; qualitative analysis acceptable, but concentration was below the minimum quantitation level (MQL).

Table 5-11, Continued. PCB Analysis of Water Samples
Collected August 26, 1988 to June 25, 1990 from
Big Bayou Creek

Station	Collection Date	Replicate	Aroclor Conc. ($\mu\text{g/L}$)		
			1248	1254	1260
BB4A	1/23/90	1	<0.080	<0.080	<0.080
		2	<0.080	<0.080	<0.080
BB4A	2/8/90	1	<0.080	0.082	<0.080
		2	<0.080	0.084	<0.080
BB4A	3/2/90	1	0.115	<0.080	<0.080
			0.173	<0.080	<0.080
			0.149	<0.080	<0.080
			0.068	<0.080	<0.080
		2	0.089	<0.081	<0.081
			0.137	<0.081	<0.081
			0.162	<0.081	<0.081
			0.089	<0.081	<0.081
BB4A	4/24/90	1	<0.081	<0.081	<0.081
			<0.081	<0.081	<0.081
		2	<0.080	<0.080	<0.080
BB4A	5/22/90		<0.080	<0.080	<0.080
		1	<0.081	<0.081	<0.081
			<0.081	<0.081	<0.081
BB4A	6/25/90	2	<0.080	<0.080	<0.080
			<0.080	<0.080	<0.080
		1	<0.081	<0.081	<0.081
			<0.081	<0.081	<0.081
		2	<0.082	<0.082	<0.082
			<0.082	<0.082	<0.082

Table 5-11, Continued. PCB Analysis of Water Samples
Collected August 26, 1988 to June 25, 1990 from
Big Bayou Creek

Station	Collection Date	Replicate	Aroclor Conc. ($\mu\text{g/L}$)		
			1248	1254	1260
BB5	1/23/90	1	<0.080	0.105	<0.080
		2	<0.080	<0.080	<0.080
BB5	2/8/90	1	0.046 ^a	<0.080	<0.080
		2	0.057 ^a	<0.081	<0.081
BB5	3/2/90	1	<0.081	<0.081	<0.081
			<0.081	0.055 ^a	<0.081
			<0.081	<0.081	<0.081
			<0.081	0.059 ^a	<0.081
		2	<0.082	<0.082	<0.082
			<0.082	<0.082	<0.082
			<0.082	<0.082	<0.082
			<0.082	<0.082	<0.082
BB5	4/24/90	1	<0.081	<0.081	<0.081
			<0.081	<0.081	<0.081
		2	<0.081	<0.081	<0.081
			<0.081	<0.081	<0.081
BB6	2/8/90	1	<0.080	<0.080	<0.080
		2	<0.080	<0.080	<0.080
BB6	3/2/90	1	<0.081	<0.081	<0.081
			<0.081	<0.081	<0.081
		2	<0.082	<0.082	<0.082
			<0.082	<0.082	<0.082
BB6	4/24/90	1	<0.084	<0.084	<0.084
			0.113	<0.084	<0.084
		2	<0.082	<0.082	<0.082
			0.106	<0.082	<0.082
BB6	6/25/90	1	<0.080	<0.080	<0.080
			<0.080	<0.080	<0.080
		2	<0.080	<0.080	<0.080
			<0.080	<0.080	<0.080
BB7	1/23/90	1	<0.080	<0.080	<0.080
		2	<0.081	<0.081	<0.081
BB8	1/23/90	1	<0.080	<0.080	<0.080
		2	<0.080	<0.080	<0.080
BB8	4/24/90	1	<0.080	<0.080	<0.080
			<0.080	<0.080	<0.080
		2	<0.081	<0.081	<0.081
			<0.081	<0.081	<0.081

^a Value given is an estimated number; qualitative analysis acceptable, but concentration was below the minimum quantitation level (MQL).

Table 5-12. PCB Analysis of Water Samples Collected
August 26, 1988 to June 25, 1990 from
Little Bayou Creek

Station	Collection Date	Replicate	Aroclor Conc. ($\mu\text{g/L}$)		
			1248	1254	1260
LB1	8/26/88	1	<0.02	<0.03	<0.03
		2	<0.01	<0.01	<0.01
LB1	10/7/88	1	0.03	<0.02	<0.02
			<0.02	<0.02	<0.02
		2	<0.02	0.11	<0.02
LB1	10/23/89		<0.02	0.12	0.02
		1	<0.082	<0.082	<0.082
			<0.082	<0.082	<0.082
		2	<0.083	<0.083	<0.083
		3	<0.083	<0.083	<0.083
LB1	6/25/90		<0.083	<0.083	<0.083
		1	<0.082	<0.082	<0.082
			<0.082	<0.082	<0.082
		2	<0.081	<0.081	<0.081
LB2A	10/7/88	1	<0.081	<0.081	<0.081
			0.04	<0.02	<0.02
			<0.02	0.03	<0.02
LB2A	10/23/89	2	0.02	<0.02	<0.02
			<0.02	0.02	<0.02
		1	0.194	<0.084	<0.084
			0.206	<0.084	<0.084
		2	0.201	<0.085	<0.085
LB2A	6/25/90		0.226	<0.085	<0.085
		3	0.176	<0.085	<0.085
			0.220	<0.085	<0.085
		1	0.153	<0.081	0.032 ^a
			0.190	<0.081	<0.081
		2	0.145	<0.081	0.028 ^a
			0.168	<0.081	<0.081

^a Value given is an estimated number; qualitative analysis acceptable, but concentration was below the minimum quantitation level (MQL).

Table 5-12, Continued. PCB Analysis of Water Samples
Collected August 26, 1988 to June 25, 1990 from
Little Bayou Creek

Station	Collection Date	Replicate	Aroclor Conc. ($\mu\text{g/L}$)		
			1248	1254	1260
LB2	10/23/89	1	0.181	<0.080	<0.080
			0.179	<0.080	<0.080
		2	0.170	<0.081	<0.081
			0.174	<0.081	<0.081
		3	0.133	<0.082	<0.082
			0.142	<0.082	<0.082
LB2	6/25/90	1	0.157	<0.082	0.041 ^a
			0.231	<0.082	<0.082
		2	0.042 ^a	<0.081	0.026 ^a
			<0.081	<0.081	<0.081
LB3	10/23/89	1	<0.083	<0.083	<0.083
			<0.083	<0.083	<0.083
		2	<0.082	<0.082	<0.082
			<0.082	<0.082	<0.082
		3	0.094	<0.083	<0.083
			0.102	<0.083	<0.083
LB3	6/25/90	1	<0.082	<0.082	<0.082
			<0.082	<0.082	<0.082
		2	<0.080	<0.080	<0.080
			<0.080	<0.080	<0.080
LB4	10/23/89	1	<0.084	<0.084	<0.084
			<0.084	<0.084	<0.084
		2	<0.085	<0.085	<0.085
			<0.085	<0.085	<0.085
		3	<0.082	<0.082	<0.082
			<0.082	<0.082	<0.082
LB4	1/23/90	1	<0.082	<0.082	<0.082
		2	<0.082	<0.082	<0.082
LB4	6/25/90	1	<0.082	<0.082	<0.082
			<0.082	<0.082	<0.082
		2	<0.081	<0.081	<0.081
			<0.081	<0.081	<0.081

^a Value given is an estimated number; qualitative analysis acceptable, but concentration was below the minimum quantitation level (MQL).

Fish Tissue

Reference: Oak Ridge National Lab's PCB fish tissue data reference. Received in correspondence from Mr. Danny R. Guminiski (Environmental Management - Lockheed Martin) to FMSM and the Nashville District on 12 September, 1995

OAK RIDGE NATIONAL LABORATORY
MANAGED BY MARTIN MARIETTA ENERGY SYSTEMS, INC.
FOR THE U.S. DEPARTMENT OF ENERGY

POST OFFICE BOX 2008
OAK RIDGE, TENNESSEE 37831

December 13, 1995

Stephen L. Scott
1409 N. Forbes Rd.
Lexington, KY 40511-2050

Dear Stephen,

Please find enclosed a diskette and a hard copy of the most recent revision of the bioaccumulation data set from the PGDP Biomonitoring Program. I've also enclosed a copy of the letter that will be sent to you by fax later today and the information-memo that should accompany the data.

Please let me know if you do not receive the information you need in good order or if you have any questions.

Sincerely,

Mark J. Peterson
Bldg. 1505, MS-6036
P.O. Box 2008,
Oak Ridge National Laboratory
Oak Ridge, TN 37830

615-576-3461 (Ph)
615-576-3989 (FAX)

December 13, 1995

Stephen L. Scott
1409 N. Forbes Rd.
Lexington, KY 40511-2050

Dear Stephen,

Please find attached a hard copy of the most recent revision of the bioaccumulation data set from the PGDP Biomonitoring Program. Also attached is a copy of the data set previously provided to you, with the values that were changed highlighted (except rounding-off differences that were not highlighted). I have sent to you this afternoon a diskette of the most recent version.

There is much wrong with the earlier version sent to you, and I strongly recommend that you use the revised data set. The major differences between the two data sets are attributable to the different ways that detection limits were handled, but there are also transcription error corrections and rounding-off differences. Unfortunately, as I mentioned before sending the preliminary data, what we were able to provide you was our first attempt at consolidating multiple data sets that were originally created for statistic purposes and were not designed to be "complete". For example, for some sampling seasons we divided the quantitation limit (reported by the analytical lab) by 10 to obtain a detection limit, for other subsets the detection limit may have been additionally halved to generate an appropriate mean for a site. There is no way to distinguish in the earlier version which values were undetected.

I have enclosed with the most recent revision a cautionary note and a short description of the parameters measured. This recent version should also be considered preliminary, since we have not had the opportunity to "test" the data set or complete the QA evaluations. However, this data set was generated directly from the original analytical sheets and it should be adequate for your preliminary risk evaluation.

Please call me if you have any questions.

Sincerely,

Mark J. Peterson
Bldg. 1505, MS-6036
P.O. Box 2008,
Oak Ridge National Laboratory
Oak Ridge, TN 37830

615-576-3461 (Ph)
615-576-3989 (FAX)

ATTACHMENT TO BIOACCUMULATION DATA SET

The attached data set is comprised of **preliminary** mercury and PCB results for fish collected from 1992-1994 for the Biological Monitoring Program at the Paducah Gaseous Diffusion Plant. The data set is in the process of being formatted for inclusion in the ORISE database where it will be available for general use. However, at this time (12/13/95) this data set has not been used for statistical evaluations (a good way to detect incongruities in the data), nor has it undergone a complete quality assurance check. **These data should be considered preliminary and are subject to change.**

Following is a general explanation of terms and units found in the data set:

Site	Sampling site designations include the kilometer distance upstream of the mouth of the stream. BBK = Big Bayou Creek kilometer, LUK = Little Bayou Creek kilometer, MAK = Massac Creek kilometer. The Massac Creek site is a reference site located near the Hwy. 285 bridge near Paducah.
Season	Spring (Apr) or Fall (Oct) sampling of the designated year.
Date	Collection date.
Spp.	Species of fish. (LNGEAR = Longear sunfish, BLUGIL = Bluegill sunfish, GREENSF = Green sunfish, SPBASS = Spotted bass, LMBASS = Largemouth bass, and YBULLHD = Yellow bullhead)
Sex	M = Male, F = Female
Tag	Unique ID number assigned to each fish sampled.
Type	R= Regular sample. QA samples (e.g. spikes, duplicates and reference samples), which would have different "type" designations, are not included in this data set.
Wgt.	Weight of fish measured in grams.
Lgt.	Total length of fish measured in centimeters.
Hg	Concentration of mercury in fish filet measured in $\mu\text{g/g}$.
1248	Concentration of Aroclor 1248 in fish filet measured in $\mu\text{g/g}$.
48qu	Data qualifiers for Aroclor 1248. "U" indicates compound was analyzed for but not detected. The sample quantitation limit is listed. (<i>detection limits are often estimated by using one tenth the quantitation limit</i>) "J" indicates an estimated value that is below the quantitation limit. "P" indicates greater than a 25% difference between the primary and secondary column results.
1254	Concentration of Aroclor 1254 in fish filet measured in $\mu\text{g/g}$.
54qu	Data qualifiers for Aroclor 1254.
1260	Concentration of Aroclor 1260 in fish filet measured in $\mu\text{g/g}$.
60qu	Data qualifiers for Aroclor 1260.
Lipids	Percent lipids in the sample.

For further information regarding these data please contact:

Mark J. Peterson or George Southworth
Bldg. 1505, MS-6036
P.O. Box 2008,
Oak Ridge National Laboratory
Oak Ridge, TN 37830

PGDP

Site	Season	Date	Spp.	Sex	Tag	Type	Wgt.	Lgt.	Hg	1248	48qu	1254	54qu	1260	60qu	Lipids
BBK9.1	Oct92	10/19/92	LNGEAR	M	3870	R	56.3	14.3	.	0.155	J	0.081	J	0.098	J	0.17
BBK9.1	Oct92	10/19/92	LNGEAR	M	3871	R	50.4	13.8	.	0.156	J	0.097	J	0.265	J	0.23
BBK9.1	Oct92	10/19/92	LNGEAR	M	3872	R	45.9	13.2	.	0.159	J	0.079	J	0.102	J	0.25
BBK9.1	Oct92	10/19/92	LNGEAR	M	3873	R	56.8	15.3	.	0.136	J	0.122	J	0.152	J	0.21
BBK9.1	Oct92	10/19/92	LNGEAR	M	3874	R	39.6	13.0	.	0.224	J	0.164	J	0.266	J	0.64
BBK9.1	Oct92	10/19/92	LNGEAR	M	3875	R	58.0	14.2	.	0.134	J	0.135	J	0.124	J	0.33
BBK9.1	Oct92	10/19/92	LNGEAR	M	3876	R	55.9	14.4	.	0.384	U	0.768	U	0.041	J	0.23
BBK9.1	Oct92	10/19/92	LNGEAR	M	3877	R	45.9	13.1	.	0.189	J	0.057	J	0.079	J	0.18
BBK2.8	Oct92	10/19/92	LNGEAR	M	3850	R	43.2	13.5	.	0.544	U	1.088	U	0.103	J	0.36
BBK2.8	Oct92	10/19/92	LNGEAR	F	3851	R	40.0	13.4	.	0.536	U	1.072	U	0.076	J	0.96
BBK2.8	Oct92	10/19/92	LNGEAR	M	3852	R	40.0	14.0	.	0.512	U	0.094	J	0.194	J	0.32
BBK2.8	Oct92	10/19/92	LNGEAR	M	3853	R	36.3	12.9	.	0.149	J	0.051	J	0.121	J	0.34
BBK2.8	Oct92	10/19/92	LNGEAR	M	3854	R	39.5	13.0	.	0.664	U	1.328	U	0.065	J	0.32
BBK2.8	Oct92	10/19/92	LNGEAR	M	3855	R	35.2	13.5	.	0.336	U	0.672	U	0.072	J	0.25
BBK2.8	Oct92	10/19/92	LNGEAR	M	3856	R	36.8	12.0	.	0.522	U	1.044	U	0.183	J	0.55
BBK2.8	Oct92	10/19/92	LNGEAR	M	3857	R	42.0	13.4	.	0.436	U	0.221	J	0.306	J	0.21
BBK12.5	Oct92	10/19/92	LNGEAR	M	3840	R	40.9	12.9	.	0.488	U	0.976	U	0.976	U	0.16
BBK12.5	Oct92	10/19/92	LNGEAR	M	3841	R	41.0	13.1	.	0.488	U	0.976	U	0.976	U	0.13
BBK12.5	Oct92	10/19/92	LNGEAR	M	3842	R	46.0	12.8	.	0.464	U	0.928	U	0.928	U	1.23
BBK12.5	Oct92	10/19/92	LNGEAR	M	3843	R	52.6	13.9	.	0.480	U	0.960	U	0.960	U	0.33
BBK12.5	Oct92	10/19/92	LNGEAR	M	3844	R	47.4	13.7	.	0.472	U	0.944	U	0.944	U	0.53
BBK12.5	Oct92	10/19/92	LNGEAR	M	3845	R	84.2	16.1	.	.	.	.	.	.	.	.
BBK12.5	Oct92	10/19/92	LNGEAR	M	3846	R	58.0	14.4	.	0.304	U	0.608	U	0.608	U	0.36
BBK12.5	Oct92	10/19/92	LNGEAR	.	3847	R	72.8	14.7	.	0.238	U	0.475	U	0.475	U	0.68
BBK10.0	Oct92	10/19/92	LNGEAR	M	3880	R	41.2	13.4	.	0.127	U	0.070	J	0.111	J	0.30
BBK10.0	Oct92	10/19/92	LNGEAR	M	3881	R	51.4	13.5	.	0.360	U	0.720	U	0.051	J	0.36
BBK10.0	Oct92	10/19/92	LNGEAR	M	3882	R	44.1	13.6	.	0.101	J	0.065	J	0.103	J	0.40
BBK10.0	Oct92	10/19/92	LNGEAR	M	3883	R	53.5	14.1	.	0.179	J	0.217	J	0.229	J	0.58
BBK10.0	Oct92	10/19/92	LNGEAR	F	3884	R	45.3	13.5	.	0.104	J	0.122	J	0.159	J	0.36
BBK10.0	Oct92	10/19/92	LNGEAR	M	3885	R	49.2	13.9	.	0.448	U	0.896	U	0.056	J	0.41
BBK10.0	Oct92	10/19/92	LNGEAR	M	3886	R	48.2	13.4	.	0.177	J	0.183	J	0.219	J	0.40
BBK10.0	Oct92	10/19/92	LNGEAR	M	3887	R	42.0	12.9	.	0.123	J	0.102	J	0.131	J	1.00
LUK9.0	Oct92	10/20/92	LNGEAR	F	3860	R	18.6	10.4	.	0.234	J	0.511	J	0.442	J	1.30
LUK9.0	Oct92	10/20/92	LNGEAR	M	3861	R	19.8	10.7	.	0.317	J	1.090	.	1.562	.	1.16
LUK9.0	Oct92	10/20/92	LNGEAR	M	3862	R	14.7	9.1	.	1.000	U	2.000	U	0.345	J	0.23
LUK9.0	Oct92	10/20/92	LNGEAR	M	3863	R	21.1	10.9	.	0.704	U	0.502	J	0.439	J	0.87
LUK9.0	Oct92	10/20/92	LNGEAR	M	3864	R	26.5	11.5	.	0.704	U	0.767	J	0.724	J	0.75
LUK9.0	Oct92	10/20/92	LNGEAR	M	3866	R	20.6	10.4	.	0.520	U	0.189	J	0.238	J	0.13
LUK9.0	Oct92	10/20/92	LNGEAR	M	3867	R	16.8	10.3	.	0.648	U	0.155	J	0.111	J	0.31
LUK9.0	Oct92	10/20/92	LNGEAR	F	3869	R	18.9	10.1	.	0.472	U	0.331	J	0.304	J	0.24
LUK4.3	Oct92	10/20/92	LNGEAR	M	4100	R	31.4	11.9	.	0.091	J	0.130	J	0.132	J	0.12
LUK4.3	Oct92	10/20/92	LNGEAR	M	4101	R	28.9	11.5	.	0.066	J	0.130	J	0.740	J	0.13
LUK4.3	Oct92	10/20/92	LNGEAR	F	4102	R	37.3	13.4	.	0.500	U	1.000	U	0.052	J	0.26
LUK4.3	Oct92	10/20/92	LNGEAR	M	4103	R	30.4	11.5	.	0.132	J	0.096	J	0.144	J	0.30
LUK4.3	Oct92	10/20/92	LNGEAR	M	4104	R	44.6	13.6	.	0.432	U	0.864	U	0.060	J	0.11

PGDP

LUK4.3	Oct92	10/20/92	LNGEAR	M	4105	R	30.8	11.8	.	0.336	U	0.672	U	0.672	U	0.14
LUK4.3	Oct92	10/20/92	LNGEAR	M	4106	R	25.5	11.3	.	0.352	U	0.704	U	0.704	U	0.23
LUK4.3	Oct92	10/20/92	LNGEAR	M	4107	R	26.6	11.5	.	0.432	U	0.864	U	0.050	J	0.20
BBK9.1	Oct92	10/20/92	SPBASS	M	3848	R	333.0	29.2	0.60	0.140	U	0.280	U	0.080	J	0.41
BBK9.1	Oct92	10/20/92	SPBASS	M	3849	R	582.0	35.9	1.00	0.057	J	0.290	U	0.129	J	0.00
BBK9.1	Oct92	10/20/92	SPBASS	F	3858	R	334.0	29.0	0.55	0.126	U	0.250	U	0.105	J	0.55
BBK9.1	Oct92	10/20/92	SPBASS	F	3859	R	651.0	35.2	0.93	0.034	J	0.340	U	0.084	J	0.00
BBK9.1	Oct92	10/20/92	SPBASS	F	3878	R	708.0	36.1	0.61	0.035	J	0.260	U	0.072	J	0.00
BBK9.1	Oct92	10/20/92	SPBASS	M	3879	R	443.0	31.5	0.44	0.034	J	0.260	U	0.096	J	0.42
BBK9.1	Oct92	10/20/92	SPBASS	M	3888	R	433.0	30.6	0.58	0.021	J	0.260	U	0.131	J	0.00
BBK9.1	Oct92	10/20/92	SPBASS	M	3889	R	540.0	35.5	1.00	0.046	J	0.340	U	0.302	J	0.00
LUK9.0	Apr93	4/27/93	LNGEAR	M	4530	R	37.7	12.5	.	0.600	U	0.369	.	0.347	.	0.00
LUK9.0	Apr93	4/27/93	LNGEAR	M	4531	R	25.8	10.9	.	0.888	U	0.312	.	0.195	.	0.20
LUK9.0	Apr93	4/27/93	LNGEAR	M	4532	R	18.5	10.0	.	0.226	.	0.143	.	0.079	.	0.03
LUK9.0	Apr93	4/27/93	LNGEAR	M	4533	R	20.6	10.1	.	0.135	.	0.180	.	0.520	.	0.03
LUK9.0	Apr93	4/27/93	LNGEAR	M	4534	R	23.1	10.4	.	0.629	.	0.518	.	0.428	.	0.00
LUK9.0	Apr93	4/27/93	LNGEAR	M	4535	R	20.8	10.1	.	1.254	.	0.922	.	0.836	.	0.38
LUK9.0	Apr93	4/27/93	LNGEAR	M	4536	R	15.5	8.8	.	1.269	.	0.800	.	0.606	.	0.06
LUK9.0	Apr93	4/27/93	LNGEAR	M	4537	R	17.7	9.6	.	1.944	.	1.440	.	1.146	.	0.08
LUK7.2	Apr93	4/27/93	LNGEAR	M	4520	R	44.5	12.4	0.10	0.432	U	0.509	.	0.499	.	0.42
LUK7.2	Apr93	4/27/93	LNGEAR	M	4521	R	44.0	13.0	0.07	.	.	.	.	.	.	.
LUK7.2	Apr93	4/27/93	LNGEAR	M	4522	R	41.8	12.2	0.10	0.400	U	0.443	.	0.291	J	0.29
LUK7.2	Apr93	4/27/93	LNGEAR	M	4523	R	52.9	12.5	0.07	.	.	.	.	.	.	.
LUK7.2	Apr93	4/27/93	LNGEAR	M	4524	R	47.9	12.4	0.10	0.049	J	0.147	J	0.140	J	0.56
LUK7.2	Apr93	4/27/93	LNGEAR	M	4525	R	46.8	13.1	0.06	.	.	.	.	.	.	.
LUK7.2	Apr93	4/27/93	LNGEAR	M	4527	R	35.6	11.0	0.08	0.592	U	0.258	J	0.212	J	0.10
LUK7.2	Apr93	4/27/93	LNGEAR	M	4528	R	51.7	13.0	0.07	.	.	.	.	.	.	.
LUK7.2	Apr93	4/27/93	LMBASS	M	4539	R	140.9	20.3	0.27	0.138	U	0.301	.	0.267	.	0.20
LUK4.3	Apr93	4/27/93	SPBASS	M	4319	R	140.4	21.3	0.18	0.111	.	0.342	.	0.478	.	0.54
LUK4.3	Apr93	4/27/93	LNGEAR	M	4500	R	56.0	13.3	.	0.400	U	0.088	J	0.242	J	0.42
LUK4.3	Apr93	4/27/93	LNGEAR	M	4501	R	44.8	12.0	.	0.571	U	0.483	.	0.540	.	2.09
LUK4.3	Apr93	4/27/93	LNGEAR	M	4502	R	32.6	11.9	.	0.500	U	0.608	.	0.088	.	0.07
LUK4.3	Apr93	4/27/93	LNGEAR	M	4503	R	34.8	11.8	.	0.375	U	0.108	.	0.129	.	0.23
LUK4.3	Apr93	4/27/93	LNGEAR	M	4504	R	60.4	13.4	.	0.042	.	0.107	.	0.104	.	4.54
LUK4.3	Apr93	4/27/93	LNGEAR	M	4507	R	33.4	11.6	.	0.490	U	0.184	.	0.233	.	0.80
LUK4.3	Apr93	4/27/93	LNGEAR	M	4508	R	38.2	11.3	.	0.456	U	0.121	.	0.169	.	0.76
LUK4.3	Apr93	4/27/93	LNGEAR	M	4509	R	39.2	11.5	.	0.664	U	0.051	.	0.050	.	0.16
BBK9.1	Apr93	4/27/93	LNGEAR	F	4437	R	.	.	.	0.496	U	0.127	J	0.127	J	0.23
BBK9.1	Apr93	4/27/93	LNGEAR	F	4438	R	64.2	14.4	0.51	0.649	U	0.242	.	0.273	.	1.18
BBK9.1	Apr93	4/27/93	LNGEAR	M	4450	R	70.2	13.8	0.32	.	.	.	.	.	.	.
BBK9.1	Apr93	4/27/93	LNGEAR	M	4451	R	51.2	13.5	0.39	0.420	U	0.152	.	0.198	.	0.16
BBK9.1	Apr93	4/27/93	LNGEAR	F	4452	R	54.7	13.2	0.49	0.445	U	0.085	.	0.890	U	0.35
BBK9.1	Apr93	4/27/93	LNGEAR	M	4453	R	57.2	13.6	0.28	0.057	J	0.214	J	0.215	J	0.19
BBK9.1	Apr93	4/27/93	LNGEAR	M	4454	R	47.9	13.0	.	0.400	U	0.107	J	0.087	J	0.18
BBK9.1	Apr93	4/27/93	LNGEAR	M	4455	R	57.0	13.8	0.29	0.381	U	0.140	.	0.122	.	0.21

BBK9.1	Apr93	4/27/93	LNGEAR	M	4456	R	51.5	13.4	.	0.406	U	0.080	.	0.813	U	0.05
BBK9.1	Apr93	4/27/93	LNGEAR	M	4457	R	55.5	14.1	.	0.522	U	0.340	.	0.162	.	0.32
BBK9.1	Apr93	4/27/93	LNGEAR	M	4458	R	48.2	12.7	0.29	0.462	U	0.117	.	0.140	.	0.44
BBK9.1	Apr93	4/27/93	LNGEAR	F	4459	R	61.6	13.4	0.39	0.384	U	0.397	.	0.370	.	1.06
BBK12.5	Apr93	4/27/93	LNGEAR	M	4510	R	69.0	13.8	0.12	0.600	U	1.200	U	1.200	U	0.32
BBK12.5	Apr93	4/27/93	LNGEAR	M	4511	R	46.0	13.2	0.09	0.436	U	0.872	U	0.872	U	0.29
BBK12.5	Apr93	4/27/93	LNGEAR	M	4512	R	51.5	13.4	0.07	0.381	U	0.762	U	0.762	U	0.60
BBK12.5	Apr93	4/27/93	LNGEAR	M	4513	R	81.0	15.0	0.15	0.800	U	1.600	U	1.600	U	0.26
BBK12.5	Apr93	4/27/93	LNGEAR	M	4514	R	75.0	13.9	0.13	0.296	U	0.592	U	0.592	U	0.63
BBK12.5	Apr93	4/27/93	LNGEAR	M	4515	R	42.3	12.3	0.07	0.500	U	1.000	U	1.000	U	0.68
BBK12.5	Apr93	4/27/93	LNGEAR	M	4516	R	57.7	13.3	0.06	0.296	U	0.592	U	0.592	U	0.46
BBK12.5	Apr93	4/27/93	LNGEAR	F	4517	R	49.9	12.7	0.12	0.315	U	0.630	U	0.630	U	0.41
BBK10.0	Apr93	4/27/93	LNGEAR	M	4490	R	91.1	15.5	0.19	0.369	U	0.066	.	0.093	.	0.60
BBK10.0	Apr93	4/27/93	LNGEAR	M	4491	R	39.7	12.1	0.12	0.522	U	0.081	.	0.123	.	0.53
BBK10.0	Apr93	4/27/93	LNGEAR	M	4492	R	65.9	15.0	0.53	0.328	U	0.656	U	0.123	.	0.24
BBK10.0	Apr93	4/27/93	LNGEAR	M	4493	R	39.2	12.3	0.16	0.470	U	0.078	.	0.133	.	0.30
BBK10.0	Apr93	4/27/93	LNGEAR	M	4494	R	41.4	12.4	0.24	0.558	U	0.118	.	0.262	.	0.36
BBK10.0	Apr93	4/27/93	LNGEAR	M	4495	R	63.1	14.3	0.16	0.342	U	0.035	.	0.116	.	0.58
BBK10.0	Apr93	4/27/93	LNGEAR	M	4496	R	42.1	13.0	0.12	0.800	U	1.600	U	0.283	.	0.18
BBK10.0	Apr93	4/27/93	LNGEAR	M	4497	R	35.5	12.0	0.27	0.686	U	0.190	.	0.189	.	0.43
MAK13.8	Apr93	4/28/93	LNGEAR	M	4430	R	57.0	14.0	0.22	.	.	.	.	.	.	.
MAK13.8	Apr93	4/28/93	LNGEAR	M	4431	R	49.5	13.6	0.17	.	.	.	.	.	.	.
MAK13.8	Apr93	4/28/93	LNGEAR	F	4432	R	39.4	11.7	0.24	.	.	.	.	.	.	.
MAK13.8	Apr93	4/28/93	LNGEAR	M	4433	R	38.0	11.7	0.14	.	.	.	.	.	.	.
MAK13.8	Apr93	4/28/93	LNGEAR	M	4434	R	65.1	14.2	0.16	.	.	.	.	.	.	.
MAK13.8	Apr93	4/28/93	LNGEAR	M	4435	R	69.8	13.6	0.08	.	.	.	.	.	.	.
MAK13.8	Apr93	4/28/93	LNGEAR	M	4436	R	36.3	11.8	0.10	.	.	.	.	.	.	.
MAK13.8	Apr93	4/28/93	LNGEAR	M	4498	R	47.6	13.4	0.19	.	.	.	.	.	.	.
BBK2.8	Apr93	5/27/93	LNGEAR	F	4710	R	51.1	12.6	0.28	0.387	U	0.033	J	0.774	U	1.13
BBK2.8	Apr93	5/27/93	LNGEAR	F	4711	R	42.5	12.6	0.26	2.213	U	4.427	U	0.004	J	0.63
BBK2.8	Apr93	5/27/93	LNGEAR	M	4712	R	36.0	11.4	0.20	2.987	U	5.973	U	0.009	J	0.47
BBK2.8	Apr93	5/27/93	LNGEAR	M	4713	R	61.8	13.0	0.19	1.510	U	3.021	U	3.021	U	0.00
BBK2.8	Apr93	5/27/93	LNGEAR	M	4714	R	67.6	14.1	0.15	0.022	J	3.028	U	0.045	J	0.90
BBK2.8	Apr93	5/27/93	LNGEAR	M	4715	R	48.9	12.4	0.20	0.036	J	4.460	U	0.046	J	1.39
BBK2.8	Apr93	5/27/93	LNGEAR	F	4716	R	46.8	12.4	0.26	2.230	U	4.460	U	0.008	J	0.58
BBK2.8	Apr93	5/27/93	LNGEAR	M	4717	R	34.7	11.2	0.31	0.013	J	5.126	U	0.090	J	1.38
BBK2.8	Oct93	10/13/93	LNGEAR	M	4770	R	58.7	14.4	.	0.302	U	0.605	U	0.605	U	0.06
BBK2.8	Oct93	10/13/93	LNGEAR	F	4771	R	37.4	12.3	.	0.592	U	1.184	U	1.184	U	0.15
BBK2.8	Oct93	10/13/93	LNGEAR	M	4772	R	40.8	12.8	.	0.455	U	0.091	U	0.091	U	0.29
BBK2.8	Oct93	10/13/93	LNGEAR	M	4773	R	41.6	13.0	.	0.464	U	0.928	U	0.928	U	0.08
BBK2.8	Oct93	10/13/93	LNGEAR	M	4774	R	63.2	15.2	.	0.320	U	0.640	U	0.640	U	0.17
BBK2.8	Oct93	10/13/93	LNGEAR	M	4775	R	68.6	15.0	.	0.280	U	0.560	U	0.560	U	0.09
BBK2.8	Oct93	10/13/93	LNGEAR	M	4776	R	49.0	13.8	.	0.384	U	0.768	U	0.768	U	0.13
BBK2.8	Oct93	10/13/93	LNGEAR	M	4777	R	36.6	12.6	.	0.496	U	0.992	U	0.992	U	0.31
BBK12.5	Oct93	10/13/93	LNGEAR	M	4980	R	52.3	14.5	.	0.392	U	0.784	U	0.784	U	0.07

BBK12.5	Oct93	10/13/93	LNGEAR	M	4981	R	57.9	13.4	.	0.376	U	0.752	U	0.752	U	0.05
BBK12.5	Oct93	10/13/93	LNGEAR	M	4982	R	45.0	13.5	.	0.448	U	0.896	U	0.896	U	0.11
BBK12.5	Oct93	10/13/93	LNGEAR	M	4983	R	36.0	12.6	.	0.432	U	0.864	U	0.864	U	0.05
BBK12.5	Oct93	10/13/93	LNGEAR	M	4984	R	42.5	13.7	.	0.400	U	0.800	U	0.800	U	0.05
BBK12.5	Oct93	10/13/93	LNGEAR	M	4985	R	46.7	13.9	.	0.336	U	0.672	U	0.672	U	0.18
BBK12.5	Oct93	10/13/93	LNGEAR	M	4986	R	48.2	13.7	.	0.360	U	0.720	U	0.720	U	0.17
BBK12.5	Oct93	10/13/93	LNGEAR	M	4987	R	43.4	13.4	.	0.360	U	0.720	U	0.720	U	0.07
BBK10.0	Oct93	10/13/93	LNGEAR	M	4610	R	45.9	13.3	.	0.440	U	0.052	J	0.016	J	0.20
BBK10.0	Oct93	10/13/93	LNGEAR	M	4611	R	48.2	13.8	.	0.344	U	0.688	U	0.688	U	0.06
BBK10.0	Oct93	10/13/93	LNGEAR	M	4612	R	43.4	13.0	.	0.380	U	0.041	J	0.032	J	0.16
BBK10.0	Oct93	10/13/93	LNGEAR	M	4613	R	55.3	13.4	.	0.316	U	0.632	U	0.024	J	0.25
BBK10.0	Oct93	10/13/93	LNGEAR	M	4614	R	41.1	12.7	.	0.024	J	0.039	J	0.015	J	0.19
BBK10.0	Oct93	10/13/93	LNGEAR	M	4615	R	45.4	13.2	.	0.029	J	0.058	J	0.032	J	0.30
BBK10.0	Oct93	10/13/93	LNGEAR	M	4616	R	52.5	13.8	.	0.311	U	0.622	U	0.622	U	0.10
BBK10.0	Oct93	10/13/93	LNGEAR	M	4617	R	42.4	13.1	.	0.500	U	1.000	U	1.000	U	0.06
LUK7.2	Oct93	10/14/93	SPBASS	F	4849	R	146.0	22.5	.	0.106	.	0.156	J	0.192	.	0.08
LUK9.0	Oct93	10/14/93	LNGEAR	M	4800	R	57.7	14.0	.	0.188	J	0.246	J	0.188	J	0.06
LUK9.0	Oct93	10/14/93	LNGEAR	M	4801	R	29.6	11.7	.	0.124	J	0.328	J	0.374	J	0.00
LUK9.0	Oct93	10/14/93	LNGEAR	M	4802	R	24.9	11.5	.	0.456	U	0.912	U	0.393	J	0.00
LUK9.0	Oct93	10/14/93	LNGEAR	M	4803	R	28.1	11.5	.	0.720	U	1.440	U	0.237	J	0.00
LUK9.0	Oct93	10/14/93	LNGEAR	M	4804	R	28.6	11.7	.	0.284	J	0.720	U	0.945	.	0.05
LUK9.0	Oct93	10/14/93	LNGEAR	M	4805	R	27.8	11.4	.	0.840	.	0.830	.	0.460	J	0.37
LUK9.0	Oct93	10/14/93	LNGEAR	M	4806	R	27.8	11.6	.	0.103	J	0.640	U	0.548	J	0.04
LUK9.0	Oct93	10/14/93	LNGEAR	M	4807	R	26.1	11.6	.	0.038	J	0.672	U	0.293	J	0.04
LUK4.3	Oct93	10/14/93	SPBASS	M	4850	R	385.0	30.9	.	0.033	J	0.084	J	0.096	J	0.09
LUK4.3	Oct93	10/14/93	SPBASS	F	4851	R	571.0	33.6	.	0.081	U	0.012	J	0.016	J	0.03
LUK4.3	Oct93	10/14/93	SPBASS	M	4852	R	679.0	35.8	.	0.035	J	0.160	J	0.286	J	0.27
LUK4.3	Oct93	10/14/93	SPBASS	M	4853	R	187.0	23.9	.	0.123	.	0.217	.	0.239	.	0.24
LUK4.3	Oct93	10/14/93	SPBASS	F	4854	R	217.0	25.2	.	0.243	.	0.393	.	0.316	J	0.60
LUK4.3	Oct93	10/14/93	LNGEAR	M	4870	R	37.3	13.0	.	0.536	U	0.029	J	0.014	J	0.04
LUK4.3	Oct93	10/14/93	LNGEAR	M	4871	R	42.7	12.9	.	0.440	U	0.074	J	0.060	J	0.52
LUK4.3	Oct93	10/14/93	LNGEAR	M	4872	R	38.9	13.1	.	0.041	J	0.163	J	0.089	J	0.02
LUK4.3	Oct93	10/14/93	LNGEAR	M	4873	R	38.4	13.7	.	0.512	U	0.128	J	0.051	J	0.06
LUK4.3	Oct93	10/14/93	LNGEAR	M	4874	R	38.3	12.3	.	0.032	J	0.157	J	0.071	J	0.64
LUK4.3	Oct93	10/14/93	LNGEAR	M	4875	R	38.5	12.9	.	0.464	U	0.021	J	0.029	J	0.06
LUK4.3	Oct93	10/14/93	LNGEAR	F	4876	R	40.5	12.5	.	0.424	U	0.848	U	0.848	U	0.09
LUK4.3	Oct93	10/14/93	LNGEAR	M	4877	R	36.4	12.6	.	0.488	U	0.050	J	0.067	J	0.14
BBK9.1	Oct93	10/14/93	SPBASS	F	4720	R	405.0	31.0	0.95	0.017	J	0.049	J	0.079	J	0.10
BBK9.1	Oct93	10/14/93	SPBASS	F	4721	R	493.0	34.2	0.58	0.025	J	0.071	J	0.076	J	0.14
BBK9.1	Oct93	10/14/93	SPBASS	M	4722	R	559.0	32.8	0.60	0.013	J	0.043	J	0.047	J	0.10
BBK9.1	Oct93	10/14/93	SPBASS	M	4723	R	349.0	29.1	0.69	0.063	J	0.178	J	0.196	J	0.19
BBK9.1	Oct93	10/14/93	SPBASS	M	4724	R	349.0	30.2	0.44	0.053	J	0.116	J	0.112	J	0.20
BBK9.1	Oct93	10/14/93	SPBASS	F	4725	R	587.0	34.1	0.59	0.023	J	0.047	J	0.049	J	0.21
BBK9.1	Oct93	10/14/93	SPBASS	F	4726	R	348.0	29.5	0.45	0.043	J	0.099	J	0.093	J	0.21
BBK9.1	Oct93	10/14/93	SPBASS	F	4727	R	480.0	32.6	0.60	0.035	J	0.095	J	0.108	J	0.24

BBK9.1	Oct93	10/14/93	LNGEAR	M	4970	R	46.1	13.6	.	0.005	J	0.011	J	0.036	J	0.10
BBK9.1	Oct93	10/14/93	LNGEAR	M	4971	R	54.9	13.9	.	0.068	J	0.128	J	0.107	J	0.30
BBK9.1	Oct93	10/14/93	LNGEAR	M	4972	R	52.7	13.6	.	0.544	U	0.026	J	0.007	J	0.00
BBK9.1	Oct93	10/14/93	LNGEAR	M	4973	R	54.4	13.8	.	0.059	J	0.078	J	0.123	J	0.25
BBK9.1	Oct93	10/14/93	LNGEAR	M	4974	R	48.1	13.1	.	0.122	J	0.127	J	0.092	J	0.49
BBK9.1	Oct93	10/14/93	LNGEAR	M	4975	R	45.1	13.6	.	0.037	J	0.032	J	0.021	J	0.09
BBK9.1	Oct93	10/14/93	LNGEAR	M	4976	R	51.9	14.0	.	0.029	J	0.040	J	0.021	J	0.11
BBK9.1	Oct93	10/14/93	LNGEAR	M	4977	R	54.7	13.6	.	0.031	J	0.034	J	0.021	J	0.10
LUK7.2	Apr94	5/2/94	LNGEAR	M	4835	R	56.7	12.8	0.10	0.063	U	0.126	U	0.126	U	0.05
LUK7.2	Apr94	5/2/94	LNGEAR	M	4836	R	52.2	13.4	0.09	0.057	J	0.197	J	0.251	J	0.05
LUK7.2	Apr94	5/2/94	LNGEAR	M	4837	R	48.3	13.2	0.08	0.120	J	0.292	J	0.208	J	0.07
LUK7.2	Apr94	5/2/94	LNGEAR	M	4838	R	45.6	12.6	0.09	0.088	U	0.127	J	0.167	J	0.04
LUK4.3	Apr94	5/2/94	LNGEAR	M	8300	R	41.0	12.1	.	0.464	U	0.020	J	0.012	J	0.14
LUK4.3	Apr94	5/2/94	LNGEAR	M	8301	R	57.7	13.1	.	0.043	J	0.075	J	0.026	J	0.43
LUK4.3	Apr94	5/2/94	LNGEAR	M	8302	R	79.9	14.2	.	0.028	J	0.075	J	0.125	J	1.59
LUK4.3	Apr94	5/2/94	LNGEAR	M	8303	R	71.9	14.1	.	0.045	J	0.080	J	0.174	J	0.94
LUK4.3	Apr94	5/2/94	LNGEAR	M	8304	R	36.9	11.8	.	0.470	U	0.061	J	0.129	J	0.14
LUK4.3	Apr94	5/2/94	LNGEAR	F	8305	R	34.0	11.3	.	0.678	U	0.023	J	0.042	J	0.79
LUK4.3	Apr94	5/2/94	LNGEAR	F	8306	R	30.5	11.0	.	0.698	U	0.041	J	0.090	J	0.41
LUK4.3	Apr94	5/2/94	LNGEAR	M	8307	R	35.1	11.1	.	0.083	J	0.192	J	0.332	J	1.03
BBK12.5	Apr94	5/2/94	LNGEAR	M	8310	R	84.9	15.0	0.08	0.312	U	0.624	U	0.624	U	0.73
BBK12.5	Apr94	5/2/94	LNGEAR	M	8311	R	54.7	12.5	0.07	0.400	U	0.800	U	0.800	U	0.91
BBK12.5	Apr94	5/2/94	LNGEAR	M	8312	R	49.8	12.8	0.08	0.352	U	0.704	U	0.704	U	1.40
BBK12.5	Apr94	5/2/94	LNGEAR	M	8313	R	87.4	14.8	0.09	0.259	U	0.518	U	0.518	U	0.83
BBK12.5	Apr94	5/2/94	LNGEAR	M	8314	R	52.6	13.1	0.10	0.585	U	1.170	U	1.170	U	1.10
BBK12.5	Apr94	5/2/94	LNGEAR	M	8315	R	37.7	11.8	0.07	0.800	U	1.600	U	1.600	U	1.00
BBK12.5	Apr94	5/2/94	LNGEAR	M	8316	R	67.6	14.2	0.09	0.532	U	1.064	U	1.064	U	0.44
BBK12.5	Apr94	5/2/94	LNGEAR	M	8317	R	41.5	11.5	0.07	0.832	U	1.664	U	1.664	U	0.42
MAK13.8	Apr94	5/3/94	LNGEAR	M	8320	R	32.6	11.5	0.07	.	.	.	.	.	.	.
MAK13.8	Apr94	5/3/94	LNGEAR	M	8321	R	74.9	15.4	0.18	.	.	.	.	.	.	.
MAK13.8	Apr94	5/3/94	LNGEAR	M	8322	R	71.5	13.9	0.14	.	.	.	.	.	.	.
MAK13.8	Apr94	5/3/94	LNGEAR	M	8323	R	43.2	12.1	0.17	.	.	.	.	.	.	.
MAK13.8	Apr94	5/3/94	LNGEAR	M	8324	R	32.4	11.4	0.12	.	.	.	.	.	.	.
MAK13.8	Apr94	5/3/94	LNGEAR	M	8325	R	70.5	14.2	0.11	.	.	.	.	.	.	.
MAK13.8	Apr94	5/3/94	LNGEAR	M	8326	R	30.2	10.9	0.12	.	.	.	.	.	.	.
MAK13.8	Apr94	5/3/94	LNGEAR	M	8327	R	35.4	11.4	0.11	.	.	.	.	.	.	.
LUK9.0	Apr94	5/3/94	LNGEAR	M	8340	R	36.1	12.2	.	0.480	U	1.365	.	2.056	.	0.22
LUK9.0	Apr94	5/3/94	LNGEAR	M	8341	R	32.6	11.3	.	0.259	J	0.770	J	1.126	.	0.25
LUK9.0	Apr94	5/3/94	LNGEAR	M	8342	R	24.3	10.2	.	0.556	J	1.264	J	0.825	J	0.60
LUK9.0	Apr94	5/3/94	LNGEAR	F	8343	R	32.3	11.0	.	0.353	J	0.315	J	0.271	J	0.14
LUK9.0	Apr94	5/3/94	LNGEAR	M	8344	R	37.4	116.0	.	0.164	J	0.172	J	0.164	J	0.00
LUK9.0	Apr94	5/3/94	LNGEAR	M	8345	R	29.1	11.9	.	0.691	U	0.124	J	0.632	J	0.00
LUK9.0	Apr94	5/3/94	LNGEAR	F	8346	R	33.7	11.6	.	0.037	J	0.016	J	0.024	J	0.03
LUK9.0	Apr94	5/3/94	LNGEAR	M	8347	R	22.9	9.9	.	0.094	J	0.294	J	0.363	J	0.16

BBK9.1	Apr94	5/3/94	LNGEAR	M	8350	R	77.7	14.8	0.19	0.032	J	0.117	J	0.116	J	1.00
BBK9.1	Apr94	5/3/94	LNGEAR	M	8351	R	60.9	13.5	0.16	.	.	.	.	.	.	.
BBK9.1	Apr94	5/3/94	LNGEAR	M	8352	R	80.5	15.0	0.27	0.041	U	0.087	J	0.082	J	0.43
BBK9.1	Apr94	5/3/94	LNGEAR	M	8353	R	53.4	13.7	0.29	0.370	U	0.740	U	0.096	J	0.09
BBK9.1	Apr94	5/3/94	LNGEAR	M	8354	R	47.3	12.8	0.15	0.447	U	0.078	J	0.088	J	0.11
BBK9.1	Apr94	5/3/94	LNGEAR	M	8355	R	86.4	15.1	0.16	0.035	U	0.033	J	0.070	U	0.59
BBK9.1	Apr94	5/3/94	LNGEAR	M	8356	R	48.0	13.0	0.26	0.408	U	0.186	J	0.316	J	0.86
BBK9.1	Apr94	5/3/94	LNGEAR	M	8357	R	51.8	13.5	0.22	0.451	U	0.086	J	0.128	J	0.19
BBK10.0	Apr94	5/3/94	LNGEAR	M	8330	R	57.4	13.5	0.35	0.538	U	1.075	U	0.113	J	0.27
BBK10.0	Apr94	5/3/94	LNGEAR	M	8331	R	55.9	13.6	0.33	0.509	U	1.018	U	0.066	J	0.42
BBK10.0	Apr94	5/3/94	LNGEAR	M	8332	R	68.8	14.6	0.18	0.526	U	1.053	U	0.219	J	0.44
BBK10.0	Apr94	5/3/94	LNGEAR	M	8333	R	62.4	13.8	0.12	0.538	U	0.037	J	1.075	U	0.37
BBK10.0	Apr94	5/3/94	LNGEAR	M	8334	R	45.3	12.4	0.16	0.608	U	0.045	J	1.216	U	0.41
BBK10.0	Apr94	5/3/94	LNGEAR	M	8335	R	47.1	12.5	0.11	0.820	U	0.127	J	0.204	J	1.00
BBK10.0	Apr94	5/3/94	LNGEAR	M	8336	R	70.5	14.2	0.13	0.037	J	0.049	J	0.071	J	0.55
BBK10.0	Apr94	5/3/94	LNGEAR	M	8337	R	54.4	13.6	0.53	1.040	U	0.046	J	0.123	J	0.44
BBK12.5	Oct94	10/19/94	LNGEAR	F	8590	R	54.4	14.1	.	0.071	U	0.071	U	0.071	U	0.41
BBK12.5	Oct94	10/19/94	LNGEAR	M	8591	R	36.6	12.8	.	0.081	U	0.081	U	0.081	U	0.31
BBK12.5	Oct94	10/19/94	LNGEAR	M	8592	R	33.8	12.6	.	0.094	U	0.094	U	0.094	U	0.21
BBK12.5	Oct94	10/19/94	LNGEAR	M	8593	R	35.1	12.1	.	0.061	U	0.061	U	0.061	U	0.43
BBK12.5	Oct94	10/19/94	LNGEAR	M	8594	R	41.9	13.1	.	0.120	U	0.120	U	0.120	U	0.41
BBK12.5	Oct94	10/19/94	LNGEAR	M	8595	R	33.2	12.4	.	0.115	U	0.115	U	0.115	U	0.44
BBK12.5	Oct94	10/19/94	LNGEAR	M	8596	R	39.2	12.4	.	0.058	U	0.058	U	0.058	U	0.41
BBK12.5	Oct94	10/19/94	LNGEAR	M	8597	R	32.7	12.6	.	0.099	U	0.099	U	0.099	U	0.53
BBK10.0	Oct94	10/19/94	LNGEAR	M	8670	R	38.2	12.6	.	0.097	U	0.06	JP	0.08	J	0.84
BBK10.0	Oct94	10/19/94	LNGEAR	M	8671	R	43.4	13.1	.	0.100	U	0.04	JP	0.11		0.44
BBK10.0	Oct94	10/19/94	LNGEAR	M	8672	R	44.3	13.7	.	0.078	U	0.06	JP	0.09	P	0.47
BBK10.0	Oct94	10/19/94	LNGEAR	M	8673	R	45.9	13.4	.	0.071	U	0.05	JP	0.07	J	0.51
BBK10.0	Oct94	10/19/94	LNGEAR	M	8674	R	37.9	13.0	.	0.102	U	0.12	P	0.17	P	1.13
BBK10.0	Oct94	10/19/94	LNGEAR	M	8675	R	43.6	12.8	.	0.080	U	0.06	JP	0.1	P	0.77
BBK10.0	Oct94	10/19/94	LNGEAR	M	8676	R	53.2	13.8	.	0.069	U	0.08	P	0.12	P	0.59
BBK10.0	Oct94	10/19/94	LNGEAR	M	8677	R	47.4	13.2	.	0.090	U	0.12	P	0.2	P	0.93
LUK9.0	Oct94	10/20/94	BLUGIL	M	8680	R	17.2	10.5	.	0.141	U	0.35	.	0.19	P	0.59
LUK9.0	Oct94	10/20/94	BLUGIL	M	8681	R	35.9	13.0	.	0.057	U	0.18	.	0.12	P	0.15
LUK9.0	Oct94	10/20/94	BLUGIL	M	8682	R	15.0	9.9	.	0.076	U	0.19	.	0.1	P	0.36
LUK9.0	Oct94	10/20/94	BLUGIL	M	8683	R	45.0	13.8	.	0.031	U	0.05	.	0.06	P	0.16
LUK9.0	Oct94	10/20/94	BLUGIL	F	8684	R	15.8	10.2	.	0.093	U	0.22	.	0.13	P	0.26
LUK9.0	Oct94	10/20/94	BLUGIL	F	8685	R	14.6	9.9	.	0.090	U	0.16	.	0.09	.	0.34
LUK9.0	Oct94	10/20/94	YBULLHD	F	8686	R	63.1	17.9	.	0.041	U	0.19	P	0.32	P	0.11
LUK9.0	Oct94	10/20/94	YBULLHD	M	8687	R	33.0	13.2	.	0.118	U	0.27	P	0.22	P	0.56
LUK9.0	Oct94	10/20/94	YBULLHD	M	8688	R	41.2	15.0	.	0.028	U	0.19	.	0.19	P	0.14
LUK4.2	Oct94	10/20/94	LNGEAR	M	8690	R	33.4	12.5	.	0.156	U	0.16	U	0.08	JP	0.06
LUK4.2	Oct94	10/20/94	LNGEAR	M	8691	R	44.7	13.1	.	0.096	U	0.04	JP	0.05	JP	0.12
LUK4.2	Oct94	10/20/94	LNGEAR	M	8692	R	51.1	13.6	.	0.074	U	0.07	JP	0.06	JP	0.28
LUK4.2	Oct94	10/20/94	LNGEAR	F	8693	R	33.1	12.8	.	0.118	U	0.07	JP	0.06	JP	0.21
LUK4.2	Oct94	10/20/94	LNGEAR	M	8694	R	33.5	12.2	.	0.102	U	0.08	JP	0.08	JP	0.24

LUK4.2	Oct94	10/20/94	LNGEAR	M	8695	R	46.3	14.0	.	0.068	U	0.06	JP	0.05	JP	0.39
LUK4.2	Oct94	10/20/94	LNGEAR	M	8696	R	27.8	11.7	.	0.128	U	0.1	JP	0.12	JP	0.33
LUK4.2	Oct94	10/20/94	LNGEAR	M	8697	R	38.0	12.6	.	0.090	U	0.07	JP	0.09	P	0.27
LUK4.2	Oct94	10/20/94	LMBASS	F	8698	R	142.0	22.7	0.23	.	.	0.053	PJ	0.098	P	0.543
LUK4.2	Oct94	10/20/94	SPBASS	M	8699	R	219.0	25.0	0.28	.	.	0.190	.	0.160	.	0.234
BBK9.1	Oct94	10/20/94	LNGEAR	M	8640	R	54.3	14.4	.	.	.	0.03	JP	0.06	.	0.28
BBK9.1	Oct94	10/20/94	LNGEAR	M	8641	R	50.1	14.5	.	.	.	0.07	J	0.1	.	0.24
BBK9.1	Oct94	10/20/94	LNGEAR	M	8642	R	48.1	13.7	.	.	.	0.11	P	0.13	P	0.47
BBK9.1	Oct94	10/20/94	LNGEAR	M	8643	R	49.6	13.7	.	.	.	0.12	P	0.19	.	0.21
BBK9.1	Oct94	10/20/94	LNGEAR	M	8644	R	69.2	15.1	.	.	.	0.06	.	0.09	.	0.26
BBK9.1	Oct94	10/20/94	LNGEAR	M	8645	R	57.7	14.3	.	.	.	0.06	.	0.08	.	0.58
BBK9.1	Oct94	10/20/94	LNGEAR	M	8646	R	41.7	13.1	.	.	.	0.04	JP	0.06	J	0.35
BBK9.1	Oct94	10/20/94	LNGEAR	M	8647	R	50.3	13.8	.	.	.	0.04	JP	0.05	JP	0.35
BBK9.1	Oct94	10/20/94	SPBASS	M	8660	R	240.0	26.0	0.49	.	.	0.064	P	0.071	.	0.15
BBK9.1	Oct94	10/20/94	SPBASS	M	8661	R	523.0	32.5	0.45	.	.	0.045	J	0.140	.	0.14
BBK9.1	Oct94	10/20/94	SPBASS	F	8662	R	460.0	32.4	0.59	.	.	0.076	.	0.240	.	0.29
BBK9.1	Oct94	10/20/94	SPBASS	M	8663	R	244.0	26.7	0.63	.	.	0.030	J	0.120	.	0.05
BBK9.1	Oct94	10/20/94	SPBASS	M	8664	R	183.0	24.8	0.22	.	.	0.030	JP	0.137	.	0.19
BBK9.1	Oct94	10/20/94	SPBASS	F	8665	R	228.0	26.2	0.31	.	.	0.038	PJ	0.077	P	0.15
BBK9.1	Oct94	10/20/94	SPBASS	M	8666	R	217.0	27.3	0.46	.	.	0.055	P	0.135	.	0.12
BBK9.1	Oct94	10/20/94	SPBASS	M	8667	R	155.0	23.0	0.30	.	.	0.041	J	0.068	.	0.10
BBK2.1	Oct94	10/20/94	LNGEAR	F	2040	R	40.4	13.5	.	.	.	0.01	JP	0.01	JP	0.51
BBK2.1	Oct94	10/20/94	LNGEAR	M	2041	R	54.4	14.0	.	.	.	0.02	JP	0.01	JP	0.25
BBK2.1	Oct94	10/20/94	LNGEAR	M	2042	R	40.1	13.4	.	.	.	0.04	U	0.01	JP	0.3
BBK2.1	Oct94	10/20/94	LNGEAR	M	2043	R	52.0	14.7	.	.	.	0.04	U	0.07	JP	0.18
BBK2.1	Oct94	10/20/94	LNGEAR	M	2044	R	43.3	13.2	.	.	.	0.01	JP	0.01	J	0.77
BBK2.1	Oct94	10/20/94	LNGEAR	M	2045	R	37.3	12.4	.	.	.	0.01	JP	0.01	JP	0.36
BBK2.1	Oct94	10/20/94	LNGEAR	M	2046	R	53.3	14.5	.	.	.	0.01	JP	0.01	JP	0.07
BBK2.1	Oct94	10/20/94	LNGEAR	M	2047	R	53.2	13.7	.	.	.	0	JP	0.02	JP	0.11

Surface Soil

CH2MHill. 1991. Results of the Site Investigation at the Paducah Gaseous
Diffusion Plant, Paducah, Kentucky. U.S. Department of Energy.
Document No. KY/ER-4.

BANKDATA FOR LITTLE BAYOU AND BIG BAYOU CREEKS									
station	sampid	labsmpid	labcode	analysis	qual	result	dataqual	units	dateanalyzed
SB001	CH202101	9008L521-3	WES	PCB-1016	U	12000	D	ug/kg	09/01/90
SB001	CH202101	9008L521-3	WES	PCB-1221	U	12000	D	ug/kg	09/01/90
SB001	CH202101	9008L521-3	WES	PCB-1232	U	12000	D	ug/kg	09/01/90
SB001	CH202101	9008L521-3	WES	PCB-1242	U	12000	D	ug/kg	09/01/90
SB001	CH202101	9008L521-3	WES	PCB-1248		53000	D	ug/kg	09/01/90
SB001	CH202101	9008L521-3	WES	PCB-1254	U	24000	D	ug/kg	09/01/90
SB001	CH202101	9008L521-3	WES	PCB-1260	J	5700	D	ug/kg	09/01/90
SB004	CH202104	9008L472-4	WES	PCB-1016	U	54	D	ug/kg	08/27/90
SB004	CH202104	9008L472-4	WES	PCB-1221	U	54	D	ug/kg	08/27/90
SB004	CH202104	9008L472-4	WES	PCB-1232	U	54	D	ug/kg	08/27/90
SB004	CH202104	9008L472-4	WES	PCB-1242	U	54	D	ug/kg	08/27/90
SB004	CH202104	9008L472-4	WES	PCB-1248	U	54	D	ug/kg	08/27/90
SB004	CH202104	9008L472-4	WES	PCB-1254	U	110	D	ug/kg	08/27/90
SB004	CH202104	9008L472-4	WES	PCB-1260		250	D	ug/kg	08/27/90
SB009	CH202109	9008L521-1	WES	PCB-1016	U	56000	D	ug/kg	09/01/90
SB009	CH202109	9008L521-1	WES	PCB-1221	U	56000	D	ug/kg	09/01/90
SB009	CH202109	9008L521-1	WES	PCB-1232	U	56000	D	ug/kg	09/01/90
SB009	CH202109	9008L521-1	WES	PCB-1242	U	56000	D	ug/kg	09/01/90
SB009	CH202109	9008L521-1	WES	PCB-1248	J	29000	D	ug/kg	09/01/90
SB009	CH202109	9008L521-1	WES	PCB-1254	U	110000	D	ug/kg	09/01/90
SB009	CH202109	9008L521-1	WES	PCB-1260	J	6100	D	ug/kg	09/01/90
SB009	CH202110	9008L521-5	WES	PCB-1016	U	22000	D	ug/kg	09/04/90
SB009	CH202110	9008L521-5	WES	PCB-1221	U	22000	D	ug/kg	09/04/90
SB009	CH202110	9008L521-5	WES	PCB-1232	U	22000	D	ug/kg	09/04/90
SB009	CH202110	9008L521-5	WES	PCB-1242	U	22000	D	ug/kg	09/04/90
SB009	CH202110	9008L521-5	WES	PCB-1248		17000	D	ug/kg	09/04/90
SB009	CH202110	9008L521-5	WES	PCB-1254	U	46000	D	ug/kg	09/04/90
SB009	CH202110	9008L521-5	WES	PCB-1260	J	4000	D	ug/kg	09/04/90
SB011	CH202113	9008L527-5	WES	PCB-1016	U	97	D	ug/kg	08/31/90
SB011	CH202113	9008L527-5	WES	PCB-1221	U	97	D	ug/kg	08/31/90
SB011	CH202113	9008L527-5	WES	PCB-1232	U	97	D	ug/kg	08/31/90
SB011	CH202113	9008L527-5	WES	PCB-1242	U	97	D	ug/kg	08/31/90
SB011	CH202113	9008L527-5	WES	PCB-1248	U	97	D	ug/kg	08/31/90
SB011	CH202113	9008L527-5	WES	PCB-1254	U	190	D	ug/kg	08/31/90
SB011	CH202113	9008L527-5	WES	PCB-1260	U	190	D	ug/kg	08/31/90
SB011	CH202114	9008L527-6	WES	PCB-1016	U	100	D	ug/kg	09/07/90
SB011	CH202114	9008L527-6	WES	PCB-1221	U	100	D	ug/kg	09/07/90
SB011	CH202114	9008L527-6	WES	PCB-1232	U	100	D	ug/kg	09/07/90
SB011	CH202114	9008L527-6	WES	PCB-1242	U	100	D	ug/kg	09/07/90
SB011	CH202114	9008L527-6	WES	PCB-1248	U	100	D	ug/kg	09/07/90
SB011	CH202114	9008L527-6	WES	PCB-1254	U	200	D	ug/kg	09/07/90
SB011	CH202114	9008L527-6	WES	PCB-1260	U	200	D	ug/kg	09/07/90

BANKDATA FOR LITTLE BAYOU AND BIG BAYOU CREEKS									
station	sampid	labsmpid	labcode	analysis	qual	result	dataqual	units	dateanalyzed
SB014	CH202119	9008L527-1	WES	PCB-1016	U	110	D	ug/kg	08/31/90
SB014	CH202119	9008L527-1	WES	PCB-1221	U	110	D	ug/kg	08/31/90
SB014	CH202119	9008L527-1	WES	PCB-1232	U	110	D	ug/kg	08/31/90
SB014	CH202119	9008L527-1	WES	PCB-1242	U	110	D	ug/kg	08/31/90
SB014	CH202119	9008L527-1	WES	PCB-1248	U	110	D	ug/kg	08/31/90
SB014	CH202119	9008L527-1	WES	PCB-1254	U	220	D	ug/kg	08/31/90
SB014	CH202119	9008L527-1	WES	PCB-1260	U	220	D	ug/kg	08/31/90

APPENDIX C

**Kentucky Department of Fish and Wildlife Resources Data
PADUCAH GASEOUS DIFFUSION PLANT
PCB SEDIMENT SAMPLING SURVEY**

409
North Forbes Road
Lexington, Kentucky
40511-2050
606-233-0574
606-254-4800 FAX

October 26, 1995

O.1.1.94355L05

Mr. Charles Logsdon
Kentucky Department of Fish and Wildlife Resources
10535 Ogden Landing Road
Kevil, Kentucky 42053

Re: PCB Risk Calculations
Paducah Gaseous Diffusion Plant

Dear Mr. Logsdon:

FMSM is conducting a preliminary risk calculation for the Little Bayou and Big Bayou areas around the Paducah Gaseous Diffusion Plant. This subject was discussed at a meeting in which you attended on September 7, 1995. During that meeting you indicated that your office could provide information on the recreational use of these areas. In response to your suggestion, we have developed the following list of questions. Please try to research your site use data and answer as many of these questions as possible. If data is not directly available to answer these questions we would appreciate an estimate based on your best professional judgment.

Big Bayou

1. What is the average number of visitors per year to Big Bayou?
2. Of this number, how many are adults and how many are children?
3. Are most of your visitors repeat or one-time visitors on a yearly basis?
4. What is the average time (hours) spent in Big Bayou? Is there a difference in average time spent between adult and child usage?
5. What are the common recreational usages in the area? What is the percentage breakdown of usages by the visitors (i.e. what percentage of visitors fish, hunt, hike, swim, etc.)?
6. What is the number of repeat visits per year by any one individual or group of individuals? What is the average time spent (hours) in the area by the higher frequency visitors?

7. For individuals who are fishing in the area, are they mostly bank fishing or wade fishing? Can you estimate the percentage breakdown between the two? What is the average time spent in the area by a fisherman?
8. Is there a harvestable fish population in Big Bayou? If there is, is there enough to support subsistence fishing (i.e., 0.284 kilograms of meat flesh/meal) for one person to eat 128 meals a year? If not, how much fish, and how often could a person best expect to harvest a meal for consumption?

Little Bayou

I realize that during the September 7th meeting, you stated there is little to no recreational use of the Little Bayou areas. However, it would be helpful if you could answer the same questions about Little Bayou, as asked of Little Bayou. Therefore, we are repeating the following questions.

1. What is the average number of visitors per year to Little Bayou?
2. Of this number, how many are adults and how many are children?
3. Are most of your visitors repeat or one-time visitors on a yearly basis?
4. What is the average time (hours) spent in Little Bayou? Is there a difference in average time spent between adult and child usage?
5. What are the common recreational usages in the area? What is the percentage breakdown of usages by the visitors (i.e. what percentage of visitors fish, hunt, hike, swim, etc.)?
6. What is the number of repeat visits per year by any one individual or group of individuals? What is the average time spent (hours) in the area by the higher frequency visitors?
7. For individuals who are fishing in the area, are they mostly bank fishing or wade fishing? Can you estimate the percentage breakdown between the two? What is the average time spent in the area by a fisherman?
8. Is there a harvestable fish population in Little Bayou? If there is, is there enough to support subsistence fishing (i.e., 0.284 kilograms of meat flesh/meal) for one person to eat 128 meals a year? If not, how much fish, and how often could a person best expect to harvest a meal for consumption?

Kentucky Department of Fish and Wildlife Resources
October 26, 1995
Page 3

We appreciate your help in answering these questions. After you have reviewed these, if you have any questions, or if the questions need clarification, please call.

Sincerely,

FULLER, MOSSBARGER, SCOTT AND MAY
ENGINEERS, INC.

Stephen L. Scott, P.E.
Project Manager

/esh

c: David Asburn ✓
Tom McGee ✓
Bob Sneed ✓
David Brancato ✓

facsimile
TRANSMITTAL

to: Stephen Scott, P.E.
fax #: 606-254-4800
re: Big Bayou & Little Bayou
date: November 8, 1995
pages: 4, including this cover sheet.

From the desk of...

Charles Logsdon
WMA Supervisor
Ky. Dept. Of Fish & Wildlife Resources
10535 Ogden Landing Rd.
Kovil, KY. 42053

(502)488-3233
Fax

Stephen Scott, P.E.
Fuller, Mossbarger, Scott and May
Engineers, Inc.
1409 North Forbes Road
Lexington, Ky. 40511-2050

Dear Mr. Scott:

I have answered these question as accurately as possible. If you have any other questions, or questions about my answers feel free to contact me. Sorry about the delay, but you're letter came during some of our deer hunting seasons.

Sincerely,

Charlie Logsdon

cc: Wayne Davis
Don Walker

Little Bayou

1. The number of people visiting Little Bayou is essentially zero, with the exception of PGDP personnel and a few fishermen(maybe, 20 visits annually) that fish a large beaver pond above the outfalls of the plant. A few people (bowhunters and dog trainers) may cross the creek occasionally, but these visits would be brief(the majority would be measured in seconds or minutes). Field trial galleries do cross the creek(over a large dirt-covered culvert) north of McCaw Road, however, they do not enter the creek and the whole process takes seconds.
2. The visitors would be adults.
3. Refer to Big Bayou question 3. Visitors to Little Bayou would be repeat users, probably less than 10 visits per year and most of them in the brief encounter scenario described in question 1.
4. Most encounters with Little Bayou would be measured in seconds. Fishermen that use the beaver pond above the outfalls, may fish on average 2 hours.
5. See Big Bayou question 5.
6. Field trials that cross the creek may occur 12-15 weekends of the year. Most of the participants would be repeat users. The sum of all the encounters with Little Bayou would be measured in minutes for the most frequent user and most would only cross the creek on the culvert and dirt crossings.
7. All fishermen in the beaver pond would be bank fishermen as the pond is too deep to wade.
8. Other than the beaver pond above the outfalls, it would be nearly impossible to catch 0.284 kgs of fish from Little Bayou. There is a fish population, but most would fall in the minnow category and are not desirable by fishermen. In the beaver pond, it would be possible to catch this amount, but it would not support subsistence fishing(128 meals/year).

Big Bayou

Question 1: The number of visits by people using Big Bayou specifically, is estimated to be 150 visits. This is for a specific activity involving Big Bayou, such as fishing. More people may be in the vicinity while using the WKWMA, but their use of Big Bayou may be for only an instant (i.e., using a log to cross Big Bayou to hunt on the other side of the creek).

Question 2: Of the 150 visits of people using Big Bayou, 100 are adults and 50 are children. This is an estimate based on our observations of people using the area.

Question 3: Most of these people would be one time users. However, 10% of the total number of users could be classified as repeat users. The highest number of visits by one person specifically using Big Bayou, would probably be <10.

Question 4: The average time spent in Big Bayou by users is unknown. However, I feel the amount of time spent/trip would be similar to other activities. During 1994, the average number of hours spent/trip for the following activities were: Quail hunting - 3.49 hrs/trip (n=158), rabbit hunting - 3.25 (n=168), bowhunting for deer - 3.48 (n=1115), duck hunting - 2.4 (n=69), and raccoon hunting - 2.63 (n=20). Raccoon hunting and duck hunting would be the activities most likely associated with Big Bayou. There would be little, if any, difference between adult and child usage of the area.

Question 5: This question is difficult to answer. Do you mean for WKWMA or Big Bayou? WKWMA is heavily used by a wide variety of users. Annually, the estimated number of visits for the following activities are: fishing - 5000 visits/year, hunting and dog training 4-6000, field trials - 1500, hiking - 100, berry & nut picking - 200, driving through for a variety of reasons - 50,000.

For activities involving Big Bayou alone: fishing - 150, hunting - ? (explained in question 1).

Question 6: Refer to questions 3 and 4.

Question 7: Most, if not all would be bank fishermen. Most of the fishing would occur at 3 points: 1) where the iron bridge in tract 4 crosses Big Bayou, 2) where the collapsed bridge in tract 4 crosses Big Bayou (by weir constructed by PGDP), and 3) where the concrete crossing bridges Big Bayou in tract 6. While it may occur, no wade fishing has been observed. No actual data is available, but should be similar to the length of visits noted in question 4.

Question 8: There is a harvestable fish population in Big Bayou. A person could potentially expect to catch 0.284 kgs of fish on a regular basis (depending on the skill of the fisherman), however, this is assuming that the person is not culling (throwing back extremely small fish). The frequency of being able to catch 0.248 kgs of fish would increase as one approaches the mouth of Big Bayou. Also, the only way the creek could support 128 meals a year is if there was major influx of fish from the Ohio River. This does occur when there is a backwater. During the backwater periods catches of 50 to several hundred pounds of catfish can be taken (this has been observed) on trotlines. This would not be indicative of risks associated with the plant.

APPENDIX D

**Exposure and Risk Calculations
PADUCAH GASEOUS DIFFUSION PLANT
PCB SEDIMENT SAMPLING SURVEY**

Pathway Exposure and Risk Summary

Risk Assessment: Polychlorinated Biphenyls

Sheet1

Calculational Spreadsheet: Dermal Absorption of PCBs in Sediment
Location: Big Bayou Creek (BBC) and Little Bayou Creek (LBC)

CALCULATIONAL NOMENCLATURE	EXPOSURE SCENARIO VALUES							
	1	2	3	4	5	6	7	8
CS = PCB Concentration in Sediment (mg/kg) =	0.0651	0.0651	0.0651	0.0651	0.4851	0.4851	0.4851	0.4851
CF = Conversion Factor (kg/mg) =	1.00E-06	1.00E-06	1.00E-06	1.00E-06	1.00E-06	1.00E-06	1.00E-06	1.00E-06
SA = Skin Surface Area (cm ² /event) =	9300.00	7400.00	9300.00	7400.00	9300.00	7400.00	9300.00	7400.00
AF = Soil to Skin Adherence Factor (mg/cm ²) =	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
ABS = Absorption Factor =	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10
EF = Exposure Frequency (event/year) =	52.00	140.00	10.00	10.00	52.00	140.00	10.00	10.00
ED = Exposure Duration (year) =	22.00	12.00	22.00	12.00	22.00	12.00	22.00	12.00
BW = Body Weight (kg) =	70.00	43.00	70.00	43.00	70.00	43.00	70.00	43.00
AT ₁ = Averaging Time Carcinogenic Effect (day)	25550.00	25550.00	25550.00	25550.00	25550.00	25550.00	25550.00	25550.00
AT ₂ = Averaging Time Non-Carcinogenic Effect (day) =	8030.00	4380.00	8030.00	4380.00	8030.00	4380.00	8030.00	4380.00
SF = Slope Factor (kg day/mg) =	7.70	7.70	7.70	7.70	7.70	7.70	7.70	7.70
RfD = Reference Dose (mg/kg day) =	2.00E-05	2.00E-05	2.00E-05	2.00E-05	2.00E-05	2.00E-05	2.00E-05	2.00E-05
CDI = Chronic (70 year) Daily Intake (mg/kg day) =	3.87E-08	7.37E-08	7.45E-09	5.26E-09	2.89E-07	5.49E-07	5.55E-08	3.92E-08
Carcinogenic Risk =	2.98E-07	5.67E-07	5.73E-08	4.05E-08	2.22E-06	4.23E-06	4.27E-07	3.02E-07
E = Non-Carcinogenic Exposure Level (mg/kg day) =	1.23E-07	4.30E-07	2.37E-08	3.07E-08	9.18E-07	3.20E-06	1.77E-07	2.29E-07
Non-Carcinogenic Hazard Index =	6.16E-03	2.15E-02	1.18E-03	1.53E-03	4.59E-02	1.60E-01	8.83E-03	1.14E-02

Scenario	Subject	Location	Method	Defaults	Lifetime Carcinogenic Risk =	
1	Adult	BBC	1	USEPA	(BBC, Method 1)	8.65E-07
2	Child	BBC	1	USEPA		
3	Adult	BBC	2	KDFWR	Lifetime Carcinogenic Risk =	9.79E-08
4	Child	BBC	2	KDFWR	(BBC, Method 2)	
5	Adult	LBC	1	USEPA		
6	Child	LBC	1	USEPA	Lifetime Carcinogenic Risk =	6.45E-06
7	Adult	LBC	2	KDFWR	(LBC, Method 1)	
8	Child	LBC	2	KDFWR	Lifetime Carcinogenic Risk =	7.29E-07
					(LBC, Method 2)	

Notes:

Lifetime Carcinogenic Risk accounts for risks due to exposure as a child and an adult.

Skin surface area for a child includes arms, hands, and lower legs.

Skin surface area for an adult includes arms, hands, feet, upper and lower legs.

Risk Assessment: Polychlorinated Biphenyls
Method: 1 (Default values provided by USEPA)
Location: Big Bayou Creek
Pathway: Dermal Absorption of PCBs in Sediment
User: Adult

where

NOMENCLATURE	VALUE
CS = PCB Concentration in Sediment (mg/kg) =	0.0651
CF = Conversion Factor (kg/mg) =	1.00E-06
SA = Skin Surface Area for Adult (cm ² /event) =	9300.00
AF = Soil to Skin Adherence Factor (mg/cm ²) =	1.00
ABS = Absorption Factor =	0.10
EF = Exposure Frequency (event/year) =	52.00
ED = Exposure Duration (year) =	22.00
BW = Body Weight (kg) =	70.00
AT ₁ = Averaging Time Carcinogenic Effects (day)	25550.00
AT ₂ = Averaging Time Non-Carcinogenic Effects (day) =	8030.00
SF = Slope Factor (kg day/mg) =	7.70
RfD = Reference Dose (mg/kg day) =	2.00E-05

CALCULATIONS:

CDI = Chronic (70 year) Daily Intake (mg/kg day)

$$\begin{aligned}
 &= \frac{CS \times CF \times SA \times AF \times ABS \times EF \times ED}{BW \times AT_1} \\
 &= \frac{0.0651 \text{ mg}}{\text{kg}} \times \frac{1.00\text{E-}6 \text{ kg}}{\text{mg}} \times \frac{9300 \text{ cm}^2}{\text{event}} \times \frac{1 \text{ mg}}{\text{cm}^2} \times 0.1 \times \frac{52 \text{ event}}{\text{year}} \times \frac{22 \text{ year}}{70 \text{ kg}} \times \frac{25550 \text{ day}}{25550 \text{ day}} \\
 &= 3.87\text{E-}08 \text{ mg/kg-day}
 \end{aligned}$$

Carcinogen Risk = CDI x SF

$$\begin{aligned}
 &= \frac{3.87\text{E-}08 \text{ mg}}{\text{kg day}} \times \frac{7.70 \text{ kg day}}{\text{mg}} \\
 &= 2.98\text{E-}07
 \end{aligned}$$

E = Non-Carcinogenic Exposure Level (mg/kg day)

$$\begin{aligned}
 &= \frac{CS \times CF \times SA \times AF \times ABS \times EF \times ED}{BW \times AT_2} \\
 &= \frac{0.0651 \text{ mg}}{\text{kg}} \times \frac{1.00\text{E-}6 \text{ kg}}{\text{mg}} \times \frac{9300 \text{ cm}^2}{\text{event}} \times \frac{1 \text{ mg}}{\text{cm}^2} \times 0.1 \times \frac{52 \text{ event}}{\text{year}} \times \frac{22 \text{ year}}{70 \text{ kg}} \times \frac{8030 \text{ day}}{8030 \text{ day}} \\
 &= 1.23\text{E-}07
 \end{aligned}$$

Risk Assessment: Polychlorinated Biphenyls
Method: 1 (Default values provided by USEPA)
Location: Big Bayou Creek
Pathway: Dermal Absorption of PCBs in Sediment
User: Adult

CALCULATIONS (cont'd):

$$\begin{aligned}\text{Non-Carcinogenic Hazard Index} &= \frac{E}{\text{RfD}} \\ &= \frac{1.23\text{E-}07 \text{ mg}}{\text{kg day}} \left| \frac{\text{kg day}}{2.00\text{E-}05 \text{ mg}} \right. \\ &= 6.16\text{E-}03\end{aligned}$$

Notes:

- 1.) Concentration data for sediment acquired from the following reference:

U.S. Corp of Engineers. 1994. PCB Sediment Survey, Big Bayou Creek and Little Bayou Creek, Paducah, Kentucky, Paducah Gaseous Diffusion Plant. Prepared for U.S. Department of Energy, Draft, September.

- 2.) RAGS dictates PCB Aroclor 1260 be used as standard PCB contaminant. PCB contaminants other than PCB 1260 which were detected in analysis were assumed to be toxicologically equivalent to PCB 1260. Thus, all PCB Arochlors detected were treated in the exposure calculations as if they were PCB 1260.
- 3.) Concentration of 0.0651 mg/kg represents the Upper 95% Confidence Interval value assuming a log normal distribution of data.
- 4.) Slope factor for dermal absorption of PCB unavailable. Oral slope factor presented in Integrated Risk Information System (IRIS) substituted.
- 5.) Linear low-dose cancer risk equation used in calculating carcinogen risk due to estimation of low risk levels at site.
- 6.) Reference dose (RfD) for dermal absorption of PCB unavailable. Oral RfD presented in IRIS substituted. Oral RfD of Aroclor 1016 and 1254 (and others) provided. Aroclor 1254 (and others) represents the most conservative value, therefore, its value utilized.
- 7.) Background sediment samples excluded as data from calculations.

Risk Assessment: Polychlorinated Biphenyls
Method: 1 (Default values provided by USEPA)
Location: Big Bayou Creek
Pathway: Dermal Absorption of PCBs in Sediment
User: Adult

Sample Point	PCB Conc. ug/kg	Ln of PCB Conc.
BBUP4	200.00	5.2983174
BBUP5	50.00	3.912023
BBU17	50.00	3.912023
BBD17	50.00	3.912023
BBU09	50.00	3.912023
BBD09	50.00	3.912023
BBU16	50.00	3.912023
BBD16S	50.00	3.912023
BBD16C	50.00	3.912023
BBU08	50.00	3.912023
BBD08	50.00	3.912023
BBU15	50.00	3.912023
BBD15	50.00	3.912023
BBU01	50.00	3.912023
BBD01	50.00	3.912023
BB0NW	50.00	3.912023
BBUBC	50.00	3.912023
BBBCI	50.00	3.912023
BBDN1	50.00	3.912023

Statistic	Value
Mean Ln Conc. =	3.98E+00
Std. Dev. Ln Conc. =	3.18E-01
Sample Size =	19
H-Statistic =	1.863
95% UCL of Conc. (ug/kg) =	65.0538
95% UCL of Conc. (mg/kg) =	6.51E-02

Risk Assessment: Polychlorinated Biphenyls
Method: 1 (Default values provided by USEPA)
Location: Little Bayou Creek
Pathway: Dermal Absorption of PCBs in Sediment
User: Adult

where

NOMENCLATURE	VALUE
CS = PCB Concentration in Sediment (mg/kg) =	0.4851
CF = Conversion Factor (kg/mg) =	1.00E-06
SA = Skin Surface Area for Adult (cm ² /event) =	9300.00
AF = Soil to Skin Adherence Factor (mg/cm ²) =	1.00
ABS = Absorption Factor =	0.10
EF = Exposure Frequency (event/year) =	52.00
ED = Exposure Duration (year) =	22.00
BW = Body Weight (kg) =	70.00
AT ₁ = Averaging Time Carcinogenic Effects (day)	25550.00
AT ₂ = Averaging Time Non-Carcinogenic Effects (day) =	8030.00
SF = Slope Factor (kg day/mg) =	7.70
RfD = Reference Dose (mg/kg day) =	2.00E-05

CALCULATIONS:

CDI = Chronic (70 year) Daily Intake (mg/kg-day)

$$= \frac{CS \times CF \times SA \times AF \times ABS \times EF \times ED}{BW \times AT_1}$$

$$= \frac{0.4851 \text{ mg}}{\text{kg}} \times \frac{1.00\text{E-}6 \text{ kg}}{\text{mg}} \times \frac{9300 \text{ cm}^2}{\text{event}} \times \frac{1 \text{ mg}}{\text{cm}^2} \times 0.1 \times \frac{52 \text{ event}}{\text{year}} \times \frac{22 \text{ year}}{70 \text{ kg}} \times \frac{1}{25550 \text{ day}}$$

$$= 2.89\text{E-}07 \text{ mg/kg-day}$$

Carcinogen Risk = CDI x SF

$$= \frac{2.89\text{E-}07 \text{ mg}}{\text{kg day}} \times \frac{7.70 \text{ kg day}}{\text{mg}}$$

$$= 2.22\text{E-}06$$

E = Non-Carcinogenic Exposure Level (mg/kg-day)

$$= \frac{CS \times CF \times SA \times AF \times ABS \times EF \times ED}{BW \times AT_2}$$

$$= \frac{0.4851 \text{ mg}}{\text{kg}} \times \frac{1.00\text{E-}6 \text{ kg}}{\text{mg}} \times \frac{9300 \text{ cm}^2}{\text{event}} \times \frac{1 \text{ mg}}{\text{cm}^2} \times 0.1 \times \frac{52 \text{ event}}{\text{year}} \times \frac{22 \text{ year}}{70 \text{ kg}} \times \frac{1}{8030 \text{ day}}$$

$$= 9.18\text{E-}07$$

Risk Assessment: Polychlorinated Biphenyls
Method: 1 (Default values provided by USEPA)
Location: Little Bayou Creek
Pathway: Dermal Absorption of PCBs in Sediment
User: Adult

CALCULATIONS (cont'd):

$$\begin{aligned}\text{Non-Carcinogenic Hazard Index} &= \frac{E}{\text{RfD}} \\ &= \frac{9.18\text{E-}07 \text{ mg}}{\text{kg day}} \left| \frac{\text{kg day}}{2.00\text{E-}05 \text{ mg}} \right. \\ &= 4.59\text{E-}02\end{aligned}$$

Notes:

- 1.) Concentration data for sediment acquired from the following reference:

U.S. Corp of Engineers. 1994. PCB Sediment Survey, Big Bayou Creek and Little Bayou Creek, Paducah, Kentucky, Paducah Gaseous Diffusion Plant. Prepared for U.S. Department of Energy, Draft, September.

- 2.) RAGS dictates PCB Aroclor 1260 be used as standard PCB contaminant. PCB contaminants other than PCB 1260 which were detected in analysis were assumed to be toxicologically equivalent to PCB 1260. Thus, all PCB Aroclors detected were treated in the exposure calculations as if they were PCB 1260.
- 3.) Concentration of 0.4851 mg/kg represents the Upper 95% Confidence Interval value assuming a log normal distribution of data.
- 4.) Slope factor for dermal absorption of PCB unavailable. Oral slope factor presented in Integrated Risk Information System (IRIS) substituted.
- 5.) Linear low-dose cancer risk equation used in calculating carcinogen risk due to estimation of low risk levels at site.
- 6.) Reference dose (RfD) for dermal absorption of PCB unavailable. Oral RfD presented in IRIS substituted. Oral RfD of Aroclor 1016 and 1254 (and others) provided. Aroclor 1254 (and others) represents the most conservative value, therefore, its value utilized.
- 7.) Background sediment samples excluded as data from calculations.

Risk Assessment: Polychlorinated Biphenyls
Method: 1 (Default values provided by USEPA)
Location: Little Bayou Creek
Pathway: Dermal Absorption of PCBs in Sediment
User: Adult

Sample Point	PCB Conc. ug/kg	Ln of PCB Conc.
LBU13	50.00	3.912023
LBD13	50.00	3.912023
LBU12	50.00	3.912023
LBD12	50.00	3.912023
LBU11	50.00	3.912023
LBD11	5400.00	8.5941542
LBU10	50.00	3.912023
LBD10	50.00	3.912023
LBU02	50.00	3.912023
LBD02	50.00	3.912023
LBU18	50.00	3.912023
LBD18	50.00	3.912023
LBDN1	50.00	3.912023
LBDN2	50.00	3.912023

Statistic	Value
Mean Ln Conc. =	4.25E+00
Std. Dev. Ln Conc. =	1.25E+00
Sample Size =	14
H-Statistic =	3.32758
95% UCL of Conc. (ug/kg) =	485.0640
95% UCL of Conc. (mg/kg) =	4.85E-01

Risk Assessment: Polychlorinated Biphenyls
Calculational Spreadsheet: Dermal Absorption of PCBs in Soil
Location: Big Bayou Creek (BBC) and Little Bayou Creek (LBC)

Sheet1

CALCULATIONAL NOMENCLATURE	EXPOSURE SCENARIO VALUES							
	1	2	3	4	5	6	7	8
CS = PCB Concentration in Soil (mg/kg) =	0.1741	0.1741	0.1741	0.1741	59.10	59.10	59.10	59.10
CF = Conversion Factor (kg/mg) =	1.00E-06	1.00E-06	1.00E-06	1.00E-06	1.00E-06	1.00E-06	1.00E-06	1.00E-06
SA = Skin Surface Area (cm ² /event) =	5190.00	7400.00	5190.00	7400.00	5190.00	7400.00	5190.00	7400.00
AF = Soil to Skin Adherence Factor (mg/cm ²) =	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
ABS = Absorption Factor =	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10
EF = Exposure Frequency (event/year) =	52.00	140.00	10.00	10.00	52.00	140.00	10.00	10.00
ED = Exposure Duration (year) =	22.00	12.00	22.00	12.00	22.00	12.00	22.00	12.00
BW = Body Weight (kg) =	70.00	43.00	70.00	43.00	70.00	43.00	70.00	43.00
AT ₁ = Averaging Time Carcinogenic Effect (day)	25550.00	25550.00	25550.00	25550.00	25550.00	25550.00	25550.00	25550.00
AT ₂ = Averaging Time Non-Carcinogenic Effect (day) =	8030.00	4380.00	8030.00	4380.00	8030.00	4380.00	8030.00	4380.00
SF = Slope Factor (kg day/mg) =	7.70	7.70	7.70	7.70	7.70	7.70	7.70	7.70
RfD = Reference Dose (mg/kg day) =	2.00E-05	2.00E-05	2.00E-05	2.00E-05	2.00E-05	2.00E-05	2.00E-05	2.00E-05
CDI = Chronic (70 year) Daily Intake (mg/kg day) =	5.78E-08	1.97E-07	1.11E-08	1.41E-08	1.96E-05	6.69E-05	3.77E-06	4.78E-06
Carcinogenic Risk =	4.45E-07	1.52E-06	8.56E-08	1.08E-07	1.51E-04	5.15E-04	2.91E-05	3.68E-05
E = Non-Carcinogenic Exposure Level (mg/kg day) =	1.84E-07	1.15E-06	3.54E-08	8.21E-08	6.24E-05	3.90E-04	1.20E-05	2.79E-05
Non-Carcinogenic Hazard Index =	9.19E-03	5.75E-02	1.77E-03	4.10E-03	3.12E+00	1.95E+01	6.00E-01	1.39E+00

Scenario	Subject	Location	Method	Defaults	Lifetime Carcinogenic Risk =	
1	Adult	BBC	1	USEPA	(BBC, Method 1)	1.96E-06
2	Child	BBC	1	USEPA		
3	Adult	BBC	2	KDFWR	Lifetime Carcinogenic Risk =	1.94E-07
4	Child	BBC	2	KDFWR	(BBC, Method 2)	
5	Adult	LBC	1	USEPA		
6	Child	LBC	1	USEPA	Lifetime Carcinogenic Risk =	6.66E-04
7	Adult	LBC	2	KDFWR	(LBC, Method 1)	
8	Child	LBC	2	KDFWR	Lifetime Carcinogenic Risk =	6.58E-05
					(LBC, Method 2)	

Notes:

Lifetime Carcinogenic Risk accounts for risks due to exposure as a child and an adult.
Skin surface area for a child includes arms, hands, legs and feet.
Skin surface area for an adult includes arms, hands and lower legs.

Risk Assessment: Polychlorinated Biphenyls
Method: 1 (Default values provided by USEPA)
Location: Big Bayou Creek
Pathway: Dermal Absorption of PCBs in Soil
User: Adult

where

NOMENCLATURE	VALUE
CS = Contaminant Concentration in Soil (mg/kg) =	0.1741
CF = Conversion Factor (kg/mg)	1.00E-06
SA = Skin Surface Area (cm ² /event) =	5190.00
AF = Soil to Skin Adherence Factor (mg/cm ²) =	1.00
ABS = Absorption Factor =	0.10
EF = Exposure Frequency (day/year) =	52.00
ED = Exposure Duration (year) =	22.00
BW = Body Weight (kg) =	70.00
AT ₁ = Averaging Time Carcinogenic Effects (day) =	25550.00
AT ₂ = Averaging Time Non-Carcinogenic Effects (day) =	8030.00
SF = Slope Factor (kg day/mg) =	7.70
RfD = Reference Dose (mg/kg day) =	2.00E-05

CALCULATIONS:

CDI = Chronic (70 year) Daily Intake (mg/kg day)

$$\begin{aligned}
 &= \frac{CS \times CF \times SA \times AF \times ABS \times EF \times ED}{BW \times AT_1} \\
 &= \frac{0.1741 \text{ m} \mid 1\text{E-6 kg} \mid 5190 \text{ cm}^2 \mid 1 \text{ mg} \mid 0.1 \mid 52 \text{ day} \mid 22 \text{ year}}{\text{kg} \mid \text{mg} \mid \text{event} \mid \text{cm}^2 \mid \text{year} \mid 70 \text{ kg} \mid 25550 \text{ day}} \\
 &= 5.78\text{E-08 mg/kg day}
 \end{aligned}$$

Carcinogen Risk = CDI x SF

$$\begin{aligned}
 &= \frac{5.78\text{E-08 mg} \mid 7.70 \text{ kg day}}{\text{kg day} \mid \text{mg}} \\
 &= 4.45\text{E-07}
 \end{aligned}$$

E = Non-Carcinogenic Exposure Level (mg/kg day)

$$\begin{aligned}
 &= \frac{CS \times CF \times SA \times AF \times ABS \times EF \times ED}{BW \times AT_2} \\
 &= \frac{0.1741 \text{ m} \mid 1\text{E-6 kg} \mid 5190 \text{ cm}^2 \mid 1 \text{ mg} \mid 0.1 \mid 52 \text{ day} \mid 22 \text{ year}}{\text{kg} \mid \text{mg} \mid \text{event} \mid \text{cm}^2 \mid \text{year} \mid 70 \text{ kg} \mid 8030 \text{ day}} \\
 &= 1.84\text{E-07 mg/kg-day}
 \end{aligned}$$

Risk Assessment: Polychlorinated Biphenyls
Method: 1 (Default values provided by USEPA)
Location: Big Bayou Creek
Pathway: Dermal Absorption of PCBs in Soil
User: Adult

CALCULATIONS (cont'd):

$$\begin{aligned}\text{Non-Carcinogenic Hazard Index} &= \frac{E}{\text{RfD}} \\ &= \frac{1.84\text{E-}07 \text{ mg}}{\text{kg day}} \bigg| \frac{\text{kg day}}{2.00\text{E-}05 \text{ mg}} \\ &= 9.20\text{E-}03\end{aligned}$$

Notes:

1.) Concentration data for soil acquired from the following reference:

CH2MHill. 1991. Results of the Site Investigation at the Paducah Gaseous Diffusion Plant, Paducah, Kentucky, U.S. Department of Energy. Document No. KY/ER-4.

- 2.) RAGS dictates PCB Aroclor 1260 be used as standard PCB contaminant. PCB contaminants other than PCB 1260 which were detected in analysis were assumed to be toxicologically equivalent to PCB 1260. Thus, all PCB Aroclors detected were treated in the exposure calculations as if they were PCB 1260.
- 3.) Concentration of 1.74E-01 mg/kg represents the Upper 95% Confidence Interval value, assuming a log normal distribution of data, for Aroclors 1248 and 1260 in an additive relationship.
- 4.) Slope factor for dermal absorption of PCB unavailable. Oral slope factor presented in Integrated Risk Information System (IRIS) substituted.
- 5.) Linear low-dose cancer risk equation used in calculating carcinogen risk due to estimation of low risk levels at site.
- 6.) Reference dose (RfD) for dermal absorption of PCB unavailable. Oral RfD presented in IRIS substituted. Oral RfD of Aroclor 1016 and 1254 (and others) provided. Aroclor 1254 (and others) represents the most conservative value, therefore, its value utilized.

Risk Assessment: Polychlorinated Biphenyls
Method: 1 (Default values provided by USEPA)
Location: Big Bayou Creek
Pathway: Dermal Absorption of PCBs in Soil
User: Adult

Sample Point	PCB 1248 Conc. ug/kg	LN of PCB 1248 Conc.	PCB 1260 Conc. ug/kg	LN of PCB 1260 Conc.
SB011-5	49.000	3.8918203	95.000	4.5538769
SB011-6	50.000	3.912023	100.000	4.6051702
SB014-1	55.000	4.0073332	110.000	4.7004804

Statistic	PCB Aroclor Values	
	1248	1260
Mean Ln Conc. =	3.94E+00	4.62E+00
Std. Dev. Ln Conc. =	6.17E-02	7.44E-02
Sample Size =	3	3
H-statistic =	2.54	2.61
95% UCL of Conc. (ug/kg) =	57.3839	116.7353
95% UCL of Conc. (mg/kg) =	0.0574	0.1167

Total Concentration: 1.74E-01

Risk Assessment: Polychlorinated Biphenyls
Method: 1 (Default values provided by USEPA)
Location: Little Bayou Creek
Pathway: Dermal Absorption of PCBs in Soil
User: Adult

where

NOMENCLATURE	VALUE
CS = Contaminant Concentration in Soil (mg/kg) =	59.10
CF = Conversion Factor (kg/mg)	1.00E-06
SA = Skin Surface Area (cm ² /event) =	5190.00
AF = Soil to Skin Adherence Factor (mg/cm ²) =	1.00
ABS = Absorption Factor =	0.10
EF = Exposure Frequency (day/year) =	52.00
ED = Exposure Duration (year) =	22.00
BW = Body Weight (kg) =	70.00
AT ₁ = Averaging Time Carcinogenic Effects (day) =	25550.00
AT ₂ = Averaging Time Non-Carcinogenic Effects (day) =	8030.00
SF = Slope Factor (kg day/mg) =	7.70
RfD = Reference Dose (mg/kg day) =	2.00E-05

CALCULATIONS:

CDI = Chronic (70 year) Daily Intake (mg/kg day)

$$= \frac{CS \times CF \times SA \times AF \times ABS \times EF \times ED}{BW \times AT_1}$$

$$= \frac{59.10 \text{ mg}}{\text{kg}} \times \frac{1\text{E-}6 \text{ kg}}{\text{mg}} \times \frac{5190 \text{ cm}^2}{\text{event}} \times \frac{1 \text{ mg}}{\text{cm}^2} \times 0.1 \times \frac{52 \text{ day}}{\text{year}} \times \frac{22 \text{ year}}{\text{year}} \times \frac{70 \text{ kg}}{25550 \text{ day}}$$

$$= 1.96\text{E-}05 \text{ mg/kg day}$$

Carcinogen Risk = CDI x SF

$$= \frac{1.95\text{E-}05 \text{ mg}}{\text{kg day}} \times \frac{7.70 \text{ kg day}}{\text{mg}}$$

$$= 1.51\text{E-}04$$

E = Non-Carcinogenic Exposure Level (mg/kg day)

$$= \frac{CS \times CF \times SA \times AF \times ABS \times EF \times ED}{BW \times AT_2}$$

$$= \frac{59.10 \text{ mg}}{\text{kg}} \times \frac{1\text{E-}6 \text{ kg}}{\text{mg}} \times \frac{5190 \text{ cm}^2}{\text{event}} \times \frac{1 \text{ mg}}{\text{cm}^2} \times 0.1 \times \frac{52 \text{ day}}{\text{year}} \times \frac{22 \text{ year}}{\text{year}} \times \frac{70 \text{ kg}}{8030 \text{ day}}$$

$$= 6.24\text{E-}05 \text{ mg/kg-day}$$

Risk Assessment: Polychlorinated Biphenyls
Method: 1 (Default values provided by USEPA)
Location: Little Bayou Creek
Pathway: Dermal Absorption of PCBs in Soil
User: Adult

CALCULATIONS (cont'd):

$$\begin{aligned} \text{Non-Carcinogenic Hazard Index} &= \frac{E}{\text{RfD}} \\ &= \frac{6.24\text{E-}05 \text{ mg}}{\text{kg day}} \bigg| \frac{\text{kg day}}{2.00\text{E-}05 \text{ mg}} \\ &= 3.12\text{E+}00 \end{aligned}$$

Notes:

- 1.) Concentration data for soil acquired from the following reference:

CH2MHill. 1991. Results of the Site Investigation at the Paducah Gaseous Diffusion Plant, Paducah, Kentucky, U.S. Department of Energy. Document No. KY/ER-4.
- 2.) RAGS dictates PCB Aroclor 1260 be used as standard PCB contaminant. PCB contaminants other than PCB 1260 which were detected in analysis were assumed to be toxicologically equivalent to PCB 1260. Thus, all PCB Arochlors detected were treated in the exposure calculations as if they were PCB 1260.
- 3.) Concentration of 59.10 mg/kg represents highest PCB 1248 and 1260 concentrations encountered in soil samples. Upper 95% CI not used.
- 4.) Slope factor for dermal absorption of PCB unavailable. Oral slope factor presented in Integrated Risk Information System (IRIS) substituted.
- 5.) Linear low-dose cancer risk equation used in calculating carcinogen risk due to estimation of low risk levels at site.
- 6.) Reference dose (RfD) for dermal absorption of PCB unavailable. Oral RfD presented in IRIS substituted. Oral RfD of Aroclor 1016 and 1254 (and others) provided. Aroclor 1254 (and others) represents the most conservative value, therefore, its value utilized.

Risk Assessment: Polychlorinated Biphenyls
Method: 1 (Default values provided by USEPA)
Location: Little Bayou Creek
Pathway: Dermal Absorption of PCBs in Soil
User: Adult

Sample Point	PCB 1248 Conc. mg/kg	Ln of PCB 1248 Conc.	PCB 1260 Conc. mg/kg	Ln of PCB 1260 Conc.
SB001-3	53.000	3.9702919	5.700	1.7404662
SB004-4	0.027	-3.611918	0.250	-1.386294
SB009-1	29.000	3.3672958	6.100	1.8082888
SB009-5	17.000	2.8332133	4.000	1.3862944

Statistic	PCB Aroclor Values	
	1248	1260
Mean Ln Conc. =	1.64E+00	8.87E-01
Standard Deviation Ln Conc. =	3.53E+00	1.53E+00
Sample Size* =	4	4
H-statistic =	45.77	19.60
95% UCL of Conc. =	8.97E+43	2.49E+08
Total Concentration:	8.97E+43	

* Concentration of 59.10 mg/kg used in calculation. Represents highest sampled PCB 1248 and 1260 concentrations encountered in soil samples. Upper 95% CI not used.

Risk Assessment: Polychlorinated Biphenyls
Calculational Spreadsheet: Incidental Ingestion of PCBs in Soil
Location: Big Bayou Creek (BBC) and Little Bayou Creek (LBC)

CALCULATIONAL NOMENCLATURE	EXPOSURE SCENARIO VALUES							
	1	2	3	4	5	6	7	8
CS = PCB Concentration in Soil (mg/kg) =	0.1741	0.1741	0.1741	0.1741	59.10	59.10	59.10	59.10
CF = Conversion Factor (kg/mg) =	1.00E-06	1.00E-06	1.00E-06	1.00E-06	1.00E-06	1.00E-06	1.00E-06	1.00E-06
IR = Ingestion Rate (mg/day) =	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
FI = Fraction Ingested from Contaminated Source =	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
EF = Exposure Frequency (event/year) =	52.00	140.00	10.00	10.00	52.00	140.00	10.00	10.00
ED = Exposure Duration (year) =	22.00	12.00	22.00	12.00	22.00	12.00	22.00	12.00
BW = Body Weight (kg) =	70.00	43.00	70.00	43.00	70.00	43.00	70.00	43.00
AT ₁ = Averaging Time Carcinogenic Effect (day)	25550.00	25550.00	25550.00	25550.00	25550.00	25550.00	25550.00	25550.00
AT ₂ = Averaging Time Non-Carcinogenic Effect (day) =	8030.00	4380.00	8030.00	4380.00	8030.00	4380.00	8030.00	4380.00
SF = Slope Factor (kg day/mg) =	7.70	7.70	7.70	7.70	7.70	7.70	7.70	7.70
RfD = Reference Dose (mg/kg day) =	2.00E-05	2.00E-05	2.00E-05	2.00E-05	2.00E-05	2.00E-05	2.00E-05	2.00E-05
CDI = Chronic (70 year) Daily Intake (mg/kg day) =	1.11E-08	2.66E-08	2.14E-09	1.90E-09	3.78E-06	9.04E-06	7.27E-07	6.46E-07
Carcinogenic Risk =	8.57E-08	2.05E-07	1.65E-08	1.46E-08	2.91E-05	6.96E-05	5.60E-06	4.97E-06
E = Non-Carcinogenic Exposure Level (mg/kg day) =	3.54E-08	1.55E-07	6.81E-09	1.11E-08	1.20E-05	5.27E-05	2.31E-06	3.77E-06
Non-Carcinogenic Hazard Index =	1.77E-03	7.76E-03	3.41E-04	5.55E-04	6.01E-01	2.64E+00	1.16E-01	1.88E-01

Scenario	Subject	Location	Method	Defaults	Lifetime Carcinogenic Risk =	
1	Adult	BBC	1	USEPA	(BBC, Method 1)	2.91E-07
2	Child	BBC	1	USEPA		
3	Adult	BBC	2	KDFWR	Lifetime Carcinogenic Risk =	3.11E-08
4	Child	BBC	2	KDFWR	(BBC, Method 2)	
5	Adult	LBC	1	USEPA		
6	Child	LBC	1	USEPA	Lifetime Carcinogenic Risk =	9.87E-05
7	Adult	LBC	2	KDFWR	(LBC, Method 1)	
8	Child	LBC	2	KDFWR		
					Lifetime Carcinogenic Risk =	1.06E-05
					(LBC, Method 2)	

Note: Lifetime Carcinogenic Risk accounts for risks due to exposure as a child and an adult.

Risk Assessment: Polychlorinated Biphenyls
Method: 1 (Default values provided by USEPA)
Location: Big Bayou Creek
Pathway: Incidental Ingestion of PCBs in Soil
User: Adult

where

NOMENCLATURE	VALUE
CS = Contaminant Concentration in Soil (mg/kg) =	0.1741
IR = Ingestion Rate (mg/day) =	100.00
CF = Conversion Factor (kg/mg)	1.00E-06
FI = Fraction Ingested from Contaminated Source =	1.00
EF = Exposure Frequency (day/year) =	52.00
ED = Exposure Duration (year) =	22.00
BW = Body Weight (kg) =	70.00
AT ₁ = Averaging Time Carcinogenic Effects (day) =	25550.00
AT ₂ = Averaging Time Non-Carcinogenic Effects (day) =	8030.00
SF = Slope Factor (kg day/mg) =	7.70
RfD = Reference Dose (mg/kg day) =	2.00E-05

CALCULATIONS:

CDI = Chronic (70 year) Daily Intake (mg/kg day)

$$\begin{aligned}
 &= \frac{CS \times IR \times CF \times FI \times EF \times ED}{BW \times AT_1} \\
 &= \frac{0.1741 \text{ mg} \mid 100 \text{ mg} \mid 1.00\text{E-}06 \text{ kg} \mid 1 \mid 52 \text{ day} \mid 22 \text{ year}}{\text{kg} \mid \text{day} \mid \text{mg} \mid \text{year} \mid 70 \text{ kg} \mid 25550 \text{ day}} \\
 &= 1.11\text{E-}08 \text{ mg/kg-day}
 \end{aligned}$$

Carcinogen Risk = CDI x SF

$$\begin{aligned}
 &= \frac{1.11\text{E-}08 \text{ mg} \mid 7.70 \text{ kg day}}{\text{kg day} \mid \text{mg}} \\
 &= 8.58\text{E-}08
 \end{aligned}$$

E = Non-Carcinogenic Exposure Level (mg/kg day)

$$\begin{aligned}
 &= \frac{CS \times IR \times CF \times FI \times EF \times ED}{BW \times AT_2} \\
 &= \frac{0.1741 \text{ mg} \mid 100 \text{ mg} \mid 1.00\text{E-}06 \text{ kg} \mid 1 \mid 52 \text{ day} \mid 22 \text{ year}}{\text{kg} \mid \text{day} \mid \text{mg} \mid \text{year} \mid 70 \text{ kg} \mid 8030 \text{ day}} \\
 &= 3.54\text{E-}08
 \end{aligned}$$

Risk Assessment: Polychlorinated Biphenyls
Method: 1 (Default values provided by USEPA)
Location: Big Bayou Creek
Pathway: Incidental Ingestion of PCBs in Soil
User: Adult

CALCULATIONS (cont'd):

$$\begin{aligned}\text{Non-Carcinogenic Hazard Index} &= \frac{E}{\text{RfD}} \\ &= \frac{3.54\text{E-}08 \text{ mg}}{\text{kg day}} \left| \frac{\text{kg day}}{2.00\text{E-}05 \text{ mg}} \right| \\ &= 1.77\text{E-}03\end{aligned}$$

Notes:

- 1.) Concentration data for soil acquired from the following reference:

CH2MHill. 1991. Results of the Site Investigation at the Paducah Gaseous Diffusion Plant, Paducah, Kentucky, U.S. Department of Energy. Document No. KY/ER-4.

- 2.) RAGS dictates PCB Aroclor 1260 be used as standard PCB contaminant. PCB contaminants other than PCB 1260 which were detected in analysis were assumed to be toxicologically equivalent to PCB 1260. Thus, all PCB Aroclors detected were treated in the exposure calculations as if they were PCB 1260.
- 3.) Concentration of 1.74E-01 mg/kg represents the Upper 95% Confidence Interval value, assuming a log normal distribution of data, for Aroclors 1248 and 1260, in an additive relationship.
- 4.) Linear low-dose cancer risk equation used in calculating carcinogen risk due to estimation of low risk levels at site.
- 5.) Oral Reference dose (RfD) of PCB Aroclor 1254 as found in IRIS used in calculation. Oral RfD of Aroclor 1016 and 1254 (and others) provided. Aroclor 1254 (and others) represents the most conservative value, therefore, its value utilized.

Risk Assessment: Polychlorinated Biphenyls
Method: 1 (Default values provided by USEPA)
Location: Big Bayou Creek
Pathway: Incidental Ingestion of PCBs in Soil
User: Adult

Sample Point	PCB 1248 Conc. mg/kg	LN of PCB 1248 Conc.	PCB 1260 Conc. mg/kg	LN of PCB 1260 Conc.
SB011-5	49.000	3.89182	95.000	4.5538769
SB011-6	50.000	3.912023	100.000	4.6051702
SB014-1	55.000	4.007333	110.000	4.7004804

Statistic	PCB Aroclor Values	
	1248	1260
Mean Ln Conc. =	3.94E+00	4.62E+00
Standard Deviation Ln Conc. =	6.17E-02	7.44E-02
Sample Size =	3	3
H-statistic =	2.54	2.61
95% UCL of Conc. (ug/kg) =	57.3839	116.7353
95% UCL of Conc. (mg/kg) =	0.0574	0.1167

Total Concentration: 1.74E-01

* Sample size of 4 used in calculation of 95% UCL due to lack of H-statistic for sample size of 3.

Risk Assessment: Polychlorinated Biphenyls
Method: 1 (Default values provided by USEPA)
Location: Little Bayou Creek
Pathway: Incidental Ingestion of PCBs in Soil
User: Adult

where

NOMENCLATURE	VALUE
CS = PCB Concentration in Soil (mg/kg) =	59.10
IR = Ingestion Rate (mg/day) =	100.00
CF = Conversion Factor (kg/mg)	1.00E-06
FI = Fraction Ingested from Contaminated Source =	1.00
EF = Exposure Frequency (day/year) =	52.00
ED = Exposure Duration (year) =	22.00
BW = Body Weight (kg) =	70.00
AT ₁ = Averaging Time Carcinogenic Effects (day) =	25550.00
AT ₂ = Averaging Time Non-Carcinogenic Effects (day) =	8030.00
SF = Slope Factor (kg day/mg) =	7.70
RfD = Reference Dose (mg/kg day) =	2.00E-05

CALCULATIONS:

CDI = Chronic (70 year) Daily Intake (mg/kg day)

$$\begin{aligned}
 &= \frac{CS \times IR \times CF \times FI \times EF \times ED}{BW \times AT_1} \\
 &= \frac{59.10 \text{ mg}}{\text{kg}} \times \frac{100 \text{ mg}}{\text{day}} \times \frac{1.00\text{E-}06 \text{ kg}}{\text{mg}} \times 1 \times \frac{52 \text{ day}}{\text{year}} \times \frac{22 \text{ year}}{\text{year}} \times \frac{70 \text{ kg}}{25550 \text{ day}} \\
 &= 3.78\text{E-}06 \text{ mg/kg-day}
 \end{aligned}$$

Carcinogen Risk = CDI x SF

$$\begin{aligned}
 &= \frac{3.78\text{E-}06 \text{ mg}}{\text{kg day}} \times \frac{7.70 \text{ kg day}}{\text{mg}} \\
 &= 2.91\text{E-}05
 \end{aligned}$$

E = Non-Carcinogenic Exposure Level (mg/kg day)

$$\begin{aligned}
 &= \frac{CS \times IR \times CF \times FI \times EF \times ED}{BW \times AT_2} \\
 &= \frac{59.10 \text{ mg}}{\text{kg}} \times \frac{100 \text{ mg}}{\text{day}} \times \frac{1.00\text{E-}06 \text{ kg}}{\text{mg}} \times 1 \times \frac{52 \text{ day}}{\text{year}} \times \frac{22 \text{ year}}{\text{year}} \times \frac{70 \text{ kg}}{8030 \text{ day}} \\
 &= 1.20\text{E-}05
 \end{aligned}$$

Risk Assessment: Polychlorinated Biphenyls
Method: 1 (Default values provided by USEPA)
Location: Little Bayou Creek
Pathway: Incidental Ingestion of PCBs in Soil
User: Adult

CALCULATIONS (cont'd):

$$\begin{aligned}\text{Non-Carcinogenic Hazard Index} &= \frac{E}{\text{RfD}} \\ &= \frac{1.20\text{E-}05 \text{ mg}}{\text{kg day}} \frac{\text{kg day}}{2.00\text{E-}05 \text{ mg}} \\ &= 6.01\text{E-}01\end{aligned}$$

Notes:

- 1.) Concentration data for soil acquired from the following reference:

CH2MHill. 1991. Results of the Site Investigation at the Paducah Gaseous Diffusion Plant, Paducah, Kentucky, U.S. Department of Energy. Document No. KY/ER-4.

- 2.) RAGS dictates PCB Aroclor 1260 be used as standard PCB contaminant. PCB contaminants other than PCB 1260 which were detected in analysis were assumed to be toxicologically equivalent to PCB 1260. Thus, all PCB Arochlors detected were treated in the exposure calculations as if they were PCB 1260.
- 3.) Concentration of 59.10 mg/kg represents highest PCB 1248 and 1260 concentrations encountered in soil samples. Upper 95% CI not used.
- 4.) Linear low-dose cancer risk equation used in calculating carcinogen risk due to estimation of low risk levels at site.
- 5.) Oral Reference dose (RfD) of PCB Aroclor 1254 as found in IRIS used in calculation. Oral RfD of Aroclor 1016 and 1254 (and others) provided. Aroclor 1254 (and others) represents the most conservative value, therefore, its value utilized.

Risk Assessment: Polychlorinated Biphenyls
Method: 1 (Default values provided by USEPA)
Location: Little Bayou Creek
Pathway: Incidental Ingestion of PCBs in Soil
User: Adult

Sample Point	PCB 1248 Conc. mg/kg	Ln of PCB 1248 Conc.	PCB 1260 Conc. mg/kg	Ln of PCB 1260 Conc.
SB001-3	53.000	3.970292	5.700	1.7404662
SB004-4	0.027	-3.61192	0.250	-1.386294
SB009-1	29.000	3.367296	6.100	1.8082888
SB009-5	17.000	2.833213	4.000	1.3862944

Statistic	PCB Aroclor Values	
	1248	1260
Mean Ln Conc. =	1.64E+00	8.87E-01
Standard Deviation Ln Conc. =	3.53E+00	1.53E+00
Sample Size* =	4	4
H-statistic =	45.77	19.60
95% UCL of Conc. =	8.97E+43	2.49E+08
Total Concentration:	8.97E+43	

* Concentration of 59.10 mg/kg used in calculation. Represents highest sampled PCB 1248 and 1260 concentration encountered in soil samples. Upper 95% CI not used.

Risk Assessment: Polychlorinated Biphenyls

Sheet1

Calculational Spreadsheet: Dermal Absorption of PCBs in Surface Water

Location: Big Bayou (BBC) and Little Bayou Creek (LBC)

CALCULATIONAL NOMENCLATURE	EXPOSURE SCENARIO VALUES							
	1	2	3	4	5	6	7	8
CW = PCB Concentration Surface Water (mg/kg) =	1.42E-04	1.42E-04	1.42E-04	1.42E-04	1.96E-04	1.96E-04	1.96E-04	1.96E-04
SA = Skin Surface Area (cm ² /event) =	9300	7400	9300	7400	9300.00	7400.00	9300.00	7400.00
ED = Exposure Duration (year) =	22.00	12.00	22.00	12.00	22.00	12.00	22.00	12.00
EF = Exposure Frequency (day/year) =	52.00	140.00	10.00	10.00	52.00	140.00	10.00	10.00
ET = Exposure Time (hr/day) =	2.50	2.50	2.00	2.00	2.50	2.50	1.00	1.00
CF = Conversion Factor (L/cm ³) =	1.00E-03	1.00E-03	1.00E-03	1.00E-03	1.00E-03	1.00E-03	1.00E-03	1.00E-03
PC = Permeability Constant (cm/hr) =	1.30	1.30	1.30	1.30	1.30	1.30	1.30	1.30
BW = Body Weight (kg) =	70.00	43.00	70.00	43.00	70.00	43.00	70.00	43.00
AT ₁ = Averaging Time Carcinogenic Effect (day)	25550.00	25550.00	25550.00	25550.00	25550.00	25550.00	25550.00	25550.00
AT ₂ = Averaging Time Non-Carcinogenic Effect (day) =	8030.00	4380.00	8030.00	4380.00	8030.00	4380.00	8030.00	4380.00
SF = Slope Factor (kg day/mg) =	7.70	7.70	7.70	7.70	7.70	7.70	7.70	7.70
RfD = Reference Dose (mg/kg day) =	2.00E-05	2.00E-05	2.00E-05	2.00E-05	2.00E-05	2.00E-05	2.00E-05	2.00E-05
CDI = Chronic (70 year) Daily Intake (mg/kg day) =	2.74E-06	5.22E-06	4.22E-07	2.98E-07	3.78E-06	7.20E-06	2.91E-07	2.06E-07
Carcinogenic Risk =	2.11E-05	4.02E-05	3.25E-06	2.3E-06	2.91E-05	5.54E-05	2.24E-06	1.58E-06
E = Non-Carcinogenic Exposure Level (mg/kg day) =	8.73E-06	3.04E-05	1.34E-06	1.74E-06	1.20E-05	4.20E-05	9.26E-07	1.20E-06
Non-Carcinogenic Hazard Index =	4.37E-01	1.52E+00	6.72E-02	8.70E-02	6.02E-01	2.10E+00	4.63E-02	6.00E-02

Scenario	Subject	Location	Method	Defaults	Lifetime Carcinogenic Risk =	
1	Adult	BBC	1	USEPA	(BBC, Method 1)	6.13E-05
2	Child	BBC	1	USEPA		
3	Adult	BBC	2	KDFWR	Lifetime Carcinogenic Risk =	5.55E-06
4	Child	BBC	2	KDFWR	(BBC, Method 2)	
5	Adult	LBC	1	USEPA		
6	Child	LBC	1	USEPA	Lifetime Carcinogenic Risk =	8.46E-05
7	Adult	LBC	2	KDFWR	(LBC, Method 1)	
8	Child	LBC	2	KDFWR		
					Lifetime Carcinogenic Risk =	3.82E-06
					(LBC, Method 2)	

Notes:

Lifetime Carcinogenic Risk accounts for risks due to exposure as a child and an adult.

Skin surface area for a child includes arms, hands, legs and feet.

Skin surface area for an adult includes arms, hands, legs and feet.

Risk Assessment: Polychlorinated Biphenyls
Method: 1 (Default values provided by USEPA)
Location: Big Bayou Creek
Pathway: Dermal Absorption of PCBs in Surface Water
User: Adult

where	NOMENCLATURE	VALUE
	CW = PCB Concentration in Water (mg/L) =	1.42E-04
	SA = Skin Surface Area (cm ² /event) =	9300.00
	ED = Exposure Duration (year) =	22.00
	EF = Exposure Frequency (day/year) =	52.00
	ET = Exposure Time (hr/day) =	2.50
	CF = Conversion Factor (L/cm ³) =	1.00E-03
	PC = Permeability Constant (cm/hr) =	1.30
	BW = Body Weight (kg) =	70.00
	AT ₁ = Averaging Time Carcinogenic Effects (day) =	25550.00
	AT ₂ = Averaging Time Non-Carcinogenic Effects (day) =	8030.00
	SF = Slope Factor (kg day/mg) =	7.70
	RfD = Reference Dose (mg/kg day) =	2.00E-05

CALCULATIONS:

CDI = Chronic (70 year) Daily Intake (mg/kg day)

$$\begin{aligned}
 &= \frac{CW \times SA \times ED \times EF \times ET \times CF \times PC}{BW \times AT_1} \\
 &= \frac{1.42\text{E-}4 \text{ mg/L} \times 9300 \text{ cm}^2/\text{event} \times 22 \text{ year} \times 52 \text{ day/year} \times 2.5 \text{ hr/day} \times 1.00\text{E-}03 \text{ L/cm}^3 \times 1.3 \text{ cm/hr}}{70 \text{ kg} \times 25550 \text{ day}} \\
 &= 2.74\text{E-}06 \text{ mg/kg-day}
 \end{aligned}$$

Carcinogen Risk = CDI x SF

$$\begin{aligned}
 &= \frac{2.74\text{E-}06 \text{ mg/kg day} \times 7.70 \text{ kg day/mg}}{1} \\
 &= 2.11\text{E-}05
 \end{aligned}$$

E = Non-Carcinogenic Exposure Level (mg/kg day)

$$\begin{aligned}
 &= \frac{CW \times SA \times ED \times EF \times ET \times CF \times PC}{BW \times AT_2} \\
 &= \frac{1.42\text{E-}4 \text{ mg/L} \times 9300 \text{ cm}^2/\text{event} \times 22 \text{ year} \times 52 \text{ day/year} \times 2.5 \text{ hr/day} \times 1.00\text{E-}03 \text{ L/cm}^3 \times 1.3 \text{ cm/hr}}{70 \text{ kg} \times 8030 \text{ day}} \\
 &= 8.73\text{E-}06
 \end{aligned}$$

Risk Assessment: Polychlorinated Biphenyls
Method: 1 (Default values provided by USEPA)
Location: Big Bayou Creek
Pathway: Dermal Absorption of PCBs in Surface Water
User: Adult

CALCULATIONS (cont'd):

$$\begin{aligned}\text{Non-Carcinogenic Hazard Index} &= \frac{E}{\text{RfD}} \\ &= \frac{8.73\text{E-}06 \text{ mg}}{\text{kg day}} \bigg| \frac{\text{kg day}}{2.00\text{E-}05 \text{ mg}} \\ &= 4.37\text{E-}01\end{aligned}$$

Notes:

- 1.) Concentration data for surface water acquired from the following reference:

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. Submitted to Oak Ridge National Laboratory, Oak Ridge, Tennessee.

- 2.) RAGS dictates PCB Aroclor 1260 be used as standard PCB contaminant. PCB contaminants other than PCB 1260 which were detected in analysis were assumed to be toxicologically equivalent to PCB 1260. Thus, all PCB Aroclors detected were treated in the exposure calculations as if they were PCB 1260.
- 3.) Concentration of 1.42E-04 mg/L represents the Upper 95% Confidence Interval value, assuming a log normal distribution of data, for Aroclors 1248, 1254, and 1260 in an additive relationship.
- 4.) Slope factor for dermal absorption of PCB unavailable. Oral slope factor presented in Integrated Risk Information System (IRIS) substituted.
- 5.) Linear low-dose cancer risk equation used in calculating carcinogen risk due to estimation of low risk levels at site.
- 6.) Reference dose (RfD) for dermal absorption of PCB unavailable. Oral RfD presented in IRIS substituted. Oral RfD of Aroclor 1016 and 1254 (and others) provided. Aroclor 1254 (and others) represents the most conservative value, therefore, its value utilized.

Risk Assessment: Polychlorinated Biphenyls
Method: 1 (Default values provided by USEPA)
Location: Big Bayou Creek
Pathway: Dermal Absorption of PCBs in Surface Water
User: Adult

Sample Point	PCB 1248 Conc. ng/L	Ln of PCB 1248 Conc.	PCB 1254 Conc. ng/L	Ln of PCB 1254 Conc.	PCB 1260 Conc. ng/L	Ln of PCB 1260 Conc.
BB1-01	10.00	2.3025851	10.00	2.3025851	15.00	2.7080502
BB1-02	5.00	1.6094379	5.00	1.6094379	5.00	1.6094379
BB1-03	40.50	3.701302	40.50	3.701302	40.50	3.701302
BB1-04	40.50	3.701302	40.50	3.701302	40.50	3.701302
BB1-05	40.50	3.701302	40.50	3.701302	40.50	3.701302
BB1-06	40.50	3.701302	40.50	3.701302	40.50	3.701302
BB1-07	40.50	3.701302	40.50	3.701302	40.50	3.701302
BB1-08	40.50	3.701302	40.50	3.701302	40.50	3.701302
BB1-09	40.50	3.701302	40.50	3.701302	40.50	3.701302
BB1-10	40.50	3.701302	40.50	3.701302	40.50	3.701302
BB1-11	40.50	3.701302	40.50	3.701302	40.50	3.701302
BB1-12	40.50	3.701302	40.50	3.701302	40.50	3.701302
BB2A-01	41.00	3.7135721	41.00	3.7135721	41.00	3.7135721
BB2A-02	42.00	3.7376696	42.00	3.7376696	42.00	3.7376696
BB3-01	40.00	3.6888795	40.00	3.6888795	40.00	3.6888795
BB3-02	40.00	3.6888795	40.00	3.6888795	40.00	3.6888795
BB3-03	40.50	3.701302	91.00	4.5108595	29.00	3.3672958
BB3-04	40.00	3.6888795	40.00	3.6888795	40.00	3.6888795
BB3-05	40.00	3.6888795	40.00	3.6888795	40.00	3.6888795
BB3-06	40.50	3.701302	40.50	3.701302	40.50	3.701302
BB3-07	40.50	3.701302	40.50	3.701302	40.50	3.701302
BB3-08	40.50	3.701302	40.50	3.701302	40.50	3.701302
BB3-09	40.50	3.701302	40.50	3.701302	40.50	3.701302
BB3-10	40.50	3.701302	40.50	3.701302	40.50	3.701302
BB3-11	40.50	3.701302	40.50	3.701302	40.50	3.701302
BB4A-01	40.00	3.6888795	40.00	3.6888795	40.00	3.6888795
BB4A-02	40.00	3.6888795	40.00	3.6888795	40.00	3.6888795
BB4A-03	40.00	3.6888795	82.00	4.4067192	40.00	3.6888795
BB4A-04	40.00	3.6888795	84.00	4.4308168	40.00	3.6888795
BB4A-05	115.00	4.7449321	40.00	3.6888795	40.00	3.6888795
BB4A-06	173.00	5.1532916	40.00	3.6888795	40.00	3.6888795
BB4A-07	149.00	5.0039463	40.00	3.6888795	40.00	3.6888795
BB4A-08	68.00	4.2195077	40.00	3.6888795	40.00	3.6888795
BB4A-09	89.00	4.4886364	40.50	3.701302	40.50	3.701302
BB4A-10	137.00	4.9199809	40.50	3.701302	40.50	3.701302
BB4A-11	162.00	5.0875963	40.50	3.701302	40.50	3.701302
BB4A-12	89.00	4.4886364	40.50	3.701302	40.50	3.701302
BB4A-13	40.50	3.701302	40.50	3.701302	40.50	3.701302
BB4A-14	40.50	3.701302	40.50	3.701302	40.50	3.701302
BB4A-15	40.00	3.6888795	40.00	3.6888795	40.00	3.6888795
BB4A-16	40.00	3.6888795	40.00	3.6888795	40.00	3.6888795

BB4A-17	40.50	3.701302	40.50	3.701302	40.50	3.701302
BB4A-18	40.50	3.701302	40.50	3.701302	40.50	3.701302
BB4A-19	40.00	3.6888795	40.00	3.6888795	40.00	3.6888795
BB4A-20	40.00	3.6888795	40.00	3.6888795	40.00	3.6888795
BB4A-21	40.50	3.701302	40.50	3.701302	40.50	3.701302
BB4A-22	40.50	3.701302	40.50	3.701302	40.50	3.701302
BB4A-23	41.00	3.7135721	41.00	3.7135721	41.00	3.7135721
BB4A-24	41.00	3.7135721	41.00	3.7135721	41.00	3.7135721
BB5-01	40.00	3.6888795	105.00	4.6539604	40.00	3.6888795
BB5-02	40.00	3.6888795	40.00	3.6888795	40.00	3.6888795
BB5-03	23.00	3.1354942	40.00	3.6888795	40.00	3.6888795
BB5-04	29.00	3.3672958	40.50	3.701302	40.50	3.701302
BB5-05	40.50	3.701302	40.50	3.701302	40.50	3.701302
BB5-06	40.50	3.701302	23.00	3.1354942	40.50	3.701302
BB5-07	40.50	3.701302	40.50	3.701302	40.50	3.701302
BB5-08	40.50	3.701302	30.00	3.4011974	40.50	3.701302
BB5-09	41.00	3.7135721	41.00	3.7135721	41.00	3.7135721
BB5-10	41.00	3.7135721	41.00	3.7135721	41.00	3.7135721
BB5-11	41.00	3.7135721	41.00	3.7135721	41.00	3.7135721
BB5-12	41.00	3.7135721	41.00	3.7135721	41.00	3.7135721
BB5-13	40.50	3.701302	40.50	3.701302	40.50	3.701302
BB5-14	40.50	3.701302	40.50	3.701302	40.50	3.701302
BB5-15	40.50	3.701302	40.50	3.701302	40.50	3.701302
BB5-16	40.50	3.701302	40.50	3.701302	40.50	3.701302
BB6-01	40.00	3.6888795	40.00	3.6888795	40.00	3.6888795
BB6-02	40.00	3.6888795	40.00	3.6888795	40.00	3.6888795
BB6-03	40.50	3.701302	40.50	3.701302	40.50	3.701302
BB6-04	40.50	3.701302	40.50	3.701302	40.50	3.701302
BB6-05	41.00	3.7135721	41.00	3.7135721	41.00	3.7135721
BB6-06	41.00	3.7135721	41.00	3.7135721	41.00	3.7135721
BB6-07	42.00	3.7376696	42.00	3.7376696	42.00	3.7376696
BB6-08	113.00	4.7273878	41.00	3.7135721	113.00	4.7273878
BB6-09	41.00	3.7135721	41.00	3.7135721	41.00	3.7135721
BB6-10	106.00	4.6634391	41.00	3.7135721	106.00	4.6634391
BB6-11	40.00	3.6888795	40.00	3.6888795	40.00	3.6888795
BB6-12	40.00	3.6888795	40.00	3.6888795	40.00	3.6888795
BB6-13	40.00	3.6888795	40.00	3.6888795	40.00	3.6888795
BB6-14	40.00	3.6888795	40.00	3.6888795	40.00	3.6888795
BB7-01	40.00	3.6888795	40.00	3.6888795	40.00	3.6888795
BB7-02	40.50	3.701302	40.50	3.701302	40.50	3.701302
BB8-01	40.00	3.6888795	40.00	3.6888795	40.00	3.6888795
BB8-02	40.00	3.6888795	40.00	3.6888795	40.00	3.6888795
BB8-03	40.00	3.6888795	40.00	3.6888795	40.00	3.6888795
BB8-04	40.00	3.6888795	40.00	3.6888795	40.00	3.6888795
BB8-05	41.00	3.7135721	41.00	3.7135721	41.00	3.7135721
BB8-06	41.00	3.7135721	41.00	3.7135721	41.00	3.7135721

Statistic	PCB Aroclor Values		
	1248	1254	1260
Mean Ln Conc. =	3.78E+00	3.69E+00	3.68E+00
Standard Deviation Ln Conc. =	4.59E-01	3.29E-01	2.94E-01

Sample Size =	86	86	86
H-statistic =	1.8438	1.7414	1.7414
95% UCL of Conc. (ng/L) =	53.1778	44.8514	43.8968
95% UCL of Conc. (mg/L) =	5.32E-05	4.49E-05	4.39E-05

Total Concentration:	1.42E-04
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Risk Assessment: Polychlorinated Biphenyls
Method: 1 (Default values provided by USEPA)
Location: Little Bayou Creek
Pathway: Dermal Absorption of PCBs in Surface Water
User: Adult

where

NOMENCLATURE	VALUE
CW = PCB Concentration in Water (mg/L) =	1.96E-04
SA = Skin Surface Area (cm ² /event) =	9300.00
ED = Exposure Duration (year) =	22.00
EF = Exposure Frequency (day/year) =	52.00
ET = Exposure Time (hr/day) =	2.50
CF = Conversion Factor (L/cm ³) =	1.00E-03
PC = Permeability Constant (cm/hr) =	1.30
BW = Body Weight (kg) =	70.00
AT ₁ = Averaging Time Carcinogenic Effects (day) =	25550.00
AT ₂ = Averaging Time Non-Carcinogenic Effects (day) =	8030.00
SF = Slope Factor (kg day/mg) =	7.70
RfD = Reference Dose (mg/kg day) =	2.00E-05

CALCULATIONS:

CDI = Chronic (70 year) Daily Intake (mg/kg day)

$$\begin{aligned}
 &= \frac{CW \times SA \times ED \times EF \times ET \times CF \times PC}{BW \times AT_1} \\
 &= \frac{1.96E-04 \text{ mg}}{\text{L}} \times \frac{9300 \text{ cm}^2}{\text{event}} \times \frac{22 \text{ year}}{\text{year}} \times \frac{52 \text{ day}}{\text{year}} \times \frac{2.5 \text{ hr}}{\text{day}} \times \frac{1.00E-03 \text{ L}}{\text{cm}^3} \times \frac{1.3 \text{ cm}}{\text{hr}} \times \frac{70 \text{ kg}}{25550 \text{ day}} \\
 &= 3.78E-06 \text{ mg/kg-day}
 \end{aligned}$$

Carcinogen Risk = CDI x SF

$$\begin{aligned}
 &= \frac{3.78E-06 \text{ mg}}{\text{kg day}} \times \frac{7.70 \text{ kg day}}{\text{mg}} \\
 &= 2.91E-05
 \end{aligned}$$

E = Non-Carcinogenic Exposure Level (mg/kg day)

$$\begin{aligned}
 &= \frac{CW \times SA \times ED \times EF \times ET \times CF \times PC}{BW \times AT_2} \\
 &= \frac{1.96E-04 \text{ mg}}{\text{L}} \times \frac{9300 \text{ cm}^2}{\text{event}} \times \frac{22 \text{ year}}{\text{year}} \times \frac{52 \text{ day}}{\text{year}} \times \frac{2.5 \text{ hr}}{\text{day}} \times \frac{1.00E-03 \text{ L}}{\text{cm}^3} \times \frac{1.3 \text{ cm}}{\text{hr}} \times \frac{70 \text{ kg}}{8030 \text{ day}} \\
 &= 1.20E-05
 \end{aligned}$$

Risk Assessment: Polychlorinated Biphenyls
Method: 1 (Default values provided by USEPA)
Location: Little Bayou Creek
Pathway: Dermal Absorption of PCBs in Surface Water
User: Adult

CALCULATIONS (cont'd):

$$\begin{aligned}\text{Non-Carcinogenic Hazard Index} &= \frac{E}{\text{RfD}} \\ &= \frac{1.20\text{E-}05 \text{ mg}}{\text{kg day}} \bigg| \frac{\text{kg day}}{2.00\text{E-}05 \text{ mg}} \\ &= 6.02\text{E-}01\end{aligned}$$

Notes:

- 1.) Concentration data for surface water acquired from the following reference:

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. Submitted to Oak Ridge National Laboratory, Oak Ridge, Tennessee.

- 2.) RAGS dictates PCB Aroclor 1260 be used as standard PCB contaminant. PCB contaminants other than PCB 1260 which were detected in analysis were assumed to be toxicologically equivalent to PCB 1260. Thus, all PCB Aroclors detected were treated in the exposure calculations as if they were PCB 1260.
- 3.) Concentration of 1.96E-04 mg/L represents the Upper 95% Confidence Interval value, assuming a log normal distribution of data, for Aroclors 1248, 1254, and 1260 in an additive relationship.
- 4.) Slope factor for dermal absorption of PCB unavailable. Oral slope factor presented in Integrated Risk Information System (IRIS) substituted.
- 5.) Linear low-dose cancer risk equation used in calculating carcinogen risk due to estimation of low risk levels at site.
- 6.) Reference dose (RfD) for dermal absorption of PCB unavailable. Oral RfD presented in IRIS substituted. Oral RfD of Aroclor 1016 and 1254 (and others) provided. Aroclor 1254 (and others) represents the most conservative value, therefore, its value utilized.

Risk Assessment: Polychlorinated Biphenyls
Method: 1 (Default values provided by USEPA)
Location: Little Bayou Creek
Pathway: Dermal Absorption of PCBs in Surface Water
User: Adult

Sample Point	PCB 1248 Conc. ng/L	Ln of PCB 1248 Conc.	PCB 1254 Conc. ng/L	Ln of PCB 1254 Conc.	PCB 1260 Conc. ng/L	Ln of PCB 1260 Conc.
LB1-01	10.00	2.3025851	15.00	2.7080502	15.00	2.7080502
LB1-02	5.00	1.6094379	5.00	1.6094379	5.00	1.6094379
LB1-03	30.00	3.4011974	10.00	2.3025851	10.00	2.3025851
LB1-04	10.00	2.3025851	10.00	2.3025851	10.00	2.3025851
LB1-05	10.00	2.3025851	110.00	4.7004804	10.00	2.3025851
LB1-06	10.00	2.3025851	120.00	4.7874917	20.00	2.9957323
LB1-07	41.00	3.7135721	41.00	3.7135721	41.00	3.7135721
LB1-08	41.00	3.7135721	41.00	3.7135721	41.00	3.7135721
LB1-09	41.50	3.7256934	41.50	3.7256934	41.50	3.7256934
LB1-10	41.50	3.7256934	41.50	3.7256934	41.50	3.7256934
LB1-11	41.50	3.7256934	41.50	3.7256934	41.50	3.7256934
LB1-12	41.50	3.7256934	41.50	3.7256934	41.50	3.7256934
LB1-13	41.00	3.7135721	41.00	3.7135721	41.00	3.7135721
LB1-14	41.00	3.7135721	41.00	3.7135721	41.00	3.7135721
LB1-15	41.00	3.7135721	40.50	3.701302	40.50	3.701302
LB1-16	41.00	3.7135721	40.50	3.701302	40.50	3.701302
LB2A-01	40.00	3.6888795	10.00	2.3025851	10.00	2.3025851
LB2A-02	10.00	2.3025851	30.00	3.4011974	10.00	2.3025851
LB2A-03	20.00	2.9957323	10.00	2.3025851	10.00	2.3025851
LB2A-04	10.00	2.3025851	20.00	2.9957323	10.00	2.3025851
LB2A-05	194.00	5.2678582	42.00	3.7376696	42.00	3.7376696
LB2A-06	206.00	5.3278762	42.00	3.7376696	42.00	3.7376696
LB2A-07	201.00	5.3033049	42.50	3.7495041	42.50	3.7495041
LB2A-08	226.00	5.420535	42.50	3.7495041	42.50	3.7495041
LB2A-09	176.00	5.170484	42.50	3.7495041	42.50	3.7495041
LB2A-10	220.00	5.3936275	42.50	3.7495041	42.50	3.7495041
LB2A-11	153.00	5.0304379	40.50	3.701302	16.00	2.7725887
LB2A-12	190.00	5.2470241	40.50	3.701302	41.50	3.7256934
LB2A-13	145.00	4.9767337	40.50	3.701302	14.00	2.6390573
LB2A-14	168.00	5.123964	40.50	3.701302	40.50	3.701302
LB2-01	181.00	5.198497	40.00	3.6888795	40.00	3.6888795
LB2-02	179.00	5.1873858	40.00	3.6888795	40.00	3.6888795
LB2-03	170.00	5.1357984	40.50	3.701302	40.50	3.701302
LB2-04	174.00	5.1590553	40.50	3.701302	40.50	3.701302
LB2-05	133.00	4.8903491	41.00	3.7135721	41.00	3.7135721
LB2-06	142.00	4.9558271	41.00	3.7135721	41.00	3.7135721
LB2-07	157.00	5.0562458	41.00	3.7135721	20.50	3.0204249
LB2-08	231.00	5.4424177	41.00	3.7135721	41.00	3.7135721
LB2-09	21.00	3.0445224	40.50	3.701302	13.00	2.5649494
LB2-10	40.50	3.701302	40.50	3.701302	40.50	3.701302
LB3-01	41.50	3.7256934	41.50	3.7256934	41.50	3.7256934

LB3-02	41.50	3.7256934	41.50	3.7256934	41.50	3.7256934
LB3-03	41.00	3.7135721	41.00	3.7135721	41.00	3.7135721
LB3-04	41.00	3.7135721	41.00	3.7135721	41.00	3.7135721
LB3-05	94.00	4.5432948	41.50	3.7256934	41.50	3.7256934
LB3-06	102.00	4.6249728	41.50	3.7256934	41.50	3.7256934
LB3-07	41.00	3.7135721	41.00	3.7135721	41.00	3.7135721
LB3-08	41.00	3.7135721	41.00	3.7135721	41.00	3.7135721
LB3-09	40.00	3.6888795	40.00	3.6888795	40.00	3.6888795
LB3-10	40.00	3.6888795	40.00	3.6888795	40.00	3.6888795
LB4-01	42.00	3.7376696	42.00	3.7376696	42.00	3.7376696
LB4-02	42.00	3.7376696	42.00	3.7376696	42.00	3.7376696
LB4-03	42.50	3.7495041	42.50	3.7495041	42.50	3.7495041
LB4-04	42.50	3.7495041	42.50	3.7495041	42.50	3.7495041
LB4-05	41.00	3.7135721	41.00	3.7135721	41.00	3.7135721
LB4-06	41.00	3.7135721	41.00	3.7135721	41.00	3.7135721
LB4-07	41.00	3.7135721	41.00	3.7135721	41.00	3.7135721
LB4-08	41.00	3.7135721	41.00	3.7135721	41.00	3.7135721
LB4-09	41.00	3.7135721	41.00	3.7135721	41.00	3.7135721
LB4-10	41.00	3.7135721	41.00	3.7135721	41.00	3.7135721
LB4-11	40.50	3.701302	40.50	3.701302	40.50	3.701302
LB4-12	40.50	3.701302	40.50	3.701302	40.50	3.701302

Statistic	PCB Aroclor Values		
	1248	1254	1260
Mean Ln Conc. =	3.97	3.59	3.43
Standard Deviation Ln Conc. =	9.42E-01	5.00E-01	5.57E-01
Sample Size =	61	61	61
H-statistic =	2.1882	1.8668	1.8742
95% UCL of Conc. (ng/L) =	107.9070	46.3845	41.4088
95% UCL of Conc. (mg/L) =	1.08E-04	4.64E-05	4.14E-05

Total Concentration: 1.96E-04

Risk Assessment: Polychlorinated Biphenyls
Calculational Spreadsheet: Inhalation of PCB Vapor from Soil
Location: Big Bayou Creek (BBC) and Little Bayou Creek (LBC)

	EXPOSURE SCENARIO VALUES							
	1	2	3	4	5	6	7	8
CALCULATIONAL NOMENCLATURE								
CS = PCB Concentration in Soil (mg/kg) =	0.1741	0.1741	0.1741	0.1741	59.10	59.10	59.10	59.10
INHR = Inhalation Rate (mg/day) =	2.50E+00	2.50E+00	2.50E+00	2.50E+00	2.50E+00	2.50E+00	2.50E+00	2.50E+00
ET = Exposure Time (hr/day) =	5.00	5.00	4.00	4.00	5.00	5.00	2.00	2.00
EF = Exposure Frequency (event/year) =	52.00	140.00	10.00	10.00	52.00	140.00	10.00	10.00
ED = Exposure Duration (year) =	22.00	12.00	22.00	12.00	22.00	12.00	22.00	12.00
VF = Volatilization Factor (m ³ /kg) =	1.54E+05	1.14E+05	1.54E+05	1.14E+05	1.54E+05	1.14E+05	1.54E+05	1.14E+05
BW = Body Weight (kg) =	70.00	43.00	70.00	43.00	70.00	43.00	70.00	43.00
AT ₁ = Averaging Time Carcinogenic Effect (day) =	25550.00	25550.00	25550.00	25550.00	25550.00	25550.00	25550.00	25550.00
AT ₂ = Averaging Time Non-Carcinogenic Effect (day) =	8030.00	4380.00	8030.00	4380.00	8030.00	4380.00	8030.00	4380.00
SF = Slope Factor (kg day/mg) =	7.70	7.70	7.70	7.70	7.70	7.70	7.70	7.70
RfD = Reference Dose (mg/kg day) =	2.00E-05	2.00E-05	2.00E-05	2.00E-05	2.00E-05	2.00E-05	2.00E-05	2.00E-05
CDI = Chronic (70 year) Daily Intake (mg/kg day) =	9.01E-09	2.92E-08	1.39E-09	1.67E-09	3.06E-06	9.90E-06	2.35E-07	2.83E-07
Carcinogenic Risk =	6.94E-08	2.25E-07	1.07E-08	1.28E-08	2.36E-05	7.62E-05	1.81E-06	2.18E-06
E = Non-Carcinogenic Exposure Level (mg/kg day) =	2.87E-08	1.70E-07	4.41E-09	9.72E-09	9.73E-06	5.78E-05	7.49E-07	1.65E-06
Non-Carcinogenic Hazard Index =	1.43E-03	8.51E-03	2.21E-04	4.86E-04	4.87E-01	2.89E+00	3.74E-02	8.25E-02

Scenario	Subject	Location	Method	Defaults	Lifetime Carcinogenic Risk = (BBC, Method 1)
1	Adult	BBC	1	USEPA	2.94E-07
2	Child	BBC	1	USEPA	
3	Adult	BBC	2	KDFWR	2.35E-08
4	Child	BBC	2	KDFWR	
5	Adult	LBC	1	USEPA	
6	Child	LBC	1	USEPA	9.98E-05
7	Adult	LBC	2	KDFWR	
8	Child	LBC	2	KDFWR	3.99E-06
				Lifetime Carcinogenic Risk = (LBC, Method 2)	

Note: Lifetime Carcinogenic Risk accounts for risks due to exposure as a child and an adult.

Risk Assessment: Polychlorinated Biphenyls
Method: 1 (Default values provided by USEPA)
Location: Big Bayou Creek
Pathway: Inhalation of PCB Vapor from Soil
User: Adult

where

NOMENCLATURE	VALUE
CS = PCB Concentration in Soil (mg/kg) =	0.1741
IR = Inhalation Rate (m ³ /hr) =	2.50
ET = Exposure Time (hr/day) =	5.00
EF = Exposure Frequency (day/year) =	52.00
ED = Exposure Duration (year) =	22.00
VF = Volatilization Factor (m ³ /kg) =	1.54E+05
BW = Body Weight (kg) =	70.00
AT ₁ = Averaging Time Carcinogenic Effects (day) =	25550.00
AT ₂ = Averaging Time Non-Carcinogenic Effects (day) =	8030.00
SF = Slope Factor (kg day/mg) =	7.70
RfD = Reference Dose (mg/kg day) =	2.00E-05

CALCULATIONS:

CDI = Chronic (70 year) Daily Intake (mg/kg day)

$$\begin{aligned}
 &= \frac{CS \times IR \times ET \times EF \times ED}{VF \times BW \times AT_1} \\
 &= \frac{0.1741 \text{ mg/kg} \times 2.50 \text{ m}^3/\text{hr} \times 5.00 \text{ hr/day} \times 104.00 \text{ day/year} \times 22 \text{ year}}{1.54E+05 \text{ m}^3/\text{kg} \times 70.00 \text{ kg} \times 25550 \text{ day}} \\
 &= 9.01E-09 \text{ mg/kg day}
 \end{aligned}$$

Carcinogen Risk = CDI x SF

$$\begin{aligned}
 &= \frac{9.01E-09 \text{ mg/kg day} \times 7.70 \text{ kg day/mg}}{1} \\
 &= 6.94E-08
 \end{aligned}$$

E = Non-Carcinogenic Exposure Level (mg/kg day)

$$\begin{aligned}
 &= \frac{CS \times IR \times ET \times EF \times ED}{VF \times BW \times AT_2} \\
 &= \frac{0.1741 \text{ mg/kg} \times 2.50 \text{ m}^3/\text{hr} \times 5.00 \text{ hr/day} \times 104.00 \text{ day/year} \times 22 \text{ year}}{1.54E+05 \text{ m}^3/\text{kg} \times 70.00 \text{ kg} \times 8030 \text{ day}} \\
 &= 2.87E-08 \text{ mg/kg day}
 \end{aligned}$$

Risk Assessment: Polychlorinated Biphenyls
Method: 1 (Default values provided by USEPA)
Location: Big Bayou Creek
Pathway: Inhalation of PCB Vapor from Soil
User: Adult

CALCULATIONS (cont'd):

$$\begin{aligned}\text{Non-Carcinogenic Hazard Index} &= \frac{E}{\text{RfD}} \\ &= \frac{2.87\text{E-}08\text{mg}}{\text{kg day}} \bigg| \frac{\text{kg day}}{2.00\text{E-}05 \text{ mg}} \\ &= 1.43\text{E-}03\end{aligned}$$

Notes:

- 1.) Concentration data for soil acquired from the following reference:

CH2MHill. 1991. Results of the Site Investigation at the Paducah Gaseous Diffusion Plant, Paducah, Kentucky, U.S. Department of Energy. Document No. KY/ER-4.

- 2.) RAGS dictates PCB Aroclor 1260 be used as standard PCB contaminant. PCB contaminants other than PCB 1260 which were detected in analysis were assumed to be toxicologically equivalent to PCB 1260. Thus, all PCB Arochlors detected were treated in the exposure calculations as if they were PCB 1260.
- 3.) Concentration of 0.1741 mg/kg represents the Upper 95% Confidence Interval value, assuming a log normal distribution of data, for Aroclors 1248 and 1260, in an additive relationship.
- 4.) Slope factor for inhalation of vapor of PCB unavailable. Oral slope factor presented in Integrated Risk Information System (IRIS) substituted.
- 5.) Linear low-dose cancer risk equation used in calculating carcinogen risk due to estimation of low risk levels at site.
- 6.) Reference dose (RfD) for inhalation of vapor of PCB unavailable. Oral RfD presented in IRIS substituted. Oral RfD of Aroclor 1016 and 1254 (and others) provided. Aroclor 1254 (and others) represents the most conservative value, therefore, its value utilized.

Risk Assessment: Polychlorinated Biphenyls
 Method: 1 (Default values provided by USEPA)
 Location: Big Bayou Creek
 Pathway: Inhalation of PCB Vapor from Soil
 User: Adult

Sample Point	PCB 1248 Conc. ug/kg	LN of PCB 1248 Conc.	PCB 1260 Conc. ug/kg	LN of PCB 1260 Conc.
SB011-5	49.000	3.891820298	95.000	4.5538769
SB011-6	50.000	3.912023005	100.000	4.6051702
SB014-1	55.000	4.007333185	110.000	4.7004804

Statistic	PCB Aroclor Values	
	1248	1260
Mean Ln Conc. =	3.94E+00	4.62E+00
Standard Deviation Ln Conc. =	6.17E-02	7.44E-02
Sample Size* =	3	3
H-statistic =	2.54	2.61
95% UCL of Conc. (ug/kg) =	57.3839	116.7353
95% UCL of Conc. (mg/kg) =	0.0574	0.1167

Total Concentration: 1.74E-01

Risk Assessment: Polychlorinated Biphenyls
Method: 1 (Default values provided by USEPA)
Location: Little Bayou Creek
Pathway: Inhalation of PCB Vapor from Soil
User: Adult

where

NOMENCLATURE	VALUE
CS = PCB Concentration in Soil (mg/kg) =	59.10
IR = Inhalation Rate (m ³ /hr) =	2.50
ET = Exposure Time (hr/day) =	5.00
EF = Exposure Frequency (day/year) =	52.00
ED = Exposure Duration (year) =	22.00
VF = Volatilization Factor (m ³ /kg) =	1.54E+05
BW = Body Weight (kg) =	70.00
AT ₁ = Averaging Time Carcinogenic Effects (day) =	25550.00
AT ₂ = Averaging Time Non-Carcinogenic Effects (day) =	8030.00
SF = Slope Factor (kg day/mg) =	7.70
RfD = Reference Dose (mg/kg day) =	2.00E-05

CALCULATIONS:

CDI = Chronic (70 year) Daily Intake (mg/kg day)

$$\begin{aligned}
 &= \frac{CS \times IR \times ET \times EF \times ED}{VF \times BW \times AT_1} \\
 &= \frac{59.10 \text{ mg}}{\text{kg}} \times \frac{2.50 \text{ m}^3}{\text{hr}} \times \frac{5.00 \text{ hr}}{\text{day}} \times \frac{52.00 \text{ day}}{\text{year}} \times \frac{22 \text{ year}}{1} \times \frac{\text{kg}}{1.54E+05 \text{ m}^3} \times \frac{1}{70.00 \text{ kg}} \times \frac{1}{25550 \text{ day}} \\
 &= 3.06E-06 \text{ mg/kg day}
 \end{aligned}$$

Carcinogen Risk = CDI x SF

$$\begin{aligned}
 &= \frac{3.06E-06 \text{ mg}}{\text{kg day}} \times \frac{7.70 \text{ kg day}}{\text{mg}} \\
 &= 2.36E-05
 \end{aligned}$$

E = Non-Carcinogenic Exposure Level (mg/kg day)

$$\begin{aligned}
 &= \frac{CS \times IR \times ET \times EF \times ED}{VF \times BW \times AT_2} \\
 &= \frac{59.10 \text{ mg}}{\text{kg}} \times \frac{2.50 \text{ m}^3}{\text{hr}} \times \frac{5.00 \text{ hr}}{\text{day}} \times \frac{52.00 \text{ day}}{\text{year}} \times \frac{22 \text{ year}}{1} \times \frac{\text{kg}}{1.54E+05 \text{ m}^3} \times \frac{1}{70.00 \text{ kg}} \times \frac{1}{8030 \text{ day}} \\
 &= 9.73E-06 \text{ mg/kg day}
 \end{aligned}$$

Risk Assessment: Polychlorinated Biphenyls
Method: 1 (Default values provided by USEPA)
Location: Little Bayou Creek
Pathway: Inhalation of PCB Vapor from Soil
User: Adult

CALCULATIONS (cont'd):

$$\begin{aligned}\text{Non-Carcinogenic Hazard Index} &= \frac{E}{\text{RfD}} \\ &= \frac{9.73\text{E-}06 \text{ mg} \text{ kg day}}{\text{kg day} \text{ } 2.00\text{E-}05 \text{ mg}} \\ &= 4.87\text{E-}01\end{aligned}$$

Notes:

- 1.) Concentration data for soil acquired from the following reference:

CH2MHill. 1991. Results of the Site Investigation at the Paducah Gaseous Diffusion Plant, Paducah, Kentucky, U.S. Department of Energy. Document No. KY/ER-4.

- 2.) RAGS dictates PCB Aroclor 1260 be used as standard PCB contaminant. PCB contaminants other than PCB 1260 which were detected in analysis were assumed to be toxicologically equivalent to PCB 1260. Thus, all PCB Arochlors detected were treated in the exposure calculations as if they were PCB 1260.
- 3.) Concentration of 59.10 mg/kg represents highest encountered PCB 1248 and 1260 concentrations encountered in soil samples. Upper 95% CI not used.
- 4.) Slope factor for inhalation of vapor of PCB unavailable. Oral slope factor presented in Integrated Risk Information System (IRIS) substituted.
- 5.) Linear low-dose cancer risk equation used in calculating carcinogen risk due to estimation of low risk levels at site.
- 6.) Reference dose (RfD) for inhalation of vapor of PCB unavailable. Oral RfD presented in IRIS substituted. Oral RfD of Aroclor 1016 and 1254 (and others) provided. Aroclor 1254 (and others) represents the most conservative value, therefore, its value utilized.

Risk Assessment: Polychlorinated Biphenyls
Method: 1 (Default values provided by USEPA)
Location: Little Bayou Creek
Pathway: Inhalation of PCB Vapor from Soil
User: Adult

Sample Point	PCB 1248 Conc. mg/kg	Ln of PCB 1248 Conc.	PCB 1260 Conc. mg/kg	Ln of PCB 1260 Conc.
SB001-3	53.000	3.970291914	5.700	1.7404662
SB004-4	0.027	-3.61191841	0.250	-1.386294
SB009-1	29.000	3.36729583	6.100	1.8082888
SB009-5	17.000	2.833213344	4.000	1.3862944

Statistic	PCB Aroclor Values	
	1248	1260
Mean Ln Conc. =	1.64E+00	8.87E-01
Standard Deviation Ln Conc. =	3.53E+00	1.53E+00
Sample Size* =	4	4
H-statistic =	45.77	19.60
95% UCL of Conc. =	8.97E+43	2.49E+08

Total Concentration: 8.97E+43

* Concentration of 59.10 mg/kg used in calculation. Represents highest sampled PCB 1248 and 1260 concentrations encountered in soil samples. Upper 95% CI concentration of 8.97E+43 not used.

Risk Assessment: Polychlorinated Biphenyls
Calculational Spreadsheet: Ingestion of PCB in Fish Tissue
Location: Big Bayou Creek (BBC) and Little Bayou Creek (LBC)

CALCULATIONAL NOMENCLATURE	EXPOSURE SCENARIO VALUES					
	1	2	3	4	5	6
CS = PCB Concentration in Fish (mg/kg) =	0.8566	0.8566	0.8566	0.8566	1.0611	1.0611
IR = Ingestion Rate (kg/meal) =	0.2840	0.2840	0.2840	0.2840	0.2840	0.2840
FI = Fraction Ingested from Contaminated Source =	1.00	1.00	1.00	1.00	1.00	1.00
EF = Exposure Frequency (meal/year) =	128.00	128.00	64.00	64.00	128.00	128.00
ED = Exposure Duration (year) =	22.00	12.00	22.00	12.00	22.00	12.00
BW = Body Weight (kg) =	70.00	43.00	70.00	43.00	70.00	43.00
AT ₁ = Averaging Time Carcinogenic Effect (day)	25550.00	25550.00	25550.00	25550.00	25550.00	25550.00
AT ₂ = Averaging Time Non-Carcinogenic Effect (day) =	8030.00	4380.00	8030.00	4380.00	8030.00	4380.00
SF = Slope Factor (kg day/mg) =	7.70	7.70	7.70	7.70	7.70	7.70
RfD = Reference Dose (mg/kg day) =	2.00E-05	2.00E-05	2.00E-05	2.00E-05	2.00E-05	2.00E-05
CDI = Chronic (70 year) Daily Intake (mg/kg day) =	3.83E-04	3.40E-04	1.92E-04	1.70E-04	4.74E-04	4.21E-04
Carcinogenic Risk =	2.95E-03	2.62E-03	1.47E-03	1.31E-03	3.65E-03	3.24E-03
E = Non-Carcinogenic Exposure Level (mg/kg day) =	1.22E-03	1.98E-03	6.09E-04	9.92E-04	1.51E-03	2.46E-03
Non-Carcinogenic Hazard Index =	6.09E+01	9.92E+01	3.05E+01	4.96E+01	7.55E+01	1.23E+02

Scenario	Subject	Location	Method	Defaults	Lifetime Carcinogenic Risk =	
1	Adult	BBC	1	USEPA	(BBC, Method 1)	5.57E-03
2	Child	BBC	1	USEPA		
3	Adult	BBC	2	KDFWR	Lifetime Carcinogenic Risk =	2.78E-03
4	Child	BBC	2	KDFWR	(BBC, Method 2)	
5	Adult	LBC	1	USEPA		
6	Child	LBC	1	USEPA	Lifetime Carcinogenic Risk =	6.90E-03
					(LBC, Method 1)	

Note: Lifetime Carcinogenic Risk accounts for risks due to exposure as a child and an adult.

Risk Assessment: Polychlorinated Biphenyls
Method: 1 (Default values provided by USEPA)
Location: Big Bayou Creek
Pathway: Ingestion of PCB in Fish Tissue
User: Adult

where

NOMENCLATURE	VALUE
CF = PCB Concentration in Fish (mg/kg) =	0.8566
IR = Ingestion Rate (kg/meal) =	0.284
FI = Fraction Ingested from Contaminated Source =	1.00
EF = Exposure Frequency (meal/year) =	128.00
ED = Exposure Duration (year) =	22.00
BW = Body Weight (kg) =	70.00
AT ₁ = Averaging Time Carcinogenic Effects (day) =	25550.00
AT ₂ = Averaging Time Non-Carcinogenic Effects (day) =	8030.00
SF = Slope Factor (kg day/mg) =	7.70
RfD = Reference Dose (mg/kg day) =	2.00E-05

CALCULATIONS:

CDI = Chronic (70 year) Daily Intake (mg/kg day)

$$\begin{aligned}
 &= \frac{CF \times IR \times FI \times EF \times ED}{BW \times AT_1} \\
 &= \frac{0.8655 \text{ mg}}{\text{kg}} \times \frac{0.284 \text{ kg}}{\text{meal}} \times 1 \times \frac{128 \text{ meal}}{\text{year}} \times \frac{22 \text{ year}}{70 \text{ kg}} \times \frac{1}{25550 \text{ day}} \\
 &= 3.83\text{E-}04 \text{ mg/kg-day}
 \end{aligned}$$

Carcinogen Risk = CDI x SF

$$\begin{aligned}
 &= \frac{3.83\text{E-}04 \text{ mg}}{\text{kg day}} \times \frac{7.70 \text{ kg day}}{\text{mg}} \\
 &= 2.95\text{E-}03
 \end{aligned}$$

E = Non-Carcinogenic Exposure Level (mg/kg day)

$$\begin{aligned}
 &= \frac{CF \times IR \times FI \times EF \times ED}{BW \times AT_2} \\
 &= \frac{0.8655 \text{ mg}}{\text{kg}} \times \frac{0.284 \text{ kg}}{\text{meal}} \times 1 \times \frac{128 \text{ meal}}{\text{year}} \times \frac{22 \text{ year}}{70 \text{ kg}} \times \frac{1}{8030 \text{ day}} \\
 &= 1.22\text{E-}03
 \end{aligned}$$

Risk Assessment: Polychlorinated Biphenyls
Method: 1 (Default values provided by USEPA)
Location: Big Bayou Creek
Pathway: Ingestion of PCB in Fish Tissue
User: Adult

CALCULATIONS (cont'd):

$$\begin{aligned}\text{Non-Carcinogenic Hazard Index} &= \frac{E}{\text{RfD}} \\ &= \frac{1.22\text{E-}03 \text{ mg}}{\text{kg day}} \frac{\text{kg day}}{2.00\text{E-}05 \text{ mg}} \\ &= 6.09\text{E+}01\end{aligned}$$

Notes:

- 1.) Concentration data for fish acquired from the following reference:

Oak Ridge National Laboratorys PCB fish tissue data reference. Received in correspondence from Mr. Danny R. Guminski (Environmental Management - Lockheed Martin) to FMSM and the Nashville District on 12, September 1995.

- 2.) RAGS dictates PCB Aroclor 1260 be used as standard PCB contaminant. PCB contaminants other than PCB 1260 which were detected in analysis were assumed to be toxicologically equivalent to PCB 1260. Thus, all PCB Aroclors detected were treated in the exposure calculations as if they were PCB 1260.
- 3.) Concentration of 0.8566 mg/kg represents the Upper 95% Confidence Interval value, assuming a log normal distribution of data, for Aroclors 1248, 1254, and 1260 in an additive relationship.
- 4.) Linear low-dose cancer risk equation used in calculating carcinogen risk due to estimation of low risk levels at site.
- 5.) Oral Reference dose (RfD) of PCB Aroclor 1254 as found in IRIS used in calculation. Oral RfD of Aroclor 1016 and 1254 (and others) provided. Aroclor 1254 (and others) represents the most conservative value, therefore, its value utilized.

Risk Assessment: Polychlorinated Biphenyls
Method: 1 (Default values provided by USEPA)
Location: Big Bayou Creek
Pathway: Ingestion of PCB in Fish Tissue
User: Adult

See USEFISH.doc for fish data

Risk Assessment: Polychlorinated Biphenyls
Method: 1 (Default values provided by USEPA)
Location: Little Bayou Creek
Pathway: Ingestion of PCB in Fish Tissue
User: Adult

where

NOMENCLATURE	VALUE
CF = PCB Concentration in Fish (mg/kg) =	1.0611
IR = Ingestion Rate (kg/meal) =	0.284
FI = Fraction Ingested from Contaminated Source =	1.00
EF = Exposure Frequency (meal/year) =	128.00
ED = Exposure Duration (year) =	22.00
BW = Body Weight (kg) =	70.00
AT ₁ = Averaging Time Carcinogenic Effects (day) =	25550.00
AT ₂ = Averaging Time Non-Carcinogenic Effects (day) =	8030.00
SF = Slope Factor (kg day/mg) =	7.70
RfD = Reference Dose (mg/kg day) =	2.00E-05

CALCULATIONS:

CDI = Chronic (70 year) Daily Intake (mg/kg day)

$$\begin{aligned}
 &= \frac{CF \times IR \times FI \times EF \times ED}{BW \times AT_1} \\
 &= \frac{1.0611 \text{ mg}}{\text{kg}} \times \frac{0.284 \text{ kg}}{\text{meal}} \times 1 \times \frac{128 \text{ meal}}{\text{year}} \times \frac{22 \text{ year}}{70 \text{ kg}} \times \frac{1}{25550 \text{ day}} \\
 &= 4.74\text{E-}04 \text{ mg/kg-day}
 \end{aligned}$$

Carcinogen Risk = CDI x SF

$$\begin{aligned}
 &= \frac{4.74\text{E-}04 \text{ mg}}{\text{kg day}} \times \frac{7.70 \text{ kg day}}{\text{mg}} \\
 &= 3.65\text{E-}03
 \end{aligned}$$

E = Non-Carcinogenic Exposure Level (mg/kg day)

$$\begin{aligned}
 &= \frac{CF \times IR \times FI \times EF \times ED}{BW \times AT_2} \\
 &= \frac{1.0611 \text{ mg}}{\text{kg}} \times \frac{0.284 \text{ kg}}{\text{meal}} \times 1 \times \frac{128 \text{ meal}}{\text{year}} \times \frac{22 \text{ year}}{70 \text{ kg}} \times \frac{1}{4380 \text{ day}} \\
 &= 1.51\text{E-}03
 \end{aligned}$$

Risk Assessment: Polychlorinated Biphenyls
Method: 1 (Default values provided by USEPA)
Location: Little Bayou Creek
Pathway: Ingestion of PCB in Fish Tissue
User: Adult

CALCULATIONS (cont'd):

$$\begin{aligned}\text{Non-Carcinogenic Hazard Index} &= \frac{E}{\text{RfD}} \\ &= \frac{1.51\text{E-}03 \text{ mg}}{\text{kg day}} \bigg| \frac{\text{kg day}}{2.00\text{E-}05 \text{ mg}} \\ &= 7.55\text{E+}01\end{aligned}$$

Notes:

- 1.) Concentration data for fish acquired from the following reference:

Oak Ridge National Laboratorys PCB fish tissue data reference. Received in correspondence from Mr. Danny R. Guminski (Environmental Management - Lockheed Martin) to FMSM and the Nashville District on 12, September 1995.

- 2.) RAGS dictates PCB Aroclor 1260 be used as standard PCB contaminant. PCB contaminants other than PCB 1260 which were detected in analysis were assumed to be toxicologically equivalent to PCB 1260. Thus, all PCB Arochlors detected were treated in the exposure calculations as if they were PCB 1260.
- 3.) Concentration of 1.0611 mg/kg represents the Upper 95% Confidence Interval value, assuming a log normal distribution of data, for Aroclors 1248, 1254, and 1260 in an additive relationship.
- 4.) Linear low-dose cancer risk equation used in calculating carcinogen risk due to estimation of low risk levels at site.
- 5.) Oral Reference dose (RfD) of PCB Aroclor 1254 as found in IRIS used in calculation. Oral RfD of Aroclor 1016 and 1254 (and others) provided. Aroclor 1254 (and others) represents the most conservative value, therefore, its value utilized.

Risk Assessment: Polychlorinated Biphenyls
Method: 1 (Default values provided by USEPA)
Location: Little Bayou Creek
Pathway: Ingestion of PCB in Fish Tissue
User: Adult

See USEFISH.doc for fish data

PCB Fish Tissue Data														
				1248	1248	1248		1254	1254	1254		Conc.	1260	1260
				Conc.	Conc.	Ln Conc.		Conc.	Conc.	Ln Conc.		Term	Conc.	Ln Conc.
Site	Date	Spp.	48qu	(ug/g)	(ng/g)	(ng/g)	54qu	(ug/g)	(ng/g)	(ng/g)	60qu	(ug/g)	(ng/g)	(ng/g)
BBK9.1	10/19/92	LNGEAR	J	0.16	155.00	5.04	J	0.08	81.00	4.39	J	0.098	98.00	4.58
BBK9.1	10/19/92	LNGEAR	J	0.16	156.00	5.05	J	0.10	97.00	4.57	J	0.265	265.00	5.58
BBK9.1	10/19/92	LNGEAR	J	0.16	159.00	5.07	J	0.08	79.00	4.37	J	0.102	102.00	4.62
BBK9.1	10/19/92	LNGEAR	J	0.14	136.00	4.91	J	0.12	122.00	4.80	J	0.152	152.00	5.02
BBK9.1	10/19/92	LNGEAR	J	0.22	224.00	5.41	J	0.16	164.00	5.10	J	0.266	266.00	5.58
BBK9.1	10/19/92	LNGEAR	J	0.13	134.00	4.90	J	0.14	135.00	4.91	J	0.124	124.00	4.82
BBK9.1	10/19/92	LNGEAR	U	0.19	192.00	5.26	U	0.38	384.00	5.95	J	0.041	41.00	3.71
BBK9.1	10/19/92	LNGEAR	J	0.19	189.00	5.24	J	0.06	57.00	4.04	J	0.079	79.00	4.37
BBK9.1	10/20/92	SPBASS	U	0.07	70.00	4.25	U	0.14	140.00	4.94	J	0.080	80.00	4.38
BBK9.1	10/20/92	SPBASS	J	0.06	57.00	4.04	U	0.15	145.00	4.98	J	0.129	129.00	4.86
BBK9.1	10/20/92	SPBASS	U	0.06	63.00	4.14	U	0.13	125.00	4.83	J	0.105	105.00	4.65
BBK9.1	10/20/92	SPBASS	J	0.03	34.00	3.53	U	0.17	170.00	5.14	J	0.084	84.00	4.43
BBK9.1	10/20/92	SPBASS	J	0.04	35.00	3.56	U	0.13	130.00	4.87	J	0.072	72.00	4.28
BBK9.1	10/20/92	SPBASS	J	0.03	34.00	3.53	U	0.13	130.00	4.87	J	0.096	96.00	4.56
BBK9.1	10/20/92	SPBASS	J	0.02	21.00	3.04	U	0.13	130.00	4.87	J	0.131	131.00	4.88
BBK9.1	10/20/92	SPBASS	J	0.05	46.00	3.83	U	0.17	170.00	5.14	J	0.302	302.00	5.71
BBK9.1	4/27/93	LNGEAR	U	0.25	248.00	5.51	J	0.13	127.00	4.84	J	0.127	127.00	4.84
BBK9.1	4/27/93	LNGEAR	U	0.32	324.40	5.78	.	0.24	241.70	5.49	.	0.273	273.10	5.61
BBK9.1	4/27/93	LNGEAR					.				.			
BBK9.1	4/27/93	LNGEAR	U	0.21	209.85	5.35	.	0.15	151.80	5.02	.	0.198	197.90	5.29
BBK9.1	4/27/93	LNGEAR	U	0.22	222.50	5.40	.	0.09	85.46	4.45	U	0.445	445.03	6.10
BBK9.1	4/27/93	LNGEAR	J	0.06	57.00	4.04	J	0.21	214.00	5.37	J	0.215	215.00	5.37
BBK9.1	4/27/93	LNGEAR	U	0.20	200.00	5.30	J	0.11	107.00	4.67	J	0.087	87.00	4.47
BBK9.1	4/27/93	LNGEAR	U	0.19	190.40	5.25	.	0.14	139.60	4.94	.	0.122	122.00	4.80
BBK9.1	4/27/93	LNGEAR	U	0.20	203.20	5.31	.	0.08	79.60	4.38	U	0.406	406.40	6.01
BBK9.1	4/27/93	LNGEAR	U	0.26	260.80	5.56	.	0.34	339.70	5.83	.	0.162	161.60	5.09
BBK9.1	4/27/93	LNGEAR	U	0.23	230.80	5.44	.	0.12	117.30	4.76	.	0.140	140.40	4.94
BBK9.1	4/27/93	LNGEAR	U	0.19	192.00	5.26	.	0.40	397.00	5.98	.	0.370	370.00	5.91
BBK9.1	10/14/93	SPBASS	J	0.02	17.20	2.84	J	0.05	48.90	3.89	J	0.079	79.00	4.37
BBK9.1	10/14/93	SPBASS	J	0.03	25.31	3.23	J	0.07	71.26	4.27	J	0.076	75.55	4.32
BBK9.1	10/14/93	SPBASS	J	0.01	13.13	2.57	J	0.04	42.82	3.76	J	0.047	46.64	3.84
BBK9.1	10/14/93	SPBASS	J	0.06	62.50	4.14	J	0.18	178.40	5.18	J	0.196	196.30	5.28

Sheet1

BBK9.1	10/14/93	SPBASS	J	0.05	53.30	3.98	J	0.12	116.00	4.75	J	0.112	112.00	4.72
BBK9.1	10/14/93	SPBASS	J	0.02	22.60	3.12	J	0.05	46.70	3.84	J	0.049	48.90	3.89
BBK9.1	10/14/93	SPBASS	J	0.04	42.64	3.75	J	0.10	99.19	4.60	J	0.093	93.44	4.54
BBK9.1	10/14/93	SPBASS	J	0.04	35.30	3.56	J	0.09	94.90	4.55	J	0.108	108.10	4.68
BBK9.1	10/14/93	LNGEAR	J	0.01	5.40	1.69	J	0.01	11.20	2.42	J	0.036	35.90	3.58
BBK9.1	10/14/93	LNGEAR	J	0.07	68.00	4.22	J	0.13	128.00	4.85	J	0.107	107.00	4.67
BBK9.1	10/14/93	LNGEAR	U	0.27	272.00	5.61	J	0.03	26.40	3.27	J	0.007	7.00	1.95
BBK9.1	10/14/93	LNGEAR	J	0.06	59.00	4.08	J	0.08	78.20	4.36	J	0.123	123.00	4.81
BBK9.1	10/14/93	LNGEAR	J	0.12	122.00	4.80	J	0.13	127.00	4.84	J	0.092	92.00	4.52
BBK9.1	10/14/93	LNGEAR	J	0.04	37.00	3.61	J	0.03	32.00	3.47	J	0.021	21.00	3.04
BBK9.1	10/14/93	LNGEAR	J	0.03	29.00	3.37	J	0.04	40.00	3.69	J	0.021	21.00	3.04
BBK9.1	10/14/93	LNGEAR	J	0.03	31.00	3.43	J	0.03	34.00	3.53	J	0.021	21.00	3.04
BBK9.1	5/3/94	LNGEAR	J	0.03	32.00	3.47	J	0.12	117.00	4.76	J	0.116	116.00	4.75
BBK9.1	5/3/94	LNGEAR	.								.			
BBK9.1	5/3/94	LNGEAR	U	0.02	20.50	3.02	J	0.09	87.00	4.47	J	0.082	82.00	4.41
BBK9.1	5/3/94	LNGEAR	U	0.18	184.90	5.22	U	0.37	369.79	5.91	J	0.096	96.00	4.56
BBK9.1	5/3/94	LNGEAR	U	0.22	223.42	5.41	J	0.08	78.00	4.36	J	0.088	88.00	4.48
BBK9.1	5/3/94	LNGEAR	U	0.02	17.50	2.86	J	0.03	33.00	3.50	U	0.035	35.00	3.56
BBK9.1	5/3/94	LNGEAR	U	0.20	204.00	5.32	J	0.19	186.00	5.23	J	0.316	316.00	5.76
BBK9.1	5/3/94	LNGEAR	U	0.23	225.60	5.42	J	0.09	86.00	4.45	J	0.128	128.00	4.85
BBK9.1	10/20/94	LNGEAR	.				JP	0.03	33.00	3.50	.	0.061	61.00	4.11
BBK9.1	10/20/94	LNGEAR	.				J	0.07	70.00	4.25	.	0.102	102.00	4.62
BBK9.1	10/20/94	LNGEAR	.				P	0.11	110.00	4.70	P	0.13	130.00	4.87
BBK9.1	10/20/94	LNGEAR	.				P	0.12	120.00	4.79	.	0.19	190.00	5.25
BBK9.1	10/20/94	LNGEAR	.				.	0.06	55.00	4.01	.	0.088	88.00	4.48
BBK9.1	10/20/94	LNGEAR	.				.	0.06	58.00	4.06	.	0.076	76.00	4.33
BBK9.1	10/20/94	LNGEAR	.				JP	0.04	37.00	3.61	J	0.062	62.00	4.13
BBK9.1	10/20/94	LNGEAR	.				JP	0.04	40.00	3.69	JP	0.05	50.00	3.91
BBK9.1	10/20/94	SPBASS	.				P	0.06	64.00	4.16	.	0.071	71.00	4.26
BBK9.1	10/20/94	SPBASS	.				J	0.05	45.00	3.81	.	0.140	140.00	4.94
BBK9.1	10/20/94	SPBASS	.				.	0.08	76.00	4.33	.	0.240	240.00	5.48
BBK9.1	10/20/94	SPBASS	.				J	0.03	30.00	3.40	.	0.120	120.00	4.79
BBK9.1	10/20/94	SPBASS	.				JP	0.03	30.00	3.40	.	0.137	137.00	4.92
BBK9.1	10/20/94	SPBASS	.				PJ	0.04	38.10	3.64	P	0.077	77.00	4.34
BBK9.1	10/20/94	SPBASS	.				P	0.06	55.00	4.01	.	0.135	135.00	4.91
BBK9.1	10/20/94	SPBASS	.				J	0.04	41.20	3.72	.	0.068	68.00	4.22
BBK2.8	10/19/92	LNGEAR	U	0.27	272.00	5.61	U	0.54	544.00	6.30	J	0.103	103.00	4.63

BBK2.8	10/19/92	LNGEAR	U	0.27	268.00	5.59	U	0.54	536.00	6.28	J	0.076	76.00	4.33
BBK2.8	10/19/92	LNGEAR	U	0.26	256.00	5.55	J	0.09	94.00	4.54	J	0.194	194.00	5.27
BBK2.8	10/19/92	LNGEAR	J	0.15	149.00	5.00	J	0.05	51.00	3.93	J	0.121	121.00	4.80
BBK2.8	10/19/92	LNGEAR	U	0.33	332.00	5.81	U	0.66	664.00	6.50	J	0.065	65.00	4.17
BBK2.8	10/19/92	LNGEAR	U	0.17	168.00	5.12	U	0.34	336.00	5.82	J	0.072	72.00	4.28
BBK2.8	10/19/92	LNGEAR	U	0.26	261.00	5.56	U	0.52	522.00	6.26	J	0.183	183.00	5.21
BBK2.8	10/19/92	LNGEAR	U	0.22	218.00	5.38	J	0.22	221.00	5.40	J	0.306	306.00	5.72
BBK2.8	5/27/93	LNGEAR	U	0.19	193.60	5.27	J	0.03	32.58	3.48	U	0.387	387.20	5.96
BBK2.8	5/27/93	LNGEAR	U	1.11	1106.71	7.01	U	2.21	2213.41	7.70	J	0.004	4.47	1.50
BBK2.8	5/27/93	LNGEAR	U	1.49	1493.28	7.31	U	2.99	2986.56	8.00	J	0.009	8.55	2.15
BBK2.8	5/27/93	LNGEAR	U	0.76	755.16	6.63	U	1.51	1510.32	7.32	U	1.510	1510.32	7.32
BBK2.8	5/27/93	LNGEAR	J	0.02	21.90	3.09	U	1.51	1513.80	7.32	J	0.045	44.70	3.80
BBK2.8	5/27/93	LNGEAR	J	0.04	36.20	3.59	U	2.23	2230.24	7.71	J	0.046	46.10	3.83
BBK2.8	5/27/93	LNGEAR	U	1.12	1115.12	7.02	U	2.23	2230.24	7.71	J	0.008	7.67	2.04
BBK2.8	5/27/93	LNGEAR	J	0.01	12.70	2.54	U	2.56	2562.85	7.85	J	0.090	90.10	4.50
BBK2.8	10/13/93	LNGEAR	U	0.15	151.20	5.02	U	0.30	302.40	5.71	U	0.302	302.40	5.71
BBK2.8	10/13/93	LNGEAR	U	0.30	296.00	5.69	U	0.59	592.00	6.38	U	0.592	592.00	6.38
BBK2.8	10/13/93	LNGEAR	U	0.23	227.60	5.43	U	0.05	45.70	3.82	U	0.046	45.52	3.82
BBK2.8	10/13/93	LNGEAR	U	0.23	232.00	5.45	U	0.46	464.00	6.14	U	0.464	464.00	6.14
BBK2.8	10/13/93	LNGEAR	U	0.16	160.00	5.08	U	0.32	320.00	5.77	U	0.320	320.00	5.77
BBK2.8	10/13/93	LNGEAR	U	0.14	140.00	4.94	U	0.28	280.00	5.63	U	0.280	280.00	5.63
BBK2.8	10/13/93	LNGEAR	U	0.19	192.00	5.26	U	0.38	384.00	5.95	U	0.384	384.00	5.95
BBK2.8	10/13/93	LNGEAR	U	0.25	248.00	5.51	U	0.50	496.00	6.21	U	0.496	496.00	6.21
BBK12.5	10/19/92	LNGEAR	U	0.24	244.00	5.50	U	0.49	488.00	6.19	U	0.488	488.00	6.19
BBK12.5	10/19/92	LNGEAR	U	0.24	244.00	5.50	U	0.49	488.00	6.19	U	0.488	488.00	6.19
BBK12.5	10/19/92	LNGEAR	U	0.23	232.00	5.45	U	0.46	464.00	6.14	U	0.464	464.00	6.14
BBK12.5	10/19/92	LNGEAR	U	0.24	240.00	5.48	U	0.48	480.00	6.17	U	0.480	480.00	6.17
BBK12.5	10/19/92	LNGEAR	U	0.24	236.00	5.46	U	0.47	472.00	6.16	U	0.472	472.00	6.16
BBK12.5	10/19/92	LNGEAR	.	.	.	.	.	.	.	.	.	.	.	.
BBK12.5	10/19/92	LNGEAR	U	0.15	152.00	5.02	U	0.30	304.00	5.72	U	0.304	304.00	5.72
BBK12.5	10/19/92	LNGEAR	U	0.12	118.80	4.78	U	0.24	237.60	5.47	U	0.238	237.60	5.47
BBK12.5	4/27/93	LNGEAR	U	0.30	300.00	5.70	U	0.60	600.00	6.40	U	0.600	600.00	6.40
BBK12.5	4/27/93	LNGEAR	U	0.22	218.00	5.38	U	0.44	436.00	6.08	U	0.436	436.00	6.08
BBK12.5	4/27/93	LNGEAR	U	0.19	190.40	5.25	U	0.38	380.80	5.94	U	0.381	380.80	5.94
BBK12.5	4/27/93	LNGEAR	U	0.40	400.00	5.99	U	0.80	800.00	6.68	U	0.800	800.00	6.68
BBK12.5	4/27/93	LNGEAR	U	0.15	148.00	5.00	U	0.30	296.00	5.69	U	0.296	296.00	5.69
BBK12.5	4/27/93	LNGEAR	U	0.25	250.00	5.52	U	0.50	500.00	6.21	U	0.500	500.00	6.21

BBK12.5	4/27/93	LNGEAR	U	0.15	148.00	5.00	U	0.30	296.00	5.69	U	0.296	296.00	5.69
BBK12.5	4/27/93	LNGEAR	U	0.16	157.60	5.06	U	0.32	315.20	5.75	U	0.315	315.20	5.75
BBK12.5	10/13/93	LNGEAR	U	0.20	196.00	5.28	U	0.39	392.00	5.97	U	0.392	392.00	5.97
BBK12.5	10/13/93	LNGEAR	U	0.19	188.00	5.24	U	0.38	376.00	5.93	U	0.376	376.00	5.93
BBK12.5	10/13/93	LNGEAR	U	0.22	224.00	5.41	U	0.45	448.00	6.10	U	0.448	448.00	6.10
BBK12.5	10/13/93	LNGEAR	U	0.22	216.00	5.38	U	0.43	432.00	6.07	U	0.432	432.00	6.07
BBK12.5	10/13/93	LNGEAR	U	0.20	200.00	5.30	U	0.40	400.00	5.99	U	0.400	400.00	5.99
BBK12.5	10/13/93	LNGEAR	U	0.17	168.00	5.12	U	0.34	336.00	5.82	U	0.336	336.00	5.82
BBK12.5	10/13/93	LNGEAR	U	0.18	180.00	5.19	U	0.36	360.00	5.89	U	0.360	360.00	5.89
BBK12.5	10/13/93	LNGEAR	U	0.18	180.00	5.19	U	0.36	360.00	5.89	U	0.360	360.00	5.89
BBK12.5	5/2/94	LNGEAR	U	0.16	156.00	5.05	U	0.31	312.00	5.74	U	0.312	312.00	5.74
BBK12.5	5/2/94	LNGEAR	U	0.20	200.00	5.30	U	0.40	400.00	5.99	U	0.400	400.00	5.99
BBK12.5	5/2/94	LNGEAR	U	0.18	176.00	5.17	U	0.35	352.00	5.86	U	0.352	352.00	5.86
BBK12.5	5/2/94	LNGEAR	U	0.13	129.60	4.86	U	0.26	259.20	5.56	U	0.259	259.20	5.56
BBK12.5	5/2/94	LNGEAR	U	0.29	292.60	5.68	U	0.59	585.20	6.37	U	0.585	585.20	6.37
BBK12.5	5/2/94	LNGEAR	U	0.40	400.00	5.99	U	0.80	800.00	6.68	U	0.800	800.00	6.68
BBK12.5	5/2/94	LNGEAR	U	0.27	266.00	5.58	U	0.53	532.00	6.28	U	0.532	532.00	6.28
BBK12.5	5/2/94	LNGEAR	U	0.42	416.00	6.03	U	0.83	832.00	6.72	U	0.832	832.00	6.72
BBK12.5	10/19/94	LNGEAR	U	0.04	35.50	3.57	U	0.04	35.50	3.57	U	0.036	35.50	3.57
BBK12.5	10/19/94	LNGEAR	U	0.04	40.50	3.70	U	0.04	40.50	3.70	U	0.041	40.50	3.70
BBK12.5	10/19/94	LNGEAR	U	0.05	47.00	3.85	U	0.05	47.00	3.85	U	0.047	47.00	3.85
BBK12.5	10/19/94	LNGEAR	U	0.03	30.50	3.42	U	0.03	30.50	3.42	U	0.031	30.50	3.42
BBK12.5	10/19/94	LNGEAR	U	0.06	60.00	4.09	U	0.06	60.00	4.09	U	0.060	60.00	4.09
BBK12.5	10/19/94	LNGEAR	U	0.06	57.50	4.05	U	0.06	57.50	4.05	U	0.058	57.50	4.05
BBK12.5	10/19/94	LNGEAR	U	0.03	29.00	3.37	U	0.03	29.00	3.37	U	0.029	29.00	3.37
BBK12.5	10/19/94	LNGEAR	U	0.05	49.50	3.90	U	0.05	49.50	3.90	U	0.050	49.50	3.90
BBK10.0	10/19/92	LNGEAR	U	0.06	63.50	4.15	J	0.07	70.00	4.25	J	0.111	111.00	4.71
BBK10.0	10/19/92	LNGEAR	U	0.18	180.00	5.19	U	0.36	360.00	5.89	J	0.051	51.00	3.93
BBK10.0	10/19/92	LNGEAR	J	0.10	101.00	4.62	J	0.07	65.00	4.17	J	0.103	103.00	4.63
BBK10.0	10/19/92	LNGEAR	J	0.18	179.00	5.19	J	0.22	217.00	5.38	J	0.229	229.00	5.43
BBK10.0	10/19/92	LNGEAR	J	0.10	104.00	4.64	J	0.12	122.00	4.80	J	0.159	159.00	5.07
BBK10.0	10/19/92	LNGEAR	U	0.22	224.00	5.41	U	0.45	448.00	6.10	J	0.056	56.00	4.03
BBK10.0	10/19/92	LNGEAR	J	0.18	177.00	5.18	J	0.18	183.00	5.21	J	0.219	219.00	5.39
BBK10.0	10/19/92	LNGEAR	J	0.12	123.00	4.81	J	0.10	102.00	4.62	J	0.131	131.00	4.88
BBK10.0	4/27/93	LNGEAR	U	0.18	184.40	5.22	.	0.07	65.80	4.19	.	0.093	93.10	4.53
BBK10.0	4/27/93	LNGEAR	U	0.26	260.80	5.56	.	0.08	81.10	4.40	.	0.123	122.80	4.81
BBK10.0	4/27/93	LNGEAR	U	0.16	164.00	5.10	U	0.33	328.00	5.79	.	0.123	123.29	4.81

BBK10.0	4/27/93	LNGEAR	U	0.24	235.20	5.46	.	0.08	77.50	4.35	.	0.133	133.30	4.89
BBK10.0	4/27/93	LNGEAR	U	0.28	278.80	5.63	.	0.12	117.70	4.77	.	0.262	262.20	5.57
BBK10.0	4/27/93	LNGEAR	U	0.17	171.20	5.14	.	0.04	35.28	3.56	.	0.116	115.80	4.75
BBK10.0	4/27/93	LNGEAR	U	0.40	400.00	5.99	U	0.80	800.00	6.68	.	0.283	282.90	5.65
BBK10.0	4/27/93	LNGEAR	U	0.34	342.80	5.84	.	0.19	190.30	5.25	.	0.189	189.10	5.24
BBK10.0	10/13/93	LNGEAR	U	0.22	220.00	5.39	J	0.05	52.00	3.95	J	0.016	16.00	2.77
BBK10.0	10/13/93	LNGEAR	U	0.17	172.00	5.15	U	0.34	344.00	5.84	U	0.344	344.00	5.84
BBK10.0	10/13/93	LNGEAR	U	0.19	190.00	5.25	J	0.04	41.00	3.71	J	0.032	32.00	3.47
BBK10.0	10/13/93	LNGEAR	U	0.16	158.00	5.06	U	0.32	316.00	5.76	J	0.024	24.00	3.18
BBK10.0	10/13/93	LNGEAR	J	0.02	24.00	3.18	J	0.04	39.00	3.66	J	0.015	15.00	2.71
BBK10.0	10/13/93	LNGEAR	J	0.03	29.00	3.37	J	0.06	58.00	4.06	J	0.032	32.00	3.47
BBK10.0	10/13/93	LNGEAR	U	0.16	155.60	5.05	U	0.31	311.20	5.74	U	0.311	311.20	5.74
BBK10.0	10/13/93	LNGEAR	U	0.25	250.00	5.52	U	0.50	500.00	6.21	U	0.500	500.00	6.21
BBK10.0	5/3/94	LNGEAR	U	0.27	268.80	5.59	U	0.54	537.60	6.29	J	0.113	113.00	4.73
BBK10.0	5/3/94	LNGEAR	U	0.25	254.40	5.54	U	0.51	508.80	6.23	J	0.066	66.00	4.19
BBK10.0	5/3/94	LNGEAR	U	0.26	263.20	5.57	U	0.53	526.40	6.27	J	0.219	219.00	5.39
BBK10.0	5/3/94	LNGEAR	U	0.27	268.80	5.59	J	0.04	37.00	3.61	U	0.538	537.60	6.29
BBK10.0	5/3/94	LNGEAR	U	0.30	304.00	5.72	J	0.05	45.00	3.81	U	0.608	608.00	6.41
BBK10.0	5/3/94	LNGEAR	U	0.41	410.00	6.02	J	0.13	127.00	4.84	J	0.204	204.00	5.32
BBK10.0	5/3/94	LNGEAR	J	0.04	37.00	3.61	J	0.05	49.00	3.89	J	0.071	71.00	4.26
BBK10.0	5/3/94	LNGEAR	U	0.52	520.00	6.25	J	0.05	46.00	3.83	J	0.123	123.00	4.81
BBK10.0	10/19/94	LNGEAR	U	0.05	48.50	3.88	JP	0.06	63.00	4.14	J	0.084	84.00	4.43
BBK10.0	10/19/94	LNGEAR	U	0.05	50.00	3.91	JP	0.04	39.00	3.66		0.11	110.00	4.70
BBK10.0	10/19/94	LNGEAR	U	0.04	39.00	3.66	JP	0.06	56.00	4.03	P	0.087	87.00	4.47
BBK10.0	10/19/94	LNGEAR	U	0.04	35.50	3.57	JP	0.05	52.00	3.95	J	0.067	67.00	4.20
BBK10.0	10/19/94	LNGEAR	U	0.05	51.00	3.93	P	0.12	120.00	4.79	P	0.17	170.00	5.14
BBK10.0	10/19/94	LNGEAR	U	0.04	40.00	3.69	JP	0.06	63.00	4.14	P	0.098	98.00	4.58
BBK10.0	10/19/94	LNGEAR	U	0.03	34.50	3.54	P	0.08	84.00	4.43	P	0.122	122.00	4.80
BBK10.0	10/19/94	LNGEAR	U	0.05	45.00	3.81	P	0.12	120.00	4.79	P	0.2	200.00	5.30
BBK2.1	10/20/94	LNGEAR	.				JP	0.01	10.00	2.30	JP	0.014	14.00	2.64
BBK2.1	10/20/94	LNGEAR	.				JP	0.02	17.00	2.83	JP	0.012	12.00	2.48
BBK2.1	10/20/94	LNGEAR	.				U	0.02	19.50	2.97	JP	0.011	11.00	2.40
BBK2.1	10/20/94	LNGEAR	.				U	0.02	19.50	2.97	JP	0.07	70.00	4.25
BBK2.1	10/20/94	LNGEAR	.				JP	0.01	7.00	1.95	J	0.011	11.00	2.40
BBK2.1	10/20/94	LNGEAR	.				JP	0.01	9.00	2.20	JP	0.009	9.00	2.20
BBK2.1	10/20/94	LNGEAR	.				JP	0.01	9.00	2.20	JP	0.013	13.00	2.56
BBK2.1	10/20/94	LNGEAR	.				JP	0.00	4.00	1.39	JP	0.017	17.00	2.83

[illegible]

PCB Fish Tissue Data														
				1248	1248	1248		1254	1254	1254		Conc.	1260	1260
				Conc.	Conc.	Ln Conc.		Conc.	Conc.	Ln Conc.		Term	Conc.	Ln Conc.
Site	Date	Spp.	48qu	(ug/g)	(ng/g)	(ng/g)	54 qu	(ug/g)	(ng/g)	(ng/g)	60 qu	(ug/g)	(ng/g)	(ng/g)
LUK9.0	10/20/92	LNGEAR	J	0.23	234.00	5.46	J	0.51	511.00	6.24	J	0.442	442.00	6.09
LUK9.0	10/20/92	LNGEAR	J	0.32	317.00	5.76	.	1.09	1090.00	6.99	.	1.562	1562.00	7.35
LUK9.0	10/20/92	LNGEAR	U	0.50	500.00	6.21	U	1.00	1000.00	6.91	J	0.345	345.00	5.84
LUK9.0	10/20/92	LNGEAR	U	0.35	352.00	5.86	J	0.50	502.00	6.22	J	0.439	439.00	6.08
LUK9.0	10/20/92	LNGEAR	U	0.35	352.00	5.86	J	0.77	767.00	6.64	J	0.724	724.00	6.58
LUK9.0	10/20/92	LNGEAR	U	0.26	260.00	5.56	J	0.19	189.00	5.24	J	0.238	238.00	5.47
LUK9.0	10/20/92	LNGEAR	U	0.32	324.00	5.78	J	0.16	155.00	5.04	J	0.111	111.00	4.71
LUK9.0	10/20/92	LNGEAR	U	0.24	236.00	5.46	J	0.33	331.00	5.80	J	0.304	304.00	5.72
LUK9.0	4/27/93	LNGEAR	U	0.30	300.00	5.70	.	0.37	369.00	5.91	.	0.347	347.00	5.85
LUK9.0	4/27/93	LNGEAR	U	0.44	444.00	6.10	.	0.31	312.00	5.74	.	0.195	195.00	5.27
LUK9.0	4/27/93	LNGEAR	.	0.23	226.00	5.42	.	0.14	143.00	4.96	.	0.079	79.00	4.37
LUK9.0	4/27/93	LNGEAR	.	0.14	135.00	4.91	.	0.18	180.00	5.19	.	0.520	520.00	6.25
LUK9.0	4/27/93	LNGEAR	.	0.63	629.00	6.44	.	0.52	518.00	6.25	.	0.428	428.00	6.06
LUK9.0	4/27/93	LNGEAR	.	1.25	1254.00	7.13	.	0.92	922.00	6.83	.	0.836	836.00	6.73
LUK9.0	4/27/93	LNGEAR	.	1.27	1269.00	7.15	.	0.80	800.00	6.68	.	0.606	606.00	6.41
LUK9.0	4/27/93	LNGEAR	.	1.94	1944.00	7.57	.	1.44	1440.00	7.27	.	1.146	1146.00	7.04
LUK9.0	10/14/93	LNGEAR	J	0.19	188.00	5.24	J	0.25	246.00	5.51	J	0.188	188.00	5.24
LUK9.0	10/14/93	LNGEAR	J	0.12	124.00	4.82	J	0.33	328.00	5.79	J	0.374	374.00	5.92
LUK9.0	10/14/93	LNGEAR	U	0.23	228.00	5.43	U	0.46	456.00	6.12	J	0.393	393.00	5.97
LUK9.0	10/14/93	LNGEAR	U	0.36	360.00	5.89	U	0.72	720.00	6.58	J	0.237	237.00	5.47
LUK9.0	10/14/93	LNGEAR	J	0.28	284.00	5.65	U	0.36	360.00	5.89	.	0.945	945.00	6.85
LUK9.0	10/14/93	LNGEAR	.	0.84	840.00	6.73	.	0.83	830.00	6.72	J	0.460	460.00	6.13
LUK9.0	10/14/93	LNGEAR	J	0.10	103.00	4.63	U	0.32	320.00	5.77	J	0.548	548.00	6.31
LUK9.0	10/14/93	LNGEAR	J	0.04	38.00	3.64	U	0.34	336.00	5.82	J	0.293	293.00	5.68
LUK9.0	5/3/94	LNGEAR	U	0.24	240.00	5.48	.	1.37	1365.00	7.22	.	2.056	2056.00	7.63
LUK9.0	5/3/94	LNGEAR	J	0.26	259.00	5.56	J	0.77	770.00	6.65	.	1.126	1126.00	7.03
LUK9.0	5/3/94	LNGEAR	J	0.56	556.00	6.32	J	1.26	1264.00	7.14	J	0.825	825.00	6.72
LUK9.0	5/3/94	LNGEAR	J	0.35	353.00	5.87	J	0.32	315.00	5.75	J	0.271	271.00	5.60
LUK9.0	5/3/94	LNGEAR	J	0.16	164.00	5.10	J	0.17	172.00	5.15	J	0.164	164.00	5.10
LUK9.0	5/3/94	LNGEAR	U	0.35	345.60	5.85	J	0.12	124.00	4.82	J	0.632	632.00	6.45
LUK9.0	5/3/94	LNGEAR	J	0.04	37.00	3.61	J	0.02	16.00	2.77	J	0.024	24.00	3.18
LUK9.0	5/3/94	LNGEAR	J	0.09	94.00	4.54	J	0.29	294.00	5.68	J	0.363	363.00	5.89
LUK9.0	10/20/94	BLUGIL	U	0.07	70.50	4.26	.	0.35	350.00	5.86	P	0.19	190.00	5.25

LUK9.0	10/20/94	BLUGIL	U	0.03	28.50	3.35	.	0.18	180.00	5.19	P	0.12	120.00	4.79
LUK9.0	10/20/94	BLUGIL	U	0.04	38.00	3.64	.	0.19	190.00	5.25	P	0.1	100.00	4.61
LUK9.0	10/20/94	BLUGIL	U	0.02	15.50	2.74	.	0.05	50.00	3.91	P	0.06	60.00	4.09
LUK9.0	10/20/94	BLUGIL	U	0.05	46.50	3.84	.	0.22	220.00	5.39	P	0.13	130.00	4.87
LUK9.0	10/20/94	BLUGIL	U	0.05	45.00	3.81	.	0.16	160.00	5.08	.	0.092	92.00	4.52
LUK9.0	10/20/94	YBULLHD	U	0.02	20.50	3.02	P	0.19	190.00	5.25	P	0.32	320.00	5.77
LUK9.0	10/20/94	YBULLHD	U	0.06	59.00	4.08	P	0.27	270.00	5.60	P	0.22	220.00	5.39
LUK9.0	10/20/94	YBULLHD	U	0.01	14.00	2.64	.	0.19	190.00	5.25	P	0.19	190.00	5.25
LUK4.3	10/20/92	LNGEAR	J	0.09	91.00	4.51	J	0.13	130.00	4.87	J	0.132	132.00	4.88
LUK4.3	10/20/92	LNGEAR	J	0.07	66.00	4.19	J	0.13	130.00	4.87	J	0.740	740.00	6.61
LUK4.3	10/20/92	LNGEAR	U	0.25	250.00	5.52	U	0.50	500.00	6.21	J	0.052	52.00	3.95
LUK4.3	10/20/92	LNGEAR	J	0.13	132.00	4.88	J	0.10	96.00	4.56	J	0.144	144.00	4.97
LUK4.3	10/20/92	LNGEAR	U	0.22	216.00	5.38	U	0.43	432.00	6.07	J	0.060	60.00	4.09
LUK4.3	10/20/92	LNGEAR	U	0.17	168.00	5.12	U	0.34	336.00	5.82	U	0.336	336.00	5.82
LUK4.3	10/20/92	LNGEAR	U	0.18	176.00	5.17	U	0.35	352.00	5.86	U	0.352	352.00	5.86
LUK4.3	10/20/92	LNGEAR	U	0.22	216.00	5.38	U	0.43	432.00	6.07	J	0.050	50.00	3.91
LUK4.3	4/27/93	SPBASS	.	0.11	111.00	4.71	.	0.34	342.00	5.83	.	0.478	478.00	6.17
LUK4.3	4/27/93	LNGEAR	U	0.20	200.00	5.30	J	0.09	88.00	4.48	J	0.242	242.00	5.49
LUK4.3	4/27/93	LNGEAR	U	0.29	285.60	5.65	.	0.48	483.00	6.18	.	0.540	540.00	6.29
LUK4.3	4/27/93	LNGEAR	U	0.25	250.00	5.52	.	0.61	608.00	6.41	.	0.088	88.00	4.48
LUK4.3	4/27/93	LNGEAR	U	0.19	187.60	5.23	.	0.11	108.00	4.68	.	0.129	129.00	4.86
LUK4.3	4/27/93	LNGEAR	.	0.04	42.00	3.74	.	0.11	107.00	4.67	.	0.104	104.00	4.64
LUK4.3	4/27/93	LNGEAR	U	0.24	244.80	5.50	.	0.18	184.00	5.21	.	0.233	233.00	5.45
LUK4.3	4/27/93	LNGEAR	U	0.23	228.00	5.43	.	0.12	121.00	4.80	.	0.169	169.00	5.13
LUK4.3	4/27/93	LNGEAR	U	0.33	332.00	5.81	.	0.05	51.00	3.93	.	0.050	50.00	3.91
LUK4.3	10/14/93	SPBASS	J	0.03	32.70	3.49	J	0.08	83.70	4.43	J	0.096	96.10	4.57
LUK4.3	10/14/93	SPBASS	U	0.04	40.40	3.70	J	0.01	12.10	2.49	J	0.016	16.40	2.80
LUK4.3	10/14/93	SPBASS	J	0.03	34.90	3.55	J	0.16	159.60	5.07	J	0.286	285.90	5.66
LUK4.3	10/14/93	SPBASS	.	0.12	122.50	4.81	.	0.22	217.30	5.38	.	0.239	239.10	5.48
LUK4.3	10/14/93	SPBASS	.	0.24	242.90	5.49	.	0.39	393.30	5.97	J	0.316	315.80	5.76
LUK4.3	10/14/93	LNGEAR	U	0.27	268.00	5.59	J	0.03	29.00	3.37	J	0.014	14.00	2.64
LUK4.3	10/14/93	LNGEAR	U	0.22	220.00	5.39	J	0.07	74.00	4.30	J	0.060	60.00	4.09
LUK4.3	10/14/93	LNGEAR	J	0.04	41.00	3.71	J	0.16	163.00	5.09	J	0.089	89.00	4.49
LUK4.3	10/14/93	LNGEAR	U	0.26	256.00	5.55	J	0.13	128.00	4.85	J	0.051	51.00	3.93
LUK4.3	10/14/93	LNGEAR	J	0.03	32.00	3.47	J	0.16	157.00	5.06	J	0.071	71.00	4.26
LUK4.3	10/14/93	LNGEAR	U	0.23	232.00	5.45	J	0.02	21.00	3.04	J	0.029	29.00	3.37
LUK4.3	10/14/93	LNGEAR	U	0.21	212.00	5.36	U	0.42	424.00	6.05	U	0.424	424.00	6.05

LUK4.3	10/14/93	LNGEAR	U	0.24	244.00	5.50	J	0.05	50.00	3.91	J	0.067	67.00	4.20
LUK4.3	5/2/94	LNGEAR	U	0.23	232.00	5.45	J	0.02	20.00	3.00	J	0.012	12.00	2.48
LUK4.3	5/2/94	LNGEAR	J	0.04	43.00	3.76	J	0.08	75.00	4.32	J	0.026	26.00	3.26
LUK4.3	5/2/94	LNGEAR	J	0.03	28.00	3.33	J	0.08	75.00	4.32	J	0.125	125.00	4.83
LUK4.3	5/2/94	LNGEAR	J	0.05	45.00	3.81	J	0.08	80.00	4.38	J	0.174	174.00	5.16
LUK4.3	5/2/94	LNGEAR	U	0.24	235.20	5.46	J	0.06	61.00	4.11	J	0.129	129.00	4.86
LUK4.3	5/2/94	LNGEAR	U	0.34	339.20	5.83	J	0.02	23.00	3.14	J	0.042	42.00	3.74
LUK4.3	5/2/94	LNGEAR	U	0.35	349.20	5.86	J	0.04	41.00	3.71	J	0.090	90.00	4.50
LUK4.3	5/2/94	LNGEAR	J	0.08	83.00	4.42	J	0.19	192.00	5.26	J	0.332	332.00	5.81
LUK7.2	4/27/93	LNGEAR	U	0.22	216.00	5.38	.	0.51	509.00	6.23	.	0.499	499.00	6.21
LUK7.2	4/27/93	LNGEAR	.				.				.			
LUK7.2	4/27/93	LNGEAR	U	0.20	200.00	5.30	.	0.44	443.00	6.09	J	0.291	291.00	5.67
LUK7.2	4/27/93	LNGEAR	.				.				.			
LUK7.2	4/27/93	LNGEAR	J	0.05	49.00	3.89	J	0.15	147.00	4.99	J	0.140	140.00	4.94
LUK7.2	4/27/93	LNGEAR	.				.				.			
LUK7.2	4/27/93	LNGEAR	U	0.30	296.00	5.69	J	0.26	258.00	5.55	J	0.212	212.00	5.36
LUK7.2	4/27/93	LNGEAR	.				.				.			
LUK7.2	4/27/93	LMBASS	U	0.07	69.20	4.24	.	0.30	301.00	5.71	.	0.267	267.00	5.59
LUK7.2	10/14/93	SPBASS	.	0.11	105.80	4.66	J	0.16	155.50	5.05	.	0.192	191.50	5.25
LUK7.2	5/2/94	LNGEAR	U	0.03	31.50	3.45	U	0.06	63.00	4.14	U	0.063	63.00	4.14
LUK7.2	5/2/94	LNGEAR	J	0.06	57.00	4.04	J	0.20	197.00	5.28	J	0.251	251.00	5.53
LUK7.2	5/2/94	LNGEAR	J	0.12	120.00	4.79	J	0.29	292.00	5.68	J	0.208	208.00	5.34
LUK7.2	5/2/94	LNGEAR	U	0.04	44.00	3.78	J	0.13	127.00	4.84	J	0.167	167.00	5.12
LUK4.2	10/20/94	LNGEAR	U	0.08	78.00	4.36	U	0.08	78.00	4.36	JP	0.078	78.00	4.36
LUK4.2	10/20/94	LNGEAR	U	0.05	48.00	3.87	JP	0.04	41.30	3.72	JP	0.0524	52.40	3.96
LUK4.2	10/20/94	LNGEAR	U	0.04	37.00	3.61	JP	0.07	70.40	4.25	JP	0.058	58.00	4.06
LUK4.2	10/20/94	LNGEAR	U	0.06	59.00	4.08	JP	0.07	70.00	4.25	JP	0.058	58.00	4.06
LUK4.2	10/20/94	LNGEAR	U	0.05	51.00	3.93	JP	0.08	80.00	4.38	JP	0.08	80.00	4.38
LUK4.2	10/20/94	LNGEAR	U	0.03	34.00	3.53	JP	0.06	56.00	4.03	JP	0.05	50.00	3.91
LUK4.2	10/20/94	LNGEAR	U	0.06	64.00	4.16	JP	0.10	96.00	4.56	JP	0.12	120.00	4.79
LUK4.2	10/20/94	LNGEAR	U	0.05	45.00	3.81	JP	0.07	66.00	4.19	P	0.092	92.00	4.52
LUK4.2	10/20/94	LMBASS	.				PJ	0.05	52.70	3.96	P	0.098	98.00	4.58
LUK4.2	10/20/94	SPBASS	.				.	0.19	190.00	5.25	.	0.160	160.00	5.08

Individual Risk Summary

Risk Assessment: Polychlorinated Biphenyls

Calculational Spreadsheet: Total Risk for Adult Exposure at Big Bayou Creek (USEPA defaults)

CALCULATIONAL NOMENCLATURE	EXPOSURE PATHWAYS					
	1	2	3	4	5	6
CS = PCB Concentration in Matrix (mg/kg) =	0.0650	0.1741	0.1741	1.42E-04	0.1741	0.8566
CF = Conversion Factor (kg/mg) =	1.00E-06	1.00E-06	1.00E-06	1.00E-03	NA	NA
SA = Skin Surface Area (cm ² /event) =	9300.00	5190.00	NA	9300.00	NA	NA
AF = Soil to Skin Adherence Factor (mg/cm ²) =	1.00	1.00	NA	NA	NA	NA
ABS = Absorption Factor =	0.10	0.10	NA	NA	NA	NA
EF = Exposure Frequency (event/year) =	52.00	52.00	52.00	52.00	52.00	128.00
ED = Exposure Duration (year) =	22.00	22.00	22.00	22.00	22.00	22.00
BW = Body Weight (kg) =	70.00	70.00	70.00	70.00	70.00	70.00
AT ₁ = Averaging Time Carcinogenic Effect (day)	25550.00	25550.00	25550.00	25550.00	25550.00	25550.00
AT ₂ = Averaging Time Non-Carcinogenic Effect (day) =	8030.00	8030.00	8030.00	8030.00	8030.00	8030.00
SF = Slope Factor (kg day/mg) =	7.70	7.70	7.70	7.70	7.70	7.70
RfD = Reference Dose (mg/kg day) =	2.00E-05	2.00E-05	2.00E-05	2.00E-05	2.00E-05	2.00E-05
INGR = Ingestion Rate (mg/day) =	NA	NA	100.00	NA	NA	0.2840
FI = Fraction Ingested from Contaminated Source =	NA	NA	1.00	NA	NA	1.00E+00
ET = Exposure Time (hr/day) =	NA	NA	NA	2.50	5.00	NA
PC = Permeability Constant (cm/hr) =	NA	NA	NA	1.30	NA	NA
INHR = Inhalation Rate (mg/day) =	NA	NA	NA	NA	2.50	NA
VF = Volatilization Factor (m ³ /kg) =	NA	NA	NA	NA	1.54E+05	NA
CDI = Chronic (70 year) Daily Intake (mg/kg day) =	3.87E-08	5.78E-08	1.11E-08	2.74E-06	9.04E-09	3.83E-04
Carcinogen Risk =	2.98E-07	4.45E-07	8.57E-08	2.11E-05	6.96E-08	2.95E-03
E = Non-Carcinogenic Exposure Level (mg/kg day) =	1.23E-07	1.84E-07	3.54E-08	8.73E-06	2.88E-08	1.22E-03
Non-Carcinogenic Hazard Index =	6.15E-03	9.19E-03	1.77E-03	4.37E-01	1.44E-03	6.09E+01

Pathway	Route
1	Dermal Absorption of Sediment
2	Dermal Absorption of Soil
3	Ingestion of Soil
4	Dermal Absorption of Surface Water
5	Inhalation of Soil Vapor
6	Ingestion of Fish

Risk Assessment: Polychlorinated Biphenyls

Calculational Spreadsheet: Total Risk for Child Exposure at Big Bayou Creek (USEPA defaults)

CALCULATIONAL NOMENCLATURE	EXPOSURE PATHWAYS					
	1	2	3	4	5	6
CS = PCB Concentration in Matrix (mg/kg) =	0.0650	0.1741	0.1741	1.42E-04	1.74E-01	0.8566
CF = Conversion Factor (kg/mg) =	1.00E-06	1.00E-06	1.00E-06	1.00E-03	NA	NA
SA = Skin Surface Area (cm ² /event) =	7400.00	7400.00	NA	7400.00	NA	NA
AF = Soil to Skin Adherence Factor (mg/cm ²) =	1.00	1.00	NA	NA	NA	NA
ABS = Absorption Factor =	0.10	0.10	NA	NA	NA	NA
EF = Exposure Frequency (event/year) =	140.00	140.00	140.00	140.00	140.00	128.00
ED = Exposure Duration (year) =	12.00	12.00	12.00	12.00	12.00	12.00
BW = Body Weight (kg) =	43.00	43.00	43.00	43.00	43.00	43.00
AT ₁ = Averaging Time Carcinogenic Effect (day)	25550.00	25550.00	25550.00	25550.00	25550.00	25550.00
AT ₂ = Averaging Time Non-Carcinogenic Effect (day) =	4380.00	4380.00	4380.00	4380.00	4380.00	4380.00
SF = Slope Factor (kg day/mg) =	7.70	7.70	7.70	7.70	7.70	7.70
RfD = Reference Dose (mg/kg day) =	2.00E-05	2.00E-05	2.00E-05	2.00E-05	2.00E-05	2.00E-05
INGR = Ingestion Rate (mg/day) =	NA	NA	100.00	NA	NA	0.2840
FI = Fraction Ingested from Contaminated Source =	NA	NA	1.00	NA	NA	1.00
ET = Exposure Time (hr/day) =	NA	NA	NA	2.50	5.00	NA
PC = Permeability Constant (cm/hr) =	NA	NA	NA	1.30	NA	NA
INHR = Inhalation Rate (mg/day) =	NA	NA	NA	NA	2.50	NA
VF = Volatilization Factor (m ³ /kg) =	NA	NA	NA	NA	1.14E+05	NA
CDI = Chronic (70 year) Daily Intake (mg/kg day) =	7.36E-08	1.97E-07	2.66E-08	5.22E-06	2.92E-08	3.40E-04
Carcinogen Risk =	5.66E-07	1.52E-06	2.05E-07	4.02E-05	2.25E-07	2.62E-03
E = Non-Carcinogenic Exposure Level (mg/kg day) =	4.29E-07	1.15E-06	1.55E-07	3.04E-05	1.70E-07	1.98E-03
Non-Carcinogenic Hazard Index =	2.15E-02	5.75E-02	7.76E-03	1.52E+00	8.52E-03	9.92E+01

Pathway	Route
1	Dermal Absorption of Sediment
2	Dermal Absorption of Soil
3	Ingestion of Soil
4	Dermal Absorption of Surface Water
5	Inhalation of Soil Vapor
6	Ingestion of Fish

Risk Assessment: Polychlorinated Biphenyls

Calculational Spreadsheet: Total Risk for Adult Exposure at Big Bayou Creek (KDFWR defaults)

CALCULATIONAL NOMENCLATURE	EXPOSURE PATHWAYS					
	1	2	3	4	5	6
CS = PCB Concentration in Matrix (mg/kg) =	0.0650	0.1741	0.1741	1.42E-04	1.74E-01	0.8566
CF = Conversion Factor (kg/mg) =	1.00E-06	1.00E-06	1.00E-06	1.00E-03	NA	NA
SA = Skin Surface Area (cm ² /event) =	9300.00	5190.00	NA	9300.00	NA	NA
AF = Soil to Skin Adherence Factor (mg/cm ²) =	1.00	1.00	NA	NA	NA	NA
ABS = Absorption Factor =	0.10	0.10	NA	NA	NA	NA
EF = Exposure Frequency (event/year) =	10.00	10.00	10.00	10.00	10.00	64.00
ED = Exposure Duration (year) =	22.00	22.00	22.00	22.00	22.00	22.00
BW = Body Weight (kg) =	70.00	70.00	70.00	70.00	70.00	70.00
AT ₁ = Averaging Time Carcinogenic Effect (day)	25550.00	25550.00	25550.00	25550.00	25550.00	25550.00
AT ₂ = Averaging Time Non-Carcinogenic Effect (day) =	8030.00	8030.00	8030.00	8030.00	8030.00	8030.00
SF = Slope Factor (kg day/mg) =	7.70	7.70	7.70	7.70	7.70	7.70
RfD = Reference Dose (mg/kg day) =	2.00E-05	2.00E-05	2.00E-05	2.00E-05	2.00E-05	2.00E-05
INGR = Ingestion Rate (mg/day) =	NA	NA	100.00	NA	NA	0.2840
FI = Fraction Ingested from Contaminated Source =	NA	NA	1.00	NA	NA	1.00
ET = Exposure Time (hr/day) =	NA	NA	NA	2.00E+00	4.00	NA
PC = Permeability Constant (cm/hr) =	NA	NA	NA	1.30E+00	NA	NA
INHR = Inhalation Rate (mg/day) =	NA	NA	NA	NA	2.50	NA
VF = Volatilization Factor (m ³ /kg) =	NA	NA	NA	NA	1.54E+05	NA
CDI = Chronic (70 year) Daily Intake (mg/kg day) =	7.44E-09	1.11E-08	2.14E-09	4.22E-07	1.39E-09	1.92E-04
Carcinogen Risk =	5.73E-08	8.56E-08	1.65E-08	3.25E-06	1.07E-08	1.47E-03
E = Non-Carcinogenic Exposure Level (mg/kg day) =	2.37E-08	3.54E-08	6.81E-09	1.34E-06	4.43E-09	6.09E-04
Non-Carcinogenic Hazard Index =	1.18E-03	1.77E-03	3.41E-04	6.72E-02	2.21E-04	3.05E+01

Pathway	Route
1	Dermal Absorption of Sediment
2	Dermal Absorption of Soil
3	Ingestion of Soil
4	Dermal Absorption of Surface Water
5	Inhalation of Soil Vapor
6	Ingestion of Fish

Risk Assessment: Polychlorinated Biphenyls

Calculational Spreadsheet: Total Risk for Child Exposure at Big Bayou Creek (KDFWR defaults)

CALCULATIONAL NOMENCLATURE	EXPOSURE PATHWAYS					
	1	2	3	4	5	6
CS = PCB Concentration in Matrix (mg/kg) =	0.0650	0.1741	0.1741	1.42E-04	1.74E-01	0.8566
CF = Conversion Factor (kg/mg) =	1.00E-06	1.00E-06	1.00E-06	1.00E-03	NA	NA
SA = Skin Surface Area (cm ² /event) =	7400.00	7400.00	NA	7400.00	NA	NA
AF = Soil to Skin Adherence Factor (mg/cm ²) =	1.00	1.00	NA	NA	NA	NA
ABS = Absorption Factor =	0.10	0.10	NA	NA	NA	NA
EF = Exposure Frequency (event/year) =	10.00	10.00	10.00	10.00	10.00	64.00
ED = Exposure Duration (year) =	12.00	12.00	12.00	12.00	12.00	12.00
BW = Body Weight (kg) =	43.00	43.00	43.00	43.00	43.00	43.00
AT ₁ = Averaging Time Carcinogenic Effect (day)	25550.00	25550.00	25550.00	25550.00	25550.00	25550.00
AT ₂ = Averaging Time Non-Carcinogenic Effect (day) =	4380.00	4380.00	4380.00	4380.00	4380.00	4380.00
SF = Slope Factor (kg day/mg) =	7.70	7.70	7.70	7.70	7.70	7.70
RfD = Reference Dose (mg/kg day) =	2.00E-05	2.00E-05	2.00E-05	2.00E-05	2.00E-05	2.00E-05
INGR = Ingestion Rate (mg/day) =	NA	NA	100.00	NA	NA	0.2840
FI = Fraction Ingested from Contaminated Source =	NA	NA	1.00	NA	NA	1.00
ET = Exposure Time (hr/day) =	NA	NA	NA	2.00	4.00	NA
PC = Permeability Constant (cm/hr) =	NA	NA	NA	1.30	NA	NA
INHR = Inhalation Rate (mg/day) =	NA	NA	NA	NA	2.50	NA
VF = Volatilization Factor (m ³ /kg) =	NA	NA	NA	NA	1.14E+05	NA
CDI = Chronic (70 year) Daily Intake (mg/kg day) =	5.25E-09	1.41E-08	1.90E-09	2.98E-07	1.67E-09	1.70E-04
Carcinogen Risk =	4.05E-08	1.08E-07	1.46E-08	2.30E-06	1.28E-08	1.31E-03
E = Non-Carcinogenic Exposure Level (mg/kg day) =	3.06E-08	8.21E-08	1.11E-08	1.74E-06	9.73E-09	9.92E-04
Non-Carcinogenic Hazard Index =	1.53E-03	4.10E-03	5.55E-04	8.70E-02	4.87E-04	4.96E+01

Pathway	Route
1	Dermal Absorption of Sediment
2	Dermal Absorption of Soil
3	Ingestion of Soil
4	Dermal Absorption of Surface Water
5	Inhalation of Soil Vapor
6	Ingestion of Fish

Risk Assessment: Polychlorinated Biphenyls

Calculational Spreadsheet: Total Risk for Adult Exposure at Little Bayou Creek (USEPA defaults)

CALCULATIONAL NOMENCLATURE	EXPOSURE PATHWAYS					
	1	2	3	4	5	6
CS = PCB Concentration in Matrix (mg/kg) =	0.4851	59.10	59.10	1.96E-04	59.10	1.0611
CF = Conversion Factor (kg/mg) =	1.00E-06	1.00E-06	1.00E-06	1.00E-03	NA	NA
SA = Skin Surface Area (cm ² /event) =	9300.00	5190.00	NA	9300.00	NA	NA
AF = Soil to Skin Adherence Factor (mg/cm ²) =	1.00	1.00	NA	NA	NA	NA
ABS = Absorption Factor =	0.10	0.10	NA	NA	NA	NA
EF = Exposure Frequency (event/year) =	52.00	52.00	52.00	52.00	52.00	128.00
ED = Exposure Duration (year) =	22.00	22.00	22.00	22.00	22.00	22.00
BW = Body Weight (kg) =	70.00	70.00	70.00	70.00	70.00	70.00
AT ₁ = Averaging Time Carcinogenic Effect (day)	25550.00	25550.00	25550.00	25550.00	25550.00	25550.00
AT ₂ = Averaging Time Non-Carcinogenic Effect (day) =	8030.00	8030.00	8030.00	8030.00	8030.00	8030.00
SF = Slope Factor (kg day/mg) =	7.70	7.70	7.70	7.70	7.70	7.70
RfD = Reference Dose (mg/kg day) =	2.00E-05	2.00E-05	2.00E-05	2.00E-05	2.00E-05	2.00E-05
INGR = Ingestion Rate (mg/day) =	NA	NA	100.00	NA	NA	0.2840
FI = Fraction Ingested from Contaminated Source =	NA	NA	1.00	NA	NA	1.00E+00
ET = Exposure Time (hr/day) =	NA	NA	NA	2.50	5.00	NA
PC = Permeability Constant (cm/hr) =	NA	NA	NA	1.30	NA	NA
INHR = Inhalation Rate (mg/day) =	NA	NA	NA	NA	2.50	NA
VF = Volatilization Factor (m ³ /kg) =	NA	NA	NA	NA	1.54E+05	NA
CDI = Chronic (70 year) Daily Intake (mg/kg day) =	2.89E-07	1.96E-05	3.78E-06	3.78E-06	3.07E-06	4.74E-04
Carcinogen Risk =	2.22E-06	1.51E-04	2.91E-05	2.91E-05	2.36E-05	3.65E-03
E = Non-Carcinogenic Exposure Level (mg/kg day) =	9.18E-07	6.24E-05	1.20E-05	1.20E-05	9.76E-06	1.51E-03
Non-Carcinogenic Hazard Index =	4.59E-02	3.12E+00	6.01E-01	6.02E-01	4.88E-01	7.55E+01

Pathway	Route
1	Dermal Absorption of Sediment
2	Dermal Absorption of Soil
3	Ingestion of Soil
4	Dermal Absorption of Surface Water
5	Inhalation of Soil Vapor
6	Ingestion of Fish

Risk Assessment: Polychlorinated Biphenyls

Calculational Spreadsheet: Total Risk for Child Exposure at Little Bayou Creek (USEPA defaults)

CALCULATIONAL NOMENCLATURE	EXPOSURE PATHWAYS					
	1	2	3	4	5	6
CS = PCB Concentration in Matrix (mg/kg) =	0.4851	59.10	59.10	1.96E-04	59.10	1.0611
CF = Conversion Factor (kg/mg) =	1.00E-06	1.00E-06	1.00E-06	1.00E-03	NA	NA
SA = Skin Surface Area (cm ² /event) =	7400.00	7400.00	NA	7400.00	NA	NA
AF = Soil to Skin Adherence Factor (mg/cm ²) =	1.00	1.00	NA	NA	NA	NA
ABS = Absorption Factor =	0.10	0.10	NA	NA	NA	NA
EF = Exposure Frequency (event/year) =	140.00	140.00	140.00	140.00	140.00	128.00
ED = Exposure Duration (year) =	12.00	12.00	12.00	12.00	12.00	12.00
BW = Body Weight (kg) =	43.00	43.00	43.00	43.00	43.00	43.00
AT ₁ = Averaging Time Carcinogenic Effect (day)	25550.00	25550.00	25550.00	25550.00	25550.00	25550.00
AT ₂ = Averaging Time Non-Carcinogenic Effect (day) =	4380.00	4380.00	4380.00	4380.00	4380.00	4380.00
SF = Slope Factor (kg day/mg) =	7.70	7.70	7.70	7.70	7.70	7.70
RfD = Reference Dose (mg/kg day) =	2.00E-05	2.00E-05	2.00E-05	2.00E-05	2.00E-05	2.00E-05
INGR = Ingestion Rate (mg/day) =	NA	NA	100.00	NA	NA	0.2840
FI = Fraction Ingested from Contaminated Source =	NA	NA	1.00	NA	NA	1.00E+00
ET = Exposure Time (hr/day) =	NA	NA	NA	2.50	5.00	NA
PC = Permeability Constant (cm/hr) =	NA	NA	NA	1.30	NA	NA
INHR = Inhalation Rate (mg/day) =	NA	NA	NA	NA	2.50	NA
VF = Volatilization Factor (m ³ /kg) =	NA	NA	NA	NA	1.14E+05	NA
CDI = Chronic (70 year) Daily Intake (mg/kg day) =	5.49E-07	6.69E-05	9.04E-06	7.20E-06	9.91E-06	4.21E-04
Carcinogen Risk =	4.23E-06	5.15E-04	6.96E-05	5.54E-05	7.63E-05	3.24E-03
E = Non-Carcinogenic Exposure Level (mg/kg day) =	3.20E-06	3.90E-04	5.27E-05	4.20E-05	5.78E-05	2.46E-03
Non-Carcinogenic Hazard Index =	1.60E-01	1.95E+01	2.64E+00	2.10E+00	2.89E+00	1.23E+02

Pathway	Route
1	Dermal Absorption of Sediment
2	Dermal Absorption of Soil
3	Ingestion of Soil
4	Dermal Absorption of Surface Water
5	Inhalation of Soil Vapor
6	Ingestion of Fish

Risk Assessment: Polychlorinated Biphenyls

Calculational Spreadsheet: Total Risk for Adult Exposure at Little Bayou Creek (KDFWR defaults)

CALCULATIONAL NOMENCLATURE	EXPOSURE PATHWAYS				
	1	2	3	4	5
CS = PCB Concentration in Matrix (mg/kg) =	0.4851	59.10	59.10	1.96E-04	59.10
CF = Conversion Factor (kg/mg) =	1.00E-06	1.00E-06	1.00E-06	1.00E-03	NA
SA = Skin Surface Area (cm ² /event) =	9300.00	5190.00	NA	9300.00	NA
AF = Soil to Skin Adherence Factor (mg/cm ²) =	1.00	1.00	NA	NA	NA
ABS = Absorption Factor =	0.10	0.10	NA	NA	NA
EF = Exposure Frequency (event/year) =	10.00	10.00	10.00	10.00	10.00
ED = Exposure Duration (year) =	22.00	22.00	22.00	22.00	22.00
BW = Body Weight (kg) =	70.00	70.00	70.00	70.00	70.00
AT ₁ = Averaging Time Carcinogenic Effect (day)	25550.00	25550.00	25550.00	25550.00	25550.00
AT ₂ = Averaging Time Non-Carcinogenic Effect (day) =	8030.00	8030.00	8030.00	8030.00	8030.00
SF = Slope Factor (kg day/mg) =	7.70	7.70	7.70	7.70	7.70
RfD = Reference Dose (mg/kg day) =	2.00E-05	2.00E-05	2.00E-05	2.00E-05	2.00E-05
INGR = Ingestion Rate (mg/day) =	NA	NA	100.00	NA	NA
FI = Fraction Ingested from Contaminated Source =	NA	NA	1.00	NA	NA
ET = Exposure Time (hr/day) =	NA	NA	NA	1.00	2.00
PC = Permeability Constant (cm/hr) =	NA	NA	NA	1.30	NA
INHR = Inhalation Rate (mg/day) =	NA	NA	NA	NA	2.50
VF = Volatilization Factor (m ³ /kg) =	NA	NA	NA	NA	1.54E+05
CDI = Chronic (70 year) Daily Intake (mg/kg day) =	5.55E-08	3.77E-06	7.27E-07	2.91E-07	2.36E-07
Carcinogen Risk =	4.27E-07	2.91E-05	5.60E-06	2.24E-06	1.82E-06
E = Non-Carcinogenic Exposure Level (mg/kg day) =	1.77E-07	1.20E-05	2.31E-06	9.26E-07	7.51E-07
Non-Carcinogenic Hazard Index =	8.83E-03	6.00E-01	1.16E-01	4.63E-02	3.76E-02

Pathway	Route
1	Dermal Absorption of Sediment
2	Dermal Absorption of Soil
3	Ingestion of Soil
4	Dermal Absorption of Surface Water
5	Inhalation of Soil Vapor

Risk Assessment: Polychlorinated Biphenyls

Calculational Spreadsheet: Total Risk for Child Exposure at Little Bayou Creek (KDFWR defaults)

CALCULATIONAL NOMENCLATURE	EXPOSURE PATHWAYS				
	1	2	3	4	5
CS = PCB Concentration in Matrix (mg/kg) =	0.4851	59.10	59.10	1.96E-04	59.10
CF = Conversion Factor (kg/mg) =	1.00E-06	1.00E-06	1.00E-06	1.00E-03	NA
SA = Skin Surface Area (cm ² /event) =	7400.00	7400.00	NA	7400.00	NA
AF = Soil to Skin Adherence Factor (mg/cm ²) =	1.00	1.00	NA	NA	NA
ABS = Absorption Factor =	0.10	0.10	NA	NA	NA
EF = Exposure Frequency (event/year) =	10.00	10.00	10.00	10.00	10.00
ED = Exposure Duration (year) =	12.00	12.00	12.00	12.00	12.00
BW = Body Weight (kg) =	43.00	43.00	43.00	43.00	43.00
AT ₁ = Averaging Time Carcinogenic Effect (day)	25550.00	25550.00	25550.00	25550.00	25550.00
AT ₂ = Averaging Time Non-Carcinogenic Effect (day) =	4380.00	4380.00	4380.00	4380.00	4380.00
SF = Slope Factor (kg day/mg) =	7.70	7.70	7.70	7.70	7.70
RfD = Reference Dose (mg/kg day) =	2.00E-05	2.00E-05	2.00E-05	2.00E-05	2.00E-05
INGR = Ingestion Rate (mg/day) =	NA	NA	100.00	NA	NA
FI = Fraction Ingested from Contaminated Source =	NA	NA	1.00	NA	NA
ET = Exposure Time (hr/day) =	NA	NA	NA	1.00	2.00
PC = Permeability Constant (cm/hr) =	NA	NA	NA	1.30	NA
INHR = Inhalation Rate (mg/day) =	NA	NA	NA	NA	2.50
VF = Volatilization Factor (m ³ /kg) =	NA	NA	NA	NA	1.14E+05
CDI = Chronic (70 year) Daily Intake (mg/kg day) =	3.92E-08	4.78E-06	6.46E-07	2.06E-07	2.83E-07
Carcinogen Risk =	3.02E-07	3.68E-05	4.97E-06	1.58E-06	2.18E-06
E = Non-Carcinogenic Exposure Level (mg/kg day) =	2.29E-07	2.79E-05	3.77E-06	1.20E-06	1.65E-06
Non-Carcinogenic Hazard Index =	1.14E-02	1.39E+00	1.88E-01	6.00E-02	8.26E-02

Pathway	Route
1	Dermal Absorption of Sediment
2	Dermal Absorption of Soil
3	Ingestion of Soil
4	Dermal Absorption of Surface Water
5	Inhalation of Soil Vapor

APPENDIX E

**Revised Final Calculation Plan
PADUCAH GASEOUS DIFFUSION PLANT
PCB SEDIMENT SAMPLING SURVEY**

**Revised Final
Calculation Plan
Preliminary Risk Calculation
Paducah Gaseous Diffusion Plant
Little Bayou and Big Bayou Creek,
PCB Sediment Evaluation
Delivery Order No. 19
Contract # DACA62-93-D-0020**

1. Introduction

This plan is submitted to the Nashville District Corps of Engineers (CEORN), Nashville, Tennessee, for approval to continue the Preliminary Risk Calculation at the Paducah Gaseous Diffusion Plant (Little Bayou and Big Bayou Creek, PCB Sediment Evaluation). The final Preliminary Risk Assessment document will be included as Chapter 5 in the final draft of the Paducah Gaseous Diffusion Plant PCB Sediment Survey, Big Bayou Creek and Little Bayou Creek, prepared by the U.S. Army Corps of Engineers, Nashville, Tennessee.

The Calculation Plan will provide information that will be used in the final Preliminary Risk Calculation. This report will briefly describe the methods and procedures to be utilized, and will also provide the various exposure factors and toxicity values to be used in the final report. The objectives of this risk calculation are to evaluate the impacts to the human health and the environment associated with the contaminants at the site; and to provide the database with which to assess the need for a more detailed risk assessment, and the need for site remediation. The Preliminary Risk Calculation will include a quantitative human health risk and a qualitative ecological risk discussion.

The human health risk assessment organization may be briefly summarized as follows

- Hazard Identification
- Exposure Assessment
- Toxicity Assessment
- Risk Characterization

2. Hazard Identification

The objective of the hazard identification is to determine the chemicals of concern through data collection and data evaluation. Although various chemicals have been determined to be present at the site, this report will analyze only the potential risk of polychlorinated biphenyl's (PCB).

A polychlorinated biphenyl is any member in a family of organic compounds with two or more chlorine substitutions on biphenyl rings. Considering the possible distribution of substituted chlorine atoms on two benzene rings of biphenyl, it is calculated that there could theoretically be 209 types (congeners) of PCB's. This report will look at seven types of PCB's which includes 35 percent of all the different PCB's commercially produced and 98 percent of the PCB's sold in the United States since 1970 (ATSDR 1992).

PCB exposure concentrations will be determined from the following reports supplied by the Nashville Corps of Engineers (COE) and the Oak Ridge National Laboratory (ORNL). No effort will be made to review the sampling or analytical methods in these reports, or to validate the data.

- **Surface Water** - Birge, W.J., Short T.M., and Lauth J.R. 1990. Biological Monitoring Program for the Paducah Gaseous Diffusion Plant, Three-Year Draft Report, December 1990. Submitted to Dr. Barbara Walton, Project Officer, Environmental Sciences Division, Oak Ridge National Laboratory, Oak Ridge, Tennessee.
- **Surface Soil** - CH2MHill. 1991. Results of the Site Investigation at the Paducah Gaseous Diffusion Plant, Paducah, Ky. U.S. Department of Energy. Document No. KY/ER-4.
- **Fish Tissue** - Oak Ridge National Lab's PCB fish tissue data reference. Received in correspondence from Mr. Danny R. Guminski (Environmental Management - Lockheed Martin) to FMSM and the Nashville District on 12 September 1995.
- **Sediment** - U.S. Corp of Engineers. 1994. PCB Sediment Survey, Big Bayou Creek and Little Bayou Creek, Paducah, Kentucky, Paducah Gaseous Diffusion Plant. Prepared for U.S. Department of Energy, Draft, September.

Four types of samples; sediment, surface water, soil, and fish will be included to provide a database on the nature and extent of contamination. If there is reason to believe that PCB's are present in a sample below the sample quantitation limit, one-half of the sample quantitation limit will be used in the calculation for the concentration term (USEPA 1989).

By request of CEORN, two methods will be used to quantify risk to human health.

- 1) The first calculation method will use default values from the United States Environmental Protection Agency (USEPA) and Kentucky Department for Environmental Protection (KYDEP) assuming a log normal distribution on the data and an upper 95% confidence interval. If default values from USEPA and KYDEP differ, those values considered most protective will be used.
- 2) The second calculation method will also assume a log normal distribution on the data and an upper 95% confidence interval. However, input/default values that would be considered more realistic for the site and potential human exposure will be used. Data incorporated in this modified risk calculation concerning recreational use and fishing practices will be furnished by the Kentucky Department of Fish and Wildlife Resources (KDFWR).

Risk calculations will be quantified for Big Bayou and Little Bayou separately.

3. Exposure Assessment

The objective of the exposure assessment is to estimate the type and magnitude of exposures to the chemicals of concern that are present at or migrating from a site. The results of the exposure assessment will be integrated with the chemical-specific toxicity information in order to characterize human health risks potentially associated from the site.

Exposure pathways describe the movement of chemicals from sources (e.g. contaminated soil) to exposure points (locations) where receptors (exposed populations) may come in contact with chemicals. Pathways through which individuals could be exposed to chemicals at the Paducah Gaseous Diffusion Plant (PGDP) are presented in Tables I-VI. These tables present data to be used for performing the risk calculation with USEPA/KYDEP defaults (calculation method No. 1) and KDFWR modified defaults (calculation method No. 2). Input received from KDFWR, used to modify the USEPA/KYDEP defaults, is presented in the Appendix.

This Preliminary Risk Assessment will assess the risk to the recreational user, adult and child (7-18 year old). The child will be assessed because the youth belongs to a more sensitive population. KYDEP values were used when considered more protective than USEPA values. The routes of exposures will be the same for each receptor, as presented below:

- Sediment - Dermal Contact
- Surface Water - Dermal Contact
- Fish - Ingestion
- Soil - Incidental Ingestion, Dermal Contact, and Inhalation of Vapors

**Table I. Exposure Intake Parameters
Dermal Contact with Sediment
Current Recreational User, Adult and Child**

$$\text{Absorbed Dose (mg / kg - day)} = \frac{\text{CS} \times \text{CF} \times \text{SA} \times \text{AF} \times \text{ABS} \times \text{EF} \times \text{ED}}{\text{BW} \times \text{AT}}$$

Parameter	Definition	Units	Calculation Method No. 1 USEPA/KYDEP Defaults		Calculation Method No. 2 KDFWR Modified Defaults	
			Value	Reference	Value	Reference
CS	Contaminant Concentration in sediment	mg/kg	Site-specific	USEPA, 1989	Site-specific	USEPA, 1989
CF	Conversion Factor	kg/mg	1E-6	USEPA, 1989	1E-6	USEPA, 1989
SA	Skin Surface	cm ² /event	7400 child[a] 9300 adult[b]	USEPA, 1989 USEPA, 1989	7400 child[a] 9300 adult[b]	USEPA, 1989 USEPA, 1989
AF	Soil to Skin Adherence Factor	mg/cm ²	1.0	USEPA, 1992	1.0	USEPA, 1992
ABS	Absorption Factor	unitless	0.10 PCB's	ATSDR, 1992	0.10 PCB's	ATSDR, 1992
EF	Exposure Frequency	event/year	140 child 52 adult	KYDEP, 1993 KYDEP, 1993	10 adult Big/Little Bayou 10 child Big/Little Bayou	KDFWR, 1995 KDFWR, ,1995
ED	Exposure Duration	years	12 child 22 adult	KYDEP, 1993 KYDEP, 1993	12 child 22 adult	KYDEP, 1993 KYDEP, 1993
BW	Body Weight	kg	43 child 70 adult	USEPA, 1989 USEPA, 1989	43 child 70 adult	USEPA, 1989 USEPA, 1989
AT	Averaging Time Carcinogenic effects Noncarcinogenic effects	days	25,550 ED x 365	USEPA, 1989 USEPA, 1989	25,550 ED x 365	USEPA, 1989 USEPA, 1989

[a] arms, hands, and lower legs

[b] arms, hands, feet, upper and lower legs.

[c] best professional judgment.

**Table II. Exposure Intake Parameters
Dermal Contact with Surface Water, Wading
Current Recreational User, Adult and Child**

$$\text{Daily Exposure (mg-hr/kg-cm/day)} = \text{CW} \times (\text{SA} \times \text{ED} \times (1/\text{BW})) \times \text{EF} \times \text{ET} \times \text{CF} \times (1/\text{AT})$$

$$\text{Daily Intake} = \text{Daily Exposure} \times \text{Permeability Coefficient (PC)}$$

Parameter	Definition	Units	Calculation Method No. 1 USEPA/KY Defaults		Calculation Method No. 2 KDFWR Modified Defaults	
			Value	Reference	Value	Reference
CW	Contaminant Concentration in Water	mg/liter	Site-specific	USEPA, 1989	Site -specific	USEPA, 1989
SA	Skin Surface	cm ²	7400 child[a] 9300 adult[b]	KYDEP, 1993 KYDEP, 1993	7400 child[a] 9300 adult[b]	KYDEP, 1993 KYDEP, 1993
PC	Permeability Constant	cm/hour	Chemical specific	USEPA, 1992	Chemical specific	USEPA, 1992
ET	Exposure Time	hrs/day	2.5 hours	BPJ[c]	2 Big Bayou 1 Little Bayou	KDFWR, 1995 KDFWR, 1995
EF	Exposure Frequency	days/year	140 child 52 adult	KYDEP, 1993 KYDEP, 1993	10 child 10 adult	KDFWR, 1995 KDFWR, 1995
ED	Exposure Duration	years	12 child 22 adult	USEPA, 1989 USEPA, 1989	12 child 22 adult	USEPA, 1989 USEPA, 1989
CF	Conversion Factor	L/cm ³	1E-3	USEPA, 1989	1E-3	USEPA, 1989
BW	Body Weight	kg	43 child 70 adult	USEPA, 1989 USEPA, 1989	43 child 70 adult	USEPA, 1989 USEPA, 1989
AT	Averaging Time Carcinogenic effects Noncarcinogenic effects	days	25,550 ED x 365	USEPA, 1989 USEPA, 1989	25,550 ED x 365	USEPA, 1989 USEPA, 1989

[a] arms, hands, legs, and feet.

[b] arms, hands, legs, and feet.

[c] best professional judgment

**Table III. Exposure Intake Parameters
Ingestion of Fish
Current Recreational User, Adult and Child**

$$\text{Intake (mg/kg-day)} = \frac{\text{CF} \times \text{IR} \times \text{FI} \times \text{EF} \times \text{ED}}{\text{BW} \times \text{AT}}$$

Parameter	Definition	Units	Calculation Method No. 1 USEPA/KY Defaults		Calculation Method No. 2 KDFWR Modified Defaults	
			Value	Reference	Value	Reference
CF	Contaminant Concentration in Fish	mg/kg	Site-specific	USEPA, 1989	Site-specific	USEPA, 1989
IR	Ingestion Rate	kg/meal	0.284 kg	USEPA, 1989	0.284 kg	USEPA, 1989
FI	Fraction Ingestion from Contaminated Source	unitless	1	USEPA, 1989	1	USEPA, 1989
EF	Exposure Frequency	meals/year	128	USEPA, 1989	64 Big Bayou 0 Little Bayou	KDFWR, 1995 KDFWR, 1995
ED	Exposure Duration	years	12 child 22 adult	KYDEP, 1993 KYDEP, 1993	12 child 22 adult	KYDEP, 1993 KYDEP, 1993
BW	Body Weight	kg	43 child 70 adult	USEPA, 1989 USEPA, 1989	43 child 70 adult	USEPA, 1989 USEPA, 1989
AT	Averaging Time	days				
	Carcinogenic effects		25,550	USEPA, 1989	25,550	USEPA, 1989
	Noncarcinogenic effects		ED x 365	USEPA, 1989	ED x 365	USEPA, 1989

**Table IV. Exposure Intake Parameters
Incidental Ingestion of Soil
Current Recreational User, Adult and Child**

$$\text{Intake (mg / kg - day)} = \frac{\text{CS} \times \text{IR} \times \text{CF} \times \text{FI} \times \text{EF} \times \text{ED}}{\text{BW} \times \text{AT}}$$

Parameter	Definition	Units	Calculation Method No. 1 USEPA/KY Defaults		Calculation Method No. 2 KDFWR Modified Defaults	
			Value	Reference	Value	Reference
CS	Contaminant Concentration in Soil	mg/kg	Site-specific	USEPA, 1989	Site-specific	USEPA, 1989
CF	Conversion Factor	kg/mg	1E-6	USEPA, 1989	1E-6	USEPA, 1989
FI	Fraction Ingestion from Source	unitless	1	USEPA, 1989	1	USEPA, 1989
IR	Ingestion Rate	mg/day	100	USEPA, 1989	100	USEPA, 1989
ET	Exposure Time	hrs/day	5	KYDEP, 1993	4 Big Bayou	KDFWR, 1995
					2 Little Bayou	KDFWR, 1995
EF	Exposure Frequency	days/year	140 child	KYDEP, 1993	10 child	KDFWR, 1995
			52 adult	KYDEP, 1993	10 adult	KDFWR, 1995
ED	Exposure Duration	years	12 child	USEPA, 1989	12 child	USEPA, 1989
			22 adult	USEPA, 1989	22 adult	USEPA, 1989
BW	Body Weight	kg	43 child	USEPA, 1989	43 child	USEPA, 1989
			70 adult	USEPA, 1989	70 adult	USEPA, 1989
AT	Averaging Time	days				
	Carcinogenic effects		25,550	USEPA, 1989	25,550	USEPA, 1989
	Noncarcinogenic effects		ED x 365	USEPA, 1989	ED x 365	USEPA, 1989

**Table V. Exposure Intake Parameters
Dermal Contact with Soil
Current Recreational User, Adult and Child**

$$\text{Absorbed Dose (mg/kg-day)} = \frac{\text{CS} \times \text{CF} \times \text{SA} \times \text{AF} \times \text{ABS} \times \text{EF} \times \text{ED}}{\text{BW} \times \text{AT}}$$

Parameter	Definition	Units	Calculation Method No. 1 USEPA/KY Defaults		Calculation Method No. 2 KDFWR Modified Defaults	
			Value	Reference	Value	Reference
CS	Contaminant Concentration in Soil	mg/kg	Site-specific	USEPA, 1989	Site-specific	USEPA, 1989
CF	Conversion Factor	kg/mg	1E-6	USEPA, 1989	1E-6	USEPA, 1989
SA	Skin Surface Area	cm ² /event	7400 child[a]	KYDEP, 1993	7400 child[a]	KYDEP, 1993
			5190 adult[b]	KYDEP, 1993	5190 adult[b]	KYDEP, 1993
AF	Soil to Skin Adherence Factor	mg/cm ²	1.0	USEPA, 1992	1.0	USEPA, 1992
ABS	Absorption Factor	unitless	0.10 PCB's	ATSDR, 1992	0.10 PCB's	ATSDR, 1992
EF	Exposure Frequency	events/year	140 child	KYDEP, 1993	10 child	KDFWR, 1995
			52 adult	KYDEP, 1993	Big/Little Bayou 10 adult	
					Big/Little Bayou	KDFWR, 1995
ED	Exposure Duration	years	12 child	KYDEP, 1989	12 child	KYDEP, 1989
			22 adult	KYDEP, 1989	22 adult	KYDEP, 1989
BW	Body Weight	kg	43 child	USEPA, 1989	43 child	USEPA, 1989
			70 adult	USEPA, 1989	70 adult	USEPA, 1989
AT	Averaging Time	days				
	Carcinogenic effects		25,550	USEPA, 1989	25,550	USEPA, 1989
	Noncarcinogenic effects		ED x 365	USEPA, 1989	ED x 365	USEPA, 1989

[a] arms, hands, legs, and feet.

[b] arms, hands, lower legs.

**Table VI. Exposure Intake Parameters
Inhalation of Vapors from Soil
Current Recreational User, Adult and Child**

$$\text{Intake (mg / kg - day)} = \frac{\text{CA} \times \text{IR} \times \text{ET} \times \text{EF} \times \text{ED}}{\text{BW} \times \text{AT}}$$

Parameter	Definition	Units	Calculation Method No. 1 USEPA/KY Defaults		Calculation Method No. 2 KDFWR Modified Defaults	
			Value	Reference	Value	Reference
CA	Contaminant Concentration in Air	mg/m ³	Site-specific	Hwang and Falco, 1989	Site-specific	Hwang and Falco, 1989
IR	Inhalation Rate	m ³ /hr	2.5 m ³ /hr	KYDEP, 1993	2.5 m ³ /hr	KYDEP, 1993
ET	Exposure Time	hrs/day	5	KYDEP, 1993	4 Big Bayou 2 Little Bayou	KDFWR, 1995 KDFWR, 1995
EF	Exposure Frequency	days/year	140 child 52 adult	KYDEP, 1993 KYDEP, 1993	10 child 10 adult	KDFWR, 1995 KDFWR, 1995
ED	Exposure Duration	years	12 child 22 adult	KYDEP, 1993 KYDEP, 1993	12 child 22 adult	KYDEP, 1993 KYDEP, 1993
BW	Body Weight	kg	43 child 70 adult	USEPA, 1989 USEPA, 1989	43 child 70 adult	USEPA, 1989 USEPA, 1989
AT	Averaging Time	days	25,550	USEPA, 1989	25,550	USEPA, 1989
	Carcinogenic effects		ED x 365	USEPA, 1989	ED x 365	USEPA, 1989
	Noncarcinogenic effects					

4. Toxicity Assessment

The objectives of the toxicity assessment are to evaluate the available information regarding the potential for particular contaminants to cause adverse effects in exposed individuals, and to provide the analytical framework for the characterization of human health impacts. For the purpose of evaluating the causal relationships between the extent of exposure to a contaminant and the increased likelihood and/or severity of adverse effects, toxicological information used to support the risk assessment is generally divided into two categories: carcinogenic and systemic (noncarcinogenic).

4.1. Toxicity Information For Carcinogenic Effects

For the purpose of assessing risks associated with potential carcinogenic risks, the USEPA has adopted the science policy of "no-threshold", i.e. there is essentially no level of exposure to a carcinogen which will not result in some finite possibility of tumor formation. Exposure is averaged over a lifetime (70 years)

4.2. Toxicity Information For Noncarcinogenic Effects

For the purpose of assessing risk associated with noncarcinogenic effects, the USEPA has adopted the science policy position that protective mechanisms must be overcome before the adverse health effect is manifested. Therefore, a range of exposures exists from zero to some finite value that can be tolerated by the organism with essentially no chance of expressing adverse effects.

The approach used by the USEPA to gauge potential noncarcinogenic effects is to identify the upper boundary of the tolerance range (threshold) for each chemical and to derive an estimate of the exposure below which adverse effects are not expected to occur. Such an estimate calculated from the oral route of exposure is an oral reference dose (RfD). The RfD is generally considered to have uncertainty spanning an order of magnitude or more, and therefore the RfD should not be viewed as a strict scientific demarcation between what level is toxic and non-toxic. The oral RfD is typically expressed as mg per chemical per kg body weight per day.

Uncertainties on the quantitative toxicity assessment have been well recognized, but degrees of uncertainty can vary, depending on the major sources of uncertainty associated with the toxicity assessment of a particular site. Uncertainties generally encountered in quantitative risk assessments will be discussed in the final document. Topics of uncertainty will include: exposure factors, toxicity data, fate and transport modeling, and other areas that may deem appropriate.

The source for the toxicological criteria used in the toxicity assessment was obtained from the Integrated Risk Information System (IRIS):

• Oral Slope factor for total PCB's :	7.7E+0 mg/kg-day
• Oral Reference dose (Aroclor 1016)	7.0E-5 mg/kg-day
(Aroclor 1254 and all others)	2.0E-5 mg/kg-day

- Oral Slope factors and Oral References dose will be used as toxic values for inhalation. ATSDR does not provide slope factors or reference doses for inhalation. Absorption through inhalation will be assumed to be 100 percent.
- Oral Absorption (ATSDR 1992) 100 percent
- Weight-of-Evidence Classification B2 (Probable Human Carcinogen)
- Warm Water Aquatic Habitat Criteria (KYDEP) 0.0014 ug/l

5. Risk Characterization

In this step of a risk assessment, information obtained during the exposure and toxicity assessment is integrated to characterize the potential risk posed by chemicals at the site. The methodology used for risk characterization is briefly outlined as follows:

- Organize outputs of exposure and toxicity assessment by the duration and route of exposure for each population.
- Quantify total carcinogenic and noncarcinogenic risk for each pathway.
- Estimate overall risks that effect each population over the same time period by combining risks across pathways.

6. Summary and Conclusions

The summary and conclusion discussion will be based on the results of the risk assessment calculations and uncertainties.

7. Ecological Risk Assessment

The ecological risk assessment will be a qualitative study comparing the concentrations of PCB's found to be at the Paducah Gaseous Diffusion Plant with various screening benchmarks. The following data obtained from ORNL will be included with state and federal regulations:

- Martin Marietta Energy Systems. 1994. Toxicological Benchmarks for Wildlife: 1994 Revision. ES/ER/TM-86/R1, September.
- Martin Marietta Energy Systems. 1994. Toxicological Benchmarks for Screening Contaminants of Potential Concern for Effects on Sediment-Associated Biota: 1994 Revision. ES/ER/TM-95R1. June.
- Martin Marietta Energy Systems. 1994. Toxicological Benchmarks for Screening Potential Contaminants for Effects on Aquatic Biota: 1994. July.
- Martin Marietta Energy Systems. 1994. Estimating Exposure of Terrestrial Wildlife to Contaminants. ES/ER/TM-125. September.

APPENDIX F

**Comments and Responses from Draft Report
PADUCAH GASEOUS DIFFUSION PLANT
PCB SEDIMENT SAMPLING SURVEY**

D. L. Ashburn - Comments and Responses

The following section addresses comments issued by David Ashburn regarding the Draft Report Preliminary Risk Calculation Paducah Gaseous Diffusion Plant.

1. Was 1242 detected as it is in one of the predominant arochlors at PGDP?

According to available data, only surface soil samples from Big Bayou and Little Bayou Creeks were analyzed for Arochlor 1242. Laboratory data does not indicate Arochlor 1242 was an analyte in the testing of surface water, fish, or sediment samples collected from Big Bayou or Little Bayou Creeks. Laboratory results from surface soil analysis show Arochlor 1242 was analyzed for and not detected. Therefore it was not included in the risk calculation.

2. From a non risk assessors technical point of view I really question using one half of the non detected concentration quantitation limit for calculations of PCB present. I saw little PCB present in water in real numbers and would not expect to see any accumulate in the fish tissue, I would like to see a number for worst case EPA estimate and a realistic number where we throw out numbers where we could not detect anything if this could be considered valid risk assessment.

Risk Assessment Guidelines for Superfund (RAGS) provides guidelines for the interpretation of laboratory data in risk assessments. The guidelines emphasize the use of laboratory data qualifiers and professional judgment in deciding inclusion or exclusion of data. These guidelines were followed in the Preliminary Risk Calculation.

Table 1 presents the percent detection of each Arochlor present in surface water samples collected from Big Bayou and Little Bayou Creeks.

Table 1.

	1248	1254	1260
Big Bayou	13.3%	5.3%	1.3%
Little Bayou	37.1%	6.4%	1.6%

Based upon the frequency of detection of PCBs at Big Bayou and Little Bayou Creeks, it was determined that PCBs were indeed present in surface water at the site. According to RAGS, "If there is reason to believe that the chemical is present in a sample at a concentration below the SQL, use one-half SQL as a proxy concentration. . . . do not simply omit the non-detected results from the risk assessment." Thus, non-detected surface water samples were included in calculations used to determine a representative exposure concentration.

The frequency of PCB detection in fish tissue samples collected from Big Bayou and Little Bayou Creeks is presented in Table 2.

Table 2.

	1248	1254	1260
Big Bayou	0%	9.6%	15.3%
Little Bayou	12.4%	32.3%	26.3%

Because of the PCB detection frequency at Big Bayou and Little Bayou Creeks, non-detect fish tissue samples were included in the exposure assessment calculation to determine a representative exposure concentration.

The frequency of PCB detection in surface soil samples collected from Big Bayou and Little Bayou Creeks is presented in Table 3.

Table 3.

	1016	1221	1232	1242	1248	1254	1260
Big Bayou	0%	0%	0%	0%	0%	0%	0%
Little Bayou	0%	0%	0%	0%	50%	0%	25%

Although the PCB detection frequency in surface soil samples at Big Bayou and Little Bayou Creeks is low, the limited number of samples necessitated inclusion of non-detect surface soil samples to determine a representative exposure concentration.

The frequency of PCB detection in sediment samples collected from Big Bayou and Little Bayou Creek is presented in Table 4.

Table 4.

	1242	1254	1260
Big Bayou	0%	5.3%	0%
Little Bayou	0%	7.1%	7.1%

Although the PCB detection frequency in sediment samples is low, the limited number of samples necessitated inclusion of non-detect sediment samples to determine a representative exposure concentration.

The Preliminary Risk Calculation was conducted following RAGS. Available data was interpreted based on the guidelines posed by RAGS and professional judgment. The risks generated from the assessment were conservative in order to present a "worst-case" scenario. While the risks may be increased based on the interpretation of analytical data, they are properly calculated. A risk calculation which would have excluded data due to non-detects or high quantification limits may have presented, on a practical basis, a more realistic risk. However, the risk assessment procedure is constructed to be conservative and inclusive. Thus, a risk assessment which does not address all the data is not correct and should not be used to interpret conditions at a site. FMSM performed the Preliminary Risk Calculation based on RAGS, in

accordance with the Calculation Plan developed for the risk assessment. A risk calculation based only on detected analytical values was not proposed in the Calculation Plan.

3. Although the N is small this could be correct and representative. We seem to be hit or miss all over in analyzing PCBs originating from PGDP.

Surface soil data available from PGDP was limited. Two sample points yielded three soil samples at Big Bayou Creek, while three sample points yielded four soil samples at Little Bayou Creek. According to RAGS, "Because of the uncertainty associated with any estimate of exposure concentration, the upper confidence limit (i.e., the 95 percent upper confidence limit) on the arithmetic average will be used for this variable." Thus, a statistical method is used to generate a reasonable, conservative concentration which accounts for variances and outliers in the data. The statistical method, however, provides unrepresentative values when sample sets are small and the variance between sample points is high. The statistically generated concentration level for PCBs in surface soil was $8.97E+43$ mg PCB/kg soil. The value is unreasonable, and, therefore, the maximum PCB 1248 and 1260 concentrations encountered in any soil sample (SB001-3 for PCB 1248 and SB009-1 for PCB 1260) were added and used in the exposure assessment calculation.

4. I would not expect you to change anything but the assumption that no fish were thrown out means that the diet would include minnows which is not realistic.

The Kentucky Department of Fish and Wildlife Recreation stated 0.284 kgs of fish could be caught at Big Bayou Creek as well as the beaver pond above Little Bayou Creek, assuming no fish were thrown back. The 0.284 kg fish/meal ingestion rate used to calculate the daily intake assumes none of the fish caught in the two locations were thrown back. It also assumes, in effect, that the entire catch is eaten (i.e., the whole fish is eaten). Realistically, these assumptions are not entirely accurate. Due to the conservative nature of the risk assessment, however, they are acceptable for the purpose of the calculations. Section 5.3.3. has been revised to reflect this uncertainty concerning high consumption.

5. This area needs some discussion as to what is the risk and why as per the comments of Rich Bonczek. I was unaware of the hazards of PCB as a non-carcinogenic material. I thought it to be almost totally inert.

The Environmental Protection Agency has determined through review of animal testing data that PCBs are probable human carcinogens. Animals ingesting large amounts of PCBs in food have experienced many serious health effects including stomach, liver and thyroid gland injuries. Rats which have ingested PCB mixtures over their lifetime have developed liver cancer. Exposure in animals to PCB through skin contact or breathing has resulted in kidney, liver and skin damage. Studies of humans exposed to PCB do not provide adequate information to determine if PCBs cause cancer in humans. Sections 5.2 and 5.6 have been expanded

to include exposure, intake health risks and other pertinent information regarding PCBs.

6. Because no one eats the fish except upstream of the plant and the number of visitors to Little Bayou Creek is essentially 0 per Charlie Logsdon's letter it seems that the risk should approach 0.

According to Mr. Charlie Logsdon, "the number of people visiting Little Bayou is essentially zero, with the exception of PGDP personnel and a few fishermen. A few people (bowhunters and dog trainers) may cross the creek occasionally." Thus, while Mr. Logsdon does state the number of people coming in contact with Little Bayou Creek is relatively few, he does identify some recreational uses that constitute exposure. The exposure to Little Bayou Creek was included in the risk assessment due to this existing, though limited exposure.

Richard R. Bonczek - Comments and Responses

The following section addresses comments issued by Richard R. Bonczek regarding the Draft Report Preliminary Risk Calculation Paducah Gaseous Diffusion Plant.

1. Generally, the report is consistent with the calculation plan presented in *Revised Final Calculation Plan, Preliminary Risk Calculation, Paducah Gaseous Diffusion Plant, Little Bayou and Big Bayou Creek, PCB Sediment Evaluation* presented as Appendix E of the reviewed report. However, in several instances the report is not consistent with common risk assessment guidance and deficient in its explanations.

N/A

2. The report, especially its site specific information concerning usage of Bayou and Little Bayou Creeks, is a valuable addition to the PGDP risk library.

N/A

3. Delete "possible" in line 5. There is PCB contamination at the PGDP.

"Possible" has been deleted at the referenced location in the Preliminary Risk Calculation.

4. In line 5, "correlated" should be replaced with "summarized".

"Correlated" has been replaced with "summarized" at the referenced location in the Preliminary Risk Calculation.

5. The information concerning the calculation of the 95% UCL is not correct. Although it appears the authors correctly applied the method recommended by EPA and KYDEP, the method is not adequately explained.

The information concerning the 95% UCL should be moved before the discussion of the two different scenarios. The differences between scenarios are related to the choice of exposure parameters and not the calculation of the 95% UCL.

Section 5.2.5. of the report has been modified to include a more thorough explanation of the statistical method used in the Preliminary Risk Calculation for the determination of exposure assessments.

6. Add "exposure to" at the end of line 5.

"Exposure" has been added at the referenced location in the Preliminary Risk Calculation.

7. Should mention which PCBs were included in the analysis plan here. The lack of detection is important.

Table 1 presents PCBs detected in the various media at PGDP. The table has been included in Section 5.2. in order to identify PCBs of concern at PGDP.

8. The material concerning why the samples from the confluence of Big Bayou and Little Bayou Creeks were not included is not clear. Ideally these data should have been included in the assessment as a "special" location. Need to expand on your explanation why these data were not included.

A more thorough explanation of the reasons for excluding surface water sample points near the confluence of the Ohio River is presented in Section 5.2.1. of the report. Evaluation of these samples within a "special location" section of the report was beyond the prescribed level of effort for this preliminary risk calculation.

9. Actually, the "nondetects" were included in the risk assessment by simply using, as the concentration of PCBs in assessment by simply using, as the concentration of PCBs in these samples, one-half the quantitation limit in the calculation of the 95% UCL. This procedure is correct according to EPA and KYDEP guidance; however, this fact should be clarified. Note, the non-detected concentrations were not "assessed."

Section 5.2.1. has been re-written to provide a more detailed explanation of the usage of non-detected samples.

10. The material about the derivation of the exposure concentration for Little Bayou Creek is not clear. Ideally, the lessor of the 95% UCL and maximum concentration should have been used in the risk assessment. Is this what was done? Please clarify this material.

Surface soil data available from PGDP was limited. Four sample points were collected from Little Bayou Creek. Upon statistical analysis, a 95% UCL of 8.97×10^{43} mg PCB/kg soil was generated. The value is unreasonable and, therefore, the maximum PCB 1248 and 1260 concentrations encountered in any soil sample (SB001-3 for PCB 1248 and SB009-1 for PCB 1260) were added and used as the representative concentration in the exposure assessment calculation.

Section 5.2.3. has been modified to clarify the origin of the exposure concentration.

11. Concerning the "background samples," need to indicate that these sampling locations are upstream from PGDP. Therefore, any PCBs in these samples should not be related to releases from the PGDP.

Sediment background samples collected from Big Bayou and Little Bayou Creeks are located upstream of the PGDP. PCBs present in the sediment samples would be unrelated to activities of the PGDP. These samples were not included in the calculation of the exposure concentration of Big Bayou and Little Bayou Creeks. Section 5.2.4. of the report has been expanded to clarify the location of the background samples.

12. The discussion about the use of samples in which PCBs were not detected needs to be corrected here as well. Please see Comment # 9.

Section 5.2.4. has been re-written to provide a more detailed explanation of the usage of non-detected samples.

13. This equation is not correct as presented. Need to indicate that the material after "e" is superscript.

The format of the equation in Section 5.2.5. has been changed for clarification.

14. These are presented as exposure pathways. They are not exposure pathways; they are media and exposure routes. This presentation should be corrected. A conceptual site model should be presented.

The exposure pathways in Section 5.3. have been re-written to be more comprehensive. Table 2 presents exposure pathways investigated at PGDP. A conceptual site model is not included. The model is beyond the prescribed level of effort for this preliminary risk calculation.

15. This summary does not mention children or teenagers, but these are included in the risk assessment. Need to stay why children are included in the assessment when this material only mentions adults.

Section 5.3.1. has been re-written to identify exposure of children at Big Bayou and Little Bayou Creek. Risks associated with childhood exposure is included in the Preliminary Risk Calculation due to the possibility of children being in contact with Big Bayou and Little Bayou Creeks.

16. Need to provide the source of the value 128 at the end of line 8.

The USEPA default value for exposure frequency associated with the ingestion of fish is 128 meals/year, while the ingestion rate is 0.284 kg/meal. The origin of these values have been identified in Section 5.3.1. of the report.

17. Need to define "subsistence fishing" as used in last sentence of paragraph in terms of rate of catching fish. This will strengthen your argument concerning the KDFWR Defaults.

The term "subsistence fishing" in reference to Little Bayou Creek has been deleted from Section 5.3.1. For clarification, the inability of Little Bayou Creek to support a significant portion of an individual's diet consistently is identified.

18. See Comment # 10 concerning the derivation of the representative concentration for soil at Little Bayou Creek. This usage should be corrected.

The usage of surface soil data from Little Bayou Creek is clarified in Section 5.3.3.

19. Need to state why you believe the results of your correspondence with KDFWR to be of limited accuracy. How could accuracy be improved?

The text in Section 5.3.3. regarding uncertainties in KDFWR responses has been revised. The revision clarifies that uncertainty exists in USEPA defaults and that KDFWR defaults should remove the majority of uncertainties associated with the exposure parameters.

20. The definition of the 95% UCL provided in this paragraph is not correct. This needs to be corrected.

The definition of the 95% UCL. has been re-written and is presented in Section 5.2.5. The new definition properly defines the 95% UCL.

21. Need to include a general discussion of the toxicological effects of PCB exposure in this section. This discussion should include the industrial source and use of PCBs, the fate of PCBs when released to the environment, a general discussion of the effect of PCB exposure (chronic, subchronic, and short-term), the absorption efficiency of PCB through the skin and gut, the EPA cancer classification of PCBs (and the meaning of the cancer classification), and the uncertainty factor associated with the PCB slope factor and RfD.

Background information concerning PCBs including PCB sources, environmental fate and exposure scenarios are presented in Section 5.2. of the Preliminary Risk Assessment. A brief summary of toxicological effects of PCB exposure is presented in Section 5.6. Uncertainties associated with the PCB slope factor and RfD are included in Section 5.3.3.

22. The last sentence concerning $1E-6$ should be deleted. There is disagreement concerning this value between EPA Region 4 and KYDEP. EPA Region 4 uses $1E-4$ as the point of departure to declare use scenarios of concern in its most recent guidance.

The referenced sentence has been deleted from Section 5.5.

23. (a) Suggest deleting the $1E-6$ "Regulatory Risk Level" stuff and just report risk value. See Comment # 22.

Referenced "Regulatory Risk Level" has been removed from Section 5.6.

- (b) The cancer risks for adults and children should be summed to give a total lifetime risk. Also, why aren't younger children included here? Actually need to discuss the reason for their exclusion from the analysis in the Exposure Assessment section of the report.

Adult and child carcinogenic risks are summed to give a lifetime carcinogenic risk associated with each pathway. Spreadsheets in Appendix D detail this calculation. The lifetime carcinogenic risks are reported in Tables 3 and 5 of Sections 5.6.2. and 5.6.3., respectively.

Risks to adults and children have been calculated in this report as stated in the Calculation Plan. It is not within the scope of this work to assess risks individually for younger and older children.

- 24. Need to be careful with use of "defaults". Suggest replacing "defaults" in line 8 of this paragraph with "exposure parameters" or some similar term. Also, in the last sentence of the paragraph, suggest replacing "figures" with "estimates".

Term "defaults" has been maintained in referenced locations due to acceptance of term in prior text. Term "figures" has been replaced with "estimates" in referenced location.

- 25. "Dermal absorption of soil pathway" should be replaced with "dermal absorption of PCBs in soil pathway" here and throughout the report.

The phrase "dermal absorption of soil pathway" has been changed to "dermal absorption of PCBs in soil" in Section 5.6.1. and throughout the report.

- 26. Need to include the data in these tables as well. This will simplify your presentation.

Analytical data for surface water was not included in Table 7 of Section 5.7.2. because benchmark values were not exceeded for any species.

- 27. The sample results presented here (from the CH2M Hill report) need to have their sample IDs from the CH2M Hill work included. The "sample" here does not match that contained in the CH2M Hill report. The correct sample IDs should be from PGDP. Please contact PGDP to get this information.

(a) The Arochlor benchmarks presented in Section 5.7.3. are correct as reported in the referenced document.

(b) Sample IDs from CH2M Hill were not available for inclusion in the Preliminary Risk Calculation.

28. The following comments are applicable to all material contained in this appendix.

- (a) AT_2 (noncancer effects) is incorrectly calculated in several places. This value should always equal ED times 365.

The non-carcinogenic averaging time (AT_2) has been corrected in the calculational spreadsheet for dermal absorption of PCB in sediment at Little Bayou Creek. The original AT_2 of 1,144 days has been changed to 8,030 days, corresponding to ED times 365.

- (b) The slope factor and RfDs vary with pathway. For the dermal absorption pathway, absorbed slope factors and RfDs versus administered slope factors and RfDs should be used. This assessment assumed 100% GI absorption which is not a conservative assumption.

Slope factors and RfDs were available for only the oral ingestion pathway. Neither ASTDR nor IRIS reported additional slope factors or RfDs. In the risk calculations, an oral slope factor and oral reference dose were used for each exposure pathway. The oral slope factor and reference dose are representative of the oral route of exposure. Although the data did not indicate whether the two toxicological factors were based upon administered or absorbed doses, the assumption was made in the calculations that the oral factors were based on absorbed doses. In contract, the oral slope factor and reference dose are not representative of the absorptive route of exposure. Due to the lack of toxicological data, however, and the preliminary nature of the risk assessment, the data was judged to be adequate.

- (c) Child and adult cancer risks should be added to get a total lifetime excess cancer risk. (Note, it is incorrect to sum adult and child HIs).

Child and adult cancer risks have been summed to provide total lifetime excess cancer risk estimates. Tables 3 and 5 present these values. Appendix D includes calculations and results for children and adults separately, as well as lifetime cancer risks.

- (d) Not clear what the "Total Carcinogenic Risk" and "Total Non-Carcinogenic Hazard Index" represent. Please provide text indicating how these were derived. Note, there should be two total cancer risks (one based on USEPA and one based on KDFWR) and four noncancer toxicity values (i.e., adult USEPA, child USEPA, adult KDFWR, child KDFWR) presented.

The total carcinogenic risk and total non-carcinogenic hazard index references have been deleted. Two total cancer risks and four non-carcinogenic toxicity values are presented in the Preliminary Risk Calculation.

- (e) The presentation of the calculations is unique and very good. The presentation makes it very clear how the various exposure parameters entered into the calculations.

N/A

- (f) For sediment data, not clear why data from sample points BBUP4 and BBUP5 are included in the calculation. These locations are upstream of PGDP according to your figures. These calculations and others should be checked to ensure that the correct data were used.

Sample Stations BBUP4 and BBUP5 were included as data points in the exposure calculation because they were not designated as background samples by the COE, as other samples (BBUP1, BBUP2, BBUP3) were.

- (g) For all dermal exposure should indicate the body parts assumed to be exposed (e.g., arms, legs, feet, and hands).

Pertinent spreadsheets in Appendix D have been modified to include the identification of exposed body parts subject to absorption.

- (h) Basis of all values need to be referenced. In particular, what are the source of the permeability constant and volatilization factor?

Empirical data used in PCB calculations was obtained from the following two sources:

Toxicological Profile for Selected PCBs, U.S. Department of Health and Human Services, Public Health Service, Agency for Toxic Substances and Disease Registry, April 1993.

Verschueren, K., Handbook of Environmental Data on Organic Chemicals, Second Edition, Van Nostrand Reinhold, New York, 1983, 1310 pp.

- (i) It is not correct to use the oral slope factor and RfD to determine "risk" for the inhalation pathway. These risk calculations should be removed from the report because this calculation is completely invalid. Note, should leave chronic daily intake from inhalation calculation in the report. Just remove the risk calculation because it is fatally flawed.

The use of the oral slope factor and RfD to determine carcinogenic risk and non-carcinogenic hazard indices was documented in the Calculation Plan. PCB slope factors and RfDs for the inhalation pathway are not readily available.

- (j) For PCBs in fish, should note that there is no exposure via this pathway at the LBC under the KDFWR because there is no exposure point.

Tables 5 and 6 in Section 5.6.2. of the Preliminary Risk Calculation indicate the fish ingestion pathway is not a valid pathway. Calculation spreadsheets for the pathway are therefore not included in Appendix D.

P.T. McGee, P.E. - Comments and Responses

The following section addresses comments issued by P.T. McGee on behalf of the Nashville District regarding the Draft Report Preliminary Risk Calculation Paducah Gaseous Diffusion Plant.

1. The report is consistent with the data quality objectives. It is concise and brings to finalization the questions that were asked. However, in going over the calculations there are some errors between tables that are to be corrected before finalization of the report.

The calculations within the Preliminary Risk Calculation have been checked for verification. Inconsistent input parameters and results have been corrected.

2. Table 3, Carcinogenic Risks Associated with Recreational use of Little Bayou Creek - the sum of the carcinogenic risk values should be $3.89\text{E-}03$ instead of $3.86\text{E-}03$; and $3.96\text{E-}03$ instead of $3.91\text{E-}03$.

The format of Table 5 (previously Table 3) in Section 5.6.2. has been modified. Adult and child risks have been combined to reflect risks over a lifetime exposure. Results are presented for each exposure pathway according to USEPA/KYDEP and KDEWR default parameters. Referenced changes have been addressed in the tables.

3. Table 4, Non-carcinogenic Hazard Indices Associated with Recreational Use of Little Bayou Creek - the Total Non-carcinogenic Hazard Indexes are 5.61, 150, $8.09\text{E-}01$, and 1.74; instead of 79.70, 148 $7.62\text{E}01$, and 1.68, respectively.

Table 6 (previously Table 4) within Section 5.6.2. has been corrected. The total non-carcinogenic hazard index estimates for adult and child exposure under USEPA/KYDEP defaults are 80.4 and 150, respectively. According to KDEWR defaults, the total non-carcinogenic hazard index for an adult and child is $8.09\text{E-}01$ and 1.73.

4. Appendix D, Exposure and Risk Calculations:

- (a) Calculation Spreadsheet: Dermal Absorption of Sediment - errors occur in exposure scenario 1 for non-cancer hazard index, and exposure scenario 2 for carcinogenic risk when compared to the Tables in Section 5.6.1.

Tables 3 and 4 (previously Tables 1 and 2) within Section 5.6.1. have been corrected to reflect the referenced inconsistencies. The carcinogenic risk to a child due to dermal absorption of PCBs in sediment according to USEPA/KYDEP default parameters is $6.16\text{E-}03$. Values presented in Tables 2 and 3 are consistent with those shown in Appendix D.

- (b) Calculation for Dermal Absorption of Surface Water - Adult (Big Bayou Creek), the value for CW is not represented correctly in the formula, and the units will not balance because of the unit m/kg (which is not properly defined).

The example calculation for the dermal absorption of PCBs in surface water at Big Bayou Creek has been corrected. The presentation of the PCB concentration in water (CW) within the calculation of the chronic daily intake has been changed to reflect the units mg/L.

- (c) Calculation for Dermal Absorption of Surface Water - Adult, (Little Bayou Creek), the value for CW is not represented correctly in the formula, and the units will not balance because of the unit m/kg (which is not properly defined).

The example calculation for the dermal absorption of PCBs in surface water at Little Bayou Creek has been corrected. The presentation of the PCB concentration in water (CW) within the calculation of the chronic daily intake has been changed to reflect the units mg/L.

- (d) Calculation Spreadsheet: Inhalation of Soil Vapor - errors occur in exposure scenarios 1,2,4,5,7, and 8 for cancer risk and non-cancer hazard index, non-cancer hazard index, non-cancer hazard index, non-cancer hazard index, cancer risk and non-cancer hazard index, and non-cancer hazard indexes when compared to their same values represented by summary Tables in Sections 5.6.1. and 5.6.2.

The format of Tables 2 through 5 (previously Tables 1 through 4) have been modified. Adult and child risks have been combined to reflect risks over a lifetime exposure. Referenced changes have been addressed in the tables. Values presented in Tables 2 through 5 (previously 1 through 4) are consistent with those shown in Appendix D.

- (e) Calculation for vapor Inhalation from Soil, the CS value, PCB concentration in soil should represent the highest sampled PCB 1248 and 1260 concentrations encountered in soil samples, yet when CS is compared to the statistic page that follows the value can not be found.

The Calculation Plan developed for the Preliminary Risk Calculation called for the use of a 95% upper confidence level (95% UCL) in the interpretation of analytical data. A 95% UCL was used in the preliminary risk calculation for all analytical data with the exception of soil samples collected from Little Bayou Creek. The 95% UCL value obtained from the statistical analysis of soil samples collected from Little Bayou Creek was 8.97 mg PCB/kg soil as indicated in the example calculation sheet presented in Appendix D. This value is unrepresentative, however. Thus, as the note on the example calculation indicates, the highest concentrations of PCB 1248 and 1260 encountered at Little Bayou Creek (53.00 mg/kg and 6.10 mg/kg) were summed to provide the representative concentration of 59.10 mg/kg.

- (f) Ingestion of Fish, Adult, Big Bayou Creek - PCB concentration in fish (95% of UCL), the value does not match the same of page 6 of the PCB Fish Tissue Data Table.

The representative 95% UCL for concentration of PCB in fish tissue in the fish analytical data and the calculational spreadsheets are consistent. A 95% UCL of 0.8566 mg/kg for Big Bayou Creek and 1.0611 mg/kg for Little Bayou Creek appear on the statistical sheets and calculational sheets.

- (g) There is a footnote to the Tables that reads, "RAGS dictates PCB Arochlor 1260 be used as a standard PCB contaminant. All PCB contaminants converted to equivalent Arochlor 1260 concentration". However, the document represents Arochlor concentrations as the sum of Arochlors 1248, 1254, and 1260. Do the Tables in fact represent the concentrations of Arochlors 1248 and 1254 as equivalents to 1260?

Concentrations of Arochlors 1248 and 1254 have been assumed to be toxicologically equivalent to Arochlor 1260. Thus, these PCB Arochlors (1248 and 1254) have been treated as if they were PCB 1260 in the exposure calculations.

- (h) On page 10, the statistic page for the PCB Fish Tissue Data, omit the decimal and two zeros after 1254 and 1260.

The decimal placement has been changed at the referenced location.