MISSOURI DEPARTMENT OF
HEALTH

John Ashcroft
Governor

John R. Bagby, Ph.D.
Director

P.O. Box 570, Jefferson City, MO 65102 • 314-751-6400 • FAX 314-751-6010

February 20, 1992

Mr. Robert L. Morby
Chief, Superfund Branch
Waste Management Division
U. S. Environmental Protection Agency
726 Minnesota Ave.
Kansas City, KS 66101

Dear Mr. Morby:

Enclosed please find the final Risk Assessment for the Bluff Electric Works Site in Butler County, MO. Several changes have been made in the risk assessment in response to comments received from the Environmental Protection Agency (EPA). Following is a summary of EPA's comments and the Department of Health's responses.

1. Section 2.1 states that 2-butanone was ruled out as a contaminant of concern. If either IRIS or HEAST has a RfD or a slope factor, please calculate its associated risk and include in the overall site risk. Also note that 2-butanone is commonly known as methyl ethyl ketone or MEK.

   - 2-Butanone has been included in the risk assessment as a contaminant of concern. Changes in text related to this inclusion will be found in section 2.1, figure 4, section 2.2, section 2.3, section 3.1, section 5.1.1, section 5.1.3, section 5.3 and section 6.0.

2. Section 2.1 rules out furans as a contaminant of concern due to the difficulty in assessing exposure to contaminants in concrete walls. As additional justification for not calculating its risk, please expand this paragraph to include that the concrete will be demolished and disposed of as part of the removal action.

   - This information has been included.

3. Figure 4 title should specify that the concentrations are Upper 95% Confidence Levels.

   - The figure title has been modified accordingly.

4. Section 5.1.1 discusses the effects of dermal contact with copper. Please define the term "pruritis."

   - The term "pruritis" has been replaced with "itching" in sections 5.1.1 and 5.1.3.

5. Section 5.1.1 discusses the blood lead levels predicted by the Biokinetic Uptake Model. Please indicate that EPA generally considers blood lead levels above 10 ug/dL to represent excessive risk and warrant a response action.

   - It has been indicated in both sections 5.1.1 and 5.1.3 that EPA generally considers blood lead levels above 10 ug/dL to represent excessive risk.

6. Section 5.2 states that an excessive cancer risk may exist when the total cancer risk exceeds the 1×10^{-4} to 1×10^{-6} range. This statement should be deleted or altered because region 7 has not yet adopted this as its policy. It would be more appropriate to state that EPA generally considers a cumulative carcinogenic risk for an RME of greater than 1×10^{-4} (or one in ten thousand) to be unacceptable and to require a cleanup.

   - Wording has been altered throughout sections 5.2 and 6.0 to incorporate this comment.

7. Please delete the second sentence in section 5.2.2.

   - The sentence has been deleted.

8. In Table 8, the heading "Intake/SF Adjusted for Absorption" is followed by a question mark. Is this a typographical error?

   - The question mark has been removed.

The incorporation of these comments has not altered the original conclusions of the risk assessment, namely that carcinogenic risk exceeds the acceptable level.

We appreciate the opportunity to work with you on this site. If you have any questions regarding this assessment, please feel free to call Ms. Cherri Baysinger-Daniel at (314) 751-6102.

Sincerely,

for Daryl W. Roberts
Chief
Bureau of Environmental Epidemiology

DWR:CBD:pw

Enclosure

cc: Mary Peterson, U. S. Environmental Protection Agency
David Crawford, U. S. Environmental Protection Agency

Risk Assessment for
Bluff Electric Works Site, Butler County, Mo

Prepared by:
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Bureau of Environmental Epidemiology
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1.0 INTRODUCTION

1.1 OBJECTIVE

Missouri Department of Health (DOH) was tasked by the U. S. Environmental Protection Agency to conduct a risk assessment for the Bluff Electric Works site in Poplar Bluff, MO. Bluff Electric Works was an electric transformer repair and distribution facility located in Poplar Bluff, MO. Soils at the site are contaminated with polychlorinated biphenyls (PCBs). The purpose of the risk assessment was to determine if contaminants at the site posed health risks severe enough to warrant a cleanup.

1.2 SITE BACKGROUND

Bluff Electric Works site is located on the northwest corner of the intersection of Highway 53 and South 11th Street in Poplar Bluff, MO (Figure 1). The site, approximately 3 acres in size, is zoned industrial and is surrounded by residential property. There are two buildings on site. One served as the office and service areas for Bluff Electric Works and the other is a vacant house. A 300-400 gallon underground storage tank is located under the west service room and two 750-1000 gallon above ground storage tanks are located outside the building on a concrete pad. The concrete pad was used for temporary storage of transformers waiting to be serviced or picked up. Southeast of the office/service area is an asphalt parking lot (Figure 2).

Bluff Electric Works sold and serviced new and used transformers and electric motors on site between 1953 and 1987. Typically, when a transformer came in for service the oil was drained then the core and electrical wires were stripped. The transformer was placed in a 4' x 6' double boiler to melt wires and coatings. Used transformer oil fueled the fire under the double boiler. In the 1960s or 1970s, the double boiler was replaced with a natural gas fired furnace. If a transformer was not serviceable, it was stored along the South 12th Street right-of-way on gravel or native soil. Electric motors were reconditioned by replacing copper wires and bushings. Paint was stripped from motor housings using an acid bath and units were degreased with gasoline. Ceramic paint was dried in a baking oven located in the west service room.

1.3 PREVIOUS INVESTIGATIONS

Several investigations have been carried out on the Bluff Electric Works site since the Butler County Health Department filed an incident report on December 30, 1986. An initial investigation was conducted by EPA in January, 1987. Three soil samples were taken and analyzed for PCBs. PCB concentrations found in these samples ranged from 47 to 185 mg/kg. Based on these results, the EPA issued a Notice of Violation to Bluff Electric Works on May 5, 1987. Bluff Electric Works contracted with National Electric, Inc. to remove contaminated soils and other materials from the Bluff Electric Works property. National Electric began the removal action in June, 1987 but halted two days later when soil sampling indicated that PCB contamination was more widespread that originally thought (The Earth Technology Corporation 1991).

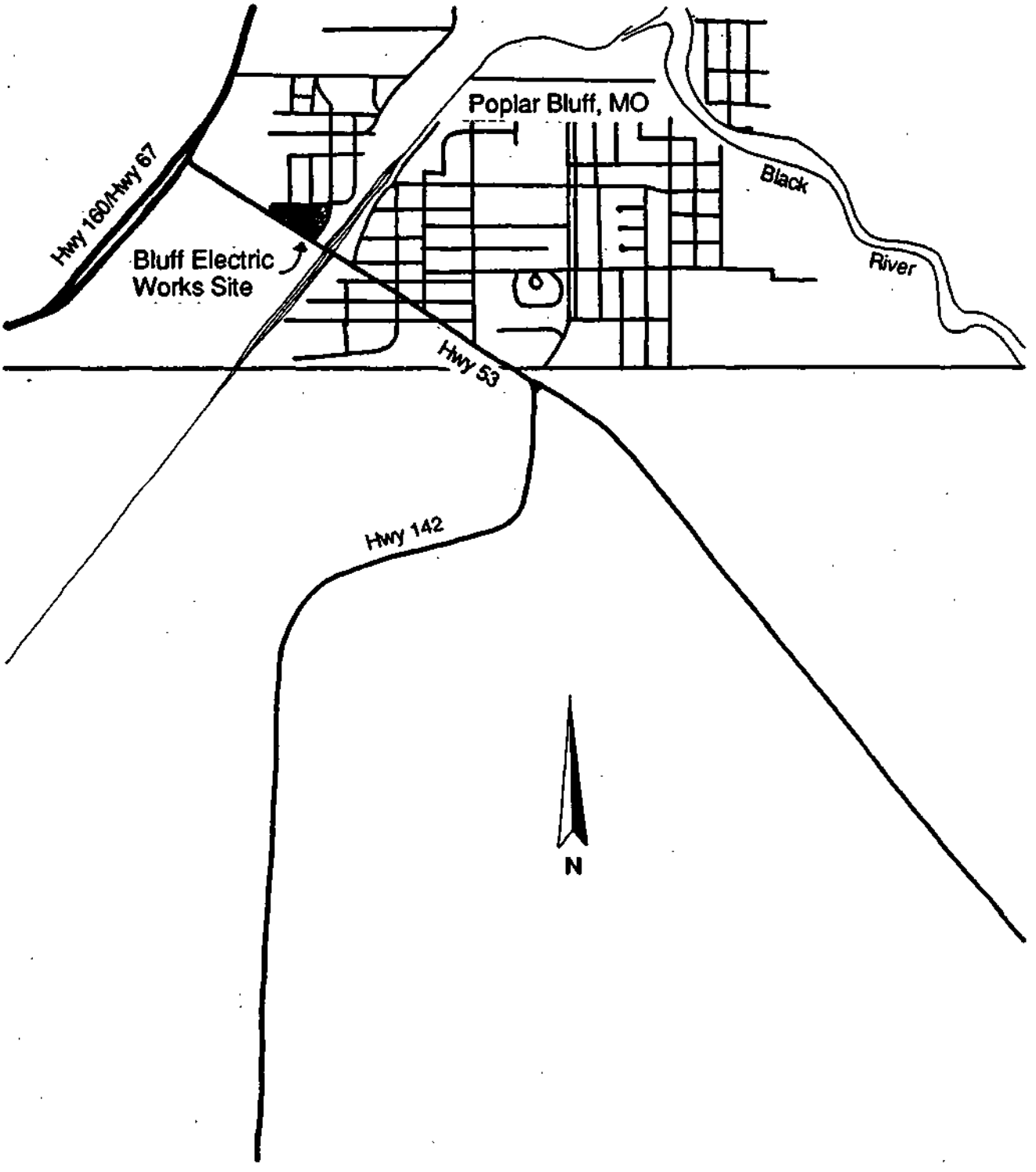

Figure 1
Location of the Bluff Electric Works Site
Bluff Electric Works Site
Butler County, MO

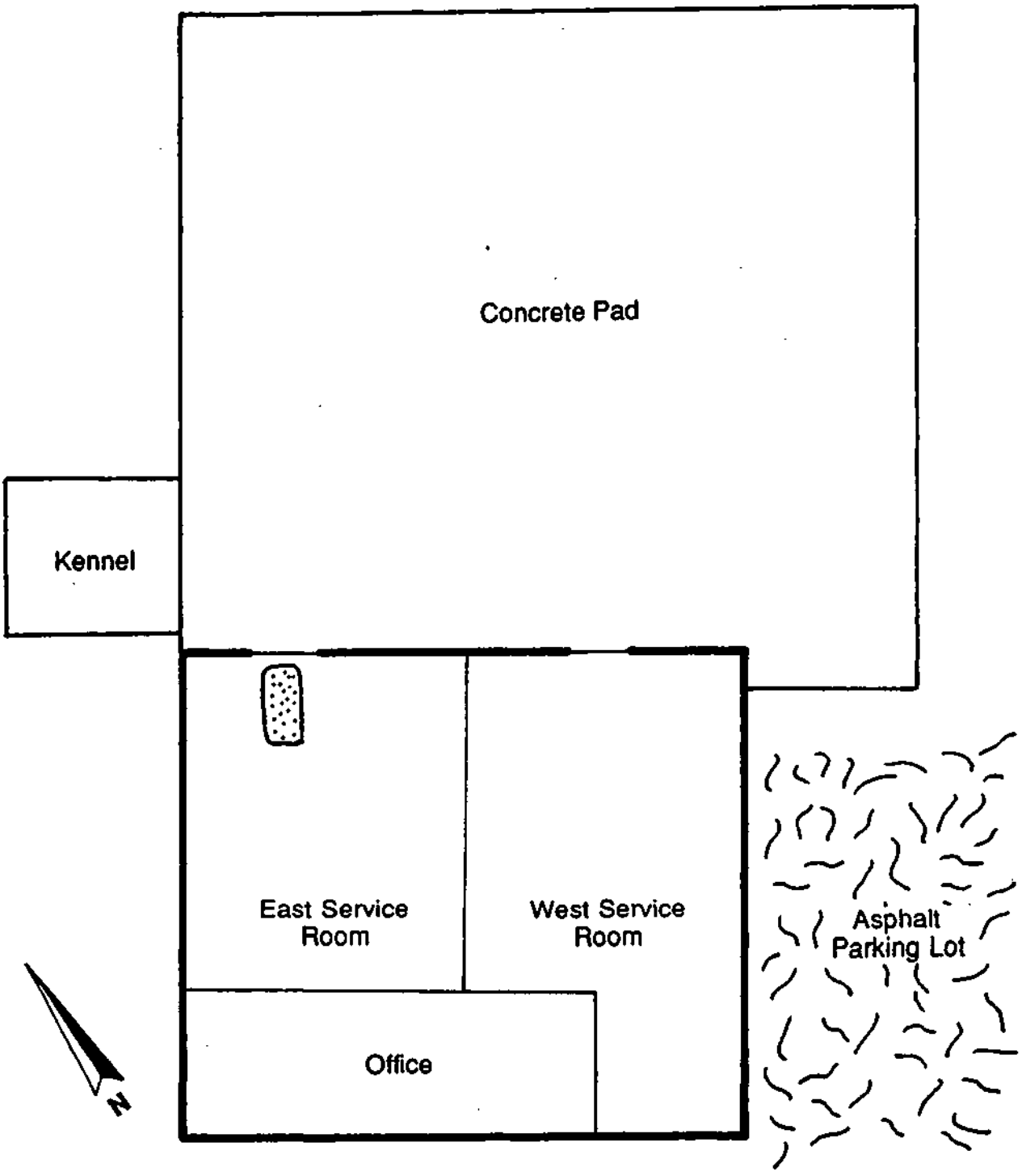

Figure 2
Dilagram of Bluff Electric Works Building
Bluff Electric Works Site
Butler County, MO

A preliminary site assessment was conducted by EPA's Technical Assistance Team (TAT) in April, 1989. A total of 69 samples were taken from surface soil, shallow soil borings, concrete and asphalt. Five wipe samples were taken from the two on site buildings. Twenty-five of the samples were sent to an EPA Contract Laboratory Program (CLP) for confirmation of PCB concentrations and analysis of target compound list (TCL) metals and volatile organic analytes (VOA). Results of this investigation indicated that 2-butanone was the only VOA present above detection limits, concentrations of copper and lead in soil were elevated, and measurable concentrations of PCBs were present throughout the site (E & E 1989, Appendix I).

EPA's TAT conducted a geophysical survey in June 1989 to determine if transformers were buried on the Bluff Electric Works site. Four anomalies were located, but no evidence of large amounts of buried iron material was found on site (The Earth Technology Corporation 1991). In September, 1990, EPA's TAT conducted a site perimeter survey to determine if PCB contamination was migrating offsite. Samples from two sides (along the west boundary of the 12th Street right-of-way and the south boundary parallel to Highway 53) had PCB concentrations above 450 mg/kg in surface samples, indicating that PCB contamination was not restricted to the Bluff Electric Works site (EPA 1990a, Appendix II).

1.4 Site Characterization Study

The site characterization study for Bluff Electric Works was completed in September 1991 by the Earth Technology Corporation. Goals of the site characterization were to evaluate horizontal and vertical extent of PCB contamination at Bluff Electric Works and adjacent properties and to determine if PCB combustion products (primarily dioxins and furans) were present at the site. To accomplish these goals, 196 samples were taken from surface and subsurface soils, drainage ditch sediments and subsurface soils under the office/service building, concrete pad and parking area and analyzed for PCB concentrations. Two concrete samples were taken from a visibly stained area in the former furnace area for dioxins and furans.

Results from these samples indicate that PCB contamination is present throughout the Bluff Electric Works site and adjacent properties (Appendix III). Four areas within the site have PCB concentrations consistently above 10 mg/kg (Figure 3). Mean PCB concentrations for each of the four areas and the mean concentration for the remainder of the site are indicated in Table 1. Levels of dioxins measured in concrete samples did not exceed levels indicating a health concern (The Earth Technology Corporation 1991, Appendix III).

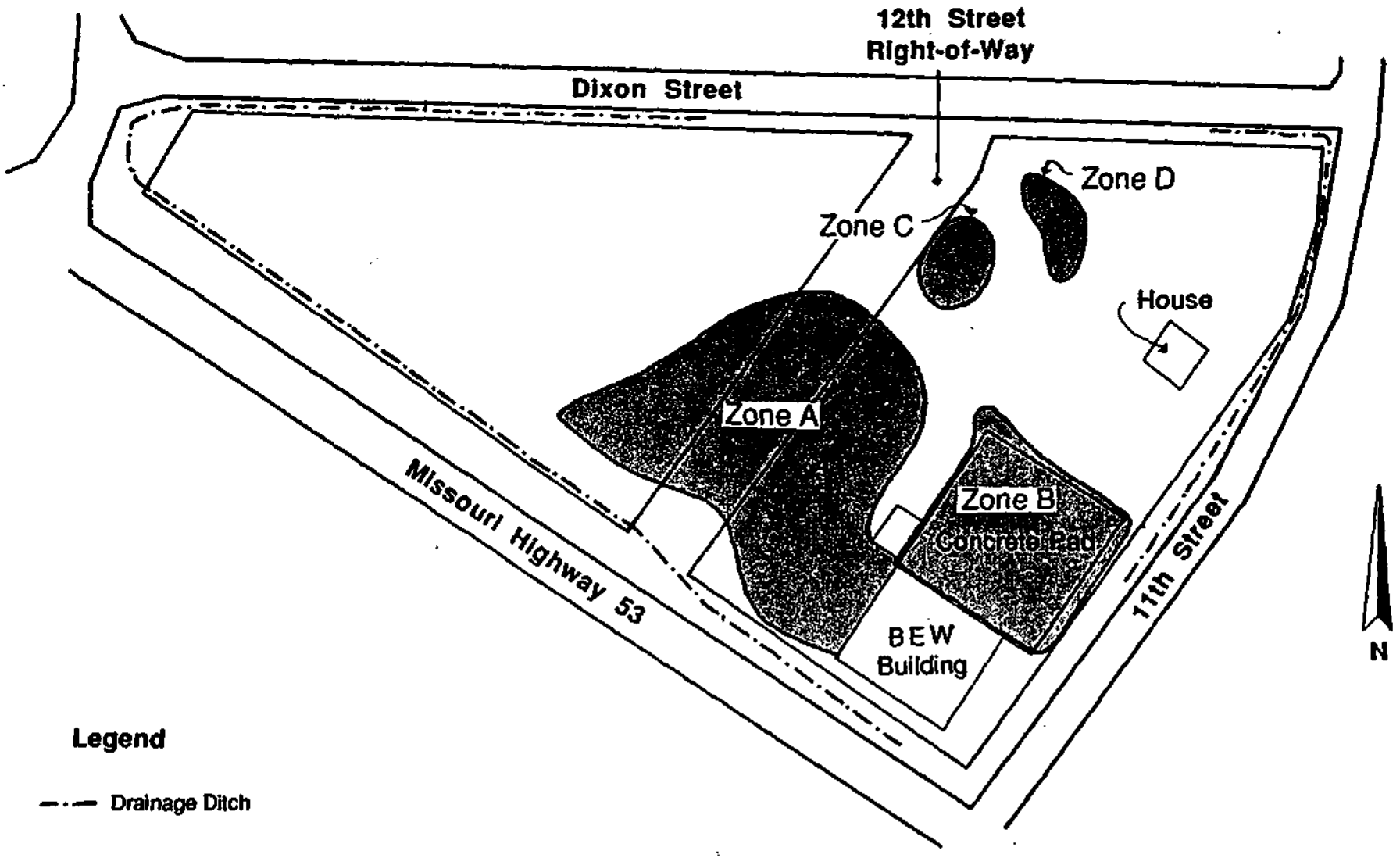

Figure 3
Location of Zones with PCB Concentrations
Greater than 10 mg/kg
Bluff Electric Works Site
Butler County, MO

Table 1.

Bluff Electric Works, Poplar Bluff, MO

Mean, Range and Upper Confidence Limits for PCBs in the Four Contaminated Zones

Zone	Mean and Range of PCB Concentrations (mg/kg)	Standard Deviation	Maximum Concentration (mg.kg)	95% Upper Confidence Limit (mg/kg)
A	485	1,406	7,900	815
	<0.1 -7,900			
B	63	69	230	96
	14-230			
C	69	52	120	65
	16-120			
D	29	26	59	54
	11-59			
Other locations on site	1.3	2.5	17	1.8
	<0.1-17			

2.0 IDENTIFICATION OF CONTAMINANTS OF POTENTIAL CONCERN

2.1 CONTAMINANTS OF CONCERN

Based on results from the preliminary site assessment and the site characterization, the list of contaminants of potential concern can be reduced to furans, 2-butanone, copper, lead, and PCBs. Results from the preliminary site assessment will be used for 2-butanone, copper and lead. Results from the site characterization will be used for furans and PCB's.

Furans were present in detectable levels in one concrete sample (Appendix III). Concrete present at the Bluff Electric Works site is scheduled to be demolished and disposed of as a part of the site remediation. Because the concrete will be removed from the site and difficulty in assessing exposure to compounds in concrete walls, furans were eliminated from the risk assessment.

In all soil samples where 2-butanone was detected, the compound identification was certain, but the concentrations were estimated (J-qualified, Appendix I). Concentrations found ranged from 6(J) - 1,700(J) mg/kg. The highest concentration found (1,700(J) mg/kg) was in a concrete dust sample from the pad north of the building. Concentrations of 2-butanone in soil ranged from 6(J) - 400(U) mg/kg. For soil samples where 2-butanone was undetected (U qualified), one half of the detection limit was used in calculations.

Copper concentrations found at the site ranged from 12 - 20,000 mg/kg. The highest concentrations found (11,000 and 20,000 mg/kg) were in dust samples from inside of the office/service building. Concentrations found in surface soil ranged from 23 - 2,900 mg/kg, with an overall site mean concentration of 675 mg/kg (Appendix I).

Lead concentrations found at the site ranged from 7.4 to 16,000 mg/kg. Two of the three highest concentrations (4,200 and 16,000 mg/kg) were again found in dust samples from inside of the office/service building. Lead concentrations in surface soil ranged from 18 to 5,100 mg/kg, with an overall site mean concentration of 463 mg/kg (Appendix I).

PCB concentrations found at the site ranged from below detection limits to 7,900 mg/kg (Appendix III). Mean PCB concentrations for each zone are shown in Table 1.

2.2 CONTAMINATED ZONES

Four zones were identified where surface soil PCB concentrations were greater than 10 mg/kg. Contaminated zone A was the largest of the four zones. Zone A occupied an area which began at the Bluff Electric Works building and extended approximately 220 feet west. At the widest point, zone A measured approximately 150 feet. Much of the southwest portion of the Bluff Electric Works property, much of the 12th Street right-of-way and a portion of the property on the other side of 12th Street was included in zone A. The highest PCB concentrations were found in zone A (Figure 4). High levels of lead and copper were also found in this zone. Upper 95% confidence limits of the mean

concentrations of PCBs, 2-butanone, lead and copper found in zone A are shown in Figure 4.

Contaminated zone B occupied the area under and around the concrete pad behind the Bluff Electric Works building. Much of zone B was covered by the concrete pad. PCB, lead and copper concentrations were lower in zone B than in zone A. Upper 95% confidence limits of the mean concentrations of PCBs, 2-butanone, lead and copper found in zone B are shown in Figure 4. Contaminated zones C and D are located in the northern half of the Bluff Electric Works site by the 12th Street right-of-way and Dixon Street, respectively. These zones are smaller and have lower PCB, lead and copper concentrations than zones A and B. Upper 95% confidence limits of the mean contaminant concentrations are shown in Figure 4.

PCB concentrations in the site outside of the four contaminated area ranged from below detection limits to 17 mg/kg. The upper 95% confidence limit on the mean concentration was 1.8 mg/kg (Table 1).

Zone A was chosen for use in the risk assessment. It covered a large portion of the Bluff Electric Works site and the four contaminants of concern were present.

2.3 PCB CONCENTRATIONS IN AIR

Because air monitoring was not done at the site, PCB concentrations for fugitive dust inhalation calculations were not available. PCB concentrations in fugitive dust particles were calculated using the formula:

Concentration in Air (mg/m^3)=(Concentration in Soil-mg/kg)(% Respirable Particles)
(Total Suspended Particles-ug/m^3)(Conversion Factor-kg/ug).

This formula was modified from Exposure Factors Handbook, Part 2, section 1-10 (EPA 1990b). A mean PCB concentration for the Bluff Electric Works site, 227 mg/kg, was used for the Concentration in Soil values. The Total Suspended Particles value in the formula was determined from historical particulate monitoring data from Cape Giradeau (84 ug/m^3, C. Hickman, Missouri Department of Natural Resources, pers. comm.). Cape Giradeau was Missouri Department of Natural Resources closest monitoring station to Poplar Bluff. Respirable fraction of particles was not provided and was assumed to be 100%. Thus, a concentration 1.9×10^{-5} mg PCB/m^3 air was used for inhalation pathway intake calculations.

2-Butanone is a volatile compound, thus it would be inappropriate to use concentrations of 2-butanone on dust particles to estimate exposure. A more appropriate estimate of exposure would be a calculation of the concentration which has volatized from contaminated soil . However, because 2-butanone concentrations are generally low at the Bluff Electric Works site (mean concentration=92 mg/kg), EPA personnel determined inhalation of volatized 2-butanone would not contribute significantly to the risk at the site and that this pathway could be eliminated from the risk assessment.

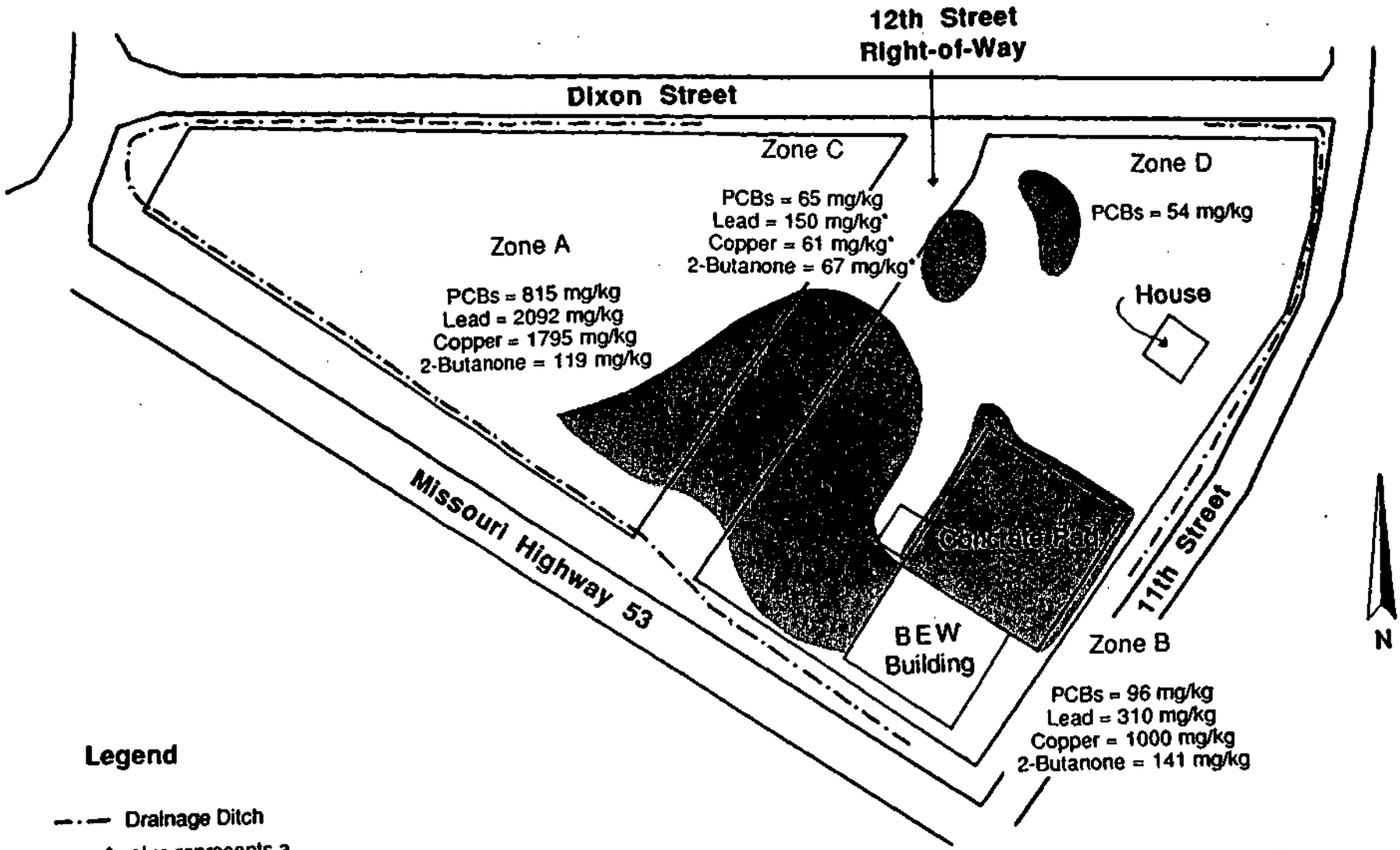

Figure 4
95% Upper Confidence Limits on the Mean Contaminant Concentrations in the Four Contaminated Zones
Bluff Electric Works Site
Butler County, MO

3.0 EXPOSURE ASSESSMENT

3.1 LAND USE SCENARIOS

Both current and future land use scenarios were considered in this risk assessment. For the current land use scenario, the site remains abandoned and is surrounded by residential property. Access to the site is unrestricted. Based on residential property currently surrounding the site, a residence is located on the site for the future land use scenario.

3.2 REASONABLE MAXIMUM EXPOSURES (RME)

3.2.1 RMEs FOR CURRENT LAND USE SCENARIO

For the current land use scenario, two RMEs were developed by EPA using site specific assumptions. RME 1 was a child, aged 5-12, visiting the site once a week for 40 weeks over a 7 year period. The child wore a t-shirt, long pants, socks and shoes while visiting the site. The child played in contaminated soil, incidentally ingested soil, and inhaled airborne contaminated dust while on the site.

The second RME for the current land use scenario was an adult who lived across the street from Bluff Electric Works for 30 years. The adult inhaled fugitive dust 24 hrs/day from the site while living adjacent to the site.

3.2.2 RMEs FOR FUTURE LAND USE SCENARIO

Based on the surrounding property, future land use for the Bluff Electric Works site was assumed to be residential. A residence will be located on the site (in zone A) and a person will live in the residence for 30 years. The person will inhale airborne contaminated dust, have dermal contact with contaminated soil and incidentally ingest contaminated soil.

3.2.2 INTAKE CALCULATIONS

Chemical intakes for all RMEs were calculated using pathway specific formulas in Tables 2-7. Exposure variables were chosen by EPA personnel so that the combination of all intake variables resulted in a reasonable maximum intake for each chemical within each pathway.

Table 2.

Bluff Electric Works, Poplar Bluff, MO

Formula for
Adult-Inhalation of chemicals in fugitive dust*

Equation:

Intake (mg/kg/day)=CA x IR x ET x EF x ED / (BW x AT)

Where:

CA=Chemical Concentration in air (mg/m^3)
IR=Inhalation Rate (m^3/hr)
ET=Exposure Time (hours/day)
EF=Exposure Frequency (days/year)
ED=Exposure Duration (years)
BW=Body Weight (kg)
AT=Averaging Time (days)

Variable values:

CA=Calculated value (section 2.3)
IR=0.83 m^3/hour (EPA 1990)
ET=24 hour/day (number of hours in a day)
EF= 365 days/year (number of days in a year)
ED=30 years (EPA 1991c)
BW=70 kg (EPA 1990b)
AT= 10950 days for noncarcinogenic effects (ED x 365 days/year)
25550 days for carcinogenic effects (70 years x 365 days/year)

*Formula was obtained from EPA 1989

Table 3.

Bluff Electric Works, Poplar Bluff, MO

Formula for
Adult-Incidental ingestion of chemicals in soil*

Equation:

Intake (mg/kg/day)=CS x IR x CF x FI x EF x ED / (BW x AT)

Where:

CS=Chemical Concentration in soil (mg/kg)
IR=Ingestion Rate (mg soil/day)
CF=Conversion Factor (kg/mg)
FI=Fraction Ingested from contaminated source (no units)
EF=Exposure Frequency (days/year)
ED=Exposure Duration (years)
BW=Body Weight (kg)
AT=Averaging Time (days)

Variable values:

CS=95% Upper Confidence Limit of the mean chemical concentration measured in Zone A (Table 1)
IR=100 mg/day (EPA 1991c)
CF=10^{-6} kg/mg
FI=1 (all soil ingested is assumed to come from the site)
EF=365 days/year (number of days in a year)
ED=30 years (EPA 1991c)
BW=70 kg (EPA 1990b)
AT=10950 days for noncarcinogenic effects (ED x 365 days/year)
25550 days for carcinogenic effects (70 years x 365 days/year)

*Formula was obtained from EPA 1989

Table 4.

Bluff Electric Works, Poplar Bluff, MO

Adult-Dermal contact with chemicals in soil*

Equation:

Absorbed Dose (mg/kg/day)=CS x CF x SA x AF x ABS x EF x ED / (BW x AT)

Where:

CS=Chemical Concentration in soil (mg/kg)
CF=Conversion Factor (kg/mg)
SA=Skin Surface Area for Contact (cm^2/event)
AF=Soil to Skin Adherence Factor (mg/cm^2)
ABS=Absorption Factor (no unit)
EF=Exposure Frequency (events/year)
ED=Exposure Duration (years)
BW=Body Weight (kg)
AT=Averaging Time (days)

Variable values:

CS=95% Upper Confidence limit on the mean chemical concentration measured (Table 1)
CF=10^{-6} kg/mg
SA=5168 cm^2 (50^{th} percentile Body Part Specific Surface Area--arms, hands, and heads of males and females--EPA 1990b)
AF=1 mg/cm^2 (EPA 1991a)
ABS=Chemical specific value (EPA 1991a)
EF=365 days (number of days in a year)
ED=30 years (EPA 1991c)
BW=70 kg (EPA 1990b)
AT=10950 days for noncarcinogenic effects (ED x 365 days/year)
25550 days for carcinogenic effects (70 years x 365 days/year)

*Formula was obtained from EPA 1989

Table 5.

Bluff Electric Works, Poplar Bluff, MO

Formula for Child-Inhalation of chemicals in fugitive dust*

Equation:

Intake (mg/kg/day)=CA x IR x ET x EF x ED / (BW x AT)

Where:

CA=Chemical Concentration in air (mg/m^3)
IR=Inhalation Rate (m^3/hr)
ET=Exposure Time (hours/day)
EF=Exposure Frequency (days/year)
ED=Exposure Duration (years)
BW=Body Weight (kg)
AT=Averaging Time (days)

Variable values:

CA=Calculated value (section 2.3)
IR=0.83 m^3/hour (EPA 1990b)
ET=1 hour/day (value defined by EPA personnel)
EF=40 days/year (value defined by EPA personnel)
ED=7 years (value defined by EPA personnel)
BW=30.5 kg (arithmetic mean of 50^{th} percentile body weights of boys and girls aged 6-9 years and 9-12 years --body weights were obtained from EPA 1990b)
AT=2555 days for noncarcinogenic effects (ED x 365 days/year)
25550 days for carcinogenic effects (70 years x 365 days/year)

*Formula was obtained from EPA 1989

Table 6.

Bluff Electric Works, Poplar Bluff, MO

Formula for
Child-Incidental ingestion of chemicals in soil*

Equation:

Intake (mg/kg/day)=CS x IR x CF x FI x EF x ED / (BW x AT)

Where:

CS=Chemical Concentration in soil (mg/kg)
IR=Ingestion Rate (mg soil/day)
CF=Conversion Factor (kg/mg)
FI=Fraction Ingested from contaminated source (no units)
EF=Exposure Frequency (days/year)
ED=Exposure Duration (years)
BW=Body Weight (kg)
AT=Averaging Time (days)

Variable values:

CS=95% Upper Confidence Limit of the mean chemical concentration measured in Zone A (Table 1)
IR=100 mg/day (EPA 1991c)
CF=10^{-6} kg/mg
FI=1 (all soil ingested is assumed to come from the site)
EF=40 days/year (value provided by EPA personnel)
ED=7 years (value provided by EPA personnel)
BW=30.5 kg (arithmetic mean of 50^{th} percentile body weights of boys aged 6-9 years and 9-12 years --body weights were obtained from EPA 1990b)
AT=2555 days for noncarcinogenic effects (ED x 365 days/year)
25550 days for carcinogenic effects (70 years x 365 days/year)

*Formula was obtained from EPA 1989

Table 7.

Bluff Electric Works, Poplar Bluff, MO

Child-Dermal contact with chemicals in soil*

Equation:

Absorbed Dose (mg/kg/day)=CS x CF x SA x AF x ABS x EF x ED / (BW x AT)

Where:

CS=Chemical Concentration in soil (mg/kg)
CF=Conversion Factor (kg/mg)
SA=Skin Surface Area for Contact (cm^2/event)
AF=Soil to Skin Adherence Factor (mg/cm^2)
ABS=Absorption Factor (no unit)
EF=Exposure Frequency (events/year)
ED=Exposure Duration (years)
BW=Body Weight (kg)
AT=Averaging Time (days)

Variable values:

CS=95% Upper Confidence limit on the mean chemical concentration measured (Table 1)
CF=10^{-6} kg/mg
SA=3178 cm^2 (50^{th} percentile Body Part Specific Surface Area--arms, hands, and heads of male and female children--EPA 1990b)
AF=1 mg/cm^2 (EPA 1991a)
ABS=Chemical specific value (EPA 1991a)
EF=40 days (value provided by EPA personnel)
ED=7 years (value provided by EPA personnel)
BW=30.5 kg (arithmetic mean of 50^{th} percentile body weights of boys aged 6-9 years and 9-12 years --body weights were obtained from EPA 1990b)
AT=2555 days for noncarcinogenic effects (ED x 365 days/year)
25550 days for carcinogenic effects (70 years x 365 days/year)

*Formula was obtained from EPA 1989

4.0 TOXICITY ASSESSMENT

4.1 NONCARCINOGENIC EFFECTS

Reference Dose (RfD) and Reference Concentration (RfC) are the toxicity values used in assessing noncarcinogenic effects from oral and inhalation exposure, respectively. EPA Integrated Risk Information System (IRIS) contains contaminant specific RfD and RfC values which have been verified by an intra-Agency work group. RfD and RfC values which have not been verified may be found in EPA Health Effects Assessment Summary Tables (HEAST, EPA 1991b).

Currently, there are no toxicity values for lead in IRIS or HEAST (EPA 1991b). Lead intake affects virtually every system in the body. Among the most serious effects of lead exposure are the central nervous system effects seen in young children. These effects range from impaired learning ability and a decrease in IQ scores to brain damage. Other effects are a decrease in growth of children, a decrease in hearing acuity and adverse effects on the kidneys and hematopoetic systems (CDC 1991). To assess the adverse health effects of lead exposure, EPA currently advises use of the Lead Biokinetic Uptake Model. This model combines intake variables from several potential lead exposure pathways and predicts blood lead levels for children. If the predicted blood lead level is greater than 10 ug/dL, a health hazard is considered to exist.

No RfD was listed in HEAST for copper. However, a drinking water criteria of 1.3 mg/l was provided. This was converted to an RfD of 3.7×10^{-2} using a formula taken from the preface to HEAST (EPA 1991). This formula is:

$$\text{RfD} = (\text{Drinking Water Criteria})(\text{Intake Rate})/(\text{Body Weight})$$

where Intake Rate = 2 L and Body Weight = 70 kg.

In order to assess noncarcinogenic effects from dermal exposure, it is necessary to adjust oral RfD's from the administered doses given in IRIS and HEAST to absorbed doses. Because dermal contact with copper may cause contact dermatitis, allergic reactions, skin discoloration and may bypass removal mechanisms, this adjustment is not appropriate (Appendix IV). Thus, dermal contact with copper is evaluated qualitatively in the risk characterization section.

Because no RfC had been determined, inhalation exposure was not evaluated for copper.

An oral RfD of 5×10^{-1} mg/kg/day is listed in HEAST for 2-butanone. The RfD is based on developmental effects, specifically fetotoxicity. Assessment of noncarcinogenic effects for the dermal route of exposure required adjustment of the RfD from an oral dose to administered dose using a factor of 100%.

3.2 CARCINOGENIC EFFECTS

Slope Factors found in IRIS and HEAST (EPA 1991b) are used to assess carcinogenic effects for specific contaminants. A Slope Factor (SF) is a plausible upper-bound estimate of the probability of a response per unit intake of a chemical expressed over a lifetime.

PCBs were the only carcinogenic compound found at the Bluff Electric Works site. They are considered B2 carcinogens, indicating there is adequate data to show carcinogenicity in animals, but human data is lacking. The SF listed in IRIS for PCBs is 7.7 $(mg/kg/day)^{-1}$. Oral PCB intake was associated with the incidence of liver tumors in rats.

Assessment of carcinogenic effects for the dermal route of exposure required adjustment of the SF from an oral dose to administered dose using a factor of 100%.

5.0 RISK CHARACTERIZATION

5.1 NONCARCINOGENIC EFFECTS

Noncancer hazard quotients are calculated for each contaminant in each pathway by dividing the Chronic Daily Intake (CDI) by the RfD. The noncancer hazard quotients within an exposure pathway are summed to give the pathway hazard index. The Total Hazard Index is then calculated by summing the pathway hazard indices. According to RAGS (EPA 1989), human health risks may exist when the Total Hazard Index exceeds unity (1.0).

5.1.1 PRESENT DAY SCENARIO - RME 1

Incidental ingestion of 5.9×10^{-3} mg/kg/day of copper and 4.3×10^{-4} mg/kg/day of 2-butanone by a 30.5 kg child resulted in a hazard index value of 0.16. Because this is less than 1, incidental ingestion of 100 mg/day of soil contaminated with 1795 mg/kg of copper and 119 mg of 2-butanone 40 days per year for 7 years did not appear to pose a health risk to the child.

Dermal contact with 1.4×10^{-3} mg/kg/day of 2-butanone on 3178 cm^2 of exposed skin on a 30.5 kg child resulted in a hazard index of 0.027. Because this is less than 1, dermal contact with 2-butanone for 40 days per year for 7 years is not expected to pose a health risk to the child.

Dermal contact with copper cannot be assessed quantitatively. Copper is an essential nutrient and there are several gastrointestinal mechanisms to prevent excess absorption of ingested copper. Dermal absorption of copper, however, would bypass these homeostatic mechanisms. As a result of dermal contact with copper, individuals may experience allergic contact dermatitis and localized itching.

The Lead Biokinetic Uptake Model was used to predicted blood lead levels of children playing on the site. Default values were used for air, water, food and paint intake variables. Soil and dust concentrations of 2092 ug/g were used in the soil and dust intake calculations. Blood lead levels between 17.4 and 19.5 ug/dL were predicted by the model. EPA generally considers a blood lead level of 10 ug/dL or greater to present a potential health risk, thus lead concentrations present at the Bluff Electric Works site may pose a health risk to children playing in zone A of the Bluff Electric Works site.

The total hazard index for ingestion of copper and 2-butanone from zone A of the Bluff Electric Works site by a 30.5 kg child for 40 days per year over a 7 year period is 0.19. Because the index value is less than 1, the site does not appear to pose a health risk to a child ingesting copper and 2-butanone. However, dermal contact with copper may cause localized allergic dermatitis and itching. Ingestion of lead from the site may cause elevated blood lead levels which indicates a potential health risk.

5.1.2 PRESENT DAY SCENARIO - RME 2

No noncarcinogenic health risks were evaluated for RME 2.

5.1.3 FUTURE LAND USE

For an adult living in zone A for 30 years ingesting 100 mg of soil each day contaminated with 1795 mg copper and 119 mg of 2-butanone per kg of soil, the Hazard Index was 0.072. This is substantially less than 1, thus no adverse health effects would be expected ingestion of copper and 2-butanone in soil.

Dermal contact with 8.8×10^{-3} mg/kg/day of 2-butanone on 5168 cm^2 of exposed skin on a 70 kg adult resulted in a hazard index of 0.18. Because this is less than 1, dermal contact with 2-butanone 365 days per year for 30 years is not expected to pose a health risk to an adult.

Dermal contact with copper cannot be assessed quantitatively. Copper is an essential nutrient, thus several gastrointestinal mechanisms exist to prevent excess absorption of ingested copper. Dermal absorption of copper, however, would bypass these homeostatic mechanisms. As a result of dermal contact with copper, individuals may experience allergic contact dermatitis and localized itching.

The Lead Biokinetic Uptake Model was used to predicted blood lead levels of a person living in zone A of the Bluff Electric Works site. Default values were used for air, water, food and paint intake variables. Soil and dust concentrations of 2092 ug/g were used in the soil and dust intake calculations. Blood lead levels between 17.4 and 19.5 ug/dL were predicted by the model. EPA generally considers a blood lead level of 10 ug/dL or greater to present a potential health risk, thus lead concentrations present at the Bluff Electric Works site may pose a health threat to a person living on the site.

The total hazard index for ingestion of copper and 2-butanone from zone A of the Bluff Electric Works site by a 70 kg adult, 365 days per year over a 30 year period is 0.25. Because the index value is less than 1, the site does not appear to pose a health risk to a adult ingesting copper and 2-butanone. However, dermal contact with copper may cause localized allergic dermatitis and itching. Ingestion of lead from the site may cause elevated blood lead levels which indicates a potential health risk.

5.2 CARCINOGENIC EFFECTS

Lifetime excess cancer risks are calculated for each contaminant in each pathway by multiplying the slope factor by the Chronic Daily Intake (CDI). Within a pathway, the chemical specific risks are summed to give the total pathway risk. The Total Lifetime Excess Cancer Risk is then determined by summing the total pathway risks. Region VII EPA generally considers an unacceptable cancer risk to exist when the Total Lifetime Excess Cancer Risk exceeds 1×10^{-4}.

5.2.1 CURRENT EXPOSURE SCENARIO - RME 1

The Lifetime Excess Cancer Risk posed to a 30 kg child playing in zone A of the Bluff Electric Works site 40 days/year for 7 years wearing a t-shirt, jeans, shoes and socks was 1.1×10^{-3} (Table 8). Pathway Cancer Risks for incidental ingestion and dermal contact were 2.2×10^{-4} and 8.6×10^{-4}, respectively. Cancer Risks for these two pathways exceed the acceptable level (1×10^{-4}), thus, a cancer risk may be posed to a child wearing a t-shirt, jeans, shoes and socks playing in zone A 40 days/year over a 7 year period (Table 8).

5.2.2 CURRENT EXPOSURE SCENARIO - RME 2

An adult living adjacent to the Bluff Electric Works site inhaling PCB contaminated fugitive dust for 30 years would face a Lifetime Excess Cancer Risk of 1.7×10^{-5} (Table 8).

5.2.3 FUTURE EXPOSURE SCENARIO

The Total Excess Lifetime Cancer Risk for an adult living in zone A for 30 years, wearing a t-shirt, jeans, shoes and socks and ingesting 100 mg of contaminated soil each day is 2.4×10^{-2}. Pathway cancer risks for incidental ingestion and dermal contact with contaminated soil were above 1×10^{-4} (3.8×10^{-3} and 2.4×10^{-2}, respectively). The Bluff Electric Works site would pose a cancer risk to a person living in zone A for a 30 year period (Table 8).

5.3 UNCERTAINTIES

Several areas of uncertainty are inherent in the risk assessment process. Most intake variables used are 95% upper confidence limits of the mean variable value. This may overestimate the true risk posed by the site. Many RfDs, RfCs and SFs are based on toxicity tests carried out on animals. It is not known if results of these tests are applicable to humans.

There are some site specific areas of uncertainty in this risk assessment. Only two samples were analyzed for dioxins and furans and none of these compounds were included in the risk assessment. If dioxins and furans are present on the site, the cancer risks in this assessment could be underestimated.

Zone A was chosen for use in the risk assesssment because the highest PCB, lead and copper concentrations were found in that zone. However, other portions of the Bluff Electric works site had higher concentrations of 2-butanone. To address this problem, hazard quotients were calculated for all pathways within RMEs 1 and 3 using the highest UCL value (239 mg/kg). Hazard quotients calculated using this value ranged from 0.0017 (soil ingestion for RME 1) to 0.35 (dermal contact for RME 3). Total hazard indices for both RMEs remained below 1.0, indicating the higher concentrations of 2-butanone did not present a health risk.

Table 8.

Bluff Electric Works, Poplar Bluff, MO

Lifetime Excess Cancer Risks

Pathway	PCB Concentration	Intake/SF Adjusted for absorption	Intake (mg/kg/day)	SF (mg/kg/day)-1	Pathway Cancer Risk	Excess Lifetime Cancer Risk
Current Exposure Scenario: Adult living adjacent to the site inhaling contaminated air 24 hrs/day over a 30 year period.						
Inhalation of PCBs in dust	1.0×10^{-5} ug/m3	no	2×10^{-5}	7.7	1.7×10^{-5}	**1.7×10^{-5}**
Current Exposure Scenario: Child trespassing on the site 1 hr/day, 40 days/year, wearing a t-shirt, jeans, shoes and socks.						
Incidental ingestion of PCBs in soil	815 mg/kg	no	2.9×10^{-5}	7.7	2.2×10^{-4}	
Dermal contact with PCBs in soil	815 mg/kg	yes	1.1×10^{-4}	7.7	8.6×10^{-4}	
Inhalation of PCBs in dust	1.0×10^{-5} ug/m3	no	5.7×10^{-9}	7.7	4.4×10^{-8}	**1.1×10^{-3}**
Future Exposure Scenario: Adult living in a residence on zone A for a 30 year period.						
Inhalation of PCBS in soil	815 mg/kg	no	5.0×10^{-4}	7.7	3.8×10^{-3}	
Dermal contact with PCBs in soil	815 mg/kg	yes	3.1×10^{-3}	7.7	2.4×10^{-2}	
Inhalation of PCBs in dust	1.0×10^{-5} ug/m3	no	2.3×10^{-6}	7.7	1.8×10^{-5}	**2.8×10^{-2}**

The Lead Biokinetic Uptake Model used to predict blood lead levels was developed for children aged 0-6 years, the ages at which effects from lead exposure are most dramatic. Effects of lead exposure are less prominent in older children and adults, thus the risks from ingesting lead at the Bluff Electric Works site for RME 2 and 3 are probably lower than reported in this assessment.

The Oral PCB RfD was used as an inhalation RfC. Inhalation exposure contributes substantially to the overall risk (ATSDR 1991). This may be revised upon receipt of PCB information requested from EPA's Environmental Criteria and Assessment Office.

6.0 SUMMARY

Bluff Electric Works is an abandoned transformer sales and service facility in Poplar Bluff, MO. Soil at the site is contaminated with copper, lead, 2-butanone and PCBs. The site is zoned industrial, but is surrounded by residential land. Both present and future land uses were considered in this risk assessment.

Two RMEs were considered for current land use: a child trespasser on the site playing in contaminated soil from zone A and an adult living adjacent to the site inhaling fugitive dust . The only noncarcinogenic risk posed was to children ingesting lead contaminated soil from zone A. Blood lead levels may be elevated in these children. Carcinogenic risks, ranging from 1.7×10^{-5} to 8.6×10^{-4}, were present for both RMEs.

The RME considered for the future land use scenario was an adult living in zone A for a 30 year period. Incidental ingestion of lead may cause elevated blood lead levels in this scenario. Carcinogenic risks from incidental ingestion and dermal contact (3.8×10^{-3} and 2.4×10^{-2}, respectively) were above the acceptable range.

Prepared by:

Cherri Baysinger-Daniel, Missouri Department of Health 2/20/92

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APPENDIX I

Bluff Electric Works Site, Poplar Bluff, MO

Sampling Results from the Preliminary Site Assessment
Conducted by EPA Technical Assistance Team in March 1989

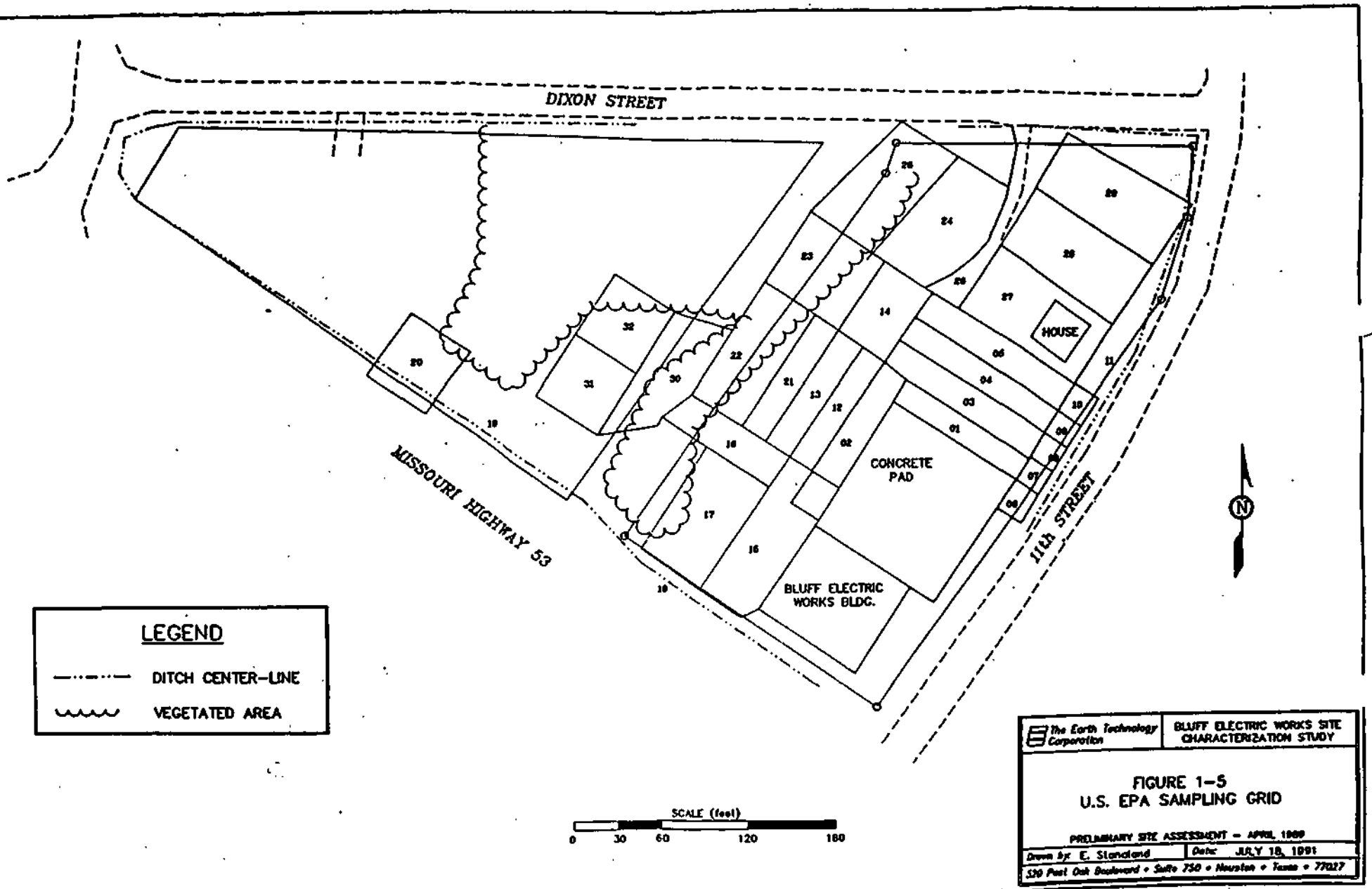

DIXON STREET
MISSOURI HIGHWAY 53
11th STREET
HOUSE
CONCRETE PAD
BLUFF ELECTRIC WORKS BLDG.
LEGEND
DITCH CENTER-LINE
VEGETATED AREA
SCALE (feet)
0 30 60 120 180
The Earth Technology Corporation
BLUFF ELECTRIC WORKS SITE CHARACTERIZATION STUDY
FIGURE 1-5
U.S. EPA SAMPLING GRID
PRELIMINARY SITE ASSESSMENT - APRIL 1989
Drawn by: E. Standaert
Date: JULY 18, 1991
539 Post Oak Boulevard • Suite 750 • Houston • Texas • 77027

TABLE 3
Sample Summary
Bluff Electric Works
Poplar Bluff, Missouri

SAMPLE NUMBER	TOTAL PCBs (PPM) Unless Otherwise Noted	MEDIA	COMMENTS
PK871000	0.000 0.000	Surface Soil (0-2")	Background Soil
PK871001	5.851 2.859	Surface Soil (0-2")	Gridded Section 01
PK871002	3.008 2.859	Surface Soil (0-2")	Gridded Section 02
PK871003	2.982 2.458	Surface Soil (0-2")	Gridded Section 03
PK871004	0.517 0.480	Surface Soil (0-2")	Gridded Section 04
PK871005	0.148 0.142	Surface Soil (0-2")	Gridded Section 05
PK871006	93.724 75.110	Surface Soil (0-2")	Gridded Section 06
PK871007	80.661 66.085	Surface Soil (0-2")	Gridded Section 07
PK871008	1.812 1.641	Surface Soil (0-2")	Gridded Section 08
PK871009	1.175 1.034	Surface Soil (0-2")	Gridded Section 09
PK871010	0.170 0.185	Surface Soil (0-2")	Gridded Section 10
PK871011	6.557 6.321	Surface Soil (0-2")	Gridded Section 11
PK871012	65.489 67.642	Surface Soil (0-2")	Gridded Section 12
PK871013	54.256 54.422	Surface Soil (0-2")	Gridded Section 13
PK871014	47.390 49.040	Surface Soil (0-2")	Gridded Section 14

TABLE 3 (continued)

SAMPLE NUMBER	TOTAL PCBs (PPM) Unless Otherwise Noted	MEDIA	COMMENTS
PK871015	10.262 9.445	Surface Soil (0-2")	Gridded Section 15
PK871016	52.320 54.360	Surface Soil (0-2")	Gridded Section 16
PK871017	16.262 15.906	Surface Soil (0-2")	Gridded Section 17
PK871018	0.759 0.713	Surface Soil (0-2")	Gridded Section 18
PK871019	6.549 6.379	Surface Soil (0-2")	Gridded Section 19
PK871020	7.507 7.087	Surface Soil (0-2")	Gridded Section 20
PK871021	11.140 10.270	Surface Soil (0-2")	Gridded Section 21
PK871022	9.421 8.752	Surface Soil (0-2")	Gridded Section 22
PK871023	498.075 644.384	Surface Soil (0-2")	Gridded Section 23
PK871024	5.278 5.224	Surface Soil (0-2")	Gridded Section 24
PK871025	10.284 10.128	Surface Soil (0-2")	Gridded Section 25
PK871026	2.793 2.476	Surface Soil (0-2")	Gridded Section 26
PK8711027	0.143 0.141	Surface Soil (0-2")	Gridded Section 27
PK871027D	0.043 0.050	Surface Soil (0-2")	Duplicate of Gridded Section 27
PK871028	0.065 0.062	Surface Soil (0-2")	Gridded Section 28
PK871029	0.000 0.000	Surface Soil (0-2")	Gridded Section 29.

TABLE 3 (continued)

SAMPLE NUMBER	TOTAL PCBs (PPM) Unless Otherwise Noted	MEDIA	COMMENTS
PK871030	121.892 118.782	Surface Soil (0-2")	Gridded Section 30
PK871031	80.771 79.224	Surface Soil (0-2")	Gridded Section 31
PK871032	72.919 68.219	Surface Soil (0-2")	Gridded Section 32
PK871033	3.331 3.246	Surface Soil (0-2")	Multi-aliquot grab sample from culvert, in Section 11
PK871033D	2.501 2.428	Surface Soil (0-2")	Duplicate of PK871033
PK871034	0.786 0.763	Surface Soil (0-2")	Multi-aliquot grab sample near concrete pad, in Section 08
PK871034D	0.653 0.633	Surface Soil (0-2")	Duplicate of PK871034
PK871035	11.725 10.779	Surface Soil (0-2")	Multi-aliquot grab sample near concrete pad, in Section 06
PK871035D	6.353 6.046	Surface Soil (0-2")	Duplicate of PK8711035
PK871036	10.571 10.172	Surface Soil (0-2")	Multi-aliquot grab sample near concrete pad, in Section 01
PK871037	0.634 0.598	Surface Soil (0-2")	Multi-aliquot grab sample near concrete pad, in Section 02
PK871038	1.243 1.285	Surface Soil (0-2")	Multi-aliquot grab sample from stained area NE corner, Section 21
PK871039	1.660 1.694	Surface Soil (0-2")	Multi-aliquot grab sample from stained area south portion, Section 23
PK871040	0.343 0.311	Surface Soil (0-2")	Multi-aliquot grab sample from drainage ditch SW of BEW building
PK871041	14.035 13.751	Surface Soil (0-2")	Multi-aliquot grab sample from culvert, in Section 18
PK871042	5353.299 4006.666	Surface Soil (0-2")	Multi-aliquot grab sample near capacitor, west of Section 22

TABLE 3 (continued)

SAMPLE NUMBER	TOTAL PCBs (PPM) Unless Otherwise Noted	MEDIA	COMMENTS
PK871043	33.954 47.145	Surface Soil (0-2")	Multi-aliquot grab sample near transformer, NW of Section 25
PK871060	0.000 0.000	Soil Core (0-8")	Core sample north of utility pole, in Section 08
PK871061	0.000 0.000	Soil Core (8-16")	Core sample north of utility pole, in Section 08
PK871070	0.000 0.000	Soil Core (0-8")	Core sample collected near NE corner of concrete pad
PK871071	0.000 0.000	Soil Core (8-16")	Core sample collected near NE corner of concrete pad
PK871080	55.953 50.630	Core Sample (0-8")	Soil core sample near NW corner of concrete pad
PK871081	793.019 710.172	Core Sample (8-16")	Soil core sample near NW corner of concrete pad
PK871090	0.000 0.000	Core Sample (0-8")	Soil core sample from SW corner of Section 22
PK871091	0.000 0.000	Core Sample (8-16")	Soil core sample from SW corner of Section 22
PK871100	0.000 0.000	Core Sample (0-8")	Soil core sample along border of Section 23 and Section 14
PK871101	0.000 0.000	Core Sample (8-16")	Soil core sample along border of Section 23 and Section 14
PK871110	1.818 1.820	Core Sample (0-8")	Soil core sample near electrical debris in in Section 22
PK871111	0.000 0.000	Core Sample (8-16")	Soil core sample near electrical debris in Section 22
PK871120	21.052 20.362	Core Sample (0-8")	Soil core sample near NW corner BEW building in Section 15
PK871121	1.775 1.735	Core Sample (8-16")	Soil core sample near NW corner BEW building in Section 15

TABLE 3 (continued)

SAMPLE NUMBER	TOTAL PCBs (PPM) Unless Otherwise Noted	MEDIA	COMMENTS
PK871130	1.091 1.025	Core Sample (0-8")	Soil core sample from drainage ditch in Section 18
PK871131	4.777 4.248	Core Sample (8-16")	Soil core sample from drainage ditch in Section 18
PK871300	39.217 36.414	Concrete Dust	Concrete dust from pad North of BEW building
PK871301	12.270 11.621	Concrete Dust	Concrete dust from interior of BEW building
PK871302	20.286 18.489	Asphalt	Asphalt lot East and South of BEW building
PK871400	23.492 22.227	Dust	Vacuum sample from West Office and Store Room in BEW building
PK871401	116.140 120.019	Dust	Vacuum sample from East Service Warehouse in BEW building
PK871200	0.008mg/cm^2 0.006mg/cm^2	Wipe	Wipe Field Blank
PK871201	0.006mg/cm^2 Not Analyzed	Wipe	Exterior siding of abandoned house
PK871202	0.339mg/cm2 0.325mg/cm^2	Wipe	Interior West wall of the East Delivery Room
PK871203	0.640mg/cm^2 0.646mg/cm^2	Wipe	Floor of West Stock Room
PK871204	25.495mg/cm^2 32.143mg/cm^2	Wipe	Wooden shelves in West Service Room

A-2 Summary of PCB Analysis - CLP Laboratory

TABLE A-2
SUMMARY OF PCB ANALYSIS - CLP LABORATORY
11-13 APRIL 1989
SITE CHARACTERIZATION STUDY

Bluff Electric Works
Poplar Bluff, Missouri

SAMPLES	PK871000	PK871006	PK871007	PK871012
PCB 1221, ug/kg	200 U	20000 U	2000 U	20000 U
PCB 1242, ug/kg	300 U	30000 U	3000 U	30000 U
PCB 1248, ug/kg	300 U	12000 J	3000 U	30000 U
PCB 1254, ug/kg	300 U	3000 U	3000 U	30000 U
PCB 1260, ug/kg	38 J	65000	130000	89000
SAMPLES	PK871013	PK871014	PK871016	PK871017
PCB 1221, ug/kg	20000 U	20000 U	200000 U	20000 U
PCB 1242, ug/kg	30000 U	30000 U	300000 U	30000 U
PCB 1248, ug/kg	30000 U	30000 U	300000 U	30000 U
PCB 1254, ug/kg	30000 U	30000 U	300000 U	30000 U
PCB 1260, ug/kg	37000	67000	2100000	170000
SAMPLES	PK871023	PK871030	PK871031	PK871032
PCB 1221, ug/kg	100000 U	20000 U	20000 U	80000 U
PCB 1242, ug/kg	150000 U	30000 U	30000 U	120000 U
PCB 1248, ug/kg	1700000	30000 U	30000 U	120000 U
PCB 1254, ug/kg	150000 U	30000 U	30000 U	230000
PCB 1260, ug/kg	200000	260000	45000	40000 U
SAMPLES	PK871036	PK871041	PK871042	PK871043
PCB 1221, ug/kg	20000 U	20000 U	2000000 U	20000 U
PCB 1242, ug/kg	30000 U	30000 U	3000000 U	30000 U
PCB 1248, ug/kg	30000 U	30000 U	3000000 U	30000 U
PCB 1254, ug/kg	30000 U	30000 U	8000000	30000 U
PCB 1260, ug/kg	23000	150000	1000000 U	270000
SAMPLES	PK871080	PK871081	PK871120	PK871121
PCB 1221, ug/kg	200000 U	1000 U	200000 U	200 U
PCB 1242, ug/kg	300000 U	1500 U	300000 U	300 U
PCB 1248, ug/kg	300000 U	1500 U	300000 U	930
PCB 1254, ug/kg	300000 U	1100 J	300000 U	6500
PCB 1260, ug/kg	1300000	500	490000	750
SAMPLES	PK871300	PK871301	PK871302	PK871400
PCB 1221, ug/kg	20000 U	20000 U	20000 U	100 U
PCB 1242, ug/kg	30000 U	30000 U	30000 U	150 U
PCB 1248, ug/kg	30000 U	30000 U	30000 U	6500
PCB 1254, ug/kg	30000 U	30000 U	30000 U	8100
PCB 1260, ug/kg	77000	44000	41000	19000

SAMPLES	PK871401
PCB 1221, ug/kg	100 U
PCB 1242, ug/kg	910
PCB 1248, ug/kg	150 U
PCB 1254, ug/kg	2500
PCB 1260, ug/kg	4500

TABLE A-4
SUMMARY OF TOTAL METALS ANALYSIS
11-13 APRIL 1989
SITE CHARACTERIZATION STUDY

Bluff Electric Works
Poplar Bluff, Missouri

SAMPLES	PK871000	PK871006	PK871007	PK871012
SILVER, mg/kg	.24 U	.31	.78	2.9
ALUMINUM, mg/kg	13000.	2200.	6000.	3400.
ARSENIC, mg/kg	4.5 J	4.3 J	5.9 J	3.4 J
BARIUM, mg/kg	100.	96.	150.	100.
BERYLLIUM, mg/kg	.36	.16	.30	.20
CADMIUM, mg/kg	.19	10.	4.9	3.1
COBALT, mg/kg	5.1	2.9	7.9	4.6
CHROMIUM, mg/kg	15.	15.	22.	16.
COPPER, mg/kg	17.	1000.	2900.	1400.
IRON, mg/kg	17000.	9800.	21000.	22000.
MANGANESE, mg/kg	150.	150.	330.	190.
MOLYBDENUM, mg/kg	.24 U	.50	.48	.20 U
NICKEL, mg/kg	9.2	6.9	15.	8.0
LEAD, mg/kg	21.	310.	360.	5100.
ANTIMONY, mg/kg	1.2 U	3.3	1.3 U	5.1
SELENIUM, mg/kg	12. U	10. U	13. U	10. U
TITANIUM, mg/kg	N/A	N/A	N/A	N/A
THALLIUM, mg/kg	7.3 U	6.0 U	7.6 U	6.0 U
VANADIUM, mg/kg	32.	7.7	21.	15.
ZINC, mg/kg	38.	2400.	590.	180.
CALCIUM, mg/kg	2400.	72000.	23000.	21000.
MAGNESIUM, mg/kg	2000.	6100.	12000.	12000.
SODIUM, mg/kg	49. U	54.	.64	68.
POTASSIUM, mg/kg	510.	230.	.490	250.

TABLE A-4 (continued)
SUMMARY OF TOTAL METALS ANALYSIS
11-13 APRIL 1989
SITE CHARACTERIZATION STUDY

Bluff Electric Works
Poplar Bluff, Missouri

SAMPLES	PK871013	PK871014	PK871016	PK871017
SILVER, mg/kg	.29	.23 U	.51	.29 U
ALUMINUM, mg/kg	2600.	6600.	5700.	5100.
ARSENIC, mg/kg	5.1 J	5.7 J	5.3 J	5.0 J
BARIUM, mg/kg	84.	70.	100.	140.
BERYLLIUM, mg/kg	.16	.20	.27	.26
CADMIUM, mg/kg	2.4	1.7	3.1	3.5
COBALT, mg/kg	3.5	4.1	5.0	6.5
CHROMIUM, mg/kg	14.	16.	17.	15.
COPPER, mg/kg	1500.	280.	740.	2100.
IRON, mg/kg	10000.	15000.	14000.	15000.
MANGANESE, mg/kg	200.	210.	270.	490.
MOLYBDENUM, mg/kg	.37	.23 U	.31	.34
NICKEL, mg/kg	6.1	6.1	6.6	8.7
LEAD, mg/kg	190.	80.	230.	240.
ANTIMONY, mg/kg	1.0 U	1.2 U	1.7	2.0
SELENIUM, mg/kg	10. U	12. U	13. U	14. U
TITANIUM, mg/kg	N/A	N/A	N/A	N/A
THALLIUM, mg/kg	6.0 U	6.9 U	7.6 U	8.6 U
VANADIUM, mg/kg	12.	22.	20.	17.
ZINC, mg/kg	140.	170.	240.	230.
CALCIUM, mg/kg	47000.	17000.	9300.	17000.
MAGNESIUM, mg/kg	27000.	11000.	3900.	2600.
SODIUM, mg/kg	110.	68.	51. U	57. U
POTASSIUM, mg/kg	220.	490.	450.	700.

TABLE A-4 (continued)
SUMMARY OF TOTAL METALS ANALYSIS
11-13 APRIL 1989
SITE CHARACTERIZATION STUDY

Bluff Electric Works
Poplar Bluff, Missouri

SS grid 29 SS grid 30 SS grid 31 SS grid 32

SAMPLES	PK871023	PK871030	PK871031	PK871032
SILVER, mg/kg	.27 U	.26 U	.26 U	.25 U
ALUMINUM, mg/kg	6200.	7000.	5000.0	5600.0
ARSENIC, mg/kg	2.7 J	4.1 J	13.0 U	13.0 U
BARIUM, mg/kg	85.	76.	65.0	56.0
BERYLLIUM, mg/kg	.23	.26	.23	.22
CADMIUM, mg/kg	1.5	.92	2.9	.83
COBALT, mg/kg	5.7	4.5	3.2	2.9
CHROMIUM, mg/kg	15.	14.	14.0	11.0
COPPER, mg/kg	270.	110.	68.0	60.0
IRON, mg/kg	15000.	12000.	13000.0	10000.0
MANGANESE, mg/kg	330.	370.	210.0	200.0
MOLYBDENUM, mg/kg	.27 U	.26 U	.26 U	.25 U
NICKEL, mg/kg	7.4	5.3	11.0	4.4
LEAD, mg/kg	96.	95.	130.0	72.0
ANTIMONY, mg/kg	1.3 U	1.3 U	1.3 U	1.3 U
SELENIUM, mg/kg	14. U	13. U	13.0 U	13.0 U
TITANIUM, mg/kg	N/A	N/A	N/A	N/A
THALLIUM, mg/kg	8.1 U	7.8 U	7.9 U	7.5 U
VANADIUM, mg/kg	23.	23.	20.0	20.0
ZINC, mg/kg	120.	90.	390.0	59.0
CALCIUM, mg/kg	1800.	1300.	2100.0	1000.0
MAGNESIUM, mg/kg	1200.	820.	600.0	660.0
SODIUM, mg/kg	54. U	52. U	53.0 U	50.0 U
POTASSIUM, mg/kg	770.	450.	320.0	370.0

TABLE A-4 (continued)
SUMMARY OF TOTAL METALS ANALYSIS
11-13 APRIL 1989
SITE CHARACTERIZATION STUDY

Bluff Electric Works
Poplar Bluff, Missouri

SAMPLES	PK871036	PK871041	PK871042	PK871043
SILVER, mg/kg	.38 U	.24 U	.30 U	.33 U
ALUMINUM, mg/kg	8700.0	7200.0	4000.	6800.
ARSENIC, mg/kg	3.9 J	10.0 J	15. U	3.5 J
BARIUM, mg/kg	100.0	67.0	140.	130.
BERYLLIUM, mg/kg	.30	.40	.21	.23
CADMIUM, mg/kg	3.6	.74	1.0	2.9
COBALT, mg/kg	5.3	5.6	4.5	7.1
CHROMIUM, mg/kg	24.0	21.0	7.9	13.
COPPER, mg/kg	230.0	41.0	26.	61.
IRON, mg/kg	15000.0	15000.0	7500.	14000.
MANGANESE, mg/kg	210.0	170.0	720.	680.
MOLYBDENUM, mg/kg	.38 U	.24 U	.30 U	.33 U
NICKEL, mg/kg	10.0	7.6	4.8	9.0
LEAD, mg/kg	100.0	160.0	80.	150.
ANTIMONY, mg/kg	1.9 U	1.3	3.0	1.6 U
SELENIUM, mg/kg	19.0 U	12.0 U	15. U	16. U
TITANIUM, mg/kg	N/A	N/A	N/A	N/A
THALLIUM, mg/kg	12.0 U	7.2 U	9.0 U	9.8 U
VANADIUM, mg/kg	21.0	26.0	14.	22.
ZINC, mg/kg	190.0	110.0	90.	460.
CALCIUM, mg/kg	4100.0	5300.0	3200.	3800.
MAGNESIUM, mg/kg	1900.0	2700.0	600.	1500.
SODIUM, mg/kg	77.0 U	48.0 U	60. U	66. U
POTASSIUM, mg/kg	720.0	470.0	390.	760.

TABLE A-4 (continued)
SUMMARY OF TOTAL METALS ANALYSIS
11-13 APRIL 1989
SITE CHARACTERIZATION STUDY

Bluff Electric Works
Poplar Bluff, Missouri

Core 0-8 Core 8-16 Core 0-8 Core 8-12

SAMPLES	PK871080	PK871081	PK871120	PK871121
SILVER, mg/kg	.26 U	.24 U	1.4	.24 U
ALUMINUM, mg/kg	30000.	15000.0	5300.	8600.
ARSENIC, mg/kg	5.3 J	12.0 U	8.7 J	4.2 J
BARIUM, mg/kg	160.	93.0	200.	110.
BERYLLIUM, mg/kg	.94	.42	.20	.35
CADMIUM, mg/kg	.24	.12 U	16.	.44
COBALT, mg/kg	5.2	4.0	6.1	5.5
CHROMIUM, mg/kg	22.	14.0	36.	13.
COPPER, mg/kg	23.	12.0	3300.	93.
IRON, mg/kg	34000.	16000.0	15000.	15000.
MANGANESE, mg/kg	280.	140.0	240.	390.
MOLYBDENUM, mg/kg	.26 U	.24 U	.96	.24 U
NICKEL, mg/kg	14.	11.0	13.	7.4
LEAD, mg/kg	18.	7.4	1000.	160.
ANTIMONY, mg/kg	1.3 U	1.2 U	7.3	1.2 U
SELENIUM, mg/kg	13. U	12.0 U	13. U	12. U
TITANIUM, mg/kg	N/A	N/A	N/A	N/A
THALLIUM, mg/kg	7.8 U	7.3 U	7.7 U	7.2 U
VANADIUM, mg/kg	52.	26.0	14.	25.
ZINC, mg/kg	39.	26.0	1700.	60.
CALCIUM, mg/kg	3200.	1800.0	10000.	1700.
MAGNESIUM, mg/kg	2300.	2200.0	1700.	1000.
SODIUM, mg/kg	110.	190.0	51. U	60.
POTASSIUM, mg/kg	910.	540.0	620.	410.

TABLE A-4 (continued)
SUMMARY OF TOTAL METALS ANALYSIS
11-13 APRIL 1989
SITE CHARACTERIZATION STUDY

Bluff Electric Works
Poplar Bluff, Missouri

SAMPLES	PK871300 (Concrete dust)	PK871301 (Concrete dust)	PK871302 (Asphalt)	PK871400 (dust)
SILVER, mg/kg	.32	.79	2.0	15.
ALUMINUM, mg/kg	5000.	6300.	11000.	30000.
ARSENIC, mg/kg	4.2 J	3.7 J	5.0 J	7.8 J
BARIUM, mg/kg	60.	79.	49.	670.
BERYLLIUM, mg/kg	.20	.20	.10	.22
CADMIUM, mg/kg	1.9	2.3	1.6	44.
COBALT, mg/kg	9.9	8.3	1.8	43.
CHROMIUM, mg/kg	12.	14.	6.3	160.
COPPER, mg/kg	93.	970.	1100.	20000.
IRON, mg/kg	7800.	8900.	6800.	50000.
MANGANESE, mg/kg	130.	130.	130.	720.
MOLYBDENUM, mg/kg	.23	.60	.99	8.1
NICKEL, mg/kg	4.9	11.	5.5	90.
LEAD, mg/kg	30.	54.	98.	4200.
ANTIMONY, mg/kg	1.0 U	1.0 U	1.0 U	7.2
SELENIUM, mg/kg	10. U	10. U	10. U	10. U
TITANIUM, mg/kg	N/A	N/A	N/A	N/A
THALLIUM, mg/kg	6.0 U	6.0 U	6.0 U	6.0 U
VANADIUM, mg/kg	13.	16.	5.4	31.
ZINC, mg/kg	72.	130.	130.	7500.
CALCIUM, mg/kg	66000.	79000.	80000.	27000.
MAGNESIUM, mg/kg	2900.	3700.	39000.	5800.
SODIUM, mg/kg	130.	970.	72.	15000.
POTASSIUM, mg/kg	610.	1400.	180.	3100.

TABLE A-4 (continued)
SUMMARY OF TOTAL METALS ANALYSIS
11-13 APRIL 1989
SITE CHARACTERIZATION STUDY

Bluff Electric Works
Poplar Bluff, Missouri

SAMPLES	PK871401
SILVER, mg/kg	9.4
ALUMINUM, mg/kg	11000.
ARSENIC, mg/kg	2.1 J
BARIUM, mg/kg	360.
BERYLLIUM, mg/kg	.100 U
CADMIUM, mg/kg	48.
COBALT, mg/kg	78.
CHROMIUM, mg/kg	200.
COPPER, mg/kg	11000.
IRON, mg/kg	55000.
MANGANESE, mg/kg	420.
MOLYBDENUM, mg/kg	11.
NICKEL, mg/kg	67.
LEAD, mg/kg	1600.
ANTIMONY, mg/kg	35.
SELENIUM, mg/kg	10. U
TITANIUM, mg/kg	N/A
THALLIUM, mg/kg	6.0 U
VANADIUM, mg/kg	17.
ZINC, mg/kg	2500.
CALCIUM, mg/kg	15000.
MAGNESIUM, mg/kg	2700.
SODIUM, mg/kg	3200.
POTASSIUM, mg/kg	3000.

TABLE A-3
SUMMARY OF VOA ANALYSIS
11-13 APRIL 1989
SITE CHARACTERIZATION STUDY

Bluff Electric Works
Poplar Bluff, Missouri

SAMPLES	PK871000	PK871006	PK871007	PK871012
CHLOROMETHANE, mg/kg	480 U	24 U	24 U	24 U
BROMOMETHANE, mg/kg	880 U	44 U	44 U	44 U
VINYL CHLORIDE, mg/kg	560 U	28 U	28 U	28 U
CHLOROETHANE, mg/kg	560 U	28 U	28 U	28 U
METHYLENE CHLORIDE, mg/kg	400 U	20 U	20 U	20 U
ACETONE, mg/kg	400 U	20 U	20 U	20 U
CARBON DISULFIDE, mg/kg	200 U	10 U	10 U	10 U
1,1-DICHLOROETHENE, mg/kg	200 U	10 U	10 U	10 U
1,1-DICHLOROETHANE, mg/kg	200 U	10 U	10 U	10 U
1,2-DICHLOROETHENE, mg/kg	200 U	10 U	10 U	10 U
CHLOROFORM, mg/kg	200 U	10 U	10 U	10 U
1,2-DICHLOROETHANE, mg/kg	200 U	10 U	10 U	10 U
2-BUTANONE, mg/kg	1700 J	99 J	110 J	70 J
1,1,1-TRICHLOROETHANE, mg/kg	200 U	10 U	10 U	10 U
CARBON TETRACHLORIDE, mg/kg	200 U	10 U	10 U	10 U
VINYL ACETATE, mg/kg	400 U	20 U	20 U	20 U
BROMODICHLOROMETHANE, mg/kg	200 U	10 U	10 U	10 U
1,2-DICHLOROPROPANE, mg/kg	200 U	10 U	10 U	10 U
CIS-1,3-DICHLOROPROPENE, mg/kg	200 U	10 U	10 U	10 U
TRICHLOROETHENE, mg/kg	200 U	10 U	10 U	10 U
BENZENE, mg/kg	200 U	10 U	10 U	10 U
DIBROMOCHLOROMETHANE, mg/kg	200 U	10 U	10 U	10 U
1,1,2-TRICHLOROETHANE, mg/kg	200 U	10 U	10 U	10 U
TRANS-1,3-DICHLOROPROPENE, mg/kg	200 U	10 U	10 U	10 U
BROMOFORM, mg/kg	200 U	10 U	10 U	10 U
4-METHYL-2-PENTANONE, mg/kg	400 U	20 U	20 U	20 U
2-HEXANONE, mg/kg	400 U	20 U	20 U	20 U
1,1,2,2-TETRACHLOROETHANE, mg/kg	200 U	10 U	10 U	10 U
TETRACHLOROETHENE, mg/kg	200 U	10 U	10 U	10 U
TOLUENE, mg/kg	200 U	10 U	10 U	10 U
CHLOROBENZENE, mg/kg	200 U	10 U	10 U	10 U
ETHYL BENZENE, mg/kg	200 U	10 U	10 U	10 U
STYRENE, mg/kg	200 U	10 U	10 U	10 U
TOTAL XYLENES, mg/kg	200 U	10 U	10 U	10 U

TABLE A-3 (continued)
SUMMARY OF VOA ANALYSIS
11-13 APRIL 1989
SITE CHARACTERIZATION STUDY

Bluff Electric Works
Poplar Bluff, Missouri

SAMPLES	PK871013	PK871014	PK871016	PK871017
CHLOROMETHANE, mg/kg	480 U	14 U	14 U	14 U
BROMOMETHANE, mg/kg	880 U	26 U	26 U	26 U
VINYL CHLORIDE, mg/kg	560 U	17 U	17 U	17 U
CHLOROETHANE, mg/kg	560 U	17 U	17 U	17 U
METHYLENE CHLORIDE, mg/kg	400 U	12 U	12 U	12 U
ACETONE, mg/kg	400 U	12 U	12 U	12 U
CARBON DISULFIDE, mg/kg	200 U	6.0 U	6.0 U	6.0 U
1,1-DICHLOROETHENE, mg/kg	200 U	6.0 U	6.0 U	6.0 U
1,1-DICHLOROETHANE, mg/kg	200 U	6.0 U	6.0 U	6.0 U
1,2-DICHLOROETHENE, mg/kg	200 U	6.0 U	6.0 U	6.0 U
CHLOROFORM, mg/kg	200 U	6.0 U	6.0 U	6.0 U
1,2-DICHLOROETHANE, mg/kg	200 U	6.0 U	6.0 U	6.0 U
2-BUTANONE, mg/kg	400 U	75 J	12 U	83 J
1,1,1-TRICHLOROETHANE, mg/kg	200 U	6.0 U	6.0 U	6.0 U
CARBON TETRACHLORIDE, mg/kg	200 U	6.0 U	6.0 U	6.0 U
VINYL ACETATE, mg/kg	400 U	12 U	12 U	12 U
BROMODICHLOROMETHANE, mg/kg	200 U	6.0 U	6.0 U	6.0 U
1,2-DICHLOROPROPANE, mg/kg	200 U	6.0 U	6.0 U	6.0 U
CIS-1,3-DICHLOROPROPENE, mg/kg	200 U	6.0 U	6.0 U	6.0 U
TRICHLOROETHENE, mg/kg	200 U	6.0 U	6.0 U	6.0 U
BENZENE, mg/kg	200 U	6.0 U	6.0 U	6.0 U
DIBROMOCHLOROMETHANE, mg/kg	200 U	6.0 U	6.0 U	6.0 U
1,1,2-TRICHLOROETHANE, mg/kg.	200 U	6.0 U	6.0 U	6.0 U
TRANS-1,3-DICHLOROPROPENE, mg/kg	200 U	6.0 U	6.0 U	6.0 U
BROMOFORM, mg/kg	200 U	6.0 U	6.0 U	6.0 U
4-METHYL-2-PENTANONE, mg/kg	400 U	12 U	12 U	12 U
2-HEXANONE, mg/kg	400 U	12 U	12 U	12 U
1,1,2,2-TETRACHLOROETHANE, mg/kg	200 U	6.0 U	6.0 U	6.0 U
TETRACHLOROETHENE, mg/kg	200 U	6.0 U	6.0 U	6.0 U
TOLUENE, mg/kg	200 U	6.0 U	6.0 U	6.0 U
CHLOROBENZENE, mg/kg	200 U	6.0 U	6.0 U	6.0 U
ETHYL BENZENE, mg/kg	200 U	6.0 U	6.0 U	6.0 U
STYRENE, mg/kg	200 U	6.0 U	6.0 U	6.0 U
TOTAL XYLENES, mg/kg	200 U	6.0 U	6.0 U	6.0 U

TABLE A-3 (continued)
SUMMARY OF VOA ANALYSIS
11-13 APRIL 1989
SITE CHARACTERIZATION STUDY

Bluff Electric Works
Poplar Bluff, Missouri

SAMPLES	PK871023	PK871030	PK871031	PK871032
CHLOROMETHANE, mg/kg	480 U	24 U	24 U	24 U
BROMOMETHANE, mg/kg	880 U	44 U	44 U	44 U
VINYL CHLORIDE, mg/kg	560 U	28 U	28 U	28 U
CHLOROETHANE, mg/kg	560 U	28 U	28 U	28 U
METHYLENE CHLORIDE, mg/kg	400 U	20 U	20 U	20 U
ACETONE, mg/kg	400 U	20 U	20 U	20 U
CARBON DISULFIDE, mg/kg	200 U	10 U	10 U	10 U
1,1-DICHLOROETHENE, mg/kg	200 U	10 U	10 U	10 U
1,1-DICHLOROETHANE, mg/kg	200 U	10 U	10 U	10 U
1,2-DICHLOROETHENE, mg/kg	200 U	10 U	10 U	10 U
CHLOROFORM, mg/kg	200 U	10 U	10 U	10 U
1,2-DICHLOROETHANE, mg/kg	200 U	10 U	10 U	10 U
2-BUTANONE, mg/kg	400 U	110 J	20 U	80 J
1,1,1-TRICHLOROETHANE, mg/kg	200 U	10 U	10 U	10 U
CARBON TETRACHLORIDE, mg/kg	200 U	10 U	10 U	10 U
VINYL ACETATE, mg/kg	400 U	20 U	20 U	20 U
BROMODICHLOROMETHANE, mg/kg	200 U	10 U	10 U	10 U
1,2-DICHLOROPROPANE, mg/kg	200 U	10 U	10 U	10 U
CIS-1,3-DICHLOROPROPENE, mg/kg	200 U	10 U	10 U	10 U
TRICHLOROETHENE, mg/kg	200 U	10 U	10 U	10 U
BENZENE, mg/kg	200 U	10 U	10 U	10 U
DIBROMOCHLOROMETHANE, mg/kg	200 U	10 U	10 U	10 U
1,1,2-TRICHLOROETHANE, mg/kg	200 U	10 U	10 U	10 U
TRANS-1,3-DICHLOROPROPENE, mg/kg	200 U	10 U	10 U	10 U
BROMOFORM, mg/kg	200 U	10 U	10 U	10 U
4-METHYL-2-PENTANONE, mg/kg	400 U	20 U	20 U	20 U
2-HEXANONE, mg/kg	400 U	20 U	20 U	20 U
1,1,2,2-TETRACHLOROETHANE, mg/kg	200 U	10 U	10 U	10 U
TETRACHLOROETHENE, mg/kg	200 U	10 U	10 U	10 U
TOLUENE, mg/kg	200 U	10 U	10 U	10 U
CHLOROBENZENE, mg/kg	200 U	10 U	10 U	10 U
ETHYL BENZENE, mg/kg	200 U	10 U	10 U	10 U
STYRENE, mg/kg	200 U	10 U	10 U	10 U
TOTAL XYLENES, mg/kg	200 U	10 U	10 U	10 U

TABLE A-3 (continued)
SUMMARY OF VOA ANALYSIS
11-13 APRIL 1989
SITE CHARACTERIZATION STUDY

Bluff Electric Works
Poplar Bluff, Missouri

SAMPLES	PK871036	PK871041	PK871042	PK871043
CHLOROMETHANE, mg/kg	24 U	480 U	14 U	14 U
BROMOMETHANE, mg/kg	44 U	880 U	26 U	26 U
VINYL CHLORIDE, mg/kg	28 U	560 U	17 U	17 U
CHLOROETHANE, mg/kg	28 U	560 U	17 U	17 U
METHYLENE CHLORIDE, mg/kg	20 U	400 U	12 U	12 U
ACETONE, mg/kg	20 U	400 U	12 U	12 U
CARBON DISULFIDE, mg/kg	10 U	200 U	6.0 U	6.0 U
1,1-DICHLOROETHENE, mg/kg	10 U	200 U	6.0 U	6.0 U
1,1-DICHLOROETHANE, mg/kg	10 U	200 U	6.0 U	6.0 U
1,2-DICHLOROETHENE, mg/kg	10 U	200 U	6.0 U	6.0 U
CHLOROFORM, mg/kg	10 U	200 U	6.0 U	6.0 U
1,2-DICHLOROETHANE, mg/kg	10 U	200 U	6.0 U	6.0 U
2-BUTANONE, mg/kg	110 J	400 U	78 J	67 J
1,1,1-TRICHLOROETHANE, mg/kg	10 U	200 U	6.0 U	6.0 U
CARBON TETRACHLORIDE, mg/kg	10 U	200 U	6.0 U	6.0 U
VINYL ACETATE, mg/kg	20 U	400 U	12 U	12 U
BROMODICHLOROMETHANE, mg/kg	10 U	200 U	6.0 U	6.0 U
1,2-DICHLOROPROPANE, mg/kg	10 U	200 U	6.0 U	6.0 U
CIS-1,3-DICHLOROPROPENE, mg/kg	10 U	200 U	6.0 U	6.0 U
TRICHLOROETHENE, mg/kg	10 U	200 U	6.0 U	6.0 U
BENZENE, mg/kg	10 U	200 U	6.0 U	6.0 U
DIBROMOCHLOROMETHANE, mg/kg	10 U	200 U	6.0 U	6.0 U
1,1,2-TRICHLOROETHANE, mg/kg	10 U	200 U	6.0 U	6.0 U
TRANS-1,3-DICHLOROPROPENE, mg/kg	10 U	200 U	6.0 U	6.0 U
BROMOFORM, mg/kg	10 U	200 U	6.0 U	6.0 U
4-METHYL-2-PENTANONE, mg/kg	20 U	400 U	12 U	12 U
2-HEXANONE, mg/kg	20 U	400 U	12 U	12 U
1,1,2,2-TETRACHLOROETHANE, mg/kg	10 U	200 U	6.0 U	6.0 U
TETRACHLOROETHENE, mg/kg	10 U	200 U	6.0 U	6.0 U
TOLUENE, mg/kg	10 U	200 U	6.0 U	6.0 U
CHLOROBENZENE, mg/kg	10 U	200 U	6.0 U	6.0 U
ETHYL BENZENE, mg/kg	10 U	200 U	6.0 U	6.0 U
STYRENE, mg/kg	10 U	200 U	6.0 U	6.0 U
TOTAL XYLENES, mg/kg	10 U	200 U	6.0 U	6.0 U

TABLE A-3 (continued)
SUMMARY OF VOA ANALYSIS
11-13 APRIL 1989
SITE CHARACTERIZATION STUDY

Bluff Electric Works
Poplar Bluff, Missouri

SAMPLES	PK871080	PK871081	PK871120	PK871121
CHLOROMETHANE, mg/kg	14 U	14 U	14 U	14 U
BROMOMETHANE, mg/kg	26 U	26 U	26 U	26 U
VINYL CHLORIDE, mg/kg	17 U	17 U	17 U	17 U
CHLOROETHANE, mg/kg	17 U	17 U	17 U	17 U
METHYLENE CHLORIDE, mg/kg	12 U	12 U	12 U	12 U
ACETONE, mg/kg	12 U	12 U	12 U	12 U
CARBON DISULFIDE, mg/kg	6.0 U	6.0 U	6.0 U	6.0 U
1,1-DICHLOROETHENE, mg/kg	6.0 U	6.0 U	6.0 U	6.0 U
1,1-DICHLOROETHANE, mg/kg	6.0 U	6.0 U	6.0 U	6.0 U
1,2-DICHLOROETHENE, mg/kg	6.0 U	6.0 U	6.0 U	6.0 U
CHLOROFORM, mg/kg	6.0 U	6.0 U	6.0 U	6.0 U
1,2-DICHLOROETHANE, mg/kg	6.0 U	6.0 U	6.0 U	6.0 U
2-BUTANONE, mg/kg	12 U	99 J	65 J	81 J
1,1,1-TRICHLOROETHANE, mg/kg	6.0 U	6.0 U	6.0 U	6.0 U
CARBON TETRACHLORIDE, mg/kg	6.0 U	6.0 U	6.0 U	6.0 U
VINYL ACETATE, mg/kg	12 U	12 U	12 U	12 U
BROMODICHLOROMETHANE, mg/kg	6.0 U	6.0 U	6.0 U	6.0 U
1,2-DICHLOROPROPANE, mg/kg	6.0 U	6.0 U	6.0 U	6.0 U
CIS-1,3-DICHLOROPROPENE, mg/kg	6.0 U	6.0 U	6.0 U	6.0 U
TRICHLOROETHENE, mg/kg	6.0 U	6.0 U	6.0 U	6.0 U
BENZENE, mg/kg	6.0 U	6.0 U	6.0 U	6.0 U
DIBROMOCHLOROMETHANE, mg/kg	6.0 U	6.0 U	6.0 U	6.0 U
1,1,2-TRICHLOROETHANE, mg/kg	6.0 U	6.0 U	6.0 U	6.0 U
TRANS-1,3-DICHLOROPROPENE, mg/kg	6.0 U	6.0 U	6.0 U	6.0 U
BROMOFORM, mg/kg	6.0 U	6.0 U	6.0 U	6.0 U
4-METHYL-2-PENTANONE, mg/kg	12 U	12 U	12 U	12 U
2-HEXANONE, mg/kg	12 U	12 U	12 U	12 U
1,1,2,2-TETRACHLOROETHANE, mg/kg	6.0 U	6.0 U	6.0 U	6.0 U
TETRACHLOROETHENE, mg/kg	6.0 U	6.0 U	6.0 U	6.0 U
TOLUENE, mg/kg	6.0 U	6.0 U	6.0 U	6.0 U
CHLOROBENZENE, mg/kg	6.0 U	6.0 U	6.0 U	6.0 U
ETHYL BENZENE, mg/kg	6.0 U	6.0 U	6.0 U	6.0 U
STYRENE, mg/kg	6.0 U	6.0 U	6.0 U	6.0 U
TOTAL XYLENES, mg/kg	6.0 U	6.0 U	6.0 U	6.0 U

TABLE A-3 (continued)
SUMMARY OF VOA ANALYSIS
11-13 APRIL 1989
SITE CHARACTERIZATION STUDY

Bluff Electric Works
Poplar Bluff, Missouri

SAMPLES	PK871300	PK871301	PK871302	PK871400
CHLOROMETHANE, mg/kg	480 U	480 U	480 U	24 U
BROMOMETHANE, mg/kg	880 U	880 U	880 U	44 U
VINYL CHLORIDE, mg/kg	560 U	560 U	560 U	28 U
CHLOROETHANE, mg/kg	560 U	560 U	560 U	28 U
METHYLENE CHLORIDE, mg/kg	400 U	400 U	400 U	20 U
ACETONE, mg/kg	400 U	400 U	400 U	20 U
CARBON DISULFIDE, mg/kg	200 U	200 U	200 U	10 U
1,1-DICHLOROETHENE, mg/kg	200 U	200 U	200 U	10 U
1,1-DICHLOROETHANE, mg/kg	200 U	200 U	200 U	10 U
1,2-DICHLOROETHENE, mg/kg	200 U	200 U	200 U	10 U
CHLOROFORM, mg/kg	200 U	200 U	200 U	10 U
1,2-DICHLOROETHANE, mg/kg	200 U	200 U	200 U	10 U
2-BUTANONE, mg/kg	1700 J	400 U	1400 J	20 U
1,1,1-TRICHLOROETHANE, mg/kg	200 U	200 U	200 U	10 U
CARBON TETRACHLORIDE, mg/kg	200 U	200 U	200 U	10 U
VINYL ACETATE, mg/kg	400 U	400 U	400 U	20 U
BROMODICHLOROMETHANE, mg/kg	200 U	200 U	200 U	10 U
1,2-DICHLOROPROPANE, mg/kg	200 U	200 U	200 U	10 U
CIS-1,3-DICHLOROPROPENE, mg/kg	200 U	200 U	200 U	10 U
TRICHLOROETHENE, mg/kg	200 U	200 U	200 U	10 U
BENZENE, mg/kg	200 U	200 U	200 U	10 U
DIBROMOCHLOROMETHANE, mg/kg	200 U	200 U	200 U	10 U
1,1,2-TRICHLOROETHANE, mg/kg	200 U	200 U	200 U	10 U
TRANS-1,3-DICHLOROPROPENE, mg/kg	200 U	200 U	200 U	10 U
BROMOFORM, mg/kg	200 U	200 U	200 U	10 U
4-METHYL-2-PENTANONE, mg/kg	400 U	400 U	400 U	20 U
2-HEXANONE, mg/kg	400 U	400 U	400 U	20 U
1,1,2,2-TETRACHLOROETHANE, mg/kg	200 U	200 U	200 U	10 U
TETRACHLOROETHENE, mg/kg	200 U	200 U	200 U	10 U
TOLUENE, mg/kg	200 U	200 U	200 U	10 U
CHLOROBENZENE, mg/kg	200 U	200 U	200 U	10 U
ETHYL BENZENE, mg/kg	200 U	200 U	200 U	10 U
STYRENE, mg/kg	200 U	200 U	200 U	10 U
TOTAL XYLENES, mg/kg	200 U	200 U	200 U	10 U

TABLE A-3 (continued)
SUMMARY OF VOA ANALYSIS
11-13 APRIL 1989
SITE CHARACTERIZATION STUDY

Bluff Electric Works
Poplar Bluff, Missouri

SAMPLES	PK871401
CHLOROMETHANE, mg/kg	24 U
BROMOMETHANE, mg/kg	44 U
VINYL CHLORIDE, mg/kg	28 U
CHLOROETHANE, mg/kg	28 U
METHYLENE CHLORIDE, mg/kg	20 U
ACETONE, mg/kg	20 U
CARBON DISULFIDE, mg/kg	10 U
1,1-DICHLOROETHENE, mg/kg	10 U
1,1-DICHLOROETHANE, mg/kg	10 U
1,2-DICHLOROETHENE, mg/kg	10 U
CHLOROFORM, mg/kg	10 U
1,2-DICHLOROETHANE, mg/kg	10 U
2-BUTANONE, mg/kg	160 J
1,1,1-TRICHLOROETHANE, mg/kg	10 U
CARBON TETRACHLORIDE, mg/kg	10 U
VINYL ACETATE, mg/kg	20 U
BROMODICHLOROMETHANE, mg/kg	10 U
1,2-DICHLOROPROPANE, mg/kg	10 U
CIS-1,3-DICHLOROPROPENE, mg/kg	10 U
TRICHLOROETHENE, mg/kg	10 U
BENZENE, mg/kg	10 U
DIBROMOCHLOROMETHANE, mg/kg	10 U
1,1,2-TRICHLOROETHANE, mg/kg	10 U
TRANS-1,3-DICHLOROPROPENE, mg/kg	10 U
BROMOFORM, mg/kg	10 U
4-METHYL-2-PENTANONE, mg/kg	20 U
2-HEXANONE, mg/kg	20 U
1,1,2,2-TETRACHLOROETHANE, mg/kg	10 U
TETRACHLOROETHENE, mg/kg	10 U
TOLUENE, mg/kg	10 U
CHLOROBENZENE, mg/kg	10 U
ETHYL BENZENE, mg/kg	10 U
STYRENE, mg/kg	10 U
TOTAL XYLENES, mg/kg	10 U

APPENDIX II

Bluff Electric Works Site, Poplar Bluff, MO

Sampling Results from the Perimeter Survey Conducted by EPA in September 1990

DIXON STREET
SECTION 2
7.1
SECTION 1
11TH STREET
21
FOUTCH PROPERTY
CLIFFORD BROWNING PROPERTY
SOUTH 12TH STREET
65
SECTION 3
OFFICE BUILDING
211
SECTION 4
HWY. 53
KEY
BLUFF ELECTRIC SITE
EXISTING FENCE
BORE-HOLE SOIL-SAMPLE LOCATION
SURFACE SOIL SAMPLE SECTION
BROWNING PROPERTY
POPLAR BLUFF PROPERTY (CITY)
FOUTCH (BELL) PROPERTY
SCALE

MEMORANDUM

TO: Bruce Morrison, EPA/OSC

FROM: Darrell Messbarger, E & E/TATH

DATE: November 1, 1990

SUBJECT: Data Review Memo for Bluff Electric Works Analyses

PAN# EM00723AAA
TDD# T07-9010-020

This is the report on the data review performed on the data package received by the Region VII TAT from Environmental Industrial Research Associates, of St. Rose, Louisiana covering the PCB analyses for the Bluff Electric Works sampling.

Holding Times - All holding times were met with the exception of the Matrix Spike and Matrix Spike Duplicate data which was reran at the request of the Analytical Services Group of TAT. The lack of proper holding time for these samples does not adversely affect the quality of the data.

Instrument performance - Separation of peaks used for quantitation are within the data validation guidelines - "Laboratory Data Validation Functional Guidelines for Evaluating Organic Analyses" EPA Sample Management Office, February 1, 1988. Surrogate Retention Time Shifts are within the Guideline specification of 1.5 % for wide-bore capillary columns.

Initial and Continuing Calibration Verification - Arochlor 1260 is the only PCB to be reported. Proper numbers of initial calibration samples were analyzed. Continuing calibrations were ran periodically and within the Guideline limits. The %D (percent difference) for the calibration factors are within acceptable limits for both columns. The % RSD's (Relative Standard Deviation) for both columns exceeded the 10% maximum. All associated data is J-coded.

Blank Data - All blank data is acceptable.

Compound Identification - All compounds identified by this data package have been verified by data reviev for each sample on both the Quantitation and Confirmation Column chromatographs.

Matrix and Matrix Spike Duplicates - Because of the high levels of PCB contaminant in the sample chosen for use of the MS and MSD, the spiking solution levels are not detectable due to the high level of dilution required to bring the runs into a quantifiable level. This will not effect the quality of the data.

Summary - This data appears to be of good quality . Although the values reported for Arochlor 1260 are qualified (J-coded), it is by only the smallest of margins that the % RSD's failed. The 10 % limit is exceeded by 0.7% on the quantitation column and 2% on the confirmation column. If the data is to be considered an approximate value, it is the reviever's contention that it is a very close approximation of the true value.

The data while good, was presented in a rather poor data package. Many questions arose concerning the data that were subsequently answered, but the data reviev process could have been greatly simplified if EIRA had taken greater pains in answering problems in the Case Narrative and producing the data package as a whole.

ANALYSIS TYPE: PESTICIDES

TITLE: BLUFF ELECTRIC WORKS PCB'S
LAB: EIRA
SAMPLE PREP: _____ ANALYST/ENTRY: DDM
REVIEW LEVEL: 2

MATRIX: SEDIMENT
METHOD: 608
REVIEWER: _____
DATA FILE : BE1

UNITS: UG/KG
CASE:
DATE: 11/01/90

SAMPLES	CLXDS001	CLXDS002	CLXDS003	CLXDS004
ALPHA-BHC	8.0 U	8.0 U	8.0 U	8.0 U
BETA-BHC	8.0 U	8.0 U	8.0 U	8.0 U
DELTA-BHC	8.0 U	8.0 U	8.0 U	8.0 U
GAMMA-BHC	8.0 U	8.0 U	8.0 U	8.0 U
HEPTACHLOR	8.0 U	8.0 U	8.0 U	8.0 U
ALDRIN	8.0 U	8.0 U	8.0 U	8.0 U
HEPTACHLOR EPOXIDE	8.0 U	8.0 U	8.0 U	8.0 U
ENDOSULFAN I	8.0 U	8.0 U	8.0 U	8.0 U
DIELDRIN	16 U	16 U	16 U	16 U
4,4'-DDE	16 U	16 U	16 U	16 U
ENDRIN	16 U	16 U	16 U	16 U
ENDOSULFAN II	16 U	16 U	16 U	16 U
4,4'-DDD	16 U	16 U	16 U	16 U
ENDRIN ALDEHYDE	16 U	16 U	16 U	16 U
ENDOSULFAN SULFATE	16 U	16 U	16 U	16 U
4,4'-DDT	16 U	16 U	16 U	16 U
ENDRIN KETONE	16 U	16 U	16 U	16 U
METHOXYCHLOR	80 U	80 U	80 U	80 U
ALPHA-CHLORDANE	80 U	80 U	80 U	80 U
GAMMA-CHLORDANE	80 U	80 U	80 U	80 U
TOXAPHENE	160 U	160 U	160 U	160 U
AROCLOR-1016	80 U	80 U	80 U	80 U
AROCLOR-1221	80 U	80 U	80 U	80 U
AROCLOR-1232	80 U	80 U	80 U	80 U
AROCLOR-1242	80 U	80 U	80 U	80 U
AROCLOR-1248	80 U	80 U	80 U	80 U
AROCLOR-1254	160 U	160 U	160 U	160 U
AROCLOR-1260	12000 J	14000 J	15000 J	4100 J

ANALYSIS TYPE: PESTICIDES

TITLE: BLUFF ELECTRIC WORKS PCB'S
LAB: EIRA
SAMPLE PREP: _____ ANALYST/ENTRY: DDM
REVIEW LEVEL: 2

MATRIX: SEDIMENT
METHOD: 608
REVIEWER: _____
DATA FILE : BE1

UNITS: UG/KG
CASE:
DATE: 11/01/90

SAMPLES	CLXDS005	CLXDS006	CLXDS007	CLXDS008
ALPHA-BHC	8.0 U	8.0 U	8.0 U	8.0 U
BETA-BHC	8.0 U	8.0 U	8.0 U	8.0 U
DELTA-BHC	8.0 U	8.0 U	8.0 U	8.0 U
GAMMA-BHC	8.0 U	8.0 U	8.0 U	8.0 U
HEPTACHLOR	8.0 U	8.0 U	8.0 U	8.0 U
ALDRIN	8.0 U	8.0 U	8.0 U	8.0 U
HEPTACHLOR EPOXIDE	8.0 U	8.0 U	8.0 U	8.0 U
ENDOSULFAN I	8.0 U	8.0 U	8.0 U	8.0 U
DIELDRIN	16 U	16 U	16 U	16 U
4,4'-DDE	16 U	16 U	16 U	16 U
ENDRIN	16 U	16 U	16 U	16 U
ENDOSULFAN II	16 U	16 U	16 U	16 U
4,4'-DDD	16 U	16 U	16 U	16 U
ENDRIN ALDEHYDE	16 U	16 U	16 U	16 U
ENDOSULFAN SULFATE	16 U	16 U	16 U	16 U
4,4'-DDT	16 U	16 U	16 U	16 U
ENDRIN KETONE	16 U	16 U	16 U	16 U
METHOXYCHLOR	80 U	80 U	80 U	80 U
ALPHA-CHLORDANE	80 U	80 U	80 U	80 U
GAMMA-CHLORDANE	80 U	80 U	80 U	80 U
TOXAPHENE	160 U	160 U	160 U	160 U
AROCLOR-1016	80 U	80 U	80 U	80 U
AROCLOR-1221	80 U	80 U	80 U	80 U
AROCLOR-1232	80 U	80 U	80 U	80 U
AROCLOR-1242	80 U	80 U	80 U	80 U
AROCLOR-1248	80 U	80 U	80 U	80 U
AROCLOR-1254	160 U	160 U	160 U	160 U
AROCLOR-1260	6300 J	3600 J	540000 ~~U~~ J	480000 J

ANALYSIS TYPE: PESTICIDES

TITLE: BLUFF ELECTRIC WORKS PCB'S
LAB: EIRA
SAMPLE PREP: _____ ANALYST/ENTRY: DDM
REVIEW LEVEL: 2

MATRIX: SEDIMENT
METHOD: 608
REVIEWER: _____
DATA FILE : BE1

UNITS: UG/KG
CASE:
DATE: 11/01/90

SAMPLES	CLXDS008D	CLXDS009	CLXDS010	CLXDS011
ALPHA-BHC	8.0 U	8.0 U	8.0 U	8.0 U
BETA-BHC	8.0 U	8.0 U	8.0 U	8.0 U
DELTA-BHC	8.0 U	8.0 U	8.0 U	8.0 U
GAMMA-BHC	8.0 U	8.0 U	8.0 U	8.0 U
HEPTACHLOR	8.0 U	8.0 U	8.0 U	8.0 U
ALDRIN	8.0 U	8.0 U	8.0 U	8.0 U
HEPTACHLOR EPOXIDE	8.0 U	8.0 U	8.0 U	8.0 U
ENDOSULFAN I	8.0 U	8.0 U	8.0 U	8.0 U
DIELDRIN	16 U	16 U	16 U	16 U
4,4'-DDE	16 U	16 U	16 U	16 U
ENDRIN	16 U	16 U	16 U	16 U
ENDOSULFAN II	16 U	16 U	16 U	16 U
4,4'-DDD	16 U	16 U	16 U	16 U
ENDRIN ALDEHYDE	16 U	16 U	16 U	16 U
ENDOSULFAN SULFATE	16 U	16 U	16 U	16 U
4,4'-DDT	16 U	16 U	16 U	16 U
ENDRIN KETONE	16 U	16 U	16 U	16 U
METHOXYCHLOR	80 U	80 U	80 U	80 U
ALPHA-CHLORDANE	80 U	80 U	80 U	80 U
GAMMA-CHLORDANE	80 U	80 U	80 U	80 U
TOXAPHENE	160 U	160 U	160 U	160 U
AROCLOR-1016	80 U	80 U	80 U	80 U
AROCLOR-1221	80 U	80 U	80 U	80 U
AROCLOR-1232	80 U	80 U	80 U	80 U
AROCLOR-1242	80 U	80 U	80 U	80 U
AROCLOR-1248	80 U	80 U	80 U	80 U
AROCLOR-1254	160 U	160 U	160 U	160 U
AROCLOR-1260	610000 J	660000 J	670000 J	560000 J

ANALYSIS TYPE: PESTICIDES

TITLE: BLUFF ELECTRIC WORKS PCB'S
LAB: EIRA
SAMPLE PREP: _____ ANALYST/ENTRY: DDM
REVIEW LEVEL: 2

MATRIX: SEDIMENT
METHOD: 608
REVIEWER: _____
DATA FILE : BE1

UNITS: UG/KG
CASE:
DATE: 11/01/90

SAMPLES	CLXDS012	CLXDS013	CLXDS017	CLXDS018
ALPHA-BHC	8.0 U	8.0 U	8.0 U	8.0 U
BETA-BHC	8.0 U	8.0 U	8.0 U	8.0 U
DELTA-BHC	8.0 U	8.0 U	8.0 U	8.0 U
GAMMA-BHC	8.0 U	8.0 U	8.0 U	8.0 U
HEPTACHLOR	8.0 U	8.0 U	8.0 U	8.0 U
ALDRIN	8.0 U	8.0 U	8.0 U	8.0 U
HEPTACHLOR EPOXIDE	8.0 U	8.0 U	8.0 U	8.0 U
ENDOSULFAN I	8.0 U	8.0 U	8.0 U	8.0 U
DIELDRIN	16 U	16 U	16 U	16 U
4,4'-DDE	16 U	16 U	16 U	16 U
ENDRIN	16 U	16 U	16 U	16 U
ENDOSULFAN II	16 U	16 U	16 U	16 U
4,4'-DDD	16 U	16 U	16 U	16 U
ENDRIN ALDEHYDE	16 U	16 U	16 U	16 U
ENDOSULFAN SULFATE	16 U	16 U	16 U	16 U
4,4'-DDT	16 U	16 U	16 U	16 U
ENDRIN KETONE	16 U	16 U	16 U	16 U
METHOXYCHLOR	80 U	80 U	80 U	80 U
ALPHA-CHLORDANE	80 U	80 U	80 U	80 U
GAMMA-CHLORDANE	80 U	80 U	80 U	80 U
TOXAPHENE	160 U	160 U	160 U	160 U
AROCLOR-1016	80 U	80 U	80 U	80 U
AROCLOR-1221	80 U	80 U	80 U	80 U
AROCLOR-1232	80 U	80 U	80 U	80 U
AROCLOR-1242	80 U	80 U	80 U	80 U
AROCLOR-1248	80 U	80 U	80 U	80 U
AROCLOR-1254	160 U	160 U	160 U	160 U
AROCLOR-1260	530000 J	160 U	160 U	160 U

ANALYSIS TYPE: PESTICIDES

TITLE: BLUFF ELECTRIC WORKS PCB'S
LAB: EIRA
SAMPLE PREP: _____ ANALYST/ENTRY: DDM
REVIEW LEVEL: 2

MATRIX: SEDIMENT
METHOD: 608
REVIEWER: _____
DATA FILE : BE1

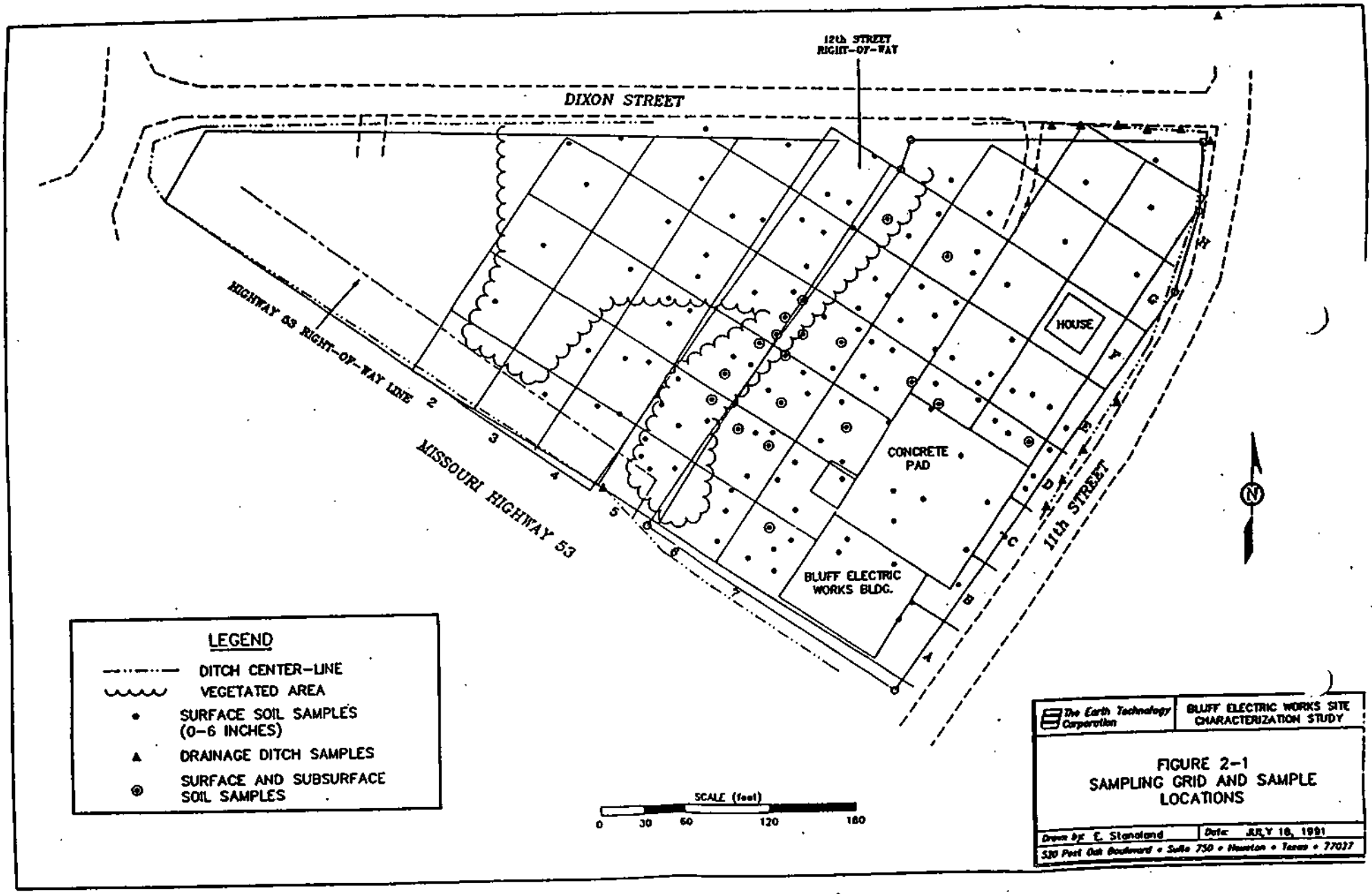
UNITS: UG/KG
CASE:
DATE: 11/01/90

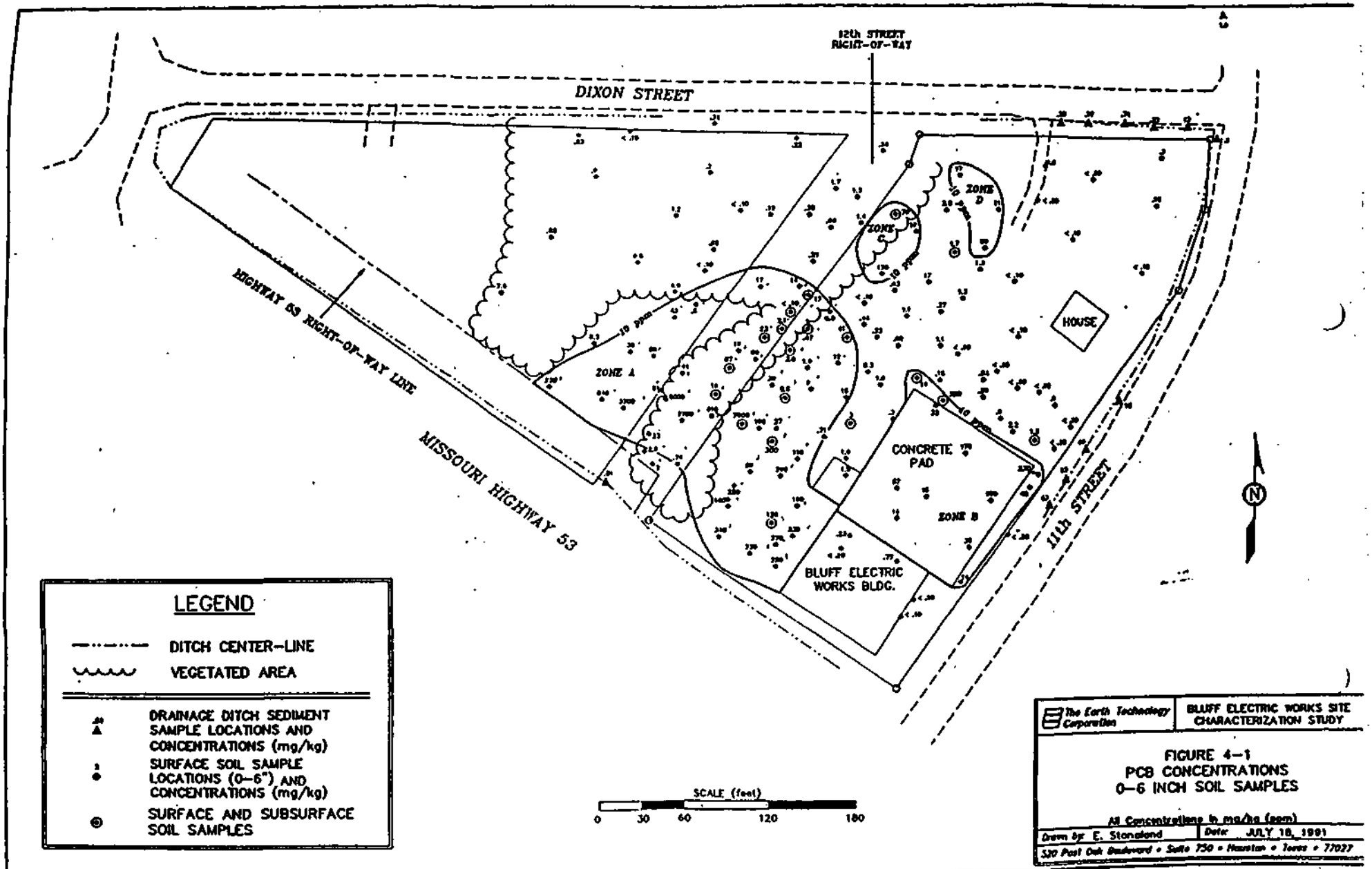
SAMPLES	CLXDS019	CLXDS020	CLXDS021	CLXDS022
ALPHA-BHC	8.0 U	8.0 U	8.0 U	8.0 U
BETA-BHC	8.0 U	8.0 U	8.0 U	8.0 U
DELTA-BHC	8.0 U	8.0 U	8.0 U	8.0 U
GAMMA-BHC	8.0 U	8.0 U	8.0 U	8.0 U
HEPTACHLOR	8.0 U	8.0 U	8.0 U	8.0 U
ALDRIN	8.0 U	8.0 U	8.0 U	8.0 U
HEPTACHLOR EPOXIDE	8.0 U	8.0 U	8.0 U	8.0 U
ENDOSULFAN I	8.0 U	8.0 U	8.0 U	8.0 U
DIELDRIN	16 U	16 U	16 U	16 U
4,4'-DDE	16 U	16 U	16 U	16 U
ENDRIN	16 U	16 U	16 U	16 U
ENDOSULFAN II	16 U	16 U	16 U	16 U
4,4'-DDD	16 U	16 U	16 U	16 U
ENDRIN ALDEHYDE	16 U	16 U	16 U	16 U
ENDOSULFAN SULFATE	16 U	16 U	16 U	16 U
4,4'-DDT	16 U	16 U	16 U	16 U
ENDRIN KETONE	16 U	16 U	16 U	16 U
METHOXYCHLOR	80 U	80 U	80 U	80 U
ALPHA-CHLORDANE	80 U	80 U	80 U	80 U
GAMMA-CHLORDANE	80 U	80 U	80 U	80 U
TOXAPHENE	160 U	160 U	160 U	160 U
AROCLOR-1016	80 U	80 U	80 U	80 U
AROCLOR-1221	80 U	80 U	80 U	80 U
AROCLOR-1232	80 U	80 U	80 U	80 U
AROCLOR-1242	80 U	80 U	80 U	80 U
AROCLOR-1248	80 U	80 U	80 U	80 U
AROCLOR-1254	160 U	160 U	160 U	160 U
AROCLOR-1260	160 U	1900 J	9800 J	160 U

APPENDIX III

Bluff Electric Works Site, Poplar Bluff, MO

Sampling Results from the Site Characterization
Conducted by The Earth Technology Corporation in September 1991


12th STREET
RIGHT-OF-WAY
DIXON STREET
HIGHWAY 63 RIGHT-OF-WAY LINE
MISSOURI HIGHWAY 53
11th STREET
HOUSE
CONCRETE
PAD
BLUFF ELECTRIC
WORKS BLDG.
1
2
3
4
5
6
7
A
B
C
D
E
F
G
H
N
LEGEND
DITCH CENTER-LINE
VEGETATED AREA
SURFACE SOIL SAMPLES
(0-6 INCHES)
DRAINAGE DITCH SAMPLES
SURFACE AND SUBSURFACE
SOIL SAMPLES
SCALE (feet)
0
30
60
120
180
The Earth Technology Corporation
BLUFF ELECTRIC WORKS SITE
CHARACTERIZATION STUDY
FIGURE 2-1
SAMPLING GRID AND SAMPLE
LOCATIONS
Drawn by: E. Stoneland
Date: JULY 16, 1991
530 Post Oak Boulevard • Suite 750 • Houston • Texas • 77027



The Earth Technology Corporation

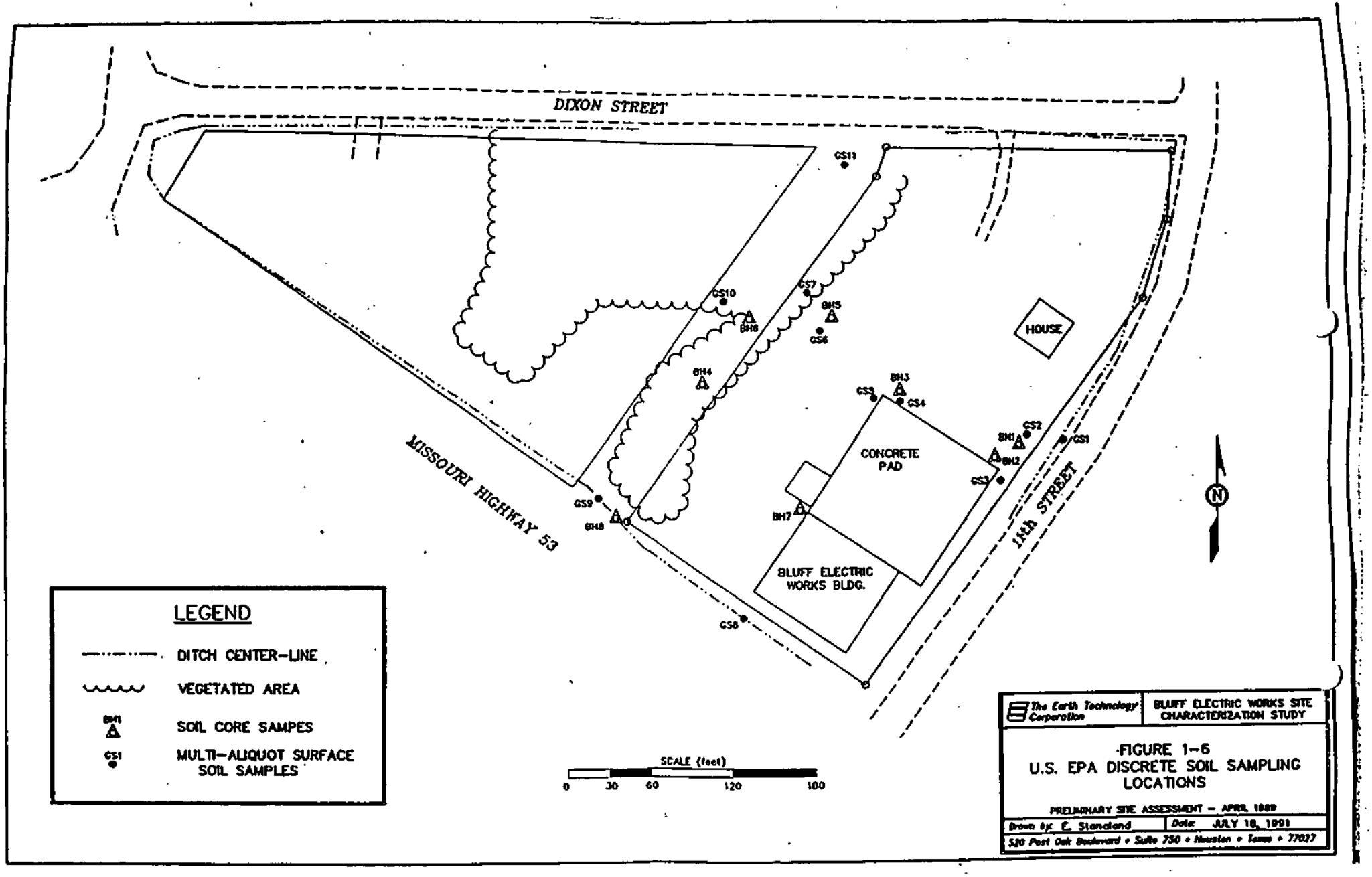
BLUFF ELECTRIC WORKS SITE CHARACTERIZATION STUDY

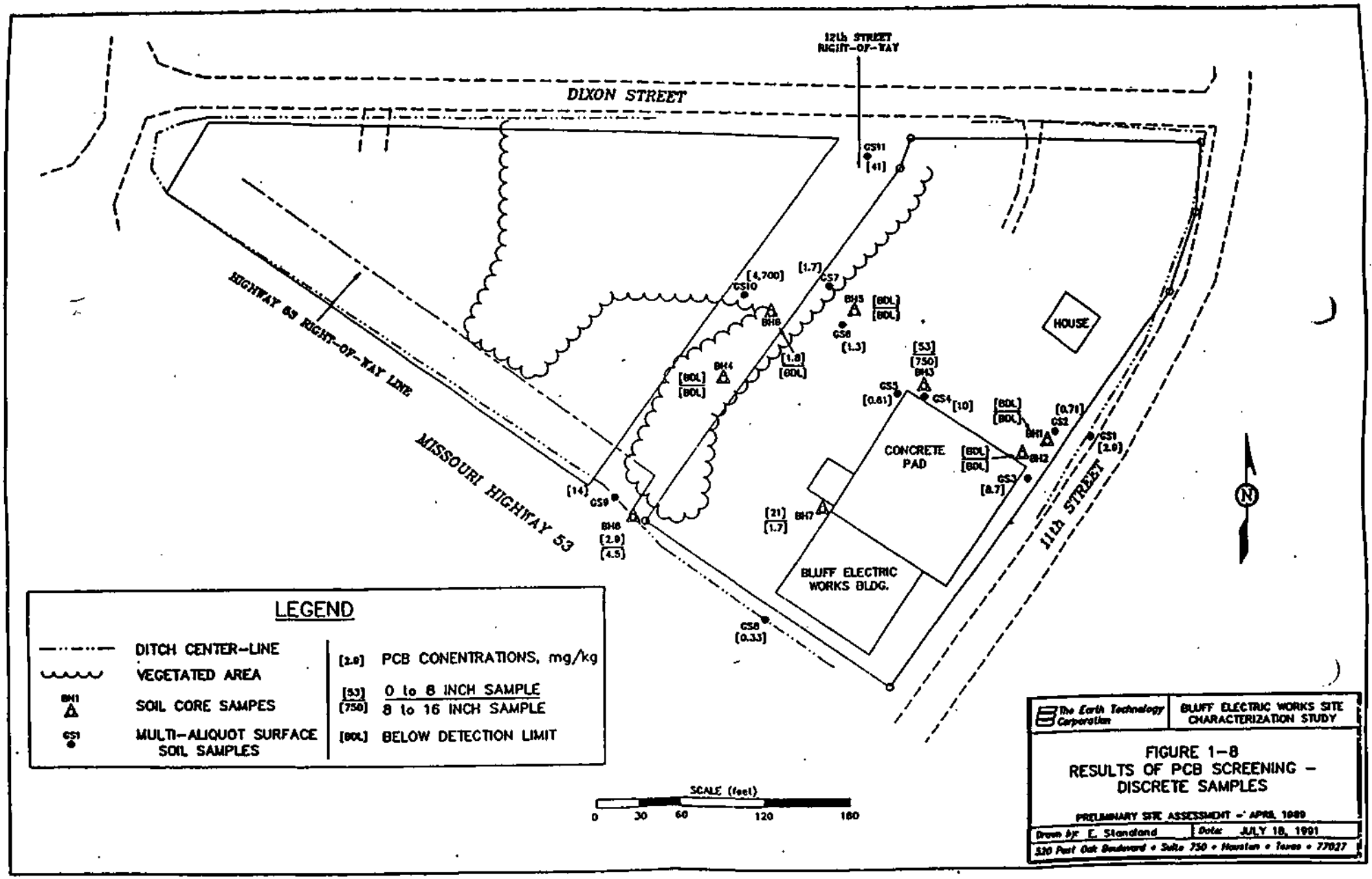
FIGURE 4-1
PCB CONCENTRATIONS
0-6 INCH SOIL SAMPLES

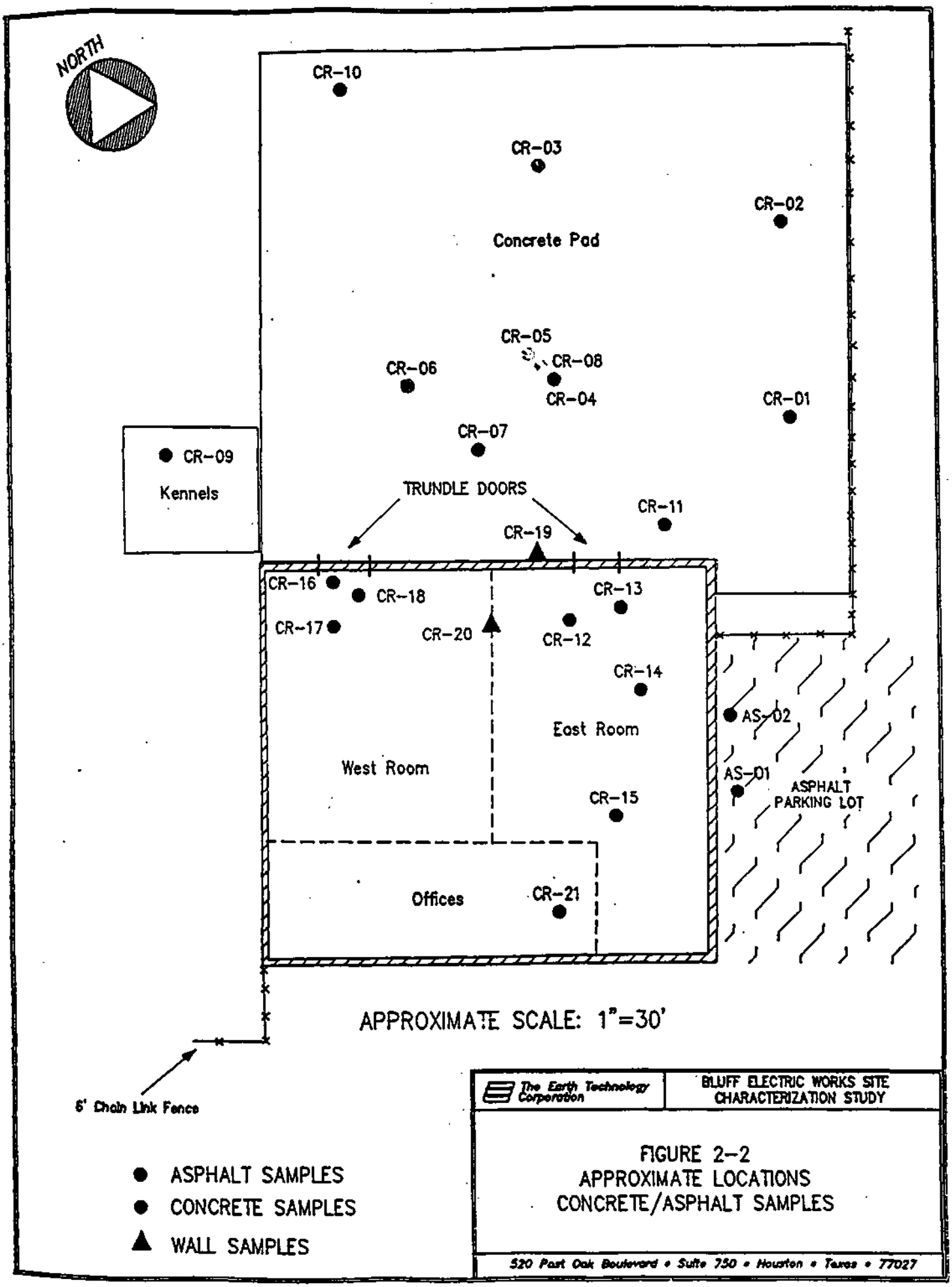
All Concentrations in mg/kg (ppm)

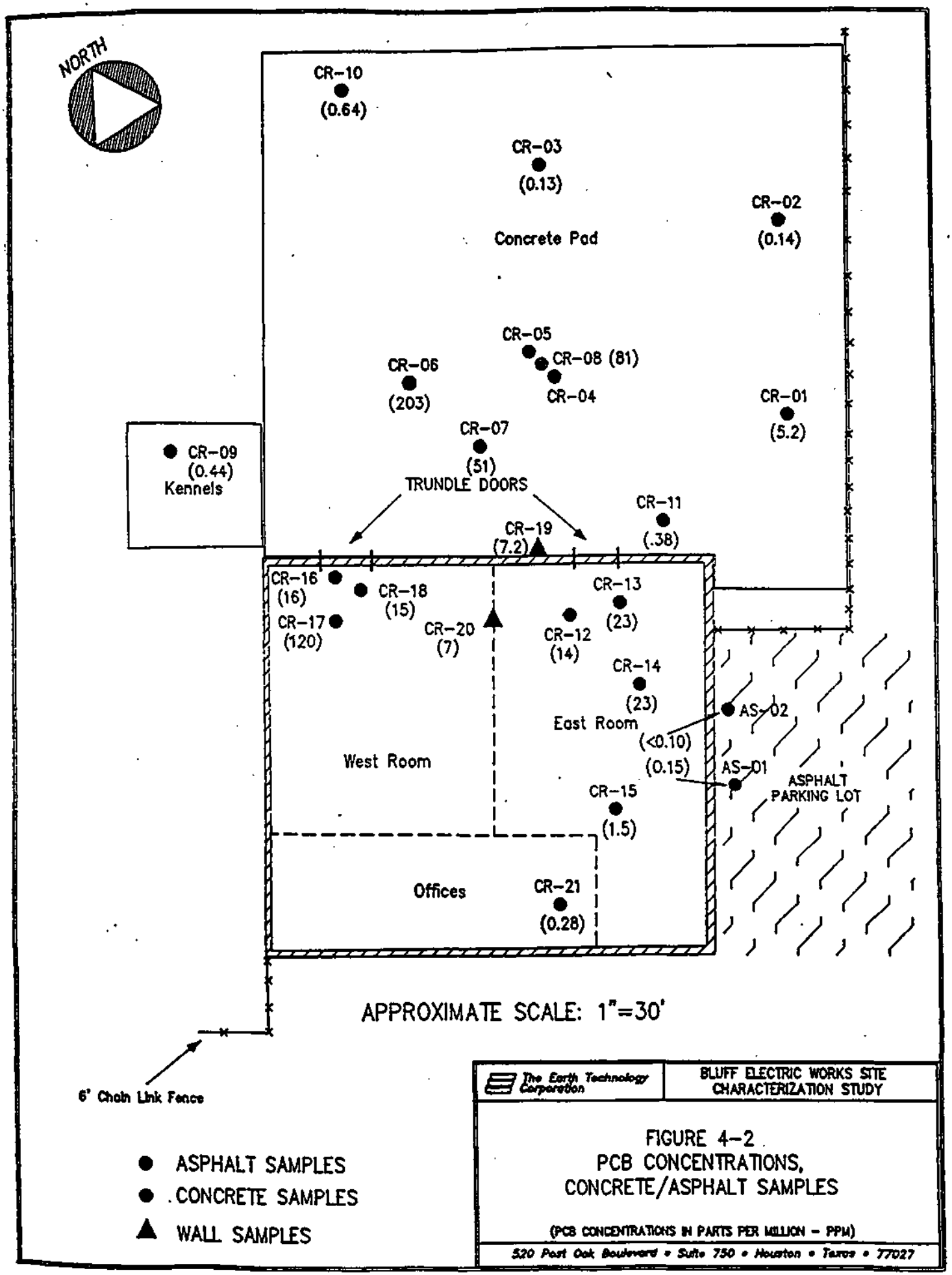
Drawn by: E. Stonsland | Date: JULY 18, 1991

530 Post Oak Boulevard • Suite 750 • Houston • Texas • 77027


DIXON STREET
MISSOURI HIGHWAY 53
14th STREET
HOUSE
CONCRETE PAD
BLUFF ELECTRIC WORKS BLDG.
GS1
GS2
GS3
GS4
GS5
GS6
GS7
GS8
GS9
GS10
GS11
BH1
BH2
BH3
BH4
BH5
BH6
BH7
BH8
N
LEGEND
DITCH CENTER-LINE
VEGETATED AREA
SOIL CORE SAMPES
MULTI-ALIQUOT SURFACE SOIL SAMPLES
SCALE (feet)
0
30
60
120
180
The Earth Technology Corporation
BLUFF ELECTRIC WORKS SITE CHARACTERIZATION STUDY
FIGURE 1-6
U.S. EPA DISCRETE SOIL SAMPLING LOCATIONS
PRELIMINARY SITE ASSESSMENT - APRIL 1989
Drawn by: E. Standland
Date: JULY 16, 1991
520 Post Oak Boulevard • Suite 750 • Houston • Texas • 77027


12th STREET
RIGHT-OF-WAY
DIXON STREET
HIGHWAY 63 RIGHT-OF-WAY LINE
MISSOURI HIGHWAY 53
11th STREET
HOUSE
CONCRETE
PAD
BLUFF ELECTRIC
WORKS BLDG.
GS11 [41]
[4,700] GS10
[1.7] GS7
BH5 [BDL] [BDL]
GS6 [1.3]
BH8
[1.8] [BDL]
BH4 [BDL] [BDL]
[53] [750] BH3
GS5 [0.61]
GS4 [10]
[BDL] [BDL]
[0.71] GS2
BH1
GS1 [2.8]
BH2 [BDL] [BDL]
GS3 [8.7]
[14] GS9
BH6 [2.9] [4.5]
[21] [1.7] BH7
GS8 [0.33]
N
LEGEND
DITCH CENTER-LINE
VEGETATED AREA
BH1 SOIL CORE SAMPES
GS1 MULTI-ALIQUOT SURFACE SOIL SAMPLES
[2.8] PCB CONENTRATIONS, mg/kg
[53] 0 to 8 INCH SAMPLE
[750] 8 to 16 INCH SAMPLE
[BDL] BELOW DETECTION LIMIT
SCALE (feet)
0 30 60 120 180
The Earth Technology Corporation
BLUFF ELECTRIC WORKS SITE CHARACTERIZATION STUDY
FIGURE 1-8
RESULTS OF PCB SCREENING - DISCRETE SAMPLES
PRELIMINARY SITE ASSESSMENT - APRIL 1989
Drawn by: E. Standard
Date: JULY 18, 1991
520 Post Oak Boulevard • Suite 750 • Houston • Texas • 77027


NORTH
CR-10
CR-03
CR-02
Concrete Pad
CR-05
CR-08
CR-06
CR-04
CR-01
CR-07
CR-09
Kennels
TRUNDLE DOORS
CR-11
CR-19
CR-16
CR-18
CR-13
CR-17
CR-20
CR-12
CR-14
AS-02
East Room
West Room
AS-01
ASPHALT
PARKING LOT
CR-15
Offices
CR-21
APPROXIMATE SCALE: 1"=30'
6' Chain Link Fence
ASPHALT SAMPLES
CONCRETE SAMPLES
WALL SAMPLES
The Earth Technology Corporation
BLUFF ELECTRIC WORKS SITE
CHARACTERIZATION STUDY
FIGURE 2-2
APPROXIMATE LOCATIONS
CONCRETE/ASPHALT SAMPLES
520 Post Oak Boulevard • Suite 750 • Houston • Texas • 77027



The Earth Technology Corporation

BLUFF ELECTRIC WORKS SITE
CHARACTERIZATION STUDY

FIGURE 4-2
PCB CONCENTRATIONS,
CONCRETE/ASPHALT SAMPLES

(PCB CONCENTRATIONS IN PARTS PER MILLION - PPM)

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TABLE B-1
PCB LABORATORY RESULTS
SITE CHARACTERIZATION STUDY

Bluff Electric Works
Poplar Bluff, Missouri

SAMPLE NUMBER	DEPTH INTERVAL	CONCENTRATION (mg/kg)	DATE SAMPLED	DATE EXTRACTED	DATE ANALYZED
BEW-SS-A03-01	0 - 6"	220	12-Jun-91	15-Jun-91	08-Jul-91
BEW-SS-A04-01	0 - 2"	3200	12-Jun-91	15-Jun-91	08-Jul-91
BEW-SS-A04-02	0 - 2"	540	12-Jun-91	15-Jun-91	07-Jul-91
BEW-SS-A05-01	0 - 6"	0.74	06-Jun-91	10-Jun-91	10-Jun-91
BEW-SS-A05-01A	0 - 6"	3.2	08-Jun-91	13-Jun-91	26-Jun-91
BEW-SS-A05-02	0 - 4"	2.6	08-Jun-91	11-Jun-91	12-Jun-91
BEW-SS-A05-03	0 - 6"	23	08-Jun-91	18-Jun-91	08-Jul-91
BEW-SS-A06-01	0 - 6"	1400	05-Jun-91	06-Jun-91	07-Jun-91
BEW-SS-A06-02	4 - 8"	250	07-Jun-91	11-Jun-91	06-Jul-91
BEW-SS-A06-03	4 - 8"	340	07-Jun-91	11-Jun-91	06-Jul-91
BEW-SS-A07-01	0 - 6"	330	05-Jun-91	06-Jun-91	07-Jun-91
BEW-SS-A07-02	3 - 9"	230	06-Jun-91	07-Jun-91	18-Jun-91
BEW-SS-A07-03-01	0 - 6"	120	06-Jun-91	07-Jun-91	18-Jun-91
BEW-SS-A07-03-02	11 - 13"	13	06-Jun-91	07-Jun-91	19-Jun-91
BEW-SS-A07-03-03	22 - 27"	NA			
BEW-SS-A07-04	0 - 6"	250	06-Jun-91	07-Jun-91	11-Jun-91
BEW-SS-A07-05	1 - 6"	270	06-Jun-91	07-Jun-91	18-Jun-91
BEW-SS-A10-01	0 - 6"	14	08-Jun-91	13-Jun-91	03-Jul-91
BEW-SS-B02-01	0 - 6"	7.6	12-Jun-91	15-Jun-91	04-Jul-91
BEW-SS-B03-01	0 - 4"	8.2	12-Jun-91	15-Jun-91	04-Jul-91
BEW-SS-B04-01	0 - 4"	51	06-Jun-91	10-Jun-91	10-Jun-91
BEW-SS-B04-02	0 - 6"	30	12-Jun-91	15-Jun-91	07-Jul-91
BEW-SS-B04-03	0 - 4"	50	12-Jun-91	15-Jun-91	04-Jul-91
BEW-SS-B05-01	0 - 6"	610	06-Jun-91	10-Jun-91	10-Jun-91
BEW-SS-B05-02	0 - 2"	2700	09-Jun-91	11-Jun-91	05-Jul-91
BEW-SS-B05-03-01	0 - 6"	18	09-Jun-91	11-Jun-91	02-Jul-91
BEW-SS-B05-03-01DUP	0 - 6"	16	09-Jun-91	11-Jun-91	02-Jul-91
BEW-SS-B05-03-02	10 - 14"	16	09-Jun-91	11-Jun-91	12-Jun-91
BEW-SS-B05-03-03	22 - 26"	2.1	09-Jun-91	18-Jun-91	06-Jul-91

9594.39 n=21

TABLE B-1 (continued)
PCB LABORATORY RESULTS
SITE CHARACTERIZATION STUDY

Bluff Electric Works
Poplar Bluff, Missouri

SAMPLE NUMBER	DEPTH INTERVAL	CONCENTRATION (mg/kg)	DATE SAMPLED	DATE EXTRACTED	DATE ANALYZED
BEW-SS-B05-04	0 - 6"	5000	09-Jun-91	12-Jun-91	07-Jul-91
BEW-SS-B05-05	0 - 6"	61	09-Jun-91	12-Jun-91	27-Jun-91
BEW-SS-B06-01	0 - 6"	27	05-Jun-91	06-Jun-91	07-Jun-91
BEW-SS-B06-02-01	0 - 6"	7900	07-Jun-91	11-Jun-91	08-Jul-91
BEW-SS-B06-02-02	10 - 14"	640	07-Jun-91	11-Jun-91	06-Jul-91
BEW-SS-B06-02-03	22 - 26"	8700	07-Jun-91	11-Jun-91	08-Jul-91
BEW-SS-B06-03-01	0 - 6"	300	07-Jun-91	11-Jun-91	06-Jul-91
BEW-SS-B06-03-02	10 - 14"	350	07-Jun-91	11-Jun-91	08-Jul-91
BEW-SS-B06-03-03	22 - 24"	34	07-Jun-91	11-Jun-91	08-Jul-91
BEW-SS-B06-04-01	0 - 6"	190	07-Jun-91	11-Jun-91	06-Jul-91
BEW-SS-B06-04-01DUP	0 - 6"	190	07-Jun-91	11-Jun-91	06-Jul-91
BEW-SS-B06-04-02	10 - 12"	250	07-Jun-91	10-Jun-91	24-Jun-91
BEW-SS-B06-05	0 - 6"	56	07-Jun-91	11-Jun-91	05-Jul-91
BEW-SS-B07-01	5 - 10"	110	05-Jun-91	06-Jun-91	07-Jun-91
BEW-SS-B07-02	0 - 6"	290	06-Jun-91	07-Jun-91	17-Jun-91
BEW-SS-B07-02DUP	0 - 6"	290	06-Jun-91	07-Jun-91	18-Jun-91
BEW-SS-B07-03	0 - 6"	160	06-Jun-91	07-Jun-91	18-Jun-91
BEW-SS-C02-01	0 - 6"	0.85	12-Jun-91	15-Jun-91	01-Jul-91
BEW-SS-C03-01	0 - 6"	6.5	12-Jun-91	14-Jun-91	28-Jun-91
BEW-SS-C04-01	0 - 6"	43	06-Jun-91	10-Jun-91	10-Jun-91
BEW-SS-C04-02	0 - 4"	4.9	12-Jun-91	15-Jun-91	07-Jul-91
BEW-SS-C04-03	0 - 6"	0.50	12-Jun-91	15-Jun-91	05-Jul-91
BEW-SS-C05-01	0 - 6"	19	06-Jun-91	10-Jun-91	10-Jun-91
BEW-SS-C05-02-01	0 - 6"	23	09-Jun-91	12-Jun-91	02-Jul-91
BEW-SS-C05-02-01DUP	0 - 6"	28	09-Jun-91	12-Jun-91	26-Jun-91
BEW-SS-C05-02-02	10 - 14"	1.1	09-Jun-91	11-Jun-91	12-Jun-91
BEW-SS-C05-02-03	22 - 26"	1.5	09-Jun-91	18-Jun-91	06-Jul-91
BEW-SS-C05-03-01	0 - 6"	57	09-Jun-91	12-Jun-91	27-Jun-91
BEW-SS-C05-03-01DUP	0 - 6"	76	09-Jun-91	12-Jun-91	27-Jun-91

1448.75 n=19

TABLE B-1 (continued)
PCB LABORATORY RESULTS
SITE CHARACTERIZATION STUDY

Bluff Electric Works
Poplar Bluff, Missouri

SAMPLE NUMBER	DEPTH INTERVAL	CONCENTRATION (mg/kg)	DATE SAMPLED	DATE EXTRACTED	DATE ANALYZED
BEW-SS-C05-03-02	10 - 14'	0.61	09-Jun-91	11-Jun-91	12-Jun-91
BEW-SS-C05-03-03	22 - 26'	18	09-Jun-91	18-Jun-91	08-Jul-91
BEW-SS-C05-04	4 - 10'	90	10-Jun-91	11-Jun-91	05-Jul-91
BEW-SS-C06-01	0 - 6'	1.9	05-Jun-91	06-Jun-91	06-Jun-91
BEW-SS-C06-02-01	6 - 12'	5.5	07-Jun-91	11-Jun-91	06-Jul-91
BEW-SS-C06-02-01DUP	6 - 12'	2.1	07-Jun-91	11-Jun-91	06-Jul-91
BEW-SS-C06-02-02	13 - 17'	0.30	07-Jun-91	11-Jun-91	08-Jul-91
BEW-SS-C06-02-03	20 - 24'	0.11	07-Jun-91	11-Jun-91	08-Jul-91
BEW-SS-C06-03	0 - 6'	39	07-Jun-91	11-Jun-91	06-Jul-91
BEW-SS-C06-04	8 - 12'	9.0	08-Jun-91	13-Jun-91	26-Jun-91
BEW-SS-C06-05-01	4 - 10'	3.9	08-Jun-91	13-Jun-91	26-Jun-91
BEW-SS-C06-05-01DUP	4 - 10'	2.1	08-Jun-91	13-Jun-91	26-Jun-91
BEW-SS-C06-05-02	12 - 20'	<0.10	08-Jun-91	11-Jun-91	12-Jun-91
BEW-SS-C06-05-03	22 - 27'	NA			
BEW-SS-C07-01	5 - 11'	0.3	05-Jun-91	06-Jun-91	07-Jun-91
BEW-SS-C07-02	6 - 12'	1.6	06-Jun-91	07-Jun-91	19-Jun-91
BEW-SS-C07-02DUP	6 - 12'	5.0	06-Jun-91	07-Jun-91	26-Jun-91
BEW-SS-C07-03-01	6 - 10'	3.0	06-Jun-91	07-Jun-91	26-Jun-91
BEW-SS-C07-03-02	10 - 14'	0.32	06-Jun-91	07-Jun-91	19-Jun-91
BEW-SS-C07-03-03	26 - 30'	NA			
BEW-SS-C07-04	6 - 12'	0.71	06-Jun-91	07-Jun-91	11-Jun-91
BEW-SS-C07-05	8 - 12'	15	06-Jun-91	07-Jun-91	18-Jun-91
BEW-SS-C10-01	0 - 6'	<0.10	06-Jun-91	15-Jun-91	02-Jul-91
BEW-SS-D02-01	0 - 6'	0.80	12-Jun-91	14-Jun-91	19-Jun-91
BEW-SS-D03-01	0 - 6'	1.2	12-Jun-91	15-Jun-91	04-Jul-91
BEW-SS-D04-01	0 - 6'	<0.10	06-Jun-91	10-Jun-91	10-Jun-91
BEW-SS-D04-02	0 - 6'	0.55	12-Jun-91	15-Jun-91	04-Jul-91
BEW-SS-D05-01	0 - 6'	14	06-Jun-91	10-Jun-91	10-Jun-91
BEW-SS-D05-02-01	6 - 12'	2.1	10-Jun-91	11-Jun-91	07-Jul-91

59.6 m = 5

TABLE B-1 (continued)
PCB LABORATORY RESULTS
SITE CHARACTERIZATION STUDY

Bluff Electric Works
Poplar Bluff, Missouri

SAMPLE NUMBER	DEPTH INTERVAL	CONCENTRATION (mg/kg)	DATE SAMPLED	DATE EXTRACTED	DATE ANALYZED
BEW-SS-D05-02-01DUP	6 - 12"	5.3	10-Jun-91	12-Jun-91	28-Jun-91
BEW-SS-D05-02-02	18 - 23"	<0.10	10-Jun-91	11-Jun-91	12-Jun-91
BEW-SS-D05-02-03	23 - 29"	NA			
BEW-SS-D05-03-01	7 - 13"	<0.10	10-Jun-91	11-Jun-91	05-Jul-91
BEW-SS-D05-03-01DUP	7 - 13"	0.64	10-Jun-91	12-Jun-91	26-Jun-91
BEW-SS-D05-03-02	17 - 22"	0.45	09-Jun-91	11-Jun-91	12-Jun-91
BEW-SS-D05-03-03	22 - 28"	0.22	10-Jun-91	18-Jun-91	06-Jul-91
BEW-SS-D05-04-01	0 - 6"	17	10-Jun-91	12-Jun-91	07-Jul-91
BEW-SS-D05-04-02	10 - 16"	3.7	10-Jun-91	11-Jun-91	12-Jun-91
BEW-SS-D05-04-03	24 - 28"	2.0	10-Jun-91	18-Jun-91	06-Jul-91
BEW-SS-D05-05	0 - 2"	17	10-Jun-91	12-Jun-91	28-Jun-91
BEW-SS-D06-01	0 - 6"	6.8	05-Jun-91	06-Jun-91	07-Jun-91
BEW-SS-D06-02-01	7 - 11"	0.47	08-Jun-91	13-Jun-91	28-Jun-91
BEW-SS-D06-02-02	11 - 15"	<0.10	08-Jun-91	11-Jun-91	12-Jun-91
BEW-SS-D06-02-03	20 - 24"	NA			
BEW-SS-D06-03	6 - 12"	12	08-Jun-91	13-Jun-91	28-Jun-91
BEW-SS-D06-04-01	0 - 6"	41	08-Jun-91	13-Jun-91	26-Jun-91
BEW-SS-D06-04-02	10 - 14"	23	08-Jun-91	11-Jun-91	13-Jun-91
BEW-SS-D06-04-03	22 - 26"	0.37	08-Jun-91	18-Jun-91	06-Jul-91
BEW-SS-D06-05	0 - 6"	0.44	08-Jun-91	13-Jun-91	28-Jun-91
BEW-SS-D07-01	0 - 6"	14	05-Jun-91	06-Jun-91	07-Jun-91
BEW-SS-D07-01-02	10 - 14"	8.2	07-Jun-91	11-Jun-91	06-Jul-91
BEW-SS-D07-01-03	22 - 27"	0.22	07-Jun-91	11-Jun-91	06-Jul-91
BEW-SS-D07-02	7 - 13"	1.9	07-Jun-91	11-Jun-91	08-Jul-91
BEW-SS-D07-03	3 - 9"	0.23	07-Jun-91	11-Jun-91	08-Jul-91
BEW-SS-D07-04	7 - 12"	5.3	07-Jun-91	11-Jun-91	08-Jul-91
BEW-SS-D07-05	0 - 6"	0.88	07-Jun-91	11-Jun-91	09-Jul-91
BEW-SS-D08-01	0 - 6"	0.15	05-Jun-91	06-Jun-91	06-Jun-91
BEW-SS-D08-02-01	0 - 6"	200	07-Jun-91	11-Jun-91	08-Jul-91

297.27 m - 9

TABLE B-1 (continued)
PCB LABORATORY RESULTS
SITE CHARACTERIZATION STUDY

Bluff Electric Works
Poplar Bluff, Missouri

SAMPLE NUMBER	DEPTH INTERVAL	CONCENTRATION (mg/kg)	DATE SAMPLED	DATE EXTRACTED	DATE ANALYZED
BEW-SS-D08-02-02	10 - 14"	81	07-Jun-91	11-Jun-91	08-Jul-91
BEW-SS-D08-02-03	23 - 29"	1.6	07-Jun-91	10-Jun-91	24-Jun-91
BEW-SS-D08-03	0 - 6"	0.39	07-Jun-91	10-Jun-91	18-Jun-91
BEW-SS-D08-03DUP	0 - 6"	0.35	07-Jun-91	10-Jun-91	18-Jun-91
BEW-SS-D09-01	0 - 6"	0.6	05-Jun-91	06-Jun-91	07-Jun-91
BEW-SS-D09-02-01	0 - 6"	1.2	07-Jun-91	10-Jun-91	24-Jun-91
BEW-SS-D09-02-02	10 - 15"	0.11	07-Jun-91	10-Jun-91	18-Jun-91
BEW-SS-D09-02-03	22 - 26"	<0.10	07-Jun-91	10-Jun-91	18-Jun-91
BEW-SS-D09-03	0 - 6"	2.2	07-Jun-91	10-Jun-91	25-Jun-91
BEW-SS-D10-01	0 - 6"	<0.10	06-Jun-91	10-Jun-91	10-Jun-91
BEW-SS-D10-02	0 - 6"	230	12-Jun-91	15-Jun-91	08-Jul-91
BEW-SS-D10-03	0 - 6"	45	12-Jun-91	15-Jun-91	04-Jul-91
BEW-SS-E01-01	0 - 6"	0.22	12-Jun-91	14-Jun-91	19-Jun-91
BEW-SS-E02-01	0 - 6"	<0.10	12-Jun-91	14-Jun-91	19-Jun-91
BEW-SS-E03-01	0 - 6"	0.20	12-Jun-91	15-Jun-91	01-Jul-91
BEW-SS-E04-01	0 - 6"	<0.10	06-Jun-91	10-Jun-91	10-Jun-91
BEW-SS-E04-02	0 - 6"	0.12	12-Jun-91	14-Jun-91	19-Jun-91
BEW-SS-E05-01	0 - 6"	0.35	06-Jun-91	10-Jun-91	10-Jun-91
BEW-SS-E05-02	0 - 6"	0.66	11-Jun-91	12-Jun-91	20-Jun-91
BEW-SS-E05-03	0 - 6"	0.35	11-Jun-91	12-Jun-91	20-Jun-91
BEW-SS-E06-01	0 - 6"	120	05-Jun-91	06-Jun-91	07-Jun-91
BEW-SS-E06-02	1 - 7"	<0.10	08-Jun-91	11-Jun-91	12-Jun-91
BEW-SS-E06-02DUP	1 - 7"	0.11	08-Jun-91	13-Jun-91	28-Jun-91
BEW-SS-E06-03	4 - 9"				
BEW-SS-E06-04	0 - 6"	0.63	08-Jun-91	13-Jun-91	28-Jun-91
BEW-SS-E07-01	5 - 11"	1.1	05-Jun-91	06-Jun-91	07-Jun-91
BEW-SS-E07-02	0 - 6"	1.1	07-Jun-91	10-Jun-91	24-Jun-91
BEW-SS-E07-03	0 - 6"	0.27	07-Jun-91	10-Jun-91	18-Jun-91
BEW-SS-E07-04	1 - 6"	17	07-Jun-91	10-Jun-91	25-Jun-91

4379 n = 20

TABLE B-1 (continued)
PCB LABORATORY RESULTS
SITE CHARACTERIZATION STUDY

Bluff Electric Works
Poplar Bluff, Missouri

SAMPLE NUMBER	DEPTH INTERVAL	CONCENTRATION (mg/kg)	DATE SAMPLED	DATE EXTRACTED	DATE ANALYZED
BEW-SS-E07-05	0 - 6"	1.3	07-Jun-91	10-Jun-91	24-Jun-91
BEW-SS-E07-05DUP	0 - 6"	0.83	07-Jun-91	10-Jun-91	18-Jun-91
BEW-SS-E08-01	0 - 6"	<0.10	05-Jun-91	06-Jun-91	06-Jun-91
BEW-SS-E08-02	0 - 6"	<0.10	07-Jun-91	10-Jun-91	18-Jun-91
BEW-SS-E08-03	0 - 6"	0.54	07-Jun-91	10-Jun-91	18-Jun-91
BEW-SS-E08-03DUP	0 - 6"	0.39	07-Jun-91	10-Jun-91	18-Jun-91
BEW-SS-E08-04	0 - 6"	<0.10	07-Jun-91	10-Jun-91	18-Jun-91
BEW-SS-E09-01	0 - 6"	<0.10	05-Jun-91	06-Jun-91	06-Jun-91
BEW-SS-E09-02	0 - 6"	<0.10	07-Jun-91	10-Jun-91	18-Jun-91
BEW-SS-E09-03	0 - 6"	0.56	07-Jun-91	10-Jun-91	18-Jun-91
BEW-SS-E09-03DUP	0 - 6"	0.71	07-Jun-91	10-Jun-91	18-Jun-91
BEW-SS-E10-01	0 - 6"	<0.10	06-Jun-91	10-Jun-91	10-Jun-91
BEW-SS-F03-01	0 - 6"	0.32	12-Jun-91	15-Jun-91	01-Jul-91
BEW-SS-F04-01	0 - 6"	0.12	06-Jun-91	10-Jun-91	10-Jun-91
BEW-SS-F04-02	0 - 6"	<0.10	12-Jun-91	15-Jun-91	04-Jul-91
BEW-SS-F05-01	0 - 6"	1.3	06-Jun-91	10-Jun-91	10-Jun-91
BEW-SS-F05-02	0 - 6"	1.4	11-Jun-91	12-Jun-91	28-Jun-91
BEW-SS-F05-03	0 - 6"	1.7	11-Jun-91	12-Jun-91	28-Jun-91
BEW-SS-F06-01	0 - 6"	16	06-Jun-91	10-Jun-91	10-Jun-91
BEW-SS-F06-02-01	0 - 6"	70	11-Jun-91	12-Jun-91	28-Jun-91
BEW-SS-F06-02-02	10 - 14"	18	11-Jun-91	18-Jun-91	06-Jul-91
BEW-SS-F06-02-03	22 - 26"	3.7	11-Jun-91	18-Jun-91	06-Jul-91
BEW-SS-F06-03	0 - 6"	3.8	11-Jun-91	12-Jun-91	14-Jun-91
BEW-SS-F07-01	0 - 6"	1.7	06-Jun-91	10-Jun-91	10-Jun-91
BEW-SS-F07-02	10 - 14"	1.3	11-Jun-91	14-Jun-91	26-Jun-91
BEW-SS-F07-03	22 - 26"	59	11-Jun-91	14-Jun-91	28-Jun-91
BEW-SS-F08-01	0 - 6"	<0.10	06-Jun-91	10-Jun-91	10-Jun-91
BEW-SS-G05-01	0 - 6"	0.34	11-Jun-91	14-Jun-91	19-Jun-91
BEW-SS-G06-01	0 - 6"	17	11-Jun-91	14-Jun-91	21-Jun-91

11E.41 n = 25

TABLE B-1 (continued)
PCB LABORATORY RESULTS
SITE CHARACTERIZATION STUDY

Bluff Electric Works
Poplar Bluff, Missouri

SAMPLE NUMBER	DEPTH INTERVAL	CONCENTRATION (mg/kg)	DATE SAMPLED	DATE EXTRACTED	DATE ANALYZED
BEW-SS-G07-01	0 - 6"	<0.10	11-Jun-91	14-Jun-91	19-Jun-91
BEW-SS-G07-02	0 - 6"	11	11-Jun-91	17-Jun-91	28-Jun-91
BEW-SS-G08-01	0 - 6"	<0.10	12-Jun-91	14-Jun-91	19-Jun-91
BEW-SS-G09-01	0 - 6"	<0.10	12-Jun-91	14-Jun-91	19-Jun-91
BEW-SS-H07-01	0 - 6"	1.8	12-Jun-91	14-Jun-91	28-Jun-91
BEW-SS-H08-01	0 - 6"	<0.10	12-Jun-91	14-Jun-91	19-Jun-91
BEW-SS-H09-01	0 - 6"	0.15	12-Jun-91	15-Jun-91	06-Jul-91
BEW-SS-I09-01	0 - 6"	0.30	12-Jun-91	15-Jun-91	08-Jul-91
BEW-SS-ASP-01-01	3 - 9"	<0.10	11-Jun-91	12-Jun-91	13-Jun-91
BEW-SS-ASP-01-02	12 - 18"	NA			
BEW-SS-ASP-02-01	3 - 9"	<0.10	11-Jun-91	12-Jun-91	13-Jun-91
BEW-SS-ASP-02-02	12 - 18"	NA			
BEW-SS-PAD-01-01	0 - 5"	36	08-Jun-91	11-Jun-91	13-Jun-91
BEW-SS-PAD-01-02	12 - 17"	<0.10	08-Jun-91	18-Jun-91	06-Jul-91
BEW-SS-PAD-02-01	0 - 6"	150	08-Jun-91	11-Jun-91	13-Jun-91
BEW-SS-PAD-02-02	12 - 18"	4.6	08-Jun-91	18-Jun-91	06-Jul-91
BEW-SS-PAD-03-01	0 - 6"	170	08-Jun-91	11-Jun-91	13-Jun-91
BEW-SS-PAD-03-02	12 - 18"	7.3	08-Jun-91	18-Jun-91	06-Jul-91
BEW-SS-PAD-06-01	0 - 6"	57	09-Jun-91	11-Jun-91	12-Jun-91
BEW-SS-PAD-06-02	12 - 18"	33	09-Jun-91	16-Jun-91	08-Jul-91
BEW-SS-PAD-07-01	0 - 6"	14	09-Jun-91	11-Jun-91	13-Jun-91
BEW-SS-PAD-07-02	12 - 18"	8.2	09-Jun-91	18-Jun-91	06-Jul-91
BEW-SS-PAD-08-01	0 - 6"	15	09-Jun-91	11-Jun-91	13-Jun-91
BEW-SS-PAD-08-02	12 - 18"	1.7	09-Jun-91	18-Jun-91	06-Jul-91
BEW-SS-PAD-09-01	0 - 6"	1.5	09-Jun-91	11-Jun-91	12-Jun-91
BEW-SS-PAD-09-02	12 - 18"	0.60	09-Jun-91	18-Jun-91	06-Jul-91
BEW-SS-PAD-10-01	0 - 6"	22	10-Jun-91	11-Jun-91	13-Jun-91
BEW-SS-PAD-10-02	12 - 18"	1.5	10-Jun-91	18-Jun-91	06-Jul-91
BEW-SS-PAD-13-01	0 - 6"	0.77	10-Jun-91	11-Jun-91	13-Jun-91

2.56 n = 8

TABLE B-1 (continued)
PCB LABORATORY RESULTS
SITE CHARACTERIZATION STUDY

Bluff Electric Works
Poplar Bluff, Missouri

SAMPLE NUMBER	DEPTH INTERVAL	CONCENTRATION (mg/kg)	DATE SAMPLED	DATE EXTRACTED	DATE ANALYZED
BEW-SS-PAD-13-02	12 - 18"	0.18	10-Jun-91	18-Jun-91	06-Jul-91
BEW-SS-PAD-16-01	0 - 6"	0.23	10-Jun-91	11-Jun-91	13-Jun-91
BEW-SS-PAD-16-02	12 - 15"	0.23	10-Jun-91	18-Jun-91	06-Jul-91
BEW-SS-PAD-17-01	0 - 6"	<0.10	10-Jun-91	11-Jun-91	13-Jun-91
BEW-SS-PAD-17-02	12 - 16"	NA			
BEW-SS-UST-01	9'	<0.10	11-Jun-91	14-Jun-91	19-Jun-91
BEW-SD-01	0 - 6"	15	06-Jun-91	10-Jun-91	10-Jun-91
BEW-SD-02	0 - 6"	0.51	06-Jun-91	10-Jun-91	10-Jun-91
BEW-SD-03	0 - 6"	13	06-Jun-91	10-Jun-91	10-Jun-91
BEW-SD-04	0 - 6"	40	10-Jun-91	11-Jun-91	08-Jul-91
BEW-SD-05	0 - 6"	0.22	10-Jun-91	11-Jun-91	05-Jul-91
BEW-SD-06	0 - 6"	0.71	11-Jun-91	13-Jun-91	19-Jun-91
BEW-SD-07	0 - 6"	0.37	11-Jun-91	13-Jun-91	19-Jun-91
BEW-SD-08	0 - 6"	0.28	11-Jun-91	13-Jun-91	19-Jun-91
BEW-SD-09	0 - 6"	53	11-Jun-91	14-Jun-91	28-Jun-91
BEW-SD-10	0 - 6"	13	11-Jun-91	14-Jun-91	26-Jun-91
BEW-SD-11	0 - 6"	0.10	11-Jun-91	12-Jun-91	13-Jun-91
BEW-SD-12	0 - 6"	1.6	11-Jun-91	12-Jun-91	13-Jun-91
BEW-AS-01	0 - 3"	0.15	11-Jun-91	14-Jun-91	19-Jun-91
BEW-AS-02	0 - 3"	<0.10	11-Jun-91	14-Jun-91	19-Jun-91
BEW-CR-01	0 - 1"	5.2	08-Jun-91	13-Jun-91	01-Jul-91
BEW-CR-02	0 - 1"	0.14	08-Jun-91	13-Jun-91	28-Jun-91
BEW-CR-03	0 - 1"	0.13	08-Jun-91	13-Jun-91	28-Jun-91
BEW-CR-04	0 - 1"	NA			
BEW-CR-05	0 - 1"	NA			
BEW-CR-06	0 - 1"	203	09-Jun-91	12-Jun-91	01-Jul-91
BEW-CR-07	0 - 1"	51	09-Jun-91	12-Jun-91	27-Jun-91
BEW-CR-08	0 - 1"	81	09-Jun-91	12-Jun-91	27-Jun-91
BEW-CR-09	0 - 1"	0.44	09-Jun-91	21-Jun-91	27-Jun-91

TABLE B-1 (continued)
PCB LABORATORY RESULTS
SITE CHARACTERIZATION STUDY

Bluff Electric Works
Poplar Bluff, Missouri

SAMPLE NUMBER	DEPTH INTERVAL	CONCENTRATION (mg/kg)	DATE SAMPLED	DATE EXTRACTED	DATE ANALYZED
BEW-CR-09DUP	0 - 1'	0.35	09-Jun-91	21-Jun-91	27-Jun-91
BEW-CR-10	0 - 1'	0.64	10-Jun-91	12-Jun-91	07-Jul-91
BEW-CR-11	0 - 1'	38	10-Jun-91	12-Jun-91	28-Jun-91
BEW-CR-12	0 - 1'	14	10-Jun-91	12-Jun-91	28-Jun-91
BEW-CR-13	0 - 1'	23	10-Jun-91	12-Jun-91	28-Jun-91
BEW-CR-14	0 - 1'	23	10-Jun-91	12-Jun-91	28-Jun-91
BEW-CR-15	0 - 1'	1.5	10-Jun-91	12-Jun-91	08-Jul-91
BEW-CR-16	0 - 1'	16	10-Jun-91	12-Jun-91	08-Jul-91
BEW-CR-17	0 - 1'	120	10-Jun-91	12-Jun-91	08-Jul-91
BEW-CR-18	0 - 1'	15	10-Jun-91	12-Jun-91	28-Jun-91
BEW-CR-19	0 - 1'	7.2	11-Jun-91	12-Jun-91	28-Jun-91
BEW-CR-20	0 - 1'	7.0	11-Jun-91	13-Jun-91	01-Jul-91
BEW-CR-21	0 - 1'	0.28	11-Jun-91	13-Jun-91	19-Jun-91
BEW-EB-01, ug/l		<2.5	07-Jun-91	11-Jun-91	24-Jun-91
BEW-EB-02, ug/l		<2.5	08-Jun-91	11-Jun-91	24-Jun-91
BEW-EB-03, ug/l		<2.5	11-Jun-91	13-Jun-91	21-Jun-91
BEW-EB-04, ug/l		<2.5	12-Jun-91	13-Jun-91	26-Jun-91
BEW-FB-01, ug/l		<2.5	07-Jun-91	11-Jun-91	24-Jun-91
BEW-FB-03, ug/l		<2.5	09-Jun-91	21-Jun-91	28-Jun-91
BEW-FB-04, ug/l		<2.5	12-Jun-91	13-Jun-91	26-Jun-91
BEW-MS-01		0.42	12-Jun-91	15-Jun-91	01-Jul-91
BEW-MSD-01		0.39	12-Jun-91	15-Jun-91	01-Jul-91

NOTE: NA - Not Analyzed

B-2 Dioxins and Furans Laboratory Results

TABLE B-2
DIOXINS AND FURANS LABORATORY RESULTS
SITE CHARACTERIZATION STUDY

Bluff Electric Works
Poplar Bluff, Missouri

ANALYTE	METHOD BLANK (S) (ppb)	BEW-CR-04 (ppb)	BEW-CR-05 (ppb)
2378-TCDD	<0.005	<0.005	0.006
12378-PeCDD	<0.01	<0.008	EMPC (0.02)
123478-HxCDD	<0.008	<0.005	0.01
123678-HxCDD	<0.008	<0.005	0.04
123789-HxCDD	<0.008	<0.005	0.04
12345678-HpCDD	<0.01	<01	0.36
OCDD	<0.01	EMPC (0.02)	1.1
2378-TCDF	<0.003	<0.003	1.1
12378-PeCDF	<0.005	<0.005	0.25
23478-PeCDF	<0.005	<0.005	0.57
123478-HxCDF	<0.005	<0.003	0.32
123678-HxCDF	<0.005	<0.003	0.46
234678-HxCDF	<0.003	<0.003	<0.003
123789-HxCDF	<0.005	<0.003	<0.003
12345678-HpCDF	<0.005	0.004	0.95
1234789-HpCDF	<0.008	<0.005	EMPC (0.04)
OCDF	<0.008	<0.005	0.10
Total TCDD	EMPC (0.60)	EMPC (0.61)	0.02
Total PeCDD	<0.01	EMPC (0.04)	0.05
Total HxCDD	<0.008	<0.005	0.36
Total HpCDD	<0.01	<0.01	0.68
Total TCDF	EMPC (0.02)	EMPC (0.02)	9.3
Total PeCDF	<0.005	EMPC (0.13)	17.1
Total HxCDF	<0.005	0.009	21.0
Total HpCDF	<0.008	0.005	2.5

ppb - parts per billion
S - Soil
EMPC - Estimated Maximum Possible Concentration

APPENDIX IV

Bluff Electric Works Site, Poplar Bluff, MO

Risk Assessment Issue Paper on the Feasibility of an Oral to Dermal RfD Extrapolation for Copper

ECAO file

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
OFFICE OF RESEARCH AND DEVELOPMENT
ENVIRONMENTAL CRITERIA AND ASSESSMENT OFFICE
CINCINNATI, OHIO 45268

JUN 3 1991

Dr. Cherri Baysinger-Daniels
Missouri Department of Health
Bureau of Environmental Epidemiology
1730 East Elm
Jefferson City, Missouri 65102

RE: Oral and Dermal Absorption Factors for Multiple Chemicals and Route-to-Route Extrapolation (Crown Plating Site/ St. Louis, MO)

Dear Dr. Baysinger-Daniels:

This letter is in response to your request for oral and dermal absorption factors for multiple chemicals and route-to-route extrapolation for the Crown Plating Site, St. Louis, MO.

The information is contained in:

Enclosure 1

Table 1 - Contains oral absorption factors for the requested chemicals.

Table 2 - Contains dermal absorption factors for the requested chemicals.

Enclosure 2

Contains a Risk Assessment Issue Paper for: Evaluation of Oral-to-Dermal Extrapolation.

If you have any additional questions, please feel free to contact me at (513) 569-7300.

Respectfully,

Pei-Fung Hurst, Ph.D.
Coordinator, Superfund Health Risk
Technology Support Center
Chemical Mixtures Assessment Branch

Enclosures

cc: D. Crawford (Region VII)
C. DeRosa (ECAO-Cin)
J. Dinan (OS-230)
T. Harvey (ECAO-Cin)
B. Means (OS-230)
W.B. Peirano (ECAO-Cin)

Enclosure II

Risk Assessment Issue Paper for: Evaluation of Oral-to-Dermal Extrapolation

Available EPA documents and ATSDR Toxicological Profiles were reviewed for each of the 18 chemicals to evaluate the use of modified oral toxicity values in characterizing dermal toxicity risk.

A general principal utilized in our evaluations is the assumption that toxic effects are not route-specific unless there are data to indicate otherwise. This principal has been discussed in the seventh draft of the General Quantitative Risk Assessment Guidelines for Noncancer Health Effects (U.S. EPA, 1989b). Thus, in the absence of dermal toxicity data, the type of effects produced are assumed to be equivalent to those produced by oral exposure unless other data (e.g., route-specific metabolism or observation of localized effects) indicate otherwise.

2. ARSENIC (U.S. EPA, 1980b, 1984a; ATSDR, 1989)

Data in humans indicate that the skin, gastrointestinal tract, and the hematological and cardiovascular systems are the targets of toxicity following oral exposure to arsenic. A chronic oral RfD is currently under review by the U.S. EPA (1991a). Arsenic has been found to be carcinogenic in humans following both oral (skin cancer) and inhalation (respiratory tract cancer) exposure and the U.S. EPA (1991a) has verified unit risk factors for cancer resulting from both oral and inhalation exposure.

Dermal exposure to inorganic arsenic has been reported to lead to dermatitis.

The available data provide no evidence that dermal exposure to arsenic will produce effects different from those produced by oral exposure; therefore oral-to-dermal extrapolation is appropriate.

6. COPPER (U.S. EPA, 1984e, 1987b; ATSDR, 1989)

Dietary studies in rats have shown that excess levels of copper in the liver and kidney can result in centrilobular necrosis and extensive degeneration of the proximal convoluted tubule epithelium. These effects are followed by regeneration of the tissue and development of tolerance to continued dosing. In humans, oral exposure to high concentrations of copper can result in gastrointestinal irritation, manifested as vomiting, nausea, and diarrhea.

There is limited information on the toxicity of topically applied

copper. Allergic contact dermatitis has been observed in some individuals. In addition, there are numerous reports of localized pruritus in individuals wearing copper containing jewelry. Thus, it appears that some individuals are unusually susceptible to the toxic effects of dermal exposure to copper.

Copper is an essential nutrient; there are several mechanisms to prevent gastrointestinal absorption of levels of copper that would exceed the nutritional requirement. Excess copper absorbed into gastrointestinal mucosal cells is bound to metallothionein. This bound copper is excreted when the cell is sloughed off. Excess copper that eludes the intestinal barrier can be stored in the liver or incorporated into bile and excreted in the feces.

There are insufficient data on the carcinogenicity of copper, it is given assigned to U.S. EPA weight of evidence group D (not classifiable as to human carcinogenicity) (U.S. EPA, 1991a).

In summary, there are numerous mechanisms of maintaining copper homeostasis. Gastrointestinal mechanisms include vomiting after ingestion of a high concentration of copper and sequestration of copper by metallothionein in gastrointestinal mucosal cells. Dermal absorption of copper would bypass these important homeostatic mechanisms and may result in increased toxicity. These differences in pharmacokinetic properties of oral and dermal exposure would preclude a route-to-route extrapolation of a dermal toxicity value from oral toxicity data.

12. CYANIDE (U.S. EPA, 1988a; ATSDR, 1988)

Ingestion of high doses of cyanide can rapidly cause death by producing histotoxic hypoxia. Lower doses of cyanide can be effectively detoxified by rhodanese in the liver. The nervous system and the thyroid appear to be the target organs for the toxicity of oral cyanide exposure. U.S. EPA (1991a) derived a verified oral RfD for free cyanide based on weight loss, thyroid effects and nervous system effects in chronically exposed rats. Cyanide has not been shown to be carcinogenic following any route of exposure.

Dermal exposure to cyanide has resulted in neurological effects in both humans and animals. In the human studies, however, concommittent inhalation and oral exposure occurred. Doses associated with the neurological effects have not been quantitated.

Ingested cyanide is effectively detoxified by the liver, but it is uncertain if dermally applied would be detoxified as effectively. It seems possible that dermally absorbed cyanide (due to the lack of a "first pass effect") may be subject to a more widespread distribution throughout the body before being detoxified in the liver. Therefore, performing an oral-to-dermal extrapolation would not be appropriate because of the uncertainty that the oral RfD for cyanide would provide protection for the