48006

Exhibit 3.8

Information Requests No. 47, 49

CONFIDENTIAL BUSINESS
INFORMATION

Pursuant to 40 CFR Part 2, Subpart B, Monsanto Company hereby asserts a business confidentiality claim covering this Exhibit and all documents attached thereto.

ESPK464A.ch

Monsanto

Total Quality

FROM (NAME-LOCATION-PHONE) B.S. Yare (694-6370) MCC Environmental Systems F2WJ

DATE : May 4, 1990

SUBJECT : Sector B Sediment and Soil Sampling

REFERENCE : NA

TO : R.A. Kimmerle - U4E

cc: B.M. Hughes - U4E
G.W. Mappes - U1F
W.L. Smull - G4WM
N. Valkenburg - G&M

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Geraghty and Miller may be collecting 180 sediment and soil samples in Sector B of Dead Creek. Up to 36 additional samples may be submitted for QA/QC analyses, e.g. duplicates and trip blanks. Analytical support is needed from ESC to insure accurate and timely characterization of these samples. The following analyses and detection limits are required:

ORGANICS	DETECTION LIMIT
Volatiles	1 ppm
Semi-Volatiles	10 ppm
PCBs	1 ppm
Dioxins	1 ppb
METALS	
Arsenic	1 ppm
Cadmium	1 ppm
Chromium	1 ppm
Copper	1 ppm
Lead	1 ppm
Mercury	1 ppm
Phosphorous	1 ppm
Nickel	1 ppm
Selenium	1 ppm
Thallium	1 ppm
Zinc	1 ppm
CYANIDE	1 ppm
INDICATORS	
Total Ion Chromatograms	10 ppm
Elemental Analysis	
Carbon	%
Total Chlorine	%
Organic Chlorine	%

MCA C156797

The volatile and semivolatile analyses must be capable of detecting the halogenated organic compounds listed in Attachment 1.

Paint filter tests and analyses for ignitability, corrosivity, reactivity and EP toxicity are also required for these samples. If a sample fails the paint filter test, analysis of the filtrate for the following parameters will be required:

PARAMETER	DETECTION LIMIT
Arsenic	500 ppm
Cadmium	100 ppm
Chromium	500 ppm
Lead	500 ppm
Mercury	20 ppm
Nickel	134 ppm
Selenium	100 ppm
Thallium	130 ppm
Cyanide	1000 ppm

The results of this testing should be summarized as shown in Attachment 2. Actual analytical results should be summarized in tabular form and included as an appendix to a report describing methods, procedures and results. All data will be supplied to Geraghty and Miller on diskettes in a compatible spread sheet or data base format for use in removal volume determinations. All lab reports must be included as an appendix to this report.

ESC will need to prepare a Quality Assurance Project Plan detailing the methods and procedures to be used in conducting these analyses. This plan must take current regulatory guidance into consideration. Method development samples may be supplied to ESC by Geraghty and Miller in early May.

Sampling may be done in late May and the analyses must be completed in 30 days. If you have any questions or need additional information, please call.

Bruce S. Yare

Bruce S. Yare

MCA 0156798

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Attachment 1. California List Halogenated Organic Compounds. Sector B Sediment and Soil Sampling Program, Sauget, Illinois

Volatiles
Bromodichloromethane
Bromomethane
Carbon Tetrachloride
Chlorobenzene
2-Chloro-1, 3-butadiene
Chlorodibromethane
Chloroethane
2-Chloroethyl vinyl ether
Chloroform
Chloromethane
3-Chloropropene
1,2-Dibromo-3-chloropropane
1,2-Dibromomethane
Dibromomethane
Trans-1,4-Dichloro-2-butene
Dichlorodifluoromethane
1,1-Dichloroethane
1,2-Dichloroethane
1,1-Dichloroethylene
Trans-1,2-Dichloroethene
1,2-Dichloropropane
Trans-1,3-Dichloropropene
Iodomethane
Methylene chloride
1,1, 1,2-Tetrachloroethane
1,1, 2,2-Tetrachloroethane
Tetrachloroethene
Tribromomethane
1,1,1-Trichloroethane
1,1,2-Trichloroethane
Trichloroethene
Trichloromonoflouromethane
1,2,3-Trichloropropane
Vinyl chloride
cis-1,3-Dichloropropene

Semivolatiles
Bis (2-Chloroethoxy)ethane
Bis (2-Chloroethyl)ether
Bis (2-Chloroisopropyl) ether
p-Chloroaniline
Chlorobenzilate
p-Chloro-m-cresol
2-Chloronaphthalene
2-Chlorophenol
3-Chloropropionitrile
m-Dichlorobenzene
o-Dichlorobenzene
p-Dichlorobenzene
3,3'-Dichlorobenzidine
2,4-Dichlorophenol
2,6-Dichlorophenol
Hexachlorobenzene
Hexachlorobutadiene
Hexachlorocyclopentadiene
Hexachloroethane
Hexachloroprophene
Hexachloropropene
4,4'-Methylenebis
(2-Chloroaniline)
Pentachlorobenzene
Pentachloroethane
Pentachloronitrobenzene
Pentachlorophenol
Pronamide
1,2,4,5-Tetrachlorobenzene
2,3,4,6-Tetrachlorophenol
1,2,4-Trichlorobenzene
2,4,5-Trichlorophenol
2,4,6-Trichlorophenol
Tris (2,3-dibromopropyl) -- phosphate

Organochlorine Pesticides

Aldrin	alpha-BHC
beta-BHC	delta-BHC
gamma-BHC	Chlordane
DDD	DDE
DDT	Dieldrin
Endosulfan I	Endosulfan II
Endrin	Endrin aldehyde
Heptachlor	Heptachlor epoxide
Isodrin	Kepone
Methoxyclor	Toxaphene

Dioxins & Furans
Hexachlorodibenzo-p-dioxins
Hexachlorodibenzofuran
Pentachlorodibenzo-p-dioxins
Pentachlorodibenzofuran
Tetrachlorodibenzo-p-dioxins
Tetrachlorodibenzofuran
2,3,7,8-Tetrachlorodibenzo-p-dioxin

PCBs

Aroclor 1016	Aroclor 1221
Aroclor 1232	Aroclor 1242
Aroclor 1248	Aroclor 1254
Aroclor 1260	

PCBs not otherwise specified

Phenoxyacetic Acid Herbacides
2,4-Dichlorophenoxyacetic acid
Silvex
2,4,5-T

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Attachment 2. California List Decision Matrix.
Sector B Sediment and Soil Sampling Program, Sauget, Illinois

PARAMETER	SAMPLE
Paint Filter Test	Pass/Fail
Filtrate:	
Arsenic	Pass/Fail
Cadmium	Pass/Fail
Chromium	Pass/Fail
Lead	Pass/Fail
Mercury	Pass/Fail
Nickel	Pass/Fail
Selenium	Pass/Fail
Thallium	Pass/Fail
Cyanide(free)	Pass/Fail
Ignitability	Pass/Fail
Corrosivity	Pass/Fail
Reactivity	Pass/Fail
EP Toxicity	Pass/Fail
PCBs	Pass/Fail
HCCs	Pass/Fail

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BEGINNING OF LOOSE DOCUMENT COLLECTION

ATTENTION
(ENVIRONMENTAL INSURANCE
LITIGATION MATERIALS)

DO NOT DESTROY OR REMOVE
WITHOUT SPECIFIC AUTHORIZATION
FROM THE LAW DEPARTMENT. CALL
314-694-6060 OR 314-694-6032 FOR
ADDITIONAL INFORMATION.

PL 1980 EAS-N
(3) - LD - MEASUREMENT OF SELECTED
CHEM. IN SOIL FROM THE
DEAD CREEK SITE ILLINOIS
EPA SPLIT SAMPLES
[1/8" loose docs]
[SECT. 1 of 1]

MCA 0023925

MEASUREMENT OF SELECTED CHEMICALS IN SOIL FROM THE DEAD CREEK SITE ILLINOIS EPA SPLIT SAMPLES

INTRODUCTION

Following media reports and subsequent Illinois EPA concern about hazardous chemicals at the Dead Creek site near Sauget, Illinois, personnel from Monsanto's W. G. Krummrich Plant and the Illinois EPA sampled several areas at the site and split the samples. The Monsanto samples were submittted to Environmental Sciences for characterization. Monsanto's concerns about the site arose from reports of high levels of polychlorinated biphenyls and phosphorus, as well as the reported presence of other chemicals, and the proximity of the site to the Krummrich Plant. These samples were taken to give both Monsanto and the Illinois EPA opportunity to confirm the reported levels found in earlier samplings by the Illinois EPA. In addition to polychlorinated biphenyls and phosphorus, several other "families" of chemicals were measured to try to identify or eliminate possible sources of the chemicals at the site.

SUMMARY

Three sediment samples and one well water sample were taken on October 2, 1980 by Monsanto and IEPA representatives. The Monsanto samples were transferred to our laboratory and analyzed for polychlorinated biphenyls, elemental phosphorus, chlorobenzenes, chlorophenols, phosphate esters, and metals (including arsenic and inorganic phosphorus). No elemental phosphorus was detected in any of the samples, which implies that phosphorus is not responsible for the "smoking earth" reported at the site. In addition, no organic chemicals were detected above the detection limits in the well water sample. However, varying amounts of the organic chemicals and metals were measured in the soil samples. One sample contained higher levels of polychlorinated biphenyls and other organic compounds, while the other two samples contained higher levels of metals. The results clearly indicate non-uniform contamination at the Dead Creek site.

DETAILS

Sampling

The three soil and one water samples were collected by Monsanto W. G. Krummrich plant personnel and IEPA personnel and split at the site. The Monsanto samples were transferred to the Environmental Analysis Group. In our laboratory, the sediment samples were handled according to Standard Operating Procedure (SOP) EAN-80-SOP-6, Homogenizing, Subdividing and Preserving Sediment Samples. Portions of the soil samples were transferred to Applied Sciences for the determination of metals and arsenic.

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Quality Assurance

The quality assurance results (i.e., recovery and precision evaluations) for these samples have been compiled along with those of similar samples analyzed concurrently. These results are reported in Special Study ES-80-SS-27, Measurement of Selected Chemicals in Soil from the Dead Creek Site - Quality Assurance.

REFERENCES

1. Methods for Chemical Analysis of Waters and Wastes, EPA-600/4-79-020, page: Metals-6, Section 4.1.3.

2. Federal Register, Vol. 44, No. 233, December 3, 1979.

3. Methods for Chemical Analysis of Waters and Wastes, EPA-600/4-79-020, Method 206-Arsenic, pages: 206.2-1 to 206.5-2.

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TABLE I. PPM LEVELS OF PCBs AND ELEMENTAL PHOSPHORUS (P_4) IN DEAD CREEK SOIL AND WATER SAMPLES

ANALYTE \ ES LOG NO. / DATE SAMPLED / LOCATION	0100301 10/2/80 40 yds south of Queeny Ave. Center of Creek	0100303 10/2/80 268 paces south of 0100301	0100305 10/2/80 270 paces south of 0100303	(Water) 0100307 10/2/80 Well at Theresa's Greenhouse, 101 Walnut, Sauget, IL.	0041701 4/16/80 Soil Blank Mo. Bottoms St.Charles, MO.
PCB's (Cl_2 to Cl_8 Homologs)	13,000	240	45	ND < 1 ppb	ND < 1
P_4	ND < 1	ND < 1	ND < 1	ND < 1 ppb	ND < 1

TABLE II. PPM LEVELS OF CHLOROBENZENES IN DEAD CREEK SOIL SAMPLES

ANALYTE \ ES LOG NO. / DATE SAMPLED / LOCATION	0100301 10/2/80 40 yds south of Queeny Ave. Center of Creek	0100303 10/2/80 268 paces south of 0100301	0100305 10/2/80 270 paces south of 0100303	0041701 4/16/80 Soil Blank Mo. Bottoms St. Charles, MO.
MONOCHLOROBENZENE	(0.9)	ND < 1	(0.3)	ND < 1
P-DICHLOROBENZENE	370	(0.3)	(0.4)	ND < 1
O-DICHLOROBENZENE	80	(0.6)	1.0	ND < 1
TRICHLOROBENZENES (3)	85	1.6	(0.7)	ND < 1
TETRACHLOROBENZENES (3)	6.1	2.4	(0.4)	ND < 1
PENTACHLOROBENZENE	ND < 1	ND < 1	ND < 1	ND < 1
HEXACHLOROBENZENE	ND < 1	1.2	ND < 1	ND < 1
NITROCHLOROBENZENES (O-, P-)	120	ND < 1	ND < 1	ND < 1

( ) Values in parentheses are below the validated detection limit. However, they represent levels detected with a S/N >2.5 and can be considered semi-quantitative.

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TABLE III. PPM LEVELS OF CHLOROPHENOLS IN DEAD CREEK SOIL SAMPLES

ANALYTE	ES LOG NO. DATE SAMPLED LOCATION	0100301 10/2/80 40 yds south of Queeny Ave. Center of Creek	0100303 10/2/80 268 paces south of 0100301	0100305 10/2/80 270 paces south of 0100303	0041701 4/16/80 Soil Blank Mo. Bottoms St.Charles,MO.
O-CHLOROPHENOL		3.7	ND < 1	ND < 1	ND < 1
P-CHLOROPHENOL		6.6	ND < 1	(0.9)	ND < 1
2,4-DICHLOROPHENOL		1.2	ND < 1	ND < 1	ND < 1
PENTACHLOROPHENOL		130	ND < 1	1.8	ND < 1

( ) Values in parentheses are below the validated detection limit. However, they represent levels detected with a S/N >2.5 and can be considered semi-quantitative.

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TABLE IV. PPM LEVELS OF PHOSPHATE ESTERS IN DEAD CREEK SOIL SAMPLES

ANALYTE \ ES LOG NO. / DATE SAMPLED / LOCATION	0100301 10/2/80 40 yds south of Queeny Ave. Center of Creek	0100303 10/2/80 268 paces south of 0100301	0100305 10/2/80 270 paces south of 0100303	0041701 4/16/80 Soil Blank Mo. Bottoms St. Charles, MO.
DIBUTYLPHENYL PHOSPHATE	330	ND < 1	(0.8)	ND < 1
BUTYLDIPHENYL PHOSPHATE	ND < 1	ND < 1	(0.8)	ND < 1
TRIPHENYL PHOSPHATE	2600	ND < 1	ND < 1	ND < 1
2-ETHYLHEXYLDIPHENYL PHOSPHATE	ND < 1	ND < 1	2.2	ND < 1
ISODECYLDIPHENYL PHOSPHATE	ND < 1	ND < 1	ND < 1	ND < 1
T-BUTYLPHENYLDIPHENYL PHOSPHATE	28	ND < 1	ND < 1	ND < 1
DI-T-BUTYLPHENYLDIPHENYL PHOSPHATE	ND < 1	ND < 1	ND < 1	ND < 1
NONYLPHENYLDIPHENYL PHOSPHATE	ND < 1	ND < 1	ND < 1	ND < 1
CUMYLPHENYLDIPHENYL PHOSPHATE	3.7	ND < 1	ND < 1	ND < 1

( ) Values in parentheses are below the validated detection limit. However, they represent levels detected with a S/N >2.5 and can be considered semi-quantitative.

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TABLE V. PPM LEVELS OF METALS IN DEAD CREEK SOIL SAMPLES

ES LOG NO. DATE SAMPLED LOCATION ANALYTE	0100301 10/2/80 40 yds south of Queeny Ave. Center of Creek	0100303 10/2/80 268 paces south of 0100301	0100305 10/2/80 270 paces south of 0100303	0041701 4/16/80 Soil Blank Mo. Bottoms St.Charles,MO.
SILVER	ND <1	42	29	ND <1
ALUMINUM	1400	5100	5300	5600
BARIUM	770	1200	1300	130
BERYLLIUM	ND <1	ND <1	ND <1	ND <1
BORON	28	160	100	27
CALCIUM	8500	9200	6200	4600
CADMIUM	5.1	60	55	3.9
COBALT	15	180	120	33
CHROMIUM	25	110	240	19
COPPER	460	28,000	18,000	19
IRON	4700	53,000	30,000	9900
MAGNESIUM	460	2200	2000	2300
MANGANESE	29	170	110	510
MOLYBDENUM	6.1	92	68	11
SODIUM	400	540	410	320
NICKEL	110	2000	1700	39
LEAD	180	2000	1600	50
PHOSPHORUS	2500	13,000	9400	610
ANTIMONY	13	240	160	29
SILICON	73	150	89	110
TIN	18	260	220	18
STRONTIUM	35	230	110	17
TITANIUM	32	110	80	37
VANADIUM	34	140	130	130
ZINC	280	32,000	18,000	56
[illegible] (By AA)	210	40	55	5

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MCA C023933

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Submitted by:

Monsanto Industrial Chemicals Company
Environmental Sciences Section - N1E
800 North Lindbergh Boulevard
St. Louis, Missouri 63166

Prepared by:

Robert G. Kaley, II
Research Group Leader

Approved by:

James P. Mieure
Manager, Environmental Sciences

MCA 0023935

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TABLE VI. SUMMARY OF PHOSPHORUS CONTENT (PPM) OF DEAD CREEK SOIL SAMPLES

ANALYTE \ ES LOG NO. / DATE SAMPLED / LOCATION	0100301 10/2/80 40 yds south of Queeny Ave. Center of Creek	0100303 10/2/80 268 paces south of 0100301	0100305 10/2/80 270 paces south of 0100305	0041701 4/16/80 Soil Blank Mo. Bottoms St.Charles,MO.
P - ELEMENTAL, By GC/MS	ND < 1	ND < 1	ND < 1	ND < 1
P-INORGANIC, By ICP	2500	13,000	9400	610
TOTAL PHOSPHATE ESTERS, By GC/MS	3000	ND < 10	4	ND < 10

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MEASUREMENT OF SELECTED CHEMICALS IN SOIL FROM THE DEAD CREEK SITE
W. G. KRUMMRICH PLANT SAMPLINGS

INTRODUCTION

Following media reports and subsequent Illinois EPA concern about the hazardous chemicals at the Dead Creek site near Sauget, Illinois, personnel from Monsanto's W. G. Krummrich Plant sampled several areas at the site. Samples were submitted to Environmental Sciences for characterization. Monsanto's concerns about the site arose from reports of high levels of polychlorinated biphenyls and phosphorus, as well as the reported presence of other chemicals, and the proximity of the site to the Krummrich Plant. These samples were taken to give Monsanto opportunity to confirm the reported levels found in earlier samplings by the Illinois EPA. In addition to polychlorinated biphenyls and phosphorus, several other "families" of chemicals were measured to try to identify or eliminate possible sources of the chemicals at the site.

SUMMARY

Eight sediment samples were taken on August 29 (1), September 15 (2), and September 18 (5), 1980 by Monsanto W. G. Krummrich plant representatives. The samples were transferred to our laboratory for analysis. The samples were analyzed for polychlorinated biphenyls, elemental phosphorus, chlorobenzenes, chlorophenols, phosphate esters, and metals (including arsenic and inorganic phosphorus). No elemental phosphorus was detected in any of the samples, which implies that phosphorus is not responsible for the "smoking earth" reported at the site. Varying amounts of the organic chemicals and metals were measured in the soil samples. The results clearly indicate non-uniform contamination at the Dead Creek site.

DETAILS

Sampling

The eight soil samples were collected by Monsanto W. G. Krummrich plant personnel. The Monsanto samples were transferred to the Environmental Analysis Group. In our laboratory, the sediment samples were handled according to Standard Operating Procedure (SOP) EAN-80-SOP-6, Homogenizing, Subdividing and Preserving Sediment Samples. Portions of the soil samples were transferred to Applied Sciences for the determination of metals and arsenic.

Analytical Procedures

The eight soil samples were analyzed for a variety of chemicals using established procedures or methods developed and validated for the chemicals of interest in soil. The following list tabulates the methods which were used.

Analyte	Method No.	Title
Polychlorinated Biphenyls	ES-80-M-28	Determination of Polychlorinated Biphenyls in Soil and Sediment
Chlorinated Benzenes	ES-80-M-29	Determination of Chlorinated Benzenes in Soil and Sediment
Chlorinated Phenols	ES-80-M-30	Determination of Chlorinated Phenols in Soil and Sediment
Elemental Phosphorus (P_4)	ES-80-M-24	Determination of Elemental Phosphorus (P_4) in Soil and Sediment
Phosphate Esters	ES-80-M-5	Determination of Group I Compounds in Sediments. . .
Metals	Ref. 1, 2	Inductively Coupled Plasma (ICP). . . Method for Trace Element Analysis of Water and Wastes
Arsenic	Ref. 3	Methods for Chemical Analysis of Water and Wastes - Arsenic

All determinations were carried out in strict accordance with these methods, except that the polychlorinated biphenyls, chlorinated benzenes and phosphate esters were measured in extracts from acidified samples to facilitate determination of chlorinated phenols in the same extracts.

Results

The analytical results for this study are tabulated in Tables I-VI. Each table contains the results for all of the samples for a specific group of compounds. All results for the soils are in ppm (parts per million or µg/g). In general, the stated detection limits are the lowest level at which a given measurement was validated. Levels which are apparently real, but which are below the validated detection limit are presented in parentheses.

Quality Assurance

The quality assurance results (i.e., recovery and precision evaluations) for these samples have been compiled along with those of similar samples analyzed concurrently. These results are reported in Special Study ES-80-SS-27, Measurement of Selected Chemicals in Soil from the Dead Creek Site - Quality Assurance.

REFERENCES

1. Methods for Chemical Analysis of Waters and Wastes, EPA-600/4-79-020, page: Metals - 6, Section 4.1.3.

2. Federal Register, Vol. 44, No. 233, December 3, 1979.

3. Methods for Chemical Analysis of Waters and Wastes, EPA-600/4-79-020, Method 206 - Arsenic, pages: 206.2-1 to 206.5-2.

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TABLE I. PPM LEVELS OF PCBs AND ELEMENTAL PHOSPHORUS (P_4) IN DEAD CREEK SOIL SAMPLES

ANALYTE \ ES LOG NO. / DATE SAMPLED / LOCATION	0091541 8/29/80 100' from Judith Ln.	0091542 9/15/80 North Start	0091543 9/15/80 300' from start	0091907 9/18/80 #9	0091908 9/18/80 #10	0091909 9/18/80 #11	0091911 9/18/80 #14	0041701 4/16/80 #15	Soil Blank Mo. Bottoms St.Charles,MO
PCB's (Cl_2 to Cl_6 Homologs)	29	5000	190	4600	150	730	400	280	ND<1
P_4	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1

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TABLE II. PPM LEVELS OF CHLOROBENZENES IN DEAD CREEK SOIL SAMPLES

ANALYTE / ES LOG NO. / DATE SAMPLED / LOCATION	0091541 8/29/80 100' from Judith Ln.	0091542 9/15/80 North Start	0091543 9/15/80 300' from start	0091907 9/18/80 #9	0091908 9/18/80 #10	0091909 9/18/80 #11	0091910 9/18/80 #14	0091911 9/18/80 #15	0041701 4/16/80 Soil Blank Mo. Bottoms St.Charles,MO
MONOCHLOROBENZENE	NA	NA	NA	(0.9)	2.0	(0.2)	ND<1	(0.1)	ND<1
P-DICHLOROBENZENE	NA	NA	NA	34	4.0	3.4	2.5	(0.7)	ND<1
O-DICHLOROBENZENE	NA	NA	NA	14	(0.5)	1.1	2.3	(0.2)	ND<1
TRICHLOROBENZENES (3)	NA	NA	NA	22	2.0	5.3	3.5	1.1	ND<1
TETRACHLOROBENZENES (3)	NA	NA	NA	4.0	(0.5)	2.1	(0.7)	(0.6)	ND<1
PENTACHLOROBENZENE	NA	NA	NA	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1
HEXACHLOROBENZENE	NA	NA	NA	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1
NITROCHLOROBENZENES (O-, P-)	NA	NA	NA	ND<5	ND<1	1.2	ND<1	ND<1	ND<1

NA - Not Analyzed

( ) Values in parentheses are below the validated detection limit. However, they represent levels detected with a S/N >2.5 and can be considered semi-quantitative.

MCA 0023939

TABLE III. PPM LEVELS OF CHLOROPHENOLS IN DEAD CREEK SOIL SAMPLES

ANALYTE	ES LOG NO.	0091541	0091542	0091543	0091907	0091908	0091909	0091910	0091911	0041701
	DATE SAMPLED	8/29/80	9/15/80	9/15/80	9/18/80	9/18/80	9/18/80	9/18/80	9/18/80	4/16/80
	LOCATION	100' from Judith Ln.	North Start	300' from start	#9	#10	#11	#14	#15	Soil Blank Mo. Bottoms St. Charles
O-CHLOROPHENOL		NA	NA	NA	17	ND<1	1.7	ND<1	ND<1	ND<1
P-CHLOROPHENOL		NA	NA	NA	20	ND<1	1.7	1.4	ND<1	ND<1
2,4-DICHLOROPHENOL		NA	NA	NA	4.6	ND<1	ND<1	ND<1	ND<1	ND<1
PENTACHLOROPHENOL		NA	NA	NA	32	ND<1	1.1	ND<1	ND<1	ND<1

NA = Not analyzed

( ) Values in parentheses are below the validated detection limit. However, they represent levels detected with a S/N >2.5 and can be considered semi-quantitative.

MCA 0023940

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TABLE IV. PPM LEVELS OF PHOSPHATE ESTERS IN DEAD CREEK SOIL SAMPLES

ANALYTE \ ES LOG NO. / DATE SAMPLED / LOCATION	0091541 8/29/80 100' from Judith Ln.	0091542 9/15/80 North Start	0091543 9/15/80 300' from start	0091907 9/18/80 #9	0091908 9/18/80 #10	0091909 9/18/80 #11	0091910 9/18/80 #14	0091911 9/18/80 #15	0041701 4/16/80 Soil Blank Mo. Bottoms St.Charles,MO.
DIBUTYLPHENYL PHOSPHATE	ND<1	ND<100	ND<10	60	ND<1	ND<1	1.0	ND<1	ND<1
BUTYLDIPHENYL PHOSPHATE	NA	NA	NA	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1
TRIPHENYL PHOSPHATE	(0.3)	150	18	200	3.0	ND<1	ND<1	ND<1	ND<1
2-ETHYLHEXYLDIPHENYL PHOSPHATE	3.5	17	11	ND<1	ND<1	1.0	(0.5)	ND<1	ND<1
ISODECYLDIPHENYL PHOSPHATE	ND<1	ND<100	ND<10	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1
T-BUTYLPHENYLDIPHENYL PHOSPHATE	ND<1	ND<100	ND<10	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1
DI-T-BUTYLPHENYLPHENYL PHOSPHATE	NA	NA	NA	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1
NONYLPHENYLDIPHENYL PHOSPHATE	ND<2	ND<200	ND<20	ND<1	1.0	ND<1	ND<1	ND<1	ND<1
CUMYLPHENYLDIPHENYL PHOSPHATE	ND<1	ND<100	ND<10	2.6	2.4	2.4	2.2	2.6	ND<1

NA - Not analyzed

( ) Values in parentheses are below the validated detection limit. However, they represent levels detected with a S/N >2.5 and can be considered semi-quantitative.

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TABLE V. [illegible] LEVELS OF METALS IN DEAD CREEK SOIL SAMPLES

ANALYTE	ES LOG NO. / DATE SAMPLED / LOCATION	0091541 8/29/80 100' from Judith Ln.	0091542 9/15/80 North Start	0091543 9/15/30 300' from start	0091907 9/18/80 #9	0091908 9/18/80 #10	0091909 9/18/80 #11	0091910 9/18/80 #14	0091911 9/18/80 #15	0041701 4/16/80 Soil Blank Mo. Bottoms St.Charles,MO.
SILVER		17	ND<1	3.3	ND<1	20	20	19	4.2	ND<1
ALUMINUM		2300	720	720	2700	2400	3100	3600	3900	5600
BARIUM		210	2000	640	2400	230	940	1000	1100	120
BERYLLIUM		ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1
BORON		68	13	21	36	100	78	76	72	27
CALCIUM		2500	2700	2200	13,000	14,000	6200	9200	5600	4600
CADMIUM		60	5.9	17	5.1	40	42	45	53	3.9
COBALT		67	8.2	13	30	120	85	89	81	33
CHROMIUM		44	19	61	29	88	110	130	51	19
COPPER		25,000	2700	16,000	590	8900	13,000	12,000	14,000	19
IRON		24,000	2000	2600	8700	31,000	28,000	28,000	28,000	9900
MAGNESIUM		1000	400	310	1300	1700	1700	2400	2100	2300
MANGANESE		45	15	9.3	60	210	91	140	90	510
MOLYBDENUM		63	9.5	38	11	54	39	38	47	11
SODIUM		350	690	710	420	510	400	440	360	320
NICKEL		950	140	260	120	1100	900	1100	1400	39
LEAD		1000	390	1400	150	1200	1000	1100	1500	50
PHOSPHORUS		4400	770	2400	1900	7400	7000	6500	6700	610
ANTIMONY		130	23	54	22	160	93	88	120	29
SILICON		210	320	270	94	83	91	63	95	110
TIN		76	27	71	19	71	78	91	62	18
STRONTIUM		64	35	42	24	130	120	110	81	17
TITANIUM		49	60	94	36	56	50	47	51	37
VANADIUM		46	13	14	67	120	92	100	110	130
ZINC		20,000	1400	5900	380	19,000	11,000	10,000	18,000	56
ARSENIC (By AA)		NA	NA	NA	180	50	90	50	30	5

NA - Not analyzed

MCA 0023942

TABLE VI. SUMMARY OF PHOSPHORUS CONTENT (PPM) OF DEAD CREEK SOIL SAMPLES

ANALYTE	ES LOG NO. DATE SAMPLED LOCATION	0091541 8/29/80 100' from Judith Ln.	0091542 9/15/80 North Start	0091543 9/15/80 300' from start	0091907 9/18/80 #9	0091908 9/18/80 #10	0091909 9/18/80 #11	0091910 9/18/80 #14	0091911 9/18/80 #15	0041701 4/16/80 Soil Blank Mo. Bottoms St.Charles,MO
P - ELEMENTAL, By GC/MS		ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1
P-INORGANIC, By ICP		4400	770	2400	1900	7400	7000	6500	6700	610
TOTAL PHOSPHATE ESTERS, By GC/MS		4	170	29	260	6.4	3.4	3.7	2.6	ND<10

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Submitted by:

Monsanto Industrial Chemicals Company
Environmental Sciences Section - NIE
800 North Lindbergh Boulevard
St. Louis, Missouri 63166

Prepared by:

Robert G. Kaley, II
Research Group Leader

Approved by:

James P. Mieure
Manager, Environmental Sciences

MEASUREMENT OF SELECTED CHEMICALS IN SOIL FROM THE DEAD CREEK SITE - QUALITY ASSURANCE

INTRODUCTION

Following media reports and subsequent Illinois EPA concern about hazardous chemicals at the Dead Creek site near Sauget, Illinois, personnel from Monsanto's W. G. Krummrich Plant sampled several areas at the site. Samples were submitted to Environmental Sciences for analyses for polychlorinated biphenyls, elemental phosphorus, chlorinated benzenes, chlorinated phenols, phosphate esters, and metals. During the various determinations, replicates and spiked samples were analyzed to evaluate the performance of the method used for these particular samples.

SUMMARY

This report summarizes the quality assurance results obtained for various samples analyzed during the course of this project. The accuracy (recovery from spiked samples) and precision (relative standard deviation of replicate determinations) results are tabulated herein. Although it would be difficult to summarize the overall performance of the methods for all the analytes, in general, the methods performed at the recovery and precision levels established during method validation.

DETAILS

Analytical Methods

The soil samples were analyzed for the various chemicals using established procedures or methods developed and validated for the chemicals of interest in soil. The following list tabulates the methods which were used.

Analyte	Method No.	Title
Polychlorinated Biphenyls	ES-80-M-28	Determination of Polychlorinated Biphenyls in Soil and Sediment
Chlorinated Benzenes	ES-80-M-29	Determination of Chlorinated Benzenes in Soil and Sediment
Chlorinated Phenols	ES-80-M-30	Determination of Chlorinated Phenols in Soil and Sediment
Elemental Phosphorus (P_4)	ES-80-M-24	Determination of Elemental Phosphorus (P_4) in Soil and Sediment
Phosphate Esters	ES-80-M-5	Determination of Group I Compounds in Sediments . . .
Metals	Ref. 1, 2	Inductively Coupled Plasma (ICP) . . . Method for Trace Element Analysis of Water and Wastes
Arsenic	Ref. 3	Methods for Chemical Analysis of Water and Wastes - Arsenic

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All determinations were carried out in strict accordance with these methods, except that the polychlorinated biphenyls, chlorinated benzenes and phosphate esters were measured in extracts from acidified samples to facilitate determination of chlorinated phenols in the same extracts.

Results

The results for the determinations of the compounds of interest have been reported in Special Studies ES-80-SS-24, 25, and 26, Measurement of Selected Chemicals in Soil from the Dead Creek Site . . . This Special Study is a compilation of the quality assurance results for all three Special Studies.

Quality Assurance

The recovery and precision results for the determinations are tabulated in Tables I-V. Each table contains the results for all quality assurance samples for a specific group of compounds. Recovery results are reported as percent recovery, calculated as

$$\% \text{ Recovery} = \frac{\text{Concentration (sample + spike)} - \text{average concentration (sample)}}{\text{Concentration (spike added)}} \times 100$$

Precision results are reported as percent relative standard deviation (RSD) for replicate determinations.

The tables present the recovery and precision results in concentration ranges (1-10 ppm to 10,000 - 100,000 ppm). The entries are averages of all values for all samples which had either recovery or precision evaluated in that range. All values are for actual samples except the metals recovery results, which are for spiked blank soil. In the recovery column, NE means Not Evaluated, i.e., no samples were spiked in that concentration range, and ND means Not Determinable, i.e., the spiking level was too low (usually <50%) compared to the level actually in the sample. In the precision columns, NE means Not Evaluated, i.e., no replicates were analyzed which contained the analyte in that concentration range.

More detailed compilations of the accuracy and precision results can be found in Reference 4.

REFERENCES

1. Methods for Chemical Analysis of Waters and Wastes, EPA-600/4-79-020, page: Metals - 6, Section 4.1.3.

2. Federal Register, Vol. 44, No. 233, December 3, 1979.

3. Methods for Chemical Analysis of Water and Wastes, EPA-600/4-79-020, Method 206 - Arsenic, pages: 206.2-1 to 206.5-2.

4. RGK NBP 1914831

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RECOVERY AND PRECISION

TABLE 1. PCBs AND ELEMENTAL PHOSPHORUS (P_4) IN DEAD CREEK SOIL SAMPLES

ANALYTE \ LEVEL	1-10 ppm		10-100 ppm		100-1,000 ppm		1,000-10,000 ppm		10,000-100,000 ppm	
	% Rec	% RSD	% Rec	%RSD	% Rec	%RSD	% Rec	%RSD	%Rec	% RSD
PCB's (Cl_2 to Cl_6 Homologs)	ND	NE	70%	17%	120%	18%	77%	58%	NE	0%
P_4	56%	NE	NE	NE	NE	NE	NE	NE	NE	NE

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RECOVERY AND PRECISION

TABLE II. CHLOROBENZENES IN DEAD CREEK SOIL SAMPLES

ANALYTE \ LEVEL	1-10 ppm % Rec	1-10 ppm % RSD	10-100 ppm % Rec	10-100 ppm % RSD	100-1,000 ppm % Rec	100-1,000 ppm % RSD
MONOCHLOROBENZENE	105%	NE	110%	NE	100%	NE
P-DICHLOROBENZENE	120%	21%	125%	64%	120%	NE
O-DICHLOROBENZENE	125%	16%	120%	NE	120%	8%
TRICHLOROBENZENES (3)	96%	14%	110%	13%	120%	NE
TETRACHLOROBENZENES (3)	110%	9%	120%	NE	130%	NE
PENTACHLOROBENZENE	140%	12%	120%	NE	140%	NE
HEXACHLOROBENZENE	135%	13%	90%	NE	110%	NE
NITROCHLOROBENZENES (O-,P-)	125%	37%	120%	NE	120%	26%

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RECOVERY AND PRECISION

TABLE III. CHLOROPHENOLS IN DEAD CREEK SOIL SAMPLES

ANALYTE \ LEVEL	1-10 ppm % Rec	1-10 ppm % RSD	10-100 ppm % Rec	10-100 ppm % RSD	100-1,000 ppm % Rec	100-1,000 ppm % RSD
O-CHLOROPHENOL	19%	34%	64%	NE	58%	NE
P-CHLOROPHENOL	36%	26%	16%	NE	30%	NE
2,4-DICHLOROPHENOL	66%	47%	59%	NE	50%	NE
PENTACHLOROPHENOL	140%	46%	40%	NE	36%	20%

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RECOVERY AND PRECISION

TABLE IV. PHOSPHATE ESTERS IN DEAD CREEK SOIL SAMPLES

ANALYTE \ LEVEL	1-10 ppm % Rec	1-10 ppm % RSD	10-100 ppm % Rec	10-100 ppm % RSD	100-1,000 ppm % Rec	100-1,000 ppm % RSD	1,000-10,000 % Rec	1,000-10,000 % RSD
DIBUTYLPHENYL PHOSPHATE	75%	NE	130%	NE	120%	12%	NE	NE
BUTYLDIPHENYL PHOSPHATE	120%	42%	115%	NE	NE	NE	NE	NE
TRIPHENYL PHOSPHATE	120%	89%	120%	NE	115%	NE	NE	6%
2-ETHYLHEXYLDIPHENYL PHOSPHATE	90%	47%	110%	NE	115%	NE	NE	NE
ISODECYLDIPHENYL PHOSPHATE	NE	NE	NE	NE	NE	NE	NE	NE
T-BUTYLPHENYLDIPHENYL PHOSPHATE	70%	NE	92%	100%	100%	NE	NE	NE
DI-T-BUTYLPHENYLPHENYL PHOSPHATE	88%	NE	96%	NE	NE	NE	NE	NE
NONYLPHENYLDIPHENYL PHOSPHATE	84%	8%	76%	NE	96%	NE	NE	NE
CUMYLPHENYLDIPHENYL PHOSPHATE	62%	21%	76%	NE	88%	NE	NE	NE

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RECOVERY AND PRECISION

TABLE V. METALS IN DEAD CREEK SOIL SAMPLES

ANALYTE \ LEVEL	1-10 ppm % Rec	1-10 ppm % RSD	1-100 ppm % Rec	1-100 ppm % RSD	100-1,000 ppm % Rec	100-1,000 ppm % RSD	1000-10,000 ppm % Rec	1000-10,000 ppm % RSD	10,000-100,000 ppm % Rec	10,000-100,000 ppm % RSD
SILVER	NE	NE	NE	46%	NE	NE	NE	NE	NE	NE
ALUMINUM	ND	NE	ND	NE	ND	NE	NE	6.5%	NE	NE
BARIUM	ND	NE	ND	NE	89%	37%	NE	0%	NE	NE
BERYLLIUM	98%	NE	98%	NE	94%	NE	NE	NE	NE	NE
BORON	0%	NE	65%	19%	81%	3%	NE	NE	NE	NE
CALCIUM	ND	NE	ND	NE	ND	NE	NE	8.3%	NE	7.5%
CADMIUM	89%	5.2%	97%	21%	96%	NE	NE	NE	NE	NE
COBALT	51%	NE	115%	6.5%	97%	5.1%	NE	NE	NE	NE
CHROMIUM	27%	NE	109%	20%	91%	6.4%	NE	NE	NE	NE
COPPER	0%	NE	143%	66%	90%	NE	NE	NE	NE	11%
IRON	ND	NE	ND	NE	ND	NE	NE	NE	NE	8.1%
MAGNESIUM	ND	NE	ND	NE	ND	NE	NE	7.8%	NE	NE
MANGANESE	ND	NE	ND	13%	ND	10%	NE	NE	NE	NE
MOLYBDENUM	53%	NE	83%	11%	83%	NE	NE	NE	NE	NE
SODIUM	ND	NE	ND	NE	ND	11%	NE	NE	NE	NE
NICKEL	0%	NE	108%	14%	91%	13%	NE	4.5%	NE	NE
LEAD	0%	NE	165%	21%	93%	NE	NE	6.5%	NE	NE
PHOSPHORUS	ND	NE	ND	NE	ND	10%	NE	17%	NE	7.9%
ANTIMONY	0%	NE	27%	2.9%	27%	13%	NE	NE	NE	NE
SILICON	ND	NE	ND	NE	0%	49%	NE	NE	NE	NE
TIN	88%	NE	85%	5.6%	96%	5.4%	NE	NE	NE	NE
STRONTIUM	81%	NE	105%	3.3%	94%	6.5%	NE	NE	NE	NE
TITANIUM	ND	NE	99%	30%	30%	1.3%	NE	NE	NE	NE
VANADIUM	ND	NE	ND	13%	120%	11%	NE	NE	NE	NE
ZINC	ND	NE	139%	34%	87%	NE	NE	8.9%	NE	16%
ARSENIC (By AA)	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE

Protected Material: Monsanto Insurance Coverage Litigation

Submitted by:

Monsanto Industrial Chemicals Company
Environmental Sciences Section - NIE
800 North Lindbergh Boulevard
St. Louis, Missouri 63166

Prepared by:

Robert G. Kaley, II
Research Group Leader

Approved by:

James P. Mieure
Manager, Environmental Sciences

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END

OF LOOSE

DOCUMENT

COLLECTION

MCA 0023953

GERAGHTY & MILLER, INC.
Environmental Services

Ground Water Engineering Hydrocarbon Remediation Education

47

September 19, 1990

Post-it™ brand fax transmittal memo 7671 | # of pages ▸ 10

To B.S. Kerr	From W.L. Smull
Co. Monsanto	Co. Monsanto
Dept. E2WJ	Phone #
Fax # 314 694 6138	Fax #

VIA TELECOPIER

Mr. Warren Smull
Monsanto Company
800 N. Lindbergh Boulevard - G4WM
St. Louis, MO 6317

Re: Proposal for a Soil Boring Program at Sauget Sites-Area I Site G, Dead Creek - Sector B and Site M, Sauget,Illinois (Project No. 50212NY).

Dear Warren:

As requested, Geraghty & Miller, Inc. is providing this proposal for an investigation in Sauget Sites Area I Site G, Dead Creek - Sector B, and Site M in Sauget, Illinois (see Figure 1). The purpose of the study is to physically and chemically characterize soil conditions and provide a rough estimate of the volume of material that may be affected by hazardous organic compounds and metals. The data generated from the study will be used to determine the feasibility of excavating and landfilling the material offsite.

To assess the feasibility of removal, it will be necessary to classify the waste prior to disposal. Since these sites are not on Monsanto property, it is unlikely that the IEPA or USEPA would consider the soil/sediment at these sites as RCRA listed wastes; (for RCRA "land ban" purposes they will probably be regarded as "soil and debris.") Therefore, it is necessary to determine whether the soil/sediment is hazardous because of its characteristics and whether stabilization will be required prior to disposal. According to Chemical Waste Management's Northeast Regional Customer Service Manager (Ty Harder, personal communication, September 18, 1990), this is accomplished through the analysis of soil samples for reactivity, PCBs, and the list of constituents which are analyzed by the Toxicity Characteristic Leaching Procedure (TCLP) shown on Table 1. The results from these analyses will be used to determine whether the soil/sediment is a hazardous waste and whether it needs to be treated prior to disposal.

MCA 156779

125 East Bethpage Road • Plainview, New York 11803 • (516) 249-7600 • FAX (516) 249-7610

SCOPE OF WORK

Site G

Site G is approximately 4.5 acres in site and has been used for disposal in the past. Scrap metal is present on the surface, along with demolition debris and scattered, corroded drums, some of which protrude from the surface. Two small pits contain oil and tar-like materials. In some areas, it appears that fly ash and cinders were used as cover material. A chain link fence surrounds the site to prevent direct contact with surface material. In 1987, E&E drilled 11 soil borings and converted six of them into shallow monitoring wells as part of its field activities. In addition, E&E performed a soil-gas study, collected surficial soil samples, and conducted a magnetometer survey and an EM conductivity survey. The results of these studies indicate that buried ferromagnetic material is present at this site and both surficial soil and subsurface soil has been impacted from past site activities. We propose the following investigation to determine if the soil at Site G can be disposed in an offsite landfill.

Previous soil sampling programs conducted by E&E in 1987 consisted of composite sampling over zones of 5 to 20 feet thick which were not consistent from boring to boring. Some of the samples included both saturated and unsaturated soil in the same composite sample. The existing data are not sufficient to determine the extent of the impact soil, nor will it satisfy the requirements for RCRA characteristic waste determination. Therefore, we propose to collect three soil samples from each of five soil borings and analyze them for the required parameters previously described. The soil samples at each location will be collected at two-foot intervals (0 to 2, 2 to 4, and 4 to 6 feet below grade) for a total of 15 samples. The samples will be collected using hand-auger equipment. All samples will be described by a Geraghty & Miller field geologist who will record sample location, depth, grain size distribution, and color. Each sample will also be screened in the field for the presence of volatile organic compounds (VOCs) using a photoionization detection instrument as part of our health and safety protocols. Each borehole will be sealed with a cement/bentonite grout and the borehole's location will be measured from a permanent landmark. These data will provide sufficient information to determine whether the soil will require pretreatment and it will also be used to provide a rough estimate of the volume of soil that may have been impacted.

Dead Creek - Sector B

Dead Creek - Sector B is located between Queeny Avenue and Judith Lane. The culverts at both ends for Sector B have been sealed to preclude inflow or outflow from this area. The banks of the creek are heavily vegetated and debris is visible in the area. The site is enclosed within a chain-line fence. In general, the creek area consists of a narrow channel about 5 feet wide which is flanked by a low bank on either side. The channel and low banks are enclosed by steep banks on either side of the creek. Precipitation that collects in the creek recharges the ground water below.

In 1987, E&E collected two surface water samples and five sediment samples from Sector B, however, the sampling locations were restricted to the north and south ends of the study area. The data from these sampling points indicates that past uses of the creek have impacted the site. Specifically, heavy metals and PCBs were evident in the sampling results. We propose the following investigation to determine if the soil/sediment from the creek will require pretreatment prior to disposal in an offsite landfill.

The existing data are not sufficient to determine the extent of the impacted soil, nor will it satisfy the requirements for a characteristic waste determination. Therefore, we propose to collected soil samples at ten locations within the creek bed, spaced approximately 200 feet apart, throughout the 2,000-foot length of Sector B for analysis of the required parameters previously described. The samples will also be collected at 2-foot intervals to 6 feet in depth (30 samples) as was described for Site G. The samples will be described, checked for VOCs in the field, and the boreholes will be sealed as previously discussed. These data will be used to evaluate offsite disposal options as well as provide a rough estimate of the volume of soil that may have been impacted.

It may be necessary to pump off standing water in the Creek in some areas to provide suitable sampling conditions. Assuming that the water can be pumped to a sewer and an access point is relatively near, direct pumping is recommended. Alternatively, if a direct discharge is not possible, we could start the boring program and work up to the area where the standing water is located, then transfer the water into the area of the Creek where the boring program has been completed.

Site M

Site M is a former sand and gravel pit excavated between 1945 and 1950. The pit is approximately 275 feet by 300 feet and is filled with water. E&E estimated the pit's depth to be 40 feet. Site M is connected to Sector B of Dead Creek at the southwest corner of the site, however, it is not known whether Site M is open to the water table. Other than miscellaneous trash, no other waste disposal was evident in the pit at the time of the E&E study. Access to the site is controlled by a chain-link fence. In 1987, E&E collected surface water samples and sediment samples from the pit, and soil-gas samples were collected from the pit's banks. The data from these sampling points indicates that past site activities may have impacted the area.

E&E previously collected two surface water samples and five sediment samples from Site M, although it is not clear where the sediment samples were collected. It appears the sediment samples were collected from the sides of the pit, based on their location map. These data indicate some impact from previous site use may have occurred. The existing data are not sufficient to determine the extent of the impacted soil, nor will it satisfy the requirements for a characteristic waste determination. Therefore, we propose to collect three sediment samples for analysis of the parameters previously described from three separate locations to obtain data on surficial sediment. However, this procedure will not provide a vertical profile of constituents that may be in the sediment. If remedial action is required for the sediment at Site M, a dredging operation may be necessary due to the depth of the pit, the volume of water in the pit, and the uncertainty as to whether the pit was excavated into the water table.

Prior to the start of the field investigation, Geraghty & Miller will develop the necessary work plans including a Quality Assurance Project Plan (QAPP), Field Sampling Plan (FSP), and Health and Safety Plan (HASP). It should be possible to prepare these documents within three weeks after receiving authorization to proceed.

Estimated costs for the project are attached and include preparing the work plans, completing the field investigation, and preparing a report detailing the soil boring and analytical program. The estimates assume that the work can be completed in level C protective equipment ~~and we will not be required to hire union personnel~~. We have also

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assumed that the field geologists will be supplied by our St. Louis office to minimize travel and expense costs.

If you have any questions or require additional information, please do not hesitate to call me at (516) 391-5234.

Sincerely,

GERAGHTY & MILLER, INC.

Dennis Colton
Project Manager

Nicholas Valkenburg
Project Officer

DC/NV:rr
smul0212.ltr

COST ESTIMATE

Sauget Sites G, M, and
Dead Creek - Sector B
Sauget, Illinois

TASK 1: DEVELOPMENT OF QAPP, FSP, AND HASP

Geraghty & Miller, Inc. Fees	
Senior Project Advisor 8 hours at $115 per hour	$ 920
Senior Scientist I 40 hours at $83 per hour	3,330
Staff Scientist I 40 hours at $65 per hour	2,600
Administration Support/Clerical 24 hours at $30 per hour	720
Technical Editor 8 hours at $49 per hour	392
Draftsperson 8 hours at $39 per hour	312
Geraghty & Miller, Inc. Expenses	
(reproduction, telephone, facsimile)	500
Task 1 Estimate:	$8,764

MCA 0156784

TASK 2: FIELD INVESTIGATION AND PROJECT MANAGEMENT

Geraghty & Miller, Inc. Fees

Senior Project Advisor 16 hours at $115 per hour	$ 1,840
Senior Scientist I 24 hours at $83 per hour	1,992
Scientist III (two people) 40 hours at $59 per hour 40 hours at $59 per hour	 2,360 2,360

Geraghty & Miller, Inc. Expenses

Airfare - 1 round trip at $750 per trip	750
Ground Transportation - 1 round trip at $80 per trip	80
Hotel - 1 day at $65 per day	65
Meals - 1 day at $35 per day - 6 days at $5 per day	35 30
Car Rental - 1 day $65 per day Mileage (Personal Car) - 150 miles	65 45
Supplies: - Miscellaneous (shipping, telephone, facsimile, safety gear, field supplies)	$ 1,000
Subtotal:	$10,622

Laboratory Fees

- 48 soil/sediment samples and 2 matrix spikes for reactivity, PCBs, and the TCLP at $1400/sample	$70,000
- laboratory preparation and shipping	1,000
- 5 percent service charge	3,550
Subtotal:	$74,550
Task 2 Estimate:	$85,172

MCA 0156785

TASK 3: REPORT PREPARATION

Geraghty & Miller, Inc. Fees

Senior Project Advisor 16 hours at $115 per hour	$ 1,840
Senior Scientist I 40 hours at $83 per hour	3,320
Scientist III 24 hours at $59 per hour	1,416
Draftsman 16 hours at $48 per hour	768
Technical Editor 8 hours at $48 per hour	392
Technician 16 hours at $38 per hour	608
Administrative Support/Clerical 30 hours at $30 per hour	900
Expenses (reproduction, telephone, facsimile)	1,000
Task 3 Estimate:	$ 10,244
Total Cost:	$105,000 (Rounded)

MCA 0156786

Table 1. Federal Toxicity Characteristic Constituents and Regulatory Levels

METALS

CONSTITUENT	REGULATORY LIMIT* (mg/L)
Arsenic	5.0
Barium	100.0
Cadmium	1.0
Chromium	5.0
Lead	5.0
Mercury	0.2
Selenium	1.0
Silver	5.0

VOLATILE ORGANICS

CONSTITUENT	REGULATORY LIMIT* (mg/L)
Benzene	0.5
Carbon tetrachloride	0.5
Chlorobenzene	100.0
Chloroform	6.0
1,4-Dichlorobenzene	7.5
1,2-Dichloroethane	0.5
1,1-Dichloroethylene	0.7
Methyl ethyl ketone	200.0
Tetrachloroethylene	0.7
Trichloroethylene	0.5
Vinyl chloride	0.2

*Federal Register, March 29, 1990

MCA C156787

Table 1. Federal Toxicity Characteristic Constituents and Regulatory Levels

SEMIVOLATILES

CONSTITUENT	REGULATORY LIMIT* (mg/L)
o-Cresol	200.0
m-Cresol	200.0
p-Cresol	200.0
Cresol (total)	200.0
2,4-Dinitrotoluene	0.13
Hexachlorobenzene	0.13
Hexachloro-1,3-butadiene	0.5
Hexachloroethane	3.0
Nitrobenzene	2.0
Pentachlorophenol	100.0
Pyridine	5.0
2,4,5-Trichlorophenol	400.0
2,4,6-Trichlorophenol	2.0

PESTICIDES/HERBICIDES

CONSTITUENT	REGULATORY LIMIT* (mg/L)
Chlordane	0.03
2,4-D	10.0
Endrin	0.02
Heptachor (and its hydroxide)	0.008
Lindane	0.4
Methoxychlor	10.0
Toxaphene	0.5
2,4,5-TP (Silvex)	1.0

*Federal Register, March 29, 1990

GERAGHTY & MILLER, INC.
Environmental Services

125 East Bethpage Road
Plainview, New York 11803
(516) 249-7600
FAX: (516) 249-7610

Telecopier # 516-249-0033

Date: 9/20/90

Time Sent: 8:55 Am

Post-It™ brand fax transmittal memo 7671 | # of pages ▸ 2 | er No.: 617/932-9589

To B.E. Kane	From W.L. Saul
Co. Monsanto	Co. Monsanto
Dept. F2WJ	Phone #
Fax # 314 694 6138	Fax #

ing Item(s):

Figure 1 Soy Bend Creek Proposal was omitted. Sorry for the inconvenience

Total No. of Pages: 2 (including this page)

Please call _____ at 516-249-7600, Ext. ____, to verify you have received this document.

Or Direct Dial: 516-391-5236

G&M Project No.: 50212NY (Proposal - office & overhead)

cc: Karen Appel

MCA 0156789

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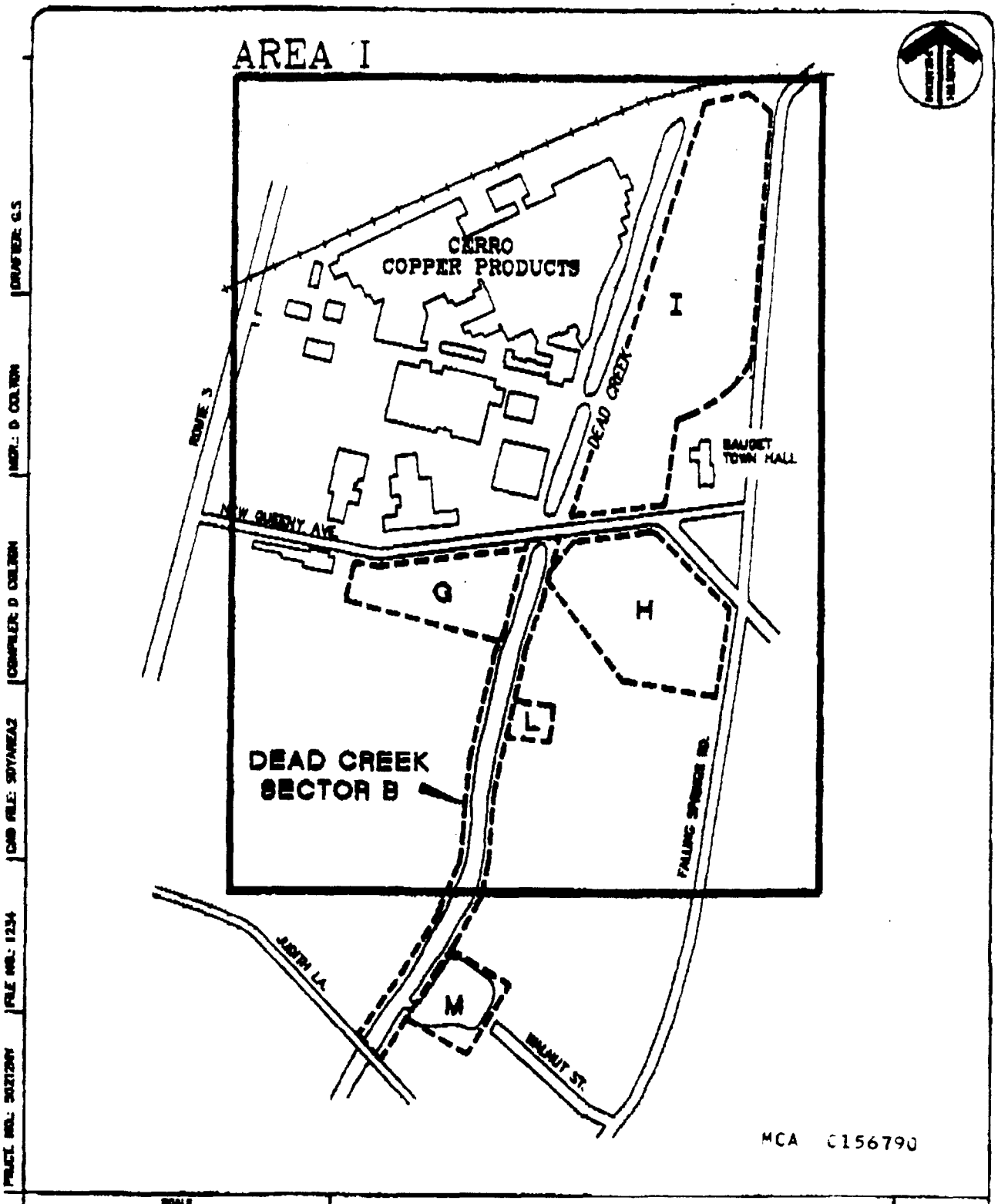

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GERAGHTY & MILLER, INC.
Environmental Services

LOCATION OF STUDY AREAS,
SAUGET SITES, AREA I
SAUGET, ILLINOIS

FIGURE
1

GERAGHTY & MILLER, INC.
Environmental Services

DRAFT

125 East Bethpage Road
Plainview New York 11803
(516) 249-7600
FAX (516) 249-7610

47

February 12, 1990

VIA TELECOPIER

Mr. Warren Smull
Monsanto Company
800 N. Lindbergh Blvd.
Mail Code G4WM
St. Louis, MO 63167

Re: Proposal for a Soil Boring Program at Dead Creek, Sector B, Sauget, Illinois (50212NY).

Dear Mr. Smull:

As requested, Geraghty & Miller, Inc. is providing this proposal for an investigation in "Sector B" of Dead Creek. The purpose of the study is to physically and chemically characterize soil conditions and estimate the volume of material above the water table that may be affected by hazardous organic compounds and metals. The data generated from the study will be used to determine the feasibility of excavating the material and disposing of it offsite.

To assess the feasibility of removal, it will be necessary to determine if the material can be disposed offsite in accordance with the USEPA's "land ban" requirements. Physical testing, to determine whether the material is a liquid or solid, and chemical analyses to determine the concentrations of specific compounds are required.

In general, the Creek area consists of a narrow channel about 5 feet wide which is flanked by a low bank on either side (see Figure 1). The channel and low banks are enclosed by steep banks on either side of the Creek. Because water is likely to have occupied the area nearest the channel most of the time, the majority of the proposed borings will be drilled near

the channel in the pattern shown on Figures 1 and 2. Our field investigation will consist of drilling approximately 60 boreholes and collecting and analyzing of about 180 soil samples. Approximately 20 soil borings will be drilled in the center of the bed itself with the remainder drilled 5 to 20 feet from the channel. Additional boreholes may be drilled if field conditions indicate that additional data is required in a particular area.

Our initial field reconnaissance of the site indicates that the material in the Creek is soil which can be cored. Soil samples will be collected continuously with a split barrel core at each location to the water table which is at approximately 7 feet below grade. All soil samples will be described by a Geraghty & Miller field geologist record sample location, depth, grain size distribution, and color. In addition, each sample will be screened for the presence of volatile organic compounds using a photoionization detection instrument as part of our health and safety protocols.

Although the material in the Creek appears to be "solid", approximately 20 samples chosen by the field geologist will be subjected to the point filter liquids test (USEPA Method 9095) either in the field or laboratory to document that the material is not a liquid. Three core samples from each boring, collected from 0 - 2, 2 to 4 and 4 to 6 feet below grade will be collected for analysis of the "California List" of compounds by the appropriate USEPA method to determine the areal and vertical distribution of chemicals. In addition, approximately 20 samples will be analyzed for reactivity, corrosivity, flammability and EP Toxicity to determine if the material is hazardous according to the RCRA definition. Upon completion of the drilling, each borehole will be sealed will a cement/bentonite grout and the final borehole locations will be surveyed relative to a permanent landmark.

Prior to the start of the field investigation, Geraghty & Miller will develop the necessary work plans including a Quality Assurance Project Plan (QAPP), Field Sampling Plan

(FSP), and Health and Safety Plan (HASP). It should be possible to prepare these documents within 3 weeks after receiving authorization to proceed.

Table 1 provides a cost estimate for preparing the work plans, completing the field investigation and preparing a report detailing the soil boring and analytical program. The estimates in Table 1 assume that the site is accessible to an all terrain vehicle, the work can be done in level C protective equipment and we are not required to hire union personnel. We have also assumed that the field geologist would be supplied by our St. Louis office to minimize travel and expense costs and that Monsanto's ESC would analyze the soil samples.

It will probably be necessary to pump off standing water in the Creek in some areas but we have not had an opportunity to determine costs for this task. Assuming that the water can be pumped to the sewer, and an access point is relatively near, direct pumping is recommended. Alternatively, if a direct discharge is not possible, we could start the boring program and work up to the area where the standing water is located, then transfer the water into the area of the Creek where the boring program has been completed.

If you have any questions or require additional information, please do not hesitate to call.

Respectfully submitted,

GERAGHTY & MILLER, INC.

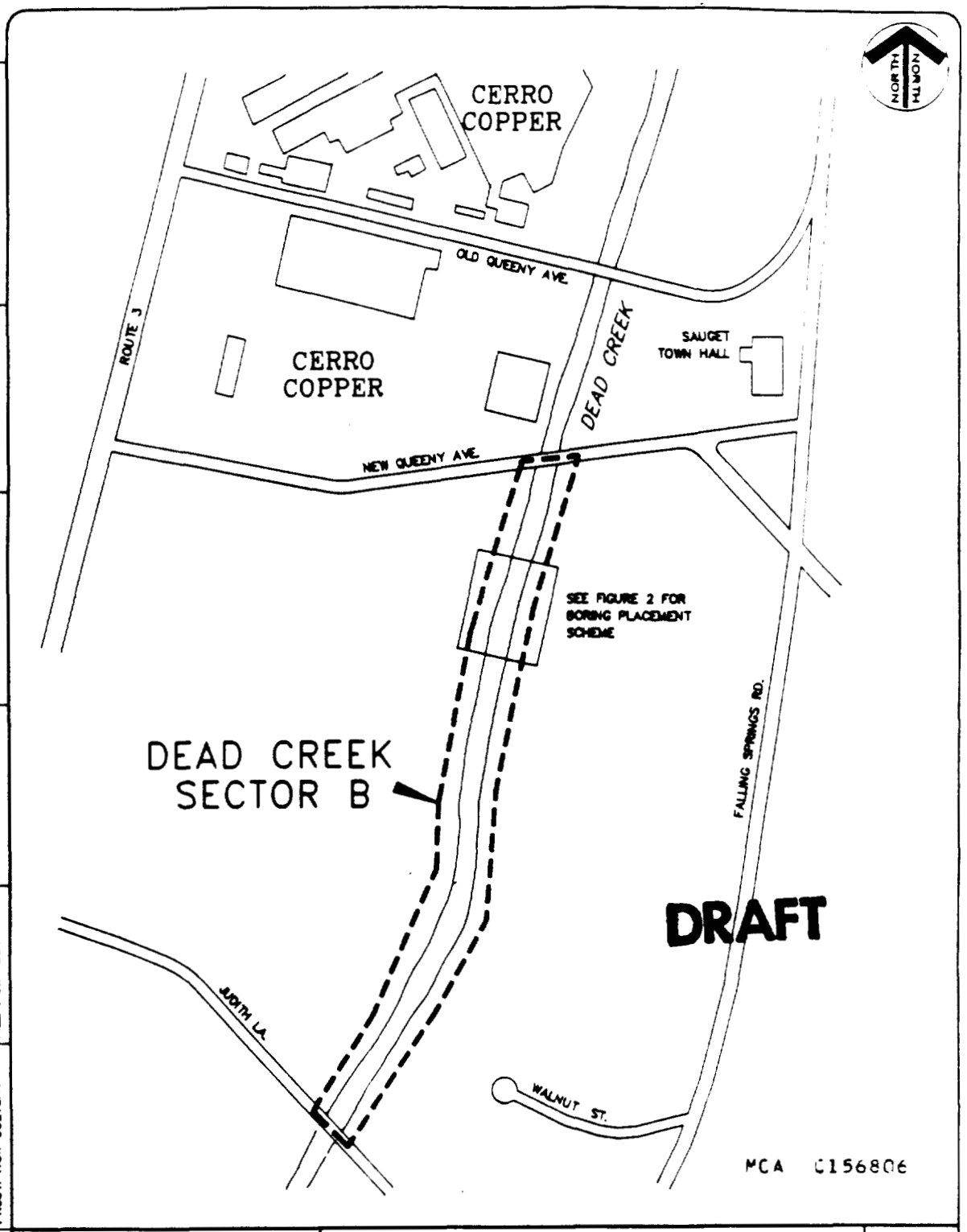
DRAFT

Nicholas Valkenburg
Vice President/Project Officer

NV:th
SMUL0212.LTR

MCA 0156805

MCO 7683590



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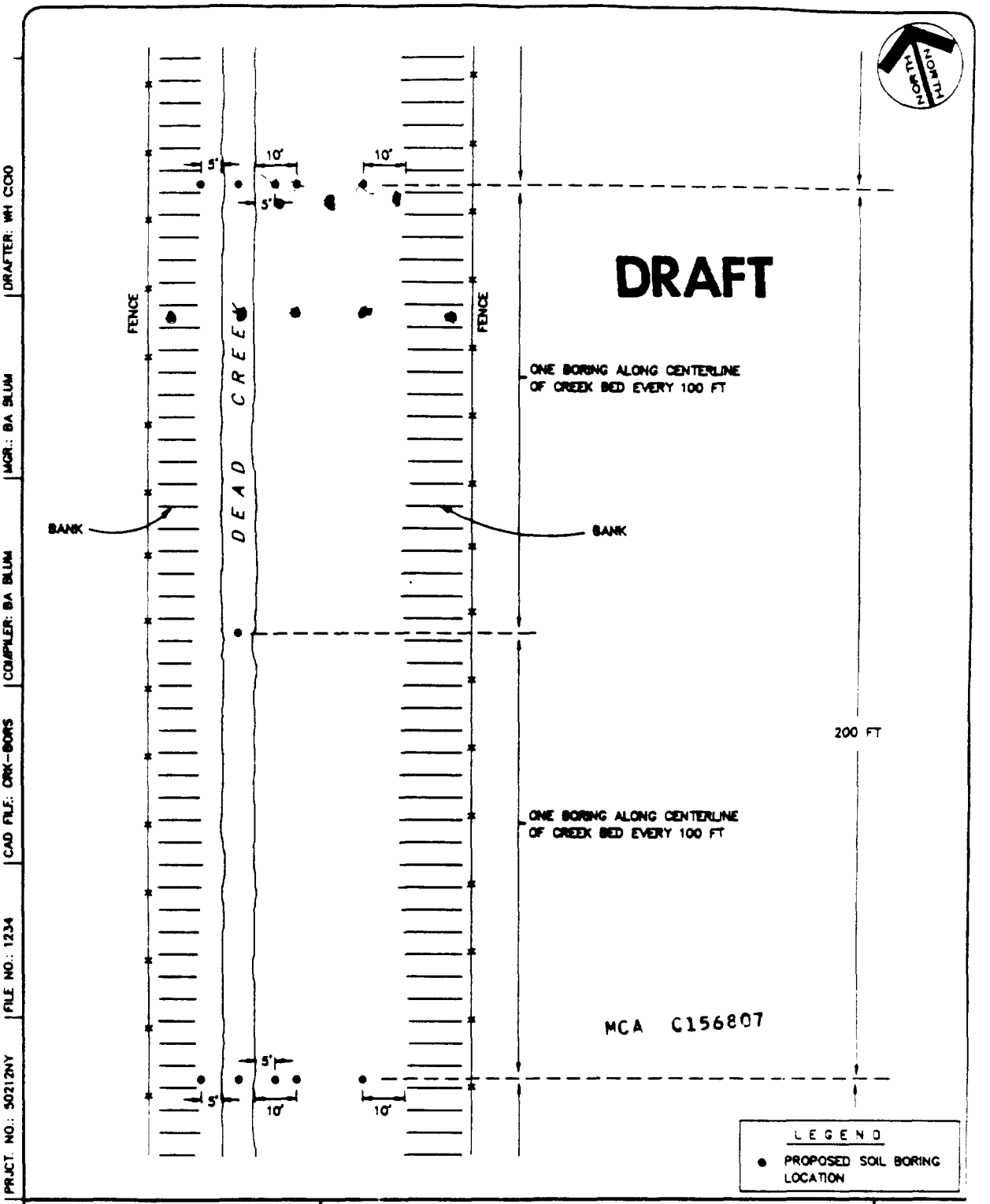
GERAGHTY & MILLER, INC.
Environmental Services

LOCATION OF PROPOSED BORINGS AT DEAD CREEK SECTOR B, SAUGET, ILLINOIS

MONSANTO COMPANY SAUGET, ILLINOIS

FIGURE 1

MCO 7683591



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MGR.: BA BLUM
COMPILER: BA BLUM
CAD FILE: CRK-BORS
FILE NO.: 1234
PRJCT. NO.: 50212NY
DATE: 13FEB90

SCALE
0 30 FT (APPROX.)

GERAGHTY & MILLER, INC.
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SCHEMATIC DIAGRAM OF PROPOSED SOIL BORING LOCATIONS AT DEAD CREEK SECTOR B

MONSANTO COMPANY SAUGET, ILLINOIS

FIGURE 2

MCO 7683592

DRAFT

Table 1. **Estimated Costs for a Soil Boring Program, Monsanto Company, Sauget, Illinois.**

TASK 1: DEVELOPMENT OF QAPP, FSP, AND HASP

Geraghty & Miller, Inc. Fees	
Senior Project Advisor 24 hours at $115 per hour	$ 2,760
Senior Scientist I 100 hours at $83 per hour	8,300
Staff Scientist I 100 hours at $65 per hour	6,500
Admin. Support/Clerical 24 hours at $30 per hour	720
Technical Editor 8 hours at $49 per hour	392
Draftsperson 8 hours at $39 per hour	312
Geraghty & Miller, Inc. Expenses	
(reproduction, telephone, facsimile)	500
Total Task 1:	$ 19,484

MCA 0156808

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TASK 2: FIELD INVESTIGATION AND PROJECT MANAGEMENT

Geraghty & Miller, Inc. Fees

Senior Project Advisor 24 hours at $115 per hour	$ 2,760
Senior Scientist I 40 hours at $83 per hour	3,320
Scientist III 200 hours at $59 per hour	11,800

Geraghty & Miller, Inc. Expenses

Airfare - 1 round trip at $625 per trip	625
Ground Transportation - 1 round trip at $80 per trip	80
Hotel - 1 day at $85 per day	85
Meals - 1 day at $35 per day	35
- 12 days at $5 per day	60
Car Rental - 1 day at $75 per day	75
Mileage (Personal Car)	315
Supplies: - Miscellaneous (shipping, telephone, facsimilie, safety gear, field supplies)	$ 1,000
Subtotal:	$20,155

MCA 0156809

DRAFT

Drilling Subcontractor

Mobilization		$ 350
Drilling (Rig, Man power 150 hours x $158/hr		23,700
Materials (cement and bentonite) $5.50 per 47 lb. bag x 100 bags		550
Water Tank and Steam Cleaner $90 per day x 12 days		1,080
Level C Protection $80 per man per day x 2 men x 12 days		1,920
	Subtotal:	$27,600
	5% Service Charge:	$ 1,380
	Subtotal	$28,980

Construction Subcontractor*

Bulldozer (to prepare access) 2 days @ $1500/day)		3,000
Install Gate and repair fence		2,500
	Subtotal:	$ 5,500
	5% Service Charge:	$ 275
	Subtotal	$ 5,775

Task 2 Cost Estimate: $ 54,910

* Note: These estimates are preliminary. More accurate Task 2 Total estimates will be obtained after contacting contractors.

MCA C15681C

DRAFT

TASK 3: REPORT PREPARATION

Geraghty & Miller, Inc. Fees

Senior Project Advisor 40 hours at $115 per hour	$ 4,600
Senior Scientist I 80 hours at $83 per hour	$ 6,640
Scientist III 100 hours at $59 per hour	$ 5,900
Draftsman 16 hours at $48 per hour	$ 768
Technical Editor 8 hours at $49 per hour	$ 392
Technician 16 hours at $38 per hour	$ 608
Administrative Support/Clerical 30 hours at $30 per hour	$ 900
Expenses (reproduction, telephone, facsimile)	1,000
Total Task 3:	$ 20,808
PROJECT TOTAL	95,000

MCA 0156911

SAUGET SITES - DEAD CREEK, SECTOR B

GOAL: Define If A Removal Of Contaminated Sediments To The Chemical Waste Management Landfill At Emelle Is Possible And, If So, Implement Same.

1. IEPA Position Definition

*Contact IEPA (McCombs) and determine approval status of Cerro Removal.
If Negative - Terminate Project
If Positive - Set up meeting with IEPA for Varnado, Smull and McCombs to discuss a similar project. Contact Gilhousen to determine if Enviro. Law wishes to be represented in this and possible future meetings. Also if we should contact the IAG relative to this project and when and how.

*Meet with IEPA, express our concern that the community reaction to a removal on sector A, an industrial area, and no action on sector B, a commercial/residential area, can be expected to be severely negative towards local industries and the Agencies. Additionally it is our perception that there is not a strong technical base on which to defend the situation. Define if IEPA has a positive interest in doing a similar removal on Sector B, if Monsanto would agree to fund and manage the project.

If Negative - Terminate Project
If Positive - Define and Detail Basis in this and future meetings. Major issues are:

a. Access, can IEPA use existing agreement for sampling and removal access.

b. What form of agreement will IEPA require for the work. We need to develop our proposal, letter agreement? or whatever.

c. Regulatory hurdles, PCB content averaging, disposal of dewatering water, etc.

d. Define Agency waste definition analytical requirements (CMW may have additional requirements). At this time we would expect to need PCB, 2,3,7,8 TCDD, landban organics, metals, moisture content. (Also need to define moisture level required to pass paint filter test.

e. Timing. The 11/8/90 landban deadline is a desirable, if not necessary, project completion date.

2. Funding

Prepare EEAR against the Executive Division for $400k to cover funding for study. Issue second EEAR, now anticipated to be in the $10M range for actual removal.

3. Removal Feasibility and Scope Definition

Request G & M to prepare proposal for defining the project, including coring and sampling. Use a fast track basis.

Define laboratory for analytical work including doing same via EASC if necessary to achieve rapid turnarounds.

Define via McCombs ability of plant to provide field supervision of contractors. If not possible, arrange for Engineering or contract support.

Define CMW capability, pricing, and requirements to transport and handle the material at Emelle. At this time the actual removal work would be held out separately as a lump sum bid contract.

4. Community Relations

Meet with MCC and WGK community relations and develop CR plan.

CREEK SECTOR B - DEAD CREEK

Site Description

Creek Sector B (CS-B) includes the portion of Dead Creek lying between Queeny Avenue and Judith Lane in Sauget, Illinois. Three other sites in the Dead Creek Project are located adjacent to CS-B. These include Site G to the northwest, Site L to the northeast, and Site M to the southeast. All of these sites have been identified at one time or another as possible sources of pollution in CS-B. Presently, CS-B and Site M are enclosed by a chain link fence which was installed by the USEPA in 1982. The banks of the creek are heavily vegetated, and debris is scattered throughout the northern one-half of CS-B. Culverts at Queeny Avenue and Judith Lane have been blocked in order to prevent any release of contaminants to the remainder of the creek, although the adequacy of these blocks has been questioned several times. Water levels in the creek vary substantially depending on rainfall, and during extended periods of no precipitation, the creek becomes a dry ditch.

Site History and Previous Investigations

The IEPA initially became aware of environmental problems at CS-B in May, 1980 when several complaints were received concerning smouldering and fires observed the creek bed. In August, 1980, a local resident's dog died, apparently of chemical burns resulting from contact with materials in the ditch. Following this incident, the IEPA conducted preliminary sampling to determine the cause of these problems in CS-B. Chemical analysis of these samples indicated high levels of PCBs, phosphorus, and heavy metals, and the IEPA subsequently authorized the installation of fencing in order to prevent public access to the creek. In September 1980, the Illinois Department of Transportation (IDOT) completed installation of 7000 feet of snow fence with warning signs around CS-B and Site M. The IEPA subsequently performed a preliminary hydrogeological investigation in the area in an attempt to identify the sources of pollution

MCQ 7683599

MCA 0156814

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in Dead Creek. The results of this investigation are documented in the St. John Report. The snow fence was later replaced with a chain link and barbed wire fence. The installation of this fence was authorized by the USEPA, and was completed in October, 1982.

Prior to the IEPA investigation in 1980, the City of Cahokia Health Department received complaints from area residents concerning discharges from Cerro Copper Product (Cerro) entering CS-8. In 1975, IEPA visited the site in order to determine if these discharges were occurring. Investigators observed discoloration in the creek and along the banks similar to what was later observed in the holding ponds at Cerro. One water sample was collected by IEPA from the creek immediately south of Queeny Avenue. Analysis of this sample indicated the presence of copper (0.3 ppm), iron (3.2 ppm), and mercury (0.1 ppb). The culvert under Queeny Avenue was sealed sometime in the early 1970's by Cerro Copper and the Monsanto Chemical Company for the purpose of restricting flow from the holding ponds at Cerro (Creek Sector A). The holding ponds were also regraded to the north to direct their flow to an interceptor discharging to the Sauget Wastewater Treatment Plant. The investigators concluded that flow through the blocked culvert had occurred, although the direction of flow could not be determined because no flow was evident at the time of the inspection.

The IEPA hydrogeological study, conducted in 1980, included collecting 20 surface sediment samples for analysis from CS-8 (Figure 8-1). Analyses of samples from the northern portion of CS-8 are presented in Table 8-1. Samples x106, x119, x120, x125, and x126 showed PCBs in concentrations ranging from 1.1 to 10,000 parts per million (ppm). Sample x125, taken adjacent to the former Waggoner Company operation, contained additional organic contaminants, including alkylbenzenes (370 ppm), dichlorobenzene (660 ppm), trichlorobenzene (78 ppm), dichlorophenol (170 ppm), and hydrocarbons (21,000 ppm). These contaminants were not detected in other surface sediment samples in the northern portion of CS-8 during this

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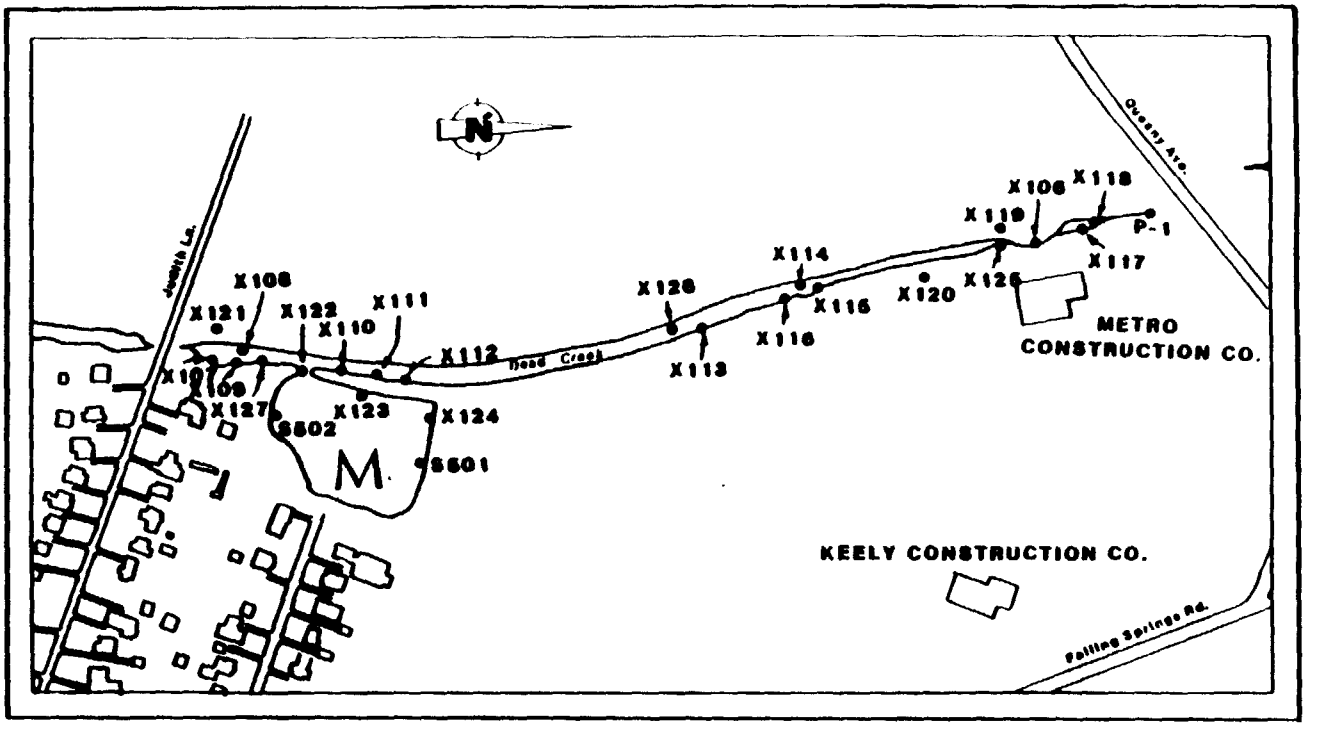

LEGEND

X106	SEDIMENT SAMPLING LOCATION
S502	SURFACE WATER SAMPLING LOCATION
P-1	SUBSURFACE SOIL SAMPLING LOCATION

SCALE

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FIGURE B-1
IEPA SAMPLING LOCATIONS AT CREEK SECTOR B AND SITE M

MCA C156816

MCO 7683601

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Protected Material: Monsanto Insurance Coverage Litigation

TABLE B-1: ANALYSIS OF SOIL SAMPLES IN THE NORTHERN PORTION OF CREEK SECTOR B (COLLECTED BY IEPA 9-8-80 THROUGH 10-25-80)

PARAMETERS	SAMPLE LOCATIONS										
	x106	x113	x114	x115	x116	x117	x118	x119	x120	x125	x126
Aluminum		18,000	6,400	9,000	9,000	1,300	1,200				
Arsenic		300	23	18	9	16	15				
Barium		2,400	1,600	3,400	300	400	1,600	510	1,200	2,500	5,000
Beryllium		-	-	-	-	-	-	1	1	-	2
Boron		-	-	-	-	-	6	-	-	-	76
Cadmium		400	-	120	-	-	-	7	3	6	70
Calcium		11,000	14,000	11,000	5,000	1,600	6,000	7,300	72,000	6,900	19,000
Chromium		250	400	120	130	-	-	36	38	50	100
Cobalt		180	-	40	-	-	-	9	10	9	50
Copper		3,000	4,800	22,000	270	160	1,000	100	150	1,000	44,800
Iron		365,000	55,000	40,000	12,000	2,400	4,300	17,500	16,200	7,000	107,000
Lead		3,600	2,000	3,200	80	-	100	43	60	260	2,000
Magnesium		4,000	2,800	5,000	2,600	1,200	1,000	4,500	4,300	380	3,700
Manganese		120	130	150	60	40	50	260	350	45	280
Mercury		30	1.7	4	0.2	2	2				
Nickel		2,500	1,700	2,400	140	-	-	-	80	130	3,000
Phosphorus										2,000	8,900
Potassium		1,400	1,300	1,500	2,300	850	1,200	1,800	1,200	770	860
Silver			-	-	-	50	-	-	-	-	100
Sodium		2,800	700	1,100	360	150	180	110	225	80	1,400
Strontium		180	140	200	40	-	-	42	140	50	300
Vanadium		-	-	150	-	-	-	27	27	13	85
Zinc		61,000	20,000	71,000	2,500	-	300	2,000	700	1,500	62,000
PCBs	6,200							1.1	80	10,000	350
Alkylbenzenes	-							-	-	370	-
Dichlorobenzene	-							-	-	660	-
Dichlorophenol	-							-	-	170	-
Hydrocarbons	-							-	-	21,000	-
Naphthalenes	-							-	-	650	-
Trichlorobenzene	-							-	-	78	-

NOTE: All results in ppm
Blank indicate parameter not analyzed
- Indicates below detection limits

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MCO 7683602

MCA C156817

investigation. In general, inorganic analysis of these samples indicated high levels of several metals in comparison with background conditions (Table B-3, sample x121).

Subsurface soil samples were also collected by IEPA from one location in the northern portion of CS-B during the 1980 investigation. Analyses of samples from boring P-1 are included in Table B-2. Results indicated the presence of PCBs to a depth of seven feet, and other organic contaminants to a depth of three feet. PCB concentrations ranged from 9,200 ppm near the surface to 53 ppm at depths greater than 4 feet and up to 7 feet. Other organic contaminants were detected at concentrations ranging from 12,000 ppm near the surface to 240 ppm at 2.5 feet. These results indicate non-uniform contaminant deposition in the northern portion of CS-B, which is common in riverine systems. The above data indicate that historical release(s) of contaminants to the northern portion of CS-B did occur. However, the horizontal and vertical extent of the resulting contamination has not been fully defined.

Analyses of sediment samples from the southern portion of CS-B are summarized in Table B-3. Sample x121 was taken from soil outside the creek bed to establish background conditions. Samples x107, x122, and x127 contained PCBs at concentrations ranging from 73 to 540 ppm. Sample x122 also showed diclorobenzene (0.35 ppm). This was the only organic contaminant other than PCBs detected in samples from the southern portion of CS-B. Several metals, including arsenic, cadmium, chromium, copper, lead, and zinc, were detected at levels significantly above background concentrations in all samples. However, the metal concentrations were comparable to concentrations detected in samples of sediment taken in the northern portion of CS-B. All of the samples were collected from the creek bed adjacent to, or downstream from Site M, which is an old sand pit excavated by the H.H. Hall Construction Company in approximately 1950. Hazardous materials were not reported to have been disposed of at Site M.

In October, 1980 IEPA and Monsanto Chemical Company cooperatively

MCO 7683603

MCA 0156818

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Protected Material: Monsanto Insurance Coverage Litigation

TABLE B-2: ANALYSIS OF SUBSURFACE SOIL SAMPLES AT BORING LOCATION P-1 IN CREEK SECTOR B. (COLLECTED BY IEPA 9-8-80)

PARAMETERS	SAMPLE DEPTH 0'-1'	1'-2'	2'-3'	3'-4'	4'-5'	5'-6	6'-7'
Biphenyl	6,000	9,000	1,100				
Chloronitrobenzene	200	240					
Dichlorobenzene	12,000	8,900	240				
PCBs	9,200	2,600	92B-6	240	53	53	54
Trichlorobenzene	380	3,700	590				
Xylene	540	250					

NOTE: All results in ppm
Blanks indicate below detection limits

MCO 7683604

MCA C156815

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Protected Material: Monsanto Insurance Coverage Litigation

TABLE B-3: ANALYSIS OF SOIL SAMPLES IN THE SOUTHERN PORTION OF CREEK SECTOR B (COLLECTED BY IEPA 9-8-80 THROUGH 10-25-80)

PARAMETERS	SAMPLE LOCATIONS								
	x107	x108	x109	x110	x111	x112	x121	x122	x127
Aluminum		8,000	9,100	7,000	8,000	6,600			
Arsenic	6,000	44	25	67	80	50			
Barium	4,800	3,800	1,600	4,300	1,800	8,000	230	5,500	2,500
Berylium	-	-	-	-	-	-	-	2	2
Boron	-	-	-	-	-	-	-	-	-
Cadmium	70	-	200	40	100	100	1	35	50
Calcium	11,000	10,000	24,000	16,000	13,000	30,000	11,000	15,000	8,000
Chromium	360	300	-	140	50	50	-	50	340
Cobalt	30	30	20	-	-	30	9	15	30
Copper	32,000	31,000	7,700	22,000	15,000	41,000	100	21,900	28,000
Iron	70,000	58,000	75,000	67,000	68,000	52,000	16,500	50,000	63,000
Lead	24,000	2,000	1,700	2,000	2,000	5,100	-	1,700	1,700
Magnesium	2,900	3,900	3,600	4,100	4,000	4,000	5,900	3,800	2,700
Manganese	150	150	300	200	160	300	370	190	150
Mercury	-	1.7	3	3.3	3.2	6	-	-	-
Nickel	3,500	3,000	900	1,900	2,000	2,700	120	1,700	
Phosphorus	7,040	-	-	-	-	-	-	-	4,700
Potassium	1,200	1,500	1,700	1,300	1,600	1,200	1,500	960	1,000
Silver	40	-	-	-	-	-	-	30	40
Sodium	1,700	900	900	700	1,000	1,600	80	630	700
Strontium	180	200	130	160	160	430	32	190	130
Vanadium	60	-	-	70	100	-	25	45	45
Zinc	25,000	22,000	27,000	25,000	47,000	52,000	230	19,900	28,000
PCBs	120	-	-	-	-	-	-	540	73
Dichlorobenzene	-	-	-	-	-	-	-	0.35	-

NOTE: All results in ppm
Blanks indicate that parameter not analyzed
- Indicates parameter is below detector limit

MCA 0156820

MCO 7683605

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collected three sediment samples from CS-8 in order to confirm results of earlier sampling done by IEPA. SD-1 was collected from the creek bed 40 yards-south of Queeny Avenue. This location is adjacent to the former Waggoner Company building and also near an old outfall (effluent pipe) from the Midwest Rubber Company. Samples SD-2 and SD-3 were collected approximately 220 yards south of SD-1, in the central portion of CS-8. Results of these samples, including a blank soil sample collected from the Missouri Bottoms in St. Charles, Mo., are presented in Tables B-4 and B-5. PCBs (45-13,000 ppm) were found in all three samples from CS-8, as were several chlorinated benzenes. Chlorinated phenols and phosphate ester were detected in samples SD-1 and SD-3, but were not found in SD-2. The analysis of these samples for inorganic parameters detected generally higher levels of inorganic parameters in SD-2 and SD-3 than those for SD-1 and the soil blank. These results clearly indicate differential contamination in CS-8, with SD-1 showing high levels of PCBs and other organic compounds, whereas SD-2 and SD-3 contained higher levels of metals.

IEPA personnel also collected two sediment samples from CS-8 in December, 1982, as part of an area-wide dioxin sampling effort managed by the USEPA which also included Site O. The first sample was collected along the east bank of the creek, approximately 80 yards south of Queeny Avenue. Previous sampling conducted by IEPA in this area had shown high concentrations of PCBs. The second sample was collected along the west bank of the creek, approximately 50 yards south of Queeny Avenue. Both samples were analyzed specifically for 2,3,7,8-tetrachlorodibenzo-p-dioxin (TCDD) by a USEPA contract laboratory. The first sample showed a quantified level (0.54 ppb) of TCDD, and the second sample was below the detection limit.

IEPAs Preliminary Hydrogeological Investigation of Dead Creek in 1980 was conducted for the purpose of determining possible sources of pollution observed in CS-8. The study included installation and

TABLE B-4: ORGANIC ANALYSIS OF SEDIMENT SAMPLES FROM DEAD CREEK, SECTOR B (SPLIT SAMPLES-IEPA AND MONSANTO COLLECTED 10-2-80)

PARAMETERS	SAMPLE LOCATIONS SD-1	SD-2	SD-3	Blank*
CHLOROBENZENES:				
Monochlorobenzene	(0.9)		(0.3)	
p-Dichlorobenzene	370	(0.3)	(0.4)	
o-Dichlorobenzene	80	(0.6)	1	
Trichlorobenzenes	85	1.6	(0.7)	
Tetrachlorobenzenes	6.1	2.4	(0.4)	
Pentacesorobenzene				
Hexachlorobenzene		1.2		
Nitrochlorobenzenes	120			
CHLOROPHENOLS:				
o-Chlorophenol	3.7			
p-Chlorophenol	6.6		(0.9)	
2,4-Dichlorophenol	1.2			
Pentachlorophenol	130		1.8	
PHOSPHATE ESTERS:				
Dibutylphenyl Phosphate	330		(0.8)	
Butyldiphenyl Phosphate			(0.8)	
Triphenyl Phosphate	2600			
2-Ethylhexyldiphenyl Phosphate			2.2	
Isodecyldiphenyl Phosphate				
T-Butylphenyldiphenyl Phosphate	28			
Di-t-butylphenyldiphenyl Phosphate				
Nonylphenyl Diphenyl Phosphate				
Cumylphenyldiphenl Phosphate	3.7			
PCBs (Cl_2 to Cl_6 Homologs)	13,000	240	45	

NOTE: All values in ppm
*Soil blank collected from Missouri Bottoms, St. Charles, Mo.
Blanks indicate below detection limits
( ) Semi-quantitative values

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TABLE B-5: INORGANIC ANALYSIS OF SEDIMENT SAMPLES FROM DEAD CREEK, SECTOR B (SPLIT SAMPLES - IEPA AND MONSANTO COLLECTED 10-2-80)

	SAMPLE LOCATIONS			
PARAMETERS	SD-1	SD-2	SD-3	Blank*
Aluminum	1,400	5,100	5,300	5,600
Antimony	13	240	160	29
Arsenic	210	40	55	5
Barium	770	1,200	1,300	130
Beryllium	-	-	-	-
Boron	28	160	100	27
Cadmium	5.1	60	55	3.9
Calcium	8,500	9,200	6,200	4,600
Chromium	25	110	240	19
Cobalt	15	180	120	33
Copper	460	28,000	18,000	19
Iron	4,700	53,000	30,000	9,900
Lead	180	2,000	1,600	50
Magnesium	460	2,200	2,000	2,300
Manganese	29	170	110	510
Molybdenum	6.1	92	68	11
Nickel	110	2,000	1,700	39
Phosphorus	2,500	13,000	9,400	610
Silicon	73	150	89	110
Silver	-	42	29	-
Sodium	400	540	410	320
Strontium	35	230	110	17
Tin	18	260	320	18
Titanium	32	110	80	37
Vanadium	34	140	130	130
Zinc	280	32,000	18,000	56

NOTE: All values in ppm
* Soil blank collected from Missouri Bottoms, St. Charles, MO.
- Indicates below detection limits.

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MCO 7683608

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sampling of 12 monitoring wells in addition to the 1980 soil/sediment sampling described above. Residential wells were also sampled to determine ground water quality in the area. Locations of IEPA monitoring wells and residential well samples are shown in Figure B-2. All IEPA wells were screened in the Henry Formation sands, with screened interval elevations ranging between 366 and 402 feet Mean Sea Level. The hydraulic gradient in the vicinity of CS-B is very flat, with ground water flow generally to the west toward the Mississippi River.

Analytical data for three sets of samples from the IEPA monitoring wells, corresponding to three sampling events in 1980 and 1981, are presented in Tables B-6, B-7, and B-8. Well G108 can be considered a background well due to its location upgradient from the known disposal areas around CS-B. Organic contaminants were consistently found in Wells G107 and G112. These wells are in downgradient monitoring positions for sites G and I respectively. Certain organic contaminants were detected in Wells G102, G109 and G110 during the initial sample event, but these wells did not show any of the organics in subsequent samples. Well G102 is located immediately west of the northern portion of CS-B, and near the southeast corner of Site G. Well G109 is located approximately 150 feet west of the former Waggoner surface impoundment (Site L). Well G110 is located downgradient of Site H. PCBs were detected at one time or another in Wells G101, G102, G104, G106, G107, G110, and G112. Of these, only G101 and G102 showed PCBs in all three sets of samples.

Inorganic analyses of samples from the IEPA monitoring wells indicate several parameters at concentrations above background (G108) and water quality standards. Standards for iron, manganese, and phosphorus were exceeded in samples from the background well. Barium, cadmium and lead were detected at concentrations exceeding standards in one or more well(s). In general, wells G109, G110, and G112 showed the most significant inorganic contamination. When compared with data for other wells, G109 contained very high concentrations of arsenic, copper, nickel, and zinc. The pH for G109

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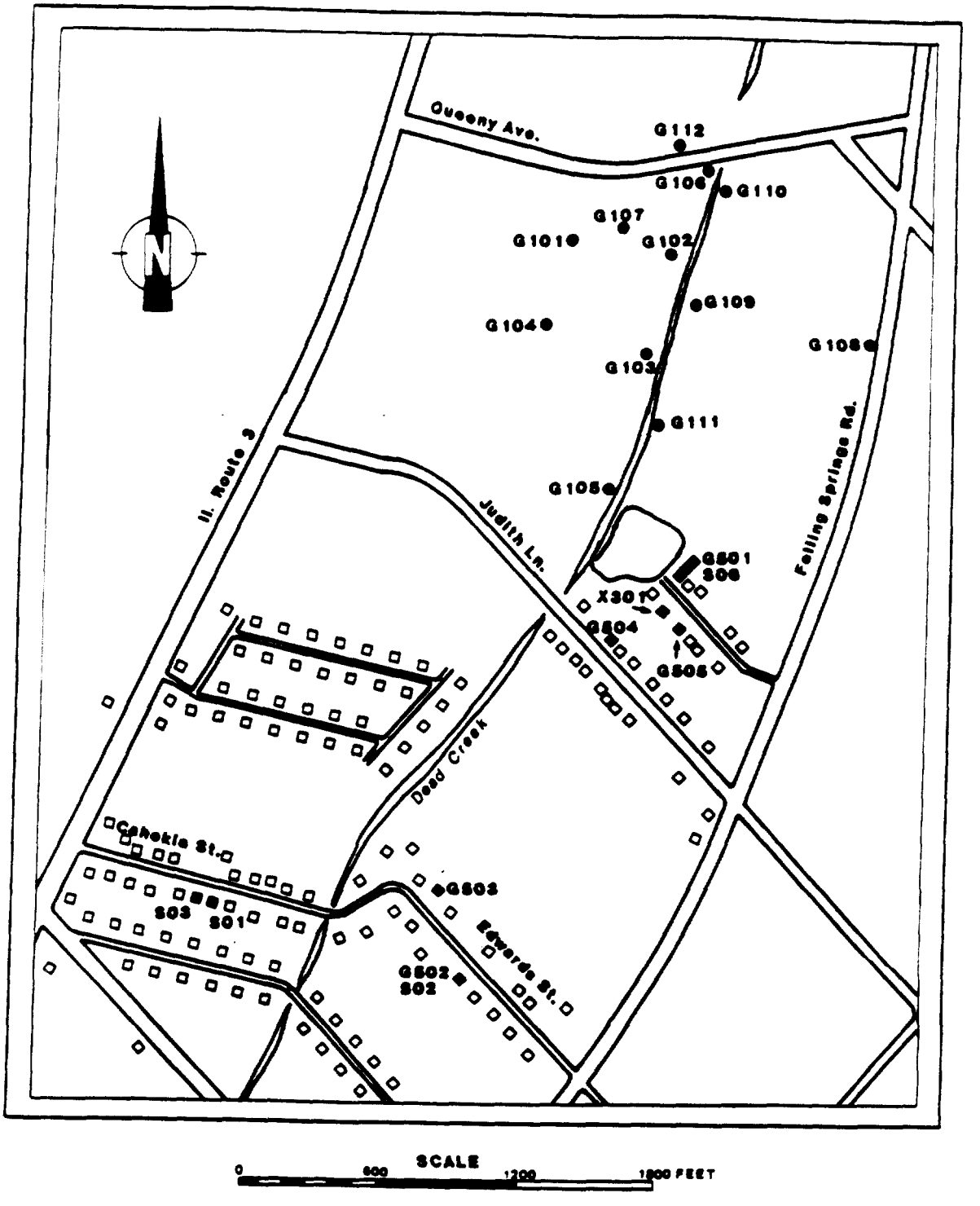

FIGURE B-2
LOCATIONS OF IEPA MONITORING WELLS AND RESIDENTIAL WELLS SAMPLED IN THE VICINITY OF DEAD CREEK

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TABLE B-6: ANALYSIS OF GROUNDWATER SAMPLES FROM THE IEPA MONITORING WELLS
(COLLECTED 10-23-80)

PARAMETERS	SAMPLE LOCATIONS											
	G101	G102	G103	G104	G105	G106	G107	G108	G109	G110	G111	G112
Alkalinity	382	410	336	406	271	387	552	375	287	210	302	698
Ammonia	0.3	1.0	1.7	0.4	0.9	2.9	0.5	0.3	4.5	1.2	0.1	1.5
Arsenic	0.023	0.023	0.043	0.049	0.067	0.16	0.043	0.008	0.055	0.053	0.008	0.019
Barium	1.3	0.8	2.9	2.2	2.0	0.6	2.1	0.3	0.2	0.5	0.2	0.5
Boron	0.5	0.4	0.5	0.6	0.4	0.5	0.5	0.4	0.4	0.5	0.5	5.6
Cadmium	0.0	0.0	0.03	0.0	0.0	0.0	0.0	0.0	0.0	1.5	0.0	0.06
Calcium	180	210	210	210	340	185	500	140	380	500	110	242
BOD	237	160	244	206	473	115	1070	298	275	780	79	162
Chloride	48	103	58	52	65	109	132	79	69	61	32	363
Chromium (Total)	0.04	0.02	0.09	0.04	0.12	0.01	0.07	0.0	0.0	0.38	0.0	0.01
Chromium (+6)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Copper	0.46	0.13	1.1	0.31	0.73	0.44	0.68	0.04	0.13	2.3	0.04	1.2
Cyanide												0.0
Fluoride	0.4	0.7	0.7	0.3	1.0	0.7	0.7	0.3	1.2	0.8	0.3	0.5
Hardness	501	804	549	630	528	637	777	496	1664	279	419	1080
Iron	51.0	30.5	86	90	18	62	13	4.1	39.0	340	5	18
Lead	0.10	0.15	0.26	0.2	0.31	0.0	0.27	0.0	0.0	7.3	0.07	0.44
Magnesium	0.09	90	79	72	108	49	205	24	100	209	24	82.5
Manganese	5.1	3.8	4.2	3.4	4.2	1.9	9.8	0.98	4.5	8.0	1.1	3.9
Mercury	0.0	0.0	0.0002	0.0	0.0	0.0	0.0	0.0001	0.0	0.0	0.0	0.0001
Nickel	0.1	0.1	0.9	0.1	0.8	0.1	0.3	0.0	0.5	1.9	0.0	0.3
Nitrate-Nitrite	0.1	0.1	0.1	0.4	0.0	0.1	0.1	1.1	0.0	0.4	0.5	0.0
pH	6.6	6.6	6.5	6.6	6.6	6.5	6.4	6.6	6.3	6.7	7.0	6.4
Phenolics	0.0	.01	0.0	0.005	0.0	0.065	2.5	0.01	0.45	0.015	0.0	0.875
Phosphorus	2.9	1.2	3.3	2.7	6.0	1.8	9.4	.18	.72	16	.24	.69
Potassium	10.6	13.1	13.4	12.3	22	7.7	15.2	13.7	14.9	29	4.9	58
R.O.E.	650	1230	765	790	824	1020	1230	704	2460	508	512	2130
Selenium	0.003	0.001	0.004	0.01	0.008	0.001	0.004	0.001	0.001	0.005	0.002	0.001
Silver	0.01	0.0	0.2	0.0	0.0	0.0	0.0	0.01	0.0	0.0	0.02	0.11
Sodium	24	60	40	29	57	96		40	40	53	24	260
S.C.	870	1500	1050	1080	1040	1340	1430	968	2470	720	490	
Sulfate	132	434	230	204	296	281	201	103	1348	93	104	518
Z	0.6	0.4	6.2	0.3	3.7	0.1	0.8	0.0	0.1	0.0	0.0	7.8
PCB (ppb)	1.0	1.2	-	-	-	-	-	-	-	2.7	-	-
Chlorophenol (ppb)	-	1200	-	-	-	-	630	-	19	-	-	-
Chlorobenzene (ppb)	-	-	-	-	-	-	19	-	-	-	-	100
Dichlorobenzene (ppb)	-	-	-	-	-	-	25	-	-	-	-	65
Dichlorophenol (ppb)	-	-	-	-	-	-	890	-	-	-	-	-
Cyclohexanone (ppb)	-	-	-	-	-	-	-	-	120	5.9	-	-
Chloroaniline (ppb)	-	-	-	-	-	-	-	-	-	-	-	3500

NOTE: All results in ppm unless otherwise noted.
Blanks indicate parameter not analyzed.
- indicates below detection limits.

MCA 156826

MCO 7683611

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TABLE B-7: ANALYSIS OF GROUNDWATER SAMPLES FROM THE IEPA MONITORING WELLS
(COLLECTED 1-28-81)

PARAMETERS	SAMPLE LOCATIONS											
	G101	G102	G103	G104	G105	G106	G107	G108	G109	G110	G111	G112
Alkalinity	447	421	266	520	363	556	821	448	18	308	394	619
Ammonia	0.3	0.0	1.4	0.2	0.7	3.3	1.0	0.0	17	0.2	0.1	0.5
Arsenic	0.015	0.016	0.018	0.002	0.037	0.11	0.021	0.004	7.5	0.013	0.014	0.027
Barium	0.9	1.2	0.9	0.3	1.8	1.0	3.2	0.5	0.2	1.0	0.7	0.5
Boron	0.3	0.4	0.4	0.7	0.4	0.5	0.5	0.2	0.8	0.2	0.6	0.9
Cadmium	0.0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.14	0.00	0.00	0.00
Calcium	220.0	320.9	176.3	218.0	319.2	226.5	1169.5	205.5	466.7	169.4	181.4	198.3
C.O.D.	45	93	56	9	143	212	635	8	1315	37	28	47
Chloride	20	128	64	29	59	156	201	76	32	36	18	210
Chromium (Total)	0.02	0.02	0.02	0.00	0.03	0.00	0.09	0.00	0.04	0.02	0.02	0.00
Copper	0.59	0.79	0.36	0.14	0.43	0.29	0.97	0.00	94.1	0.11	0.04	0.28
Cyanide	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.01
Hardness	554	1072	490	717	764	617	960	564	2144	447	530	486
Iron	30.4	16.5	20.8	1.4	60.8	67.5	172	0.3	198	19.1	10.1	18.9
Lead	0.17	0.00	0.00	0.00	0.07	0.00	0.32	0.00	0.00	0.00	0.00	0.00
Magnesium	48.2	78.0	46.3	49.1	73.6	49.1	288.1	34.3	184.4	43.5	37.9	54.0
Manganese	3.02	3.15	3.07	1.41	4.10	2.13	9.64	0.34	8.30	0.77	1.76	2.78
Mercury	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0004	0.0	0.0	0.0
Nickel	0.1	0.1	0.4	0.0	0.2	0.0	0.5	0.0	176	0.9	0.0	0.0
Nitrate-Nitrite	0.0	2.5	0.1	0.5	0.0	0.0	0.2	3.5	0.3	18	0.5	0.0
pH	7.0	7.0	7.1	7.2	7.0	6.9	6.9	7.1	4.1	6.9	7.0	6.9
Phenolics	0.0	0.0	0.0	0.0	0.0	1.46	0.5	0.01	1.86	0.02	0.015	0.05
Phosphorus	0.91	0.88	0.41	0.06	3.6	2.1	10	0.03	3.7	1.0	0.51	0.53
Potassium	6.4	12	8.8	6.0	13	6.2	20	16	18	7.5	4.2	20
Selenium	0.002	0.002	0.002	0.002	0.003	0.002	0.011	0.004	0.006	0.016	0.002	0.0
Silver	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Sodium	13	63	48	15	50	94	60	30	37	13	14	18
Sulfate	129	583	256	265	468	143	276	86	3371	57	153	212
Zinc	0.3	1.2	1.8	0.1	1.5	0.1	1.5	0.0	10.1	2.0	0.1	2.8
PCB (ppb)	0.22	3.9	-	0.3	-	-	0.4	-	-	-	-	-
Chlorobenzene (ppb)							6.3	-	-			2.5
Dichlorophenol (ppb)							560	-	-			-
Chloroaniline (ppb)							90	-	-			2.1

NOTE: All results in ppm unless otherwise noted.
Blanks indicate parameter not analyzed.
- indicates below detection limits.

MCO 7683612

MCA 156627

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TABLE B-8: ANALYSIS OF GROUNDWATER SAMPLES FROM THE IEPA MONITORING WELLS
(COLLECTED 3-10-81 - 3-11-81)

PARAMETERS	SAMPLE LOCATIONS											
	G101	G102	G103	G104	G105	G106	G107	G108	G109	G110	G111	G112
Alkalinity	483	464	319	568	393	594	657	464	58	331	387	400
Ammonia	0.2	0.0	1.5	0.0	0.4	3.0	0.2	0.0	15	0.0	0.1	0.7
Arsenic	0.001	0.0	0.003	0.001	0.013	0.085	0.004	0.001	3.9	0.001	0.001	0.00
Barium	0.0	0.7	0.1	0.2	0.2	0.3	0.1	0.2	0.1	0.1	0.1	0.0
Boron	0.2	0.4	0.3	0.7	0.3	0.5	0.5	0.2	0.5	0.1	0.4	3.4
Cadmium	0.0	0.01	0.01	0.0	0.0	0.0	0.01	0.0	0.07	1.1	0.0	0.17
Calcium	154	333	161	205	218	175	186	148	431	121	164	207
BOD	10	24	47	9	23	146	47	12	930	10	9	52
Chloride	16	124	46	20	57	150	235	51	24	27	16	133
Chromium (Total)	0.0	0.0	0.0	0.01	0.0	0.0	0.0	0.0	0.01	0.0	0.0	0.0
Copper	0.04	0.06	0.08	0.02	0.02	0.01	0.01	0.03	67	0.02	0.07	0.48
Cyanide	0.0	0.0	0.0	0.01	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Hardness	542	1062	620	839	796	675	1096	479	1651	424	485	789
Iron	0.3	0.3	1.6	0.0	9.4	4.9	2.4	0.0	1.4	0.0	0.2	0.5
Lead	0.0	0.0	0.0	0.0	0.0	0.06	0.0	0.0	0.0	0.0	0.07	0.0
Magnesium	34.2	77.9	41.9	56.8	47	44.8	44.8	22.3	138	28.7	31.8	72
Manganese	2.0	2.98	3.51	0.61	2.32	1.62	2.12	0.23	6.22	0.14	1.02	2.1
Mercury	-	-	-	-	-	-	0.0002	-	0.0003	-	-	-
Nickel	0.0	0.3	1.1	0.0	0.2	0.0	0.0	0.1	123	1.2	0.0	0.4
Nitrate-Nitrite	0.0	1.1	0.0	2.3	0.0	0.0	0.0	0.3	0.3	15	2.7	0.2
pH	6.9	6.8	6.8	6.9	6.8	6.7	6.7	7.0	4.6	6.6	6.8	6.6
Phenolics	0.0	0.0	0.005	0.0	0.0	0.0	1.7	0.1	1.4	0.0	0.0	0.00
Phosphorus	0.0	0.08	0.03	0.02	0.1	1.5	0.03	0.02	2.2	0.01	0.01	0.03
Potassium	4.0	10.8	10.4	5.9	8.9	5.7	2.8	18.2	6.4	6.3	2.9	40.2
Selenium	0.0	0.0	0.001	0.003	0.0	0.0	0.0	0.001	0.003	0.018	0.001	0.0
Silver	0.01	0.02	0.0	0.0	0.02	0.01	0.01	0.0	0.0	0.01	0.01	0.01
Sodium	11	64	65.6	17.4	51.2	92.6	39.2	25.2	12.1	14.2	15.5	96.6
Sulfate	118	617	471	303	466	146	313	55	2629	61	147	544
Zinc	0.1	0.8	2.8	0.1	0.3	0.1	0.1	0.3	6.3	1.8	0.1	11.8
PCB (ppb)	0.13	0.46	-	0.1	-	2.4	0.37	-	-	0.9	-	2.0

NOTE: All results in ppm unless otherwise noted.
Blanks indicate parameter not analyzed.
- indicates below detection limits.

MCA 0156828
MCO 7683613
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was 6.3, 4.1, and 4.6 during the three sampling events. This indicates an unidentified source was releasing acid to the groundwater. Other wells which exhibited significant inorganic contamination include G102, G103, G105, and G106, all of which are located adjacent to CS-B along the west side. The data indicates non-uniform ground water contamination in the area, likely resulting from a variety of pollutional sources.

Private wells in the area have been periodically sampled by the IEPA and the USEPA. These wells are no longer used for potable water, but they are used for watering lawns and gardens. Locations of private well samples in the Dead Creek area are shown in Figure B-2. IEPA sampled five residential wells and collected one basement seepage sample near Creek Sectors B and C. Analytical data for these samples are presented in Table B-9. G504, located east of CS-B on Judith Lane, exceeded the standard for copper. The wells all showed water quality similar to that found in IEPA monitoring well G108, indicative of background conditions in the area. The basement seepage sample was collected from a residence on Walnut Street, just east of Site M. Analysis of this sample indicated higher levels of barium and copper, when compared with the private well samples. The seepage sample (x301) also showed a measurable level of chlordane, which was likely due to the application of commercial pesticides.

In March, 1982 the USEPA collected ground water samples from four private wells (S01, S02, S03, and S06) and two IEPA monitoring wells (S04 and S05). Ground water samples S04 and S05 correspond to IEPA monitoring wells G102 and G101 respectively. In addition, soil samples (S07 S10, S11) were collected from three gardens where well water is used for watering. Soil Samples S07, S010, and S011 were collected from gardens at the locations of ground water samples S01, S02, and S03 respectively (see Figure B-2 for approximate sample locations). Water and soil blank samples, R09 and R12 respectively, were also collected and analyzed. Analytical data for these samples are presented in Tables B-10 and B-11.

TABLE B-9: ANALYSIS OF RESIDENTIAL WELL AND SEEPAGE SAMPLES COLLECTED BY IEPA

SAMPLE DATES AND LOCATIONS

PARAMETERS	9/16/80 G501	9/16/80 G502	9/16/80 G503	9/23/80 G504	6/8/83 G505	1/5/83 x301
Arsenic	0.008	0.004	0.001		0.01	0.017
Barium	0.2	0.16	0.39	0.05	0.4	1.1
Boron	0.28	0.27	0.25	0.58	0.4	0.3
Cadmium						
Chromium						
Copper	0.02			0.06	0.01	0.03
Iron	4.6	19	17.7	0.73	26	31
Lead						0.03
Magnesium	33	39	36	30	35.3	54
Manganese	1.02	1.26	0.79	0.65	1.3	1.49
Mercury				0.0001		
Nickel				0.02		0.1
Phosphorus				0.02	0.62	1.2
Potassium	6.6	5.7	4.5	6	6.2	6.4
Silver						
Sodium	21	24	12	26	15.2	19
Zinc	0.85		0.18	0.8		0.7
PCBs	-	-	-			
Chlordane (ppb)	-	-	-	-		0.13

NOTE: All results in ppm unless otherwise noted
Blanks indicate below detection limit
- Indicates parameter not analyzed
Sample x301 was collected from basement seepage

MCA 0156830

MCO 7683615

Protected Material: Monsanto Insurance Coverage Litigation

TABLE B-10: ANALYSIS OF IDENTIFIED ORGANICS IN GROUND WATER AND SOIL SAMPLES IN THE VICINITY OF CREEK SECTOR B (COLLECTED BY USEPA 3-3-82)

	SAMPLE LOCATION										
	Ground Water							Soil			
PARAMETERS	S01	S02	S03	S04	S05	S06	R09	S07	S010	S011	R012
bis(2-ethylhexyl) phthalate	64	62			19	a				a	0.44
di-n-butyl phthalate	a	a	a	a	11	a				a	a
diethyl phthalate	a	a	a	a			a				
3,4 benzofluoranthene	a										
benzo(k) fluoranthene	a										
butyl benzylphthalate				a			a				
methylene chloride	16	16	2300	3100	990	2000	19	1	0.1		0.75
1,2-dichlorobenzene				a							
1,4-dichlorobenzene				a							
chlorobenzene				a	a						
heptachlor				0.11b	0.146						
beta-BHC				0.18b	0.3b	4.04b					
gamma-BHC				0.16b	0.25b						
alpha-BHC					0.18b	0.25b					
aldrin				0.17b							
dieldrin								0.012		0.0046	
chlordane									0.11b		
heptachlorepoxide						1.46b					
delta-BHC						0.95b					
fluoranthene							a			a	
benzo(a) anthracene							a			a	
anthracene							a				
pyrene							a			a	
Chrysene										a	0.02b

NOTE: All results in ppb
Blanks indicate below detection limit
a - Compound detected at value below specified contract detection limit (compound identified as present, but not quantified)
b- value not confirmed by GCMS
Samples R09 and R012 are water and soil blanks, respectively

MCA 0156831

MCO 7683616

EPA/CERRO COPPER/EIL/PCB ATTORNEY WORK PRODUCT / ATTORNEY CLIENT PRIVILEGE

Protected Material: Monsanto Insurance Coverage Litigation

TABLE B-11: INORGANIC ANALYSIS OF GROUND WATER AND SOIL SAMPLES IN THE VICINITY OF CREEK SECTOR B (COLLECTED BY USEPA 3-3-82)

SAMPLE LOCATIONS

PARAMETERS	GROUND WATER - in PPB S01	S02	S03	S04	S05	S06	SOIL IN PPM S07	S010	S011	R012
Aluminum		400	390		940	1,200	750	600	430	
Antimony										
Arsenic	11			29			1.3	1.0		
Barium							80	80	80	
Beryllium										
Boron	10,500	11,000	8,000	1,800	140	110				
Cadmium	4.2	14	31	5.3		2.8	1.06	1.64	0.29	
Chromium	12						2.2			3.2
Cobalt	62	70	82	95						
Copper	65						16	24	13	
Iron	65,000	31,000	30,000	28,000	530	250	340	360	240	
Lead	570	97	74	9	11	10	(45)	(20)	(25)	
Manganese	1,600	1,100	1,500	5,100	480	80	120	630	134	
Mercury										
Mercury*	0.1	0.4	0.4	0.2	0.1					
Nickel							6.5	5.5	4	
Selenium										
Silver										
Thallium										
Tin									2	
Vanadium										
Zinc	107,000	109,000	40,000	1,900	260	350	96	77	130	

NOTE: Blanks indicate below detection limits
( ) - Results did not meet USEPA Quality Control criteria - Data unreliable
* Duplicate analysis performed by USEPA central regional laboratory
Samples R09 and R012 are water and soil blanks, respectively

MCA 0156832

MCO 7683617

EPA/CERRO COPPER/EIL/PCB ATTORNEY WORK PRODUCT / ATTORNEY CLIENT PRIVILEGE

Quantified levels of bis-(2-ethylhexyl) phthalate were found in wells S01, S02, and S05. In addition, seven compounds from the pesticide fraction were detected in Wells S04, S05 (IEPA wells), and S06. Diethyl phthalate, butyl benzylphthalate, and methylene chloride were detected in the water blank, indicating that values of these parameters found in other samples should be disregarded. Methylene chloride was used to decontaminate sampling equipment, and concentrations of this parameter in all samples should not be considered indicative of aquifer conditions. Water quality standards for lead and cadmium were exceeded in one or more wells.

The soil samples showed trace levels of chlordane and dieldrin. It could not be determined if levels of pesticides found in the gardens soils were attributable to the use of well water or application of commercial pesticide products to the gardens. Phthalates, methylene chloride, chrysene, and chromium were detected in the soil blank (R012), and these compounds should be disregarded in other samples.

In September and October, 1980 IEPA conducted preliminary air monitoring in CS-B. The survey included use of detector tubes (Drager) for halogenated hydrocarbons, and collection of air samples in charcoal tubes with subsequent laboratory analysis. The detector tubes showed positive readings for hydrocarbons in the northern portion of CS-B, adjacent to the former Waggoner Building. Results were not quantified, and negative readings were observed in all other areas surveyed. Air samples were collected from two locations in CS-B using charcoal tubes and sampling pumps. Two samples were collected from each location in order to monitor conditions for undisturbed and disturbed soil. Samples from the first location, 40 yards south of Queeny Avenue, showed no positive readings for volatile organic compounds (VOCs) for disturbed or undisturbed soil conditions. Xylene was detected for disturbed and undisturbed soil conditions at the second sampling location, which was 60 yards north of Judith Lane, adjacent to Site M. All samples were extracted and analyzed at IEPAs Springfield Laboratory.

A USEPA Field Investigation Team (FIT) contractor also performed an air monitoring survey in the creek bed in March, 1982. This survey involved the use of an organic vapor analyzer (OVA), an HNU photoionizer, and Drager detector tubes for phosgene gas. Results indicated that a small, but measurable, concentration of organic vapors were present in the breathing zone (5 feet above ground surface), with concentrations increasing closer to the creek bed. In the breathing zone, the OVA showed readings up to 0.5 ppm above background, and the HNU readings were as high as 9 ppm above background. The survey crew also observed a 3-inch effluent pipeline adjacent to the former Waggoner Building which was discharging a small stream of oily liquid. OVA and HNU readings were taken approximately 6 inches from the surface where this liquid had pooled. The OVA showed concentrations up to 350 ppm, and the HNU showed concentrations ranging from 400 to 900 ppm in this area. Phosgene gas was not detected in any area using the Drager tubes.

HRS scores have been calculated on two separate occasions for Dead Creek. The creek was first scored in July, 1982, by Ecology & Environment, Inc., with a final migration score of 18.48. The site was again scored in March, 1985 by IEPA in an attempt to increase the previous score. IEPAs assessment led to a final score of 29.23, however, this score has not been finalized by USEPA. Route scores for the 1982 assessment were as follows: ground water 4.24, surface water 7.55, and air 30.77. Corresponding route scores in the 1985 assessment were 5.65, 10.07, and 49.23. Observed releases were used for all route scores in both the 1982 and the 1985 scoring packages. The only difference in the assessments was in the value assigned for waste quantity in the three routes. The 1982 package listed waste quantity as unknown (assigned value - 0), while IEPA calculated an approximate volume of waste based on sample results and visual observations.

A significant amount of data has been developed showing a wide range of contaminants in and around CS-8. Review of existing file data indicates numerous possible sources of contamination in the area.

Prior to blocking the culvert at Queeny Avenue, Cerro Copper and Monsanto Chemical reportedly discharged process wastes directly into the creek. According to past IEPA inspection reports the former Waggoner Company, an industrial waste hauling operation, discharged wash waters from truck cleaning activities directly to CS-B. After IEPA order Waggoner to cease this practice, an unlined surface impoundment was apparently used for disposal of wash water. In the 1940s and 1950s sites H and I were used for disposal of various industrial wastes. These sites were actually a single, large disposal area prior to the construction of Queeny Avenue in the late 1940s. In the 1950s, the Midwest Rubber Company, located west of State Route 50 and south of Queeny Avenue, had an effluent pipeline which ran from their plant location to the northern portion of CS-B. Midwest Rubber Co. reportedly discharged process wastes, including oils and cooling water, to the creek. Site G is a surface/subsurface disposal area with corroded drums and other wastes exposed on the surface. Surface drainage for at least a portion of this site is directed to CS-B.

Data Assessment and Recommendations

The scope of field investigation work for CS-B during the Dead Creek Project includes collecting three surface water samples from the Creek in Sector B. This sampling program should be sufficient to characterize the water currently in the creek. Soil gas and ambient air monitoring will also be done in and around CS-B.

Although a great deal of data is available for CS-B, most of the data is 4-6 years old. Because of the dynamic nature of the creek and disposal activities in the area, existing conditions may not be accurately characterized by historical sampling data. Feasibility study activities for CS-B could be accomplished using existing data and applying assumptions concerning chemical profiles (contaminant distribution). However, to properly accomplish the feasibility study activities, a current chemical depth profile of the creek bed should be developed. This would consist of collecting

sediment and subsurface soil samples from several locations in the creek bed and along the banks. The hydrology of the area has not been well-defined and should be addressed further. It has not been established whether the ground water discharges to Dead Creek or the creek acts as a recharge conduit for the Henry Formation aquifer. If discharge to the creek is occurring, the subsurface disposal areas (Sites H and I in particular) may be major contributors to the contamination of the creek.

Accordingly, existing IEPA monitoring wells on both sides of the creek should be redeveloped to allow for accurate water level measurements. This, in conjunction with detailed surveying of the creek bed and water levels in the creek, would allow adequate assessment of the hydrology in the area. This would be best accomplished using continuous-recording water level instrumentation, and should be continued over a period of time sufficient to address seasonal fluctuations. In addition, records of industries in the area should be thoroughly reviewed to establish a profile of possible releases from each source.

SITE M. HALL CONSTRUCTION PIT

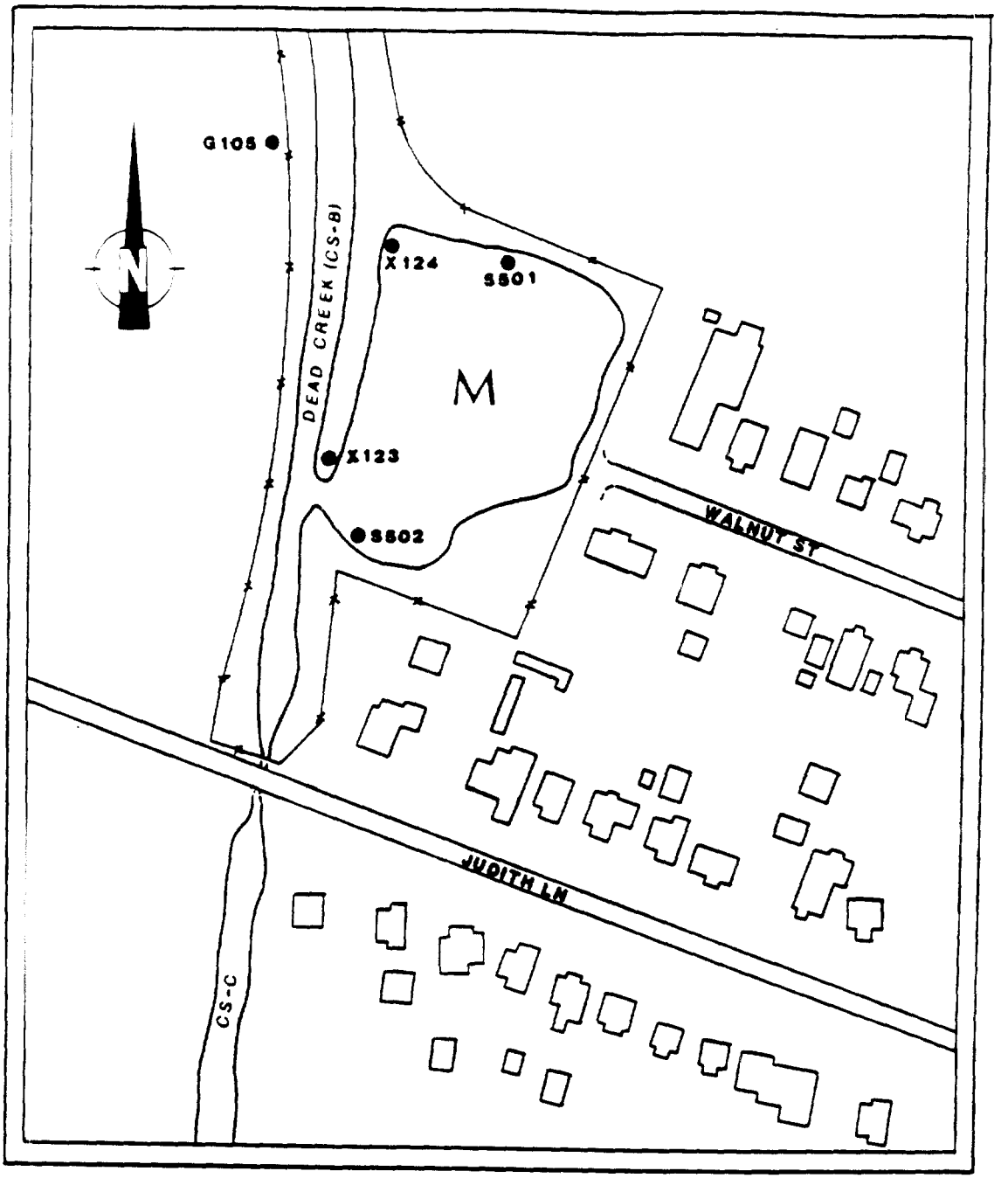
Site Description

Site M is a sand pit excavated by the H.H. Hall Construction Company in the mid to late 1940's. The pit is located immediately east of Dead Creek, and approximately 300 feet north of Judith Lane in Cahokia, Illinois (Figure M-1). The dimensions of the pit are approximately 275 by 350 feet. Presently, Site M is enclosed by a chain link fence, which also surrounds Creek Sector B. A small residential area is located just east of the pit on Walnut Street, which earlier served as an access road to Site M. The pit was excavated prior to any residential development on this street. Observations suggest that the pit is apparently isolated from Dead Creek by an embankment; however, this embankment may not be continuous. Aerial photographs indicate that a small break in the southern part of the embankment may allow flow between the creek and Site M. This possibility is supported by past IEPA inspections indicating discoloration in the pit similar to that observed in Dead Creek.

Site History and Previous Investigations

No information is available on file concerning waste disposal activities at Site M. It is possible that disposal did occur, since access to the pit remained unrestricted until a snow fence was erected in 1980. From review of historical aerial photographs, it is evident that minor changes in the dimensions of the pit have occurred. This could be an indication of filling around the perimeter of the pit. IEPA and the Cahokia Health Department have received numerous complaints about Site M and the creek from residents in the area. These complaints address, for the most part, seepage of odoriferous water into basements and problems associated with well water used to water gardens and lawns.

IEPA sampled several private wells in the area during the preliminary



LEGEND

G105	IEPA MONITORING WELL
X124	IEPA SEDIMENT SAMPLING LOCATION
SS02	IEPA SURFACE WATER SAMPLING LOCATION

FIGURE M-1
DEAD CREEK SITE AREA M WITH SAMPLING LOCATIONS

MCA 156839

MCO 7683624

hydrogeological study conducted in 1980. In addition, one sample of basement seepage from a home on Walnut Street near Site M was collected. Analytical results of these samples are presented in Table B-9, located in the Creek Sector B portion of the report. The results show concentrations of copper, manganese, and phosphorus above the state's water quality standards in one or more wells as well as in the basement seepage sample.

In conjunction with the creek sampling done in 1980, IEPA collected sediment and water samples from Site M. Analytical data for these samples are presented in Table M-1. In general, the water samples showed no significant contamination, although water quality standards for copper, phosphorous, and zinc were exceeded. Trace levels of PCBs (0.9 to 4.4 ppb) were found in both samples. The sediment samples, however, did show fairly high levels of several contaminants, including cadmium, chromium, copper, lead, nickel, zinc, and PCBs. In general, the samples closer to the break in the embankment separating Site M from Dead Creek showed higher levels of contaminants than the other samples.

Because water levels in the pit were approximately two feet higher than those found in the closest monitoring wells, the IEPA study concluded that there is no hydrological connection between water in the pit and the ground water aquifer. This assessment may or may not be accurate.

Data Assessments and Recommendations

The IEPA study conducted in 1980 showed significant contamination at Site M and identified specific waste types present. Investigation of Site M for the Dead Creek Project includes collecting two surface water and three sediment samples. A soil gas survey and ambient air monitoring will also be conducted at Site M. This sampling program will not provide sufficient data to adequately evaluate remedial alternatives. Core samples should be collected from the bottom of the pit in order to determine the types of wastes present and the

TABLE M-1:

ANALYSIS OF SURFACE WATER AND SEDIMENT SAMPLES FROM SITE M
(COLLECTED BY IEPA 9-15-80)

	SAMPLE LOCATIONS			
	Water		Sediment	
PARAMETERS	S 501	S 502	X 123	X 124
Alkalinity	80	85		
Arsenic	0.006	0.01		
Barium	0.2	0.5	4,400	350
Berylium			3	1
BOD-5	4	33		
Boron	0.2	0.2	-	25
Cadmium	-	-	40	4
Calcium			12,500	4,500
COD	58	85		
Chloride	27	28		
Chromium	-	-	150	50
Copper	0.035	0.33	18,700	4,500
Cyanide	0.02	-		
Flouride	0.4	0.4		
Iron	0.8	1.8	49,000	13,500
Lead	-	0.01	1,400	130
Magnesium	6	6	3,400	3,500
Manganese	0.06	0.82	200	80
Mercury	-	-		
Nickel	0.02	0.05	1,600	590
Phenol	0.01	0.01		
Phosphorus	0.17	0.31		
Potassium	5.9	6.2	950	1,000
Silver	-	-	30	6
Sodium	24	25	650	100
Strontium			175	27
Vanadium			42	19
Zinc	0.1	0.7	17,700	2,600
PCBs	0.0009	0.0044	1,100	24
Dichlorobenzene				

NOTE: All results in ppm.
Blanks indicate parameter not analyzed.
- Indicates below detection limits.

MCA 0156841

MCO 7683626

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extent of vertical migration of contaminants that has occurred. In addition, several borings should be completed around the perimeter of the pit, including the embankment between the pit and the creek. It would also be necessary to verify that there is no hydrological connection between the water in the pit and the ground water aquifer. This would be best accomplished using continuous recording gauging stations at wells in the vicinity of the creek and at the pit. These activities would provide the information necessary to proceed with a viable remedial program.

CREEK SECTOR B - DEAD CREEK

Site Description

Creek Sector B (CS-B) includes the portion of Dead Creek lying between Queeny Avenue and Judith Lane in Sauget, Illinois. Three other sites in the Dead Creek Project are located adjacent to CS-B. These include Site G to the northwest, Site L to the northeast, and Site M to the southeast. All of these sites have been identified at one time or another as possible sources of pollution in CS-B. Presently, CS-B and Site M are enclosed by a chain link fence which was installed by the USEPA in 1982. The banks of the creek are heavily vegetated, and debris is scattered throughout the northern one-half of CS-B. Culverts at Queeny Avenue and Judith Lane have been blocked in order to prevent any release of contaminants to the remainder of the creek, although the adequacy of these blocks has been questioned several times. Water levels in the creek vary substantially depending on rainfall, and during extended periods of no precipitation, the creek becomes a dry ditch.

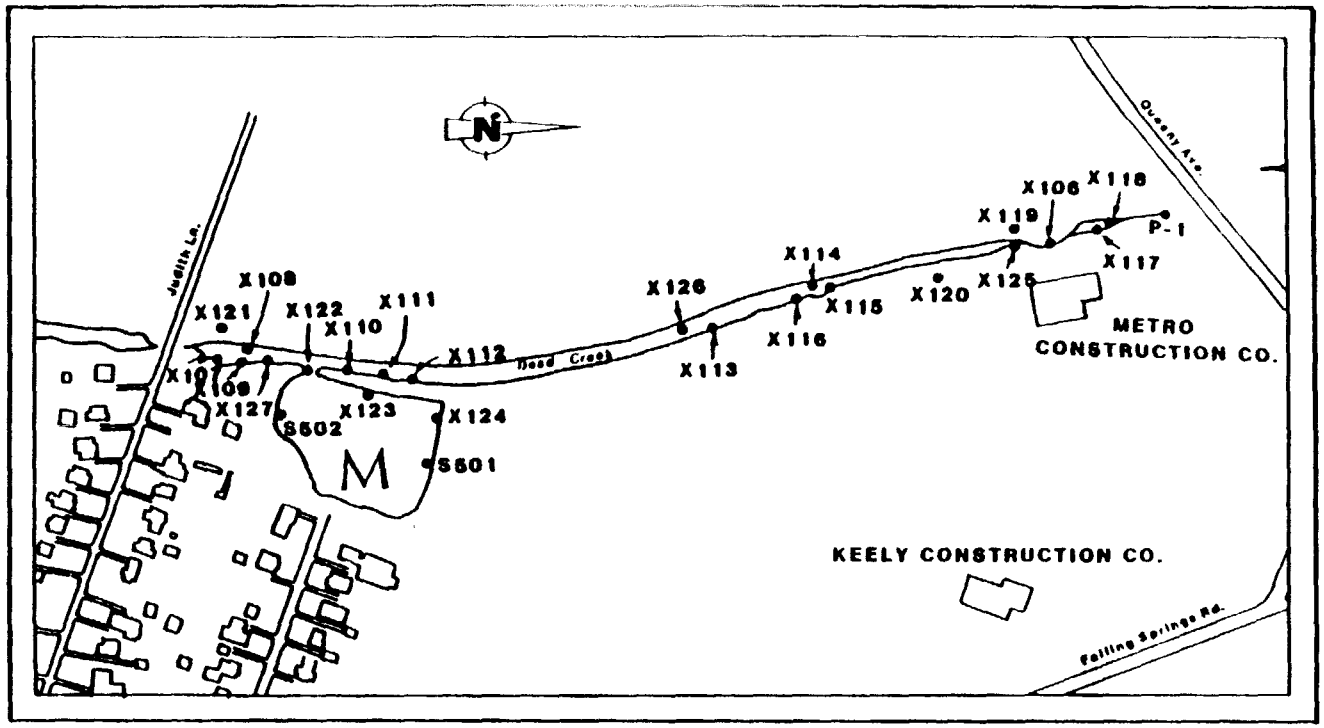
Site History and Previous Investigations

The IEPA initially became aware of environmental problems at CS-B in May, 1980 when several complaints were received concerning smouldering and fires observed the creek bed. In August, 1980, a local resident's dog died, apparently of chemical burns resulting from contact with materials in the ditch. Following this incident, the IEPA conducted preliminary sampling to determine the cause of these problems in CS-B. Chemical analysis of these samples indicated high levels of PCBs, phosphorus, and heavy metals, and the IEPA subsequently authorized the installation of fencing in order to prevent public access to the creek. In September 1980, the Illinois Department of Transportation (IDOT) completed installation of 7000 feet of snow fence with warning signs around CS-B and Site M. The IEPA subsequently performed a preliminary hydrogeological investigation in the area in an attempt to identify the sources of pollution

in Dead Creek. The results of this investigation are documented in the St. John Report. The snow fence was later replaced with a chain link and barbed wire fence. The installation of this fence was authorized by the USEPA, and was completed in October, 1982.

Prior to the IEPA investigation in 1980, the City of Cahokia Health Department received complaints from area residents concerning discharges from Cerro Copper Product (Cerro) entering CS-B. In 1975, IEPA visited the site in order to determine if these discharges were occurring. Investigators observed discoloration in the creek and along the banks similar to what was later observed in the holding ponds at Cerro. One water sample was collected by IEPA from the creek immediately south of Queeny Avenue. Analysis of this sample indicated the presence of copper (0.3 ppm), iron (3.2 ppm), and mercury (0.1 ppb). The culvert under Queeny Avenue was sealed sometime in the early 1970's by Cerro Copper and the Monsanto Chemical Company for the purpose of restricting flow from the holding ponds at Cerro (Creek Sector A). The holding ponds were also regraded to the north to direct their flow to an interceptor discharging to the Sauget Wastewater Treatment Plant. The investigators concluded that flow through the blocked culvert had occurred, although the direction of flow could not be determined because no flow was evident at the time of the inspection.

The IEPA hydrogeological study, conducted in 1980, included collecting 20 surface sediment samples for analysis from CS-B (Figure B-1). Analyses of samples from the northern portion of CS-B are presented in Table B-1. Samples x106, x119, x120, x125, and x126 showed PCBs in concentrations ranging from 1.1 to 10,000 parts per million (ppm). Sample x125, taken adjacent to the former Waggoner Company operation, contained additional organic contaminants, including alkylbenzenes (370 ppm), dichlorobenzene (660 ppm), trichlorobenzene (78 ppm), dichlorophenol (170 ppm), and hydrocarbons (21,000 ppm). These contaminants were not detected in other surface sediment samples in the northern portion of CS-B during this



LEGEND

X106	SEDIMENT SAMPLING LOCATION
S502	SURFACE WATER SAMPLING LOCATION
P-1	SUBSURFACE SOIL SAMPLING LOCATION

SCALE

0 150 600 900 FEET

FIGURE B-1
IEPA SAMPLING LOCATIONS AT CREEK SECTOR B AND SITE M

MCA 015,845

MCO 6565821

Protected Material: Monsanto Insurance Coverage Litigation

TABLE B-1: ANALYSIS OF SOIL SAMPLES IN THE NORTHERN PORTION OF CREEK SECTOR B (COLLECTED BY IEPA 9-8-80 THROUGH 10-25-80)

	SAMPLE LOCATIONS										
PARAMETERS	x106	x113	x114	x115	x116	x117	x118	x119	x120	x125	x126
Aluminum		10,000	6,400	9,000	9,000	1,300	1,200				
Arsenic		300	23	18	9	16	15				
Barium		2,400	1,600	3,400	300	400	1,600	510	1,200	2,500	5,000
Beryllium		-	-	-	-	-	-	1	1	-	2
Boron		-	-	-	-	-	6	-	-	-	76
Cadmium		400	-	120	-	-	-	7	3	6	70
Calcium		11,000	14,000	11,000	5,000	1,600	6,000	7,300	72,000	6,900	19,000
Chromium		250	400	120	130	-	-	36	38	50	100
Cobalt		100	-	40	-	-	-	9	10	9	50
Copper		3,800	4,800	22,000	270	160	1,000	100	150	1,000	44,800
Iron		365,000	55,000	40,000	12,000	2,400	4,300	17,500	16,200	7,000	107,000
Lead		3,600	2,000	3,200	80	-	100	43	60	260	2,000
Magnesium		4,000	2,800	5,000	2,600	1,200	1,000	4,500	4,300	380	3,700
Manganese		120	130	150	60	40	50	260	350	45	280
Mercury		30	1.7	4	0.2	2	2				
Nickel		2,500	1,700	2,400	140	-	-	-	80	130	3,000
Phosphorus										2,000	8,900
Potassium		1,400	1,300	1,500	2,300	850	1,200	1,800	1,200	770	860
Silver			-	-	-	50	-	-	-	-	100
Sodium		2,800	700	1,100	360	150	180	110	225	80	1,400
Strontium		180	140	200	40	-	-	42	140	50	300
Vanadium		-	-	150	-	-	-	27	27	13	85
Zinc		61,000	20,000	71,000	2,500	-	300	2,000	700	1,500	62,000
PCBs	5,200							1.1	80	10,000	350
Alkylbenzenes	-							-	-	370	-
Dichlorobenzene	-							-	-	660	-
Dichlorophenol	-							-	-	170	-
Hydrocarbons	-							-	-	21,000	-
Naphthalenes	-							-	-	650	-
Trichlorobenzene	-							-	-	78	-

NOTE: All results in ppm
Blank indicate parameter not analyzed
- Indicates below detection limits

MCO 6565822

MCA 01 56846

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investigation. In general, inorganic analysis of these samples indicated high levels of several metals in comparison with background conditions (Table B-3, sample x121).

Subsurface soil samples were also collected by IEPA from one location in the northern portion of CS-B during the 1980 investigation. Analyses of samples from boring P-1 are included in Table B-2. Results indicated the presence of PCBs to a depth of seven feet, and other organic contaminants to a depth of three feet. PCB concentrations ranged from 9,200 ppm near the surface to 53 ppm at depths greater than 4 feet and up to 7 feet. Other organic contaminants were detected at concentrations ranging from 12,000 ppm near the surface to 240 ppm at 2.5 feet. These results indicate non-uniform contaminant deposition in the northern portion of CS-B, which is common in riverine systems. The above data indicate that historical release(s) of contaminants to the northern portion of CS-B did occur. However, the horizontal and vertical extent of the resulting contamination has not been fully defined.

Analyses of sediment samples from the southern portion of CS-B are summarized in Table B-3. Sample x121 was taken from soil outside the creek bed to establish background conditions. Samples x107, x122, and x127 contained PCBs at concentrations ranging from 73 to 540 ppm. Sample x122 also showed diclorobenzene (0.35 ppm). This was the only organic contaminant other than PCBs detected in samples from the southern portion of CS-B. Several metals, including arsenic, cadmium, chromium, copper, lead, and zinc, were detected at levels significantly above background concentrations in all samples. However, the metal concentrations were comparable to concentrations detected in samples of sediment taken in the northern portion of CS-B. All of the samples were collected from the creek bed adjacent to, or downstream from Site M, which is an old sand pit excavated by the H.H. Hall Construction Company in approximately 1950. Hazardous materials were not reported to have been disposed of at Site M.

In October, 1980 IEPA and Monsanto Chemical Company cooperatively

Protected Material: Monsanto Insurance Coverage Litigation

TABLE B-2: ANALYSIS OF SUBSURFACE SOIL SAMPLES AT BORING LOCATION P-1 IN CREEK SECTOR B. (COLLECTED BY IEPA 9-8-80)

PARAMETERS	SAMPLE DEPTH 0'-1'	1'-2'	2'-3'	3'-4'	4'-5'	5'-6	6'-7'
Biphenyl	6,000	9,000	1,100				
Chloronitrobenzene	200	240					
Dichlorobenzene	12,000	8,900	240				
PCBs	9,200	2,600	92B-6	240	53	53	54
Trichlorobenzene	380	3,700	590				
Xylene	540	250					

NOTE: All results in ppm
Blanks indicate below detection limits

MCO 6565824

MCA 0156848

EPA/CERRO COPPER/EIL/PCB ATTORNEY WORK PRODUCT / ATTORNEY CLIENT PRIVILEGE

Protected Material: Monsanto Insurance Coverage Litigation

TABLE B-3: ANALYSIS OF SOIL SAMPLES IN THE SOUTHERN PORTION OF CREEK SECTOR B (COLLECTED BY IEPA 9-8-80 THROUGH 10-25-80)

	SAMPLE LOCATIONS								
PARAMETERS	x107	x108	x109	x110	x111	x112	x121	x122	x127
Aluminum		8,000	9,100	7,000	8,000	6,600			
Arsenic	6,000	44	25	67	80	50			
Barium	4,800	3,800	1,600	4,300	1,800	8,000	230	5,500	2,500
Beryllium	-	-	-	-	-	-	-	2	2
Boron	-	-	-	-	-	-	-	-	-
Cadmium	70	-	200	40	100	100	1	35	50
Calcium	11,000	10,000	24,000	16,000	13,000	30,000	11,000	15,000	8,000
Chromium	360	300	-	140	50	50	-	50	340
Cobalt	30	30	20	-	-	30	9	15	30
Copper	32,000	31,000	7,700	22,000	15,000	41,000	100	21,900	28,000
Iron	70,000	58,000	75,000	67,000	68,000	52,000	16,500	50,000	63,000
Lead	24,000	2,000	1,700	2,000	2,000	5,100	-	1,700	1,700
Magnesium	2,900	3,900	3,600	4,100	4,000	4,000	5,900	3,800	2,700
Manganese	150	150	300	200	160	300	370	190	150
Mercury	-	1.7	3	3.3	3.2	6	-	-	-
Nickel	3,500	3,000	900	1,900	2,000	2,700	120	1,700	
Phosphorus	7,040	-	-	-	-	-	-	-	4,700
Potassium	1,200	1,500	1,700	1,300	1,600	1,200	1,500	960	1,000
Silver	40	-	-	-	-	-	-	30	40
Sodium	1,700	900	900	700	1,000	1,600	80	630	700
Strontium	180	200	130	160	160	430	32	190	130
Vanadium	60	-	-	70	100	-	25	45	45
Zinc	25,000	22,000	27,000	25,000	47,000	52,000	230	19,900	28,000
PCBs	120	-	-	-	-	-	-	540	73
Dichlorobenzene	-	-	-	-	-	-	-	0.35	-

NOTE: All results in ppm
Blanks indicate that parameter not analyzed
- Indicates parameter is below detector limit

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collected three sediment samples from CS-B in order to confirm results of earlier sampling done by IEPA. SD-1 was collected from the creek bed 40 yards-south of Queeny Avenue. This location is adjacent to the former Waggoner Company building and also near an old outfall (effluent pipe) from the Midwest Rubber Company. Samples SD-2 and SD-3 were collected approximately 220 yards south of SD-1, in the central portion of CS-B. Results of these samples, including a blank soil sample collected from the Missouri Bottoms in St. Charles, Mo., are presented in Tables B-4 and B-5. PCBs (45-13,000 ppm) were found in all three samples from CS-B, as were several chlorinated benzenes. Chlorinated phenols and phosphate ester were detected in samples SD-1 and SD-3, but were not found in SD-2. The analysis of these samples for inorganic parameters detected generally higher levels of inorganic parameters in SD-2 and SD-3 than those for SD-1 and the soil blank. These results clearly indicate differential contamination in CS-B, with SD-1 showing high levels of PCBs and other organic compounds, whereas SD-2 and SD-3 contained higher levels of metals.

IEPA personnel also collected two sediment samples from CS-B in December, 1982, as part of an area-wide dioxin sampling effort managed by the USEPA which also included Site O. The first sample was collected along the east bank of the creek, approximately 80 yards south of Queeny Avenue. Previous sampling conducted by IEPA in this area had shown high concentrations of PCBs. The second sample was collected along the west bank of the creek, approximately 50 yards south of Queeny Avenue. Both samples were analyzed specifically for 2,3,7,8-tetrachlorodibenzo-p-dioxin (TCDD) by a USEPA contract laboratory. The first sample showed a quantified level (0.54 ppb) of TCDD, and the second sample was below the detection limit.

IEPAs Preliminary Hydrogeological Investigation of Dead Creek in 1980 was conducted for the purpose of determining possible sources of pollution observed in CS-B. The study included installation and

TABLE B-4: ORGANIC ANALYSIS OF SEDIMENT SAMPLES FROM DEAD CREEK, SECTOR B (SPLIT SAMPLES-IEPA AND MONSANTO COLLECTED 10-2-80)

PARAMETERS	SAMPLE LOCATIONS SD-1	SD-2	SD-3	Blank*
CHLOROBENZENES:				
Monochlorobenzene	(0.9)		(0.3)	
p-Dichlorobenzene	370	(0.3)	(0.4)	
o-Dichlorobenzene	80	(0.6)	1	
Trichlorobenzenes	85	1.6	(0.7)	
Tetrachlorobenzenes	6.1	2.4	(0.4)	
Pentacesorobenzene				
Hexachlorobenzene		1.2		
Nitrochlorobenzenes	120			
CHLOROPHENOLS:				
o-Chlorophenol	3.7			
p-Chlorophenol	6.6		(0.9)	
2,4-Dichlorophenol	1.2			
Pentachlorophenol	130		1.8	
PHOSPHATE ESTERS:				
Dibutylphenyl Phosphate	330		(0.8)	
Butyldiphenyl Phosphate			(0.8)	
Triphenyl Phosphate	2600			
2-Ethylhexyldiphenyl Phosphate			2.2	
Isodecyldiphenyl Phosphate				
T-Butylphenyldiphenyl Phosphate	28			
Di-t-butylphenyldiphenyl Phosphate				
Nonylphenyl Diphenyl Phosphate				
Cumylphenyldiphenl Phosphate	3.7			
PCBs (Cl_2 to Cl_6 Homologs)	13,000	240	45	

NOTE: All values in ppm
*Soil blank collected from Missouri Bottoms, St. Charles, Mo.
Blanks indicate below detection limits
( ) Semi-quantitative values

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sampling of 12 monitoring wells in addition to the 1980 soil/sediment sampling described above. Residential wells were also sampled to determine ground water quality in the area. Locations of IEPA monitoring wells and residential well samples are shown in Figure B-2. All IEPA wells were screened in the Henry Formation sands, with screened interval elevations ranging between 366 and 402 feet Mean Sea Level. The hydraulic gradient in the vicinity of CS-B is very flat, with ground water flow generally to the west toward the Mississippi River.

Analytical data for three sets of samples from the IEPA monitoring wells, corresponding to three sampling events in 1980 and 1981, are presented in Tables B-6, B-7, and B-8. Well G108 can be considered a background well due to its location upgradient from the known disposal areas around CS-B. Organic contaminants were consistently found in Wells G107 and G112. These wells are in downgradient monitoring positions for sites G and I respectively. Certain organic contaminants were detected in Wells G102, G109 and G110 during the initial sample event, but these wells did not show any of the organics in subsequent samples. Well G102 is located immediately west of the northern portion of CS-B, and near the southeast corner of Site G. Well G109 is located approximately 150 feet west of the former Waggoner surface impoundment (Site L). Well G110 is located downgradient of Site H. PCBs were detected at one time or another in Wells G101, G102, G104, G106, G107, G110, and G112. Of these, only G101 and G102 showed PCBs in all three sets of samples.

Inorganic analyses of samples from the IEPA monitoring wells indicate several parameters at concentrations above background (G108) and water quality standards. Standards for iron, manganese, and phosphorus were exceeded in samples from the background well. Barium, cadmium and lead were detected at concentrations exceeding standards in one or more well(s). In general, wells G109, G110, and G112 showed the most significant inorganic contamination. When compared with data for other wells, G109 contained very high concentrations of arsenic, copper, nickel, and zinc. The pH for G109

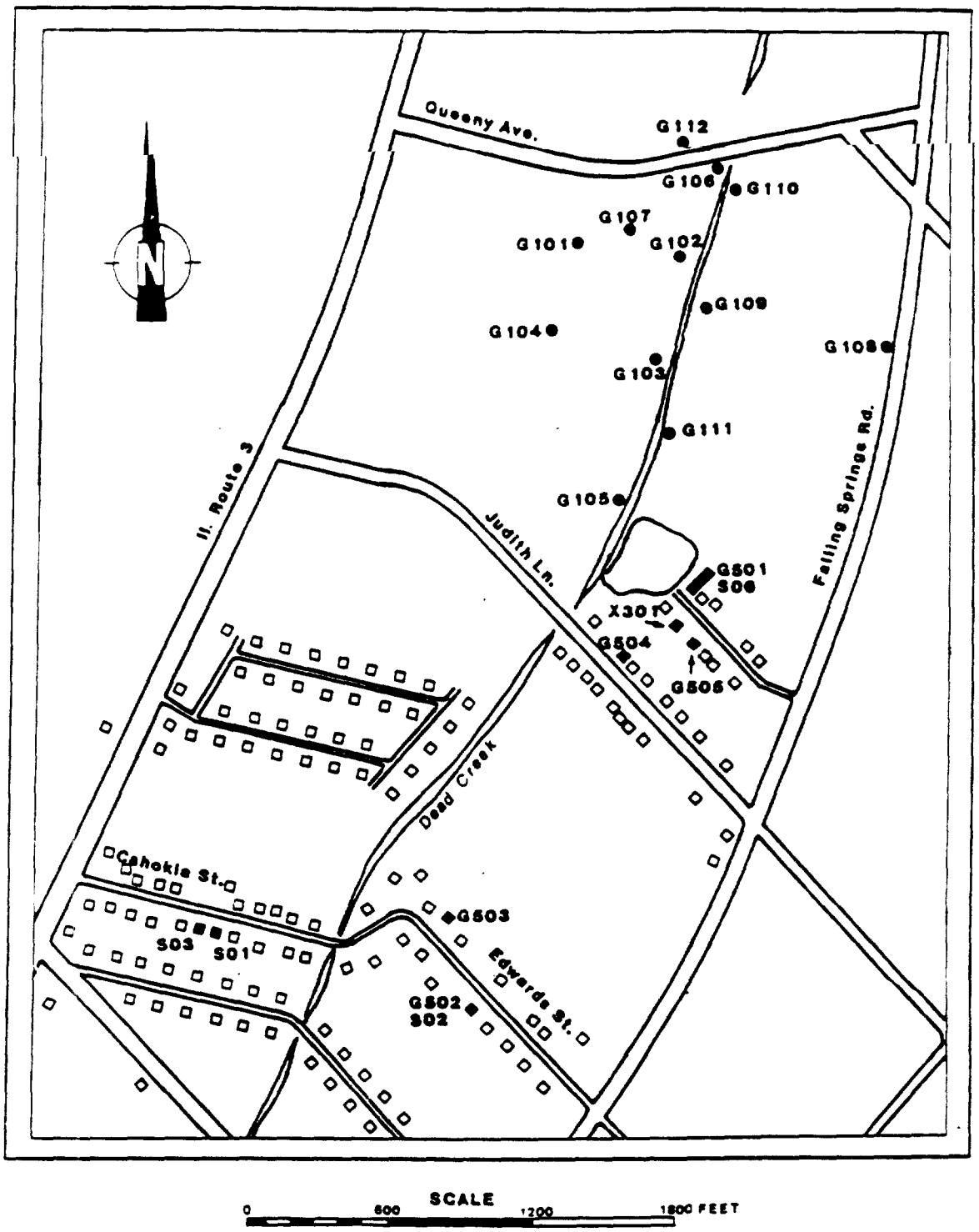

FIGURE B-2
LOCATIONS OF IEPA MONITORING WELLS AND RESIDENTIAL WELLS SAMPLED IN THE VICINITY OF DEAD CREEK

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TABLE B-6: ANALYSIS OF GROUNDWATER SAMPLES FROM THE IEPA MONITORING WELLS
(COLLECTED 10-23-80)

PARAMETERS	SAMPLE LOCATIONS											
	G101	G102	G103	G104	G105	G106	G107	G108	G109	G110	G111	G112
Alkalinity	362	410	336	406	271	387	552	375	287	210	302	699
Ammonia	0.3	1.0	1.7	0.4	0.9	2.9	0.5	0.3	4.5	1.2	0.1	1.5
Arsenic	0.023	0.023	0.043	0.049	0.067	0.16	0.043	0.008	0.055	0.053	0.008	0.019
Barium	1.3	0.8	2.9	2.2	2.0	0.6	2.1	0.3	0.2	0.5	0.2	0.5
Boron	0.5	0.4	0.5	0.6	0.4	0.5	0.5	0.4	0.4	0.5	0.5	5.6
Cadmium	0.0	0.0	0.03	0.0	0.0	0.0	0.0	0.0	0.0	1.5	0.0	0.06
Calcium	180	210	210	210	340	185	500	140	380	500	110	242
BOD	237	160	244	206	473	115	1070	298	275	780	79	162
Chloride	48	103	58	52	65	109	132	79	69	61	32	363
Chromium (Total)	0.04	0.02	0.09	0.04	0.12	0.01	0.07	0.0	0.0	0.38	0.0	0.01
Chromium (+6)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Copper	0.46	0.13	1.1	0.31	0.73	0.44	0.68	0.04	0.13	2.3	0.04	1.2
Cyanide												0.0
Fluoride	0.4	0.7	0.7	0.3	1.0	0.7	0.7	0.3	1.2	0.8	0.3	0.5
Hardness	501	884	549	630	528	637	777	496	1664	279	419	1080
Iron	51.0	30.5	86	90	18	62	13	4.1	39.0	340	5	18
Lead	0.10	0.15	0.26	0.2	0.31	0.0	0.27	0.0	0.0	7.3	0.07	0.44
Magnesium	0.09	90	79	72	100	49	205	24	100	209	24	82.5
Manganese	5.1	3.8	4.2	3.4	4.2	1.9	9.8	0.98	4.5	8.0	1.1	3.9
Mercury	0.0	0.0	0.0002	0.0	0.0	0.0	0.0	0.0001	0.0	0.0	0.0	0.0001
Nickel	0.1	0.1	0.9	0.1	0.8	0.1	0.3	0.0	0.5	1.9	0.0	0.3
Nitrate-Nitrite	0.1	0.1	0.1	0.4	0.0	0.1	0.1	1.1	0.0	0.4	0.5	0.0
pH	6.6	6.6	6.5	6.6	6.6	6.5	6.4	6.6	6.3	6.7	7.0	6.4
Phenolics	0.0	.01	0.0	0.005	0.0	0.065	2.5	0.01	0.45	0.015	0.0	0.875
Phosphorus	2.9	1.2	3.3	2.7	6.0	1.8	9.4	.18	.72	16	.24	.69
Potassium	10.6	13.1	13.4	12.3	22	7.7	15.2	13.7	14.9	29	4.9	58
R.O.E.	650	1230	765	790	824	1020	1230	704	2460	508	512	2130
Selenium	0.003	0.001	0.004	0.01	0.008	0.001	0.004	0.001	0.001	0.005	0.002	0.001
Silver	0.01	0.0	0.2	0.0	0.0	0.0	0.0	0.01	0.0	0.0	0.02	0.11
Sodium	24	60	40	29	57	96		40	40	53	24	260
S.C.	870	1500	1050	1080	1040	1340	1430	960	2470	720	490	
Sulfate	132	434	230	204	296	281	201	103	1348	93	104	518
Z	0.6	0.4	6.2	0.3	3.7	0.1	0.8	0.0	0.1	8.0	0.0	7.8
PCB (ppb)	1.0	1.2	-	-	-	-	-	-	-	2.7	-	-
Chlorophenol (ppb)	-	1200	-	-	-	-	630	-	19	-	-	-
Chlorobenzene (ppb)	-	-	-	-	-	-	19	-	-	-	-	100
Dichlorobenzene (ppb)	-	-	-	-	-	-	25	-	-	-	-	65
Dichlorophenol (ppb)	-	-	-	-	-	-	890	-	-	-	-	-
Cyclohexanone (ppb)	-	-	-	-	-	-	-	-	120	5.9	-	-
Chloroaniline (ppb)	-	-	-	-	-	-	-	-	-	-	-	3500

NOTE: All results in ppm unless otherwise noted.
Blanks indicate parameter not analyzed.
- indicates below detection limits.

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TABLE B-7: ANALYSIS OF GROUNDWATER SAMPLES FROM THE IEPA MONITORING WELLS
(COLLECTED 1-28-81)

SAMPLE LOCATIONS

PARAMETERS	G101	G102	G103	G104	G105	G106	G107	G108	G109	G110	G111	G112
Alkalinity	447	421	266	520	363	556	621	448	18	308	394	619
Ammonia	0.3	0.0	1.4	0.2	0.7	3.3	1.0	0.0	17	0.2	0.1	0.5
Arsenic	0.015	0.016	0.018	0.002	0.037	0.11	0.021	0.004	7.5	0.013	0.014	0.027
Barium	0.9	1.2	0.9	0.3	1.8	1.0	3.2	0.5	0.2	1.0	0.7	0.5
Boron	0.3	0.4	0.4	0.7	0.4	0.5	0.5	0.2	0.8	0.2	0.6	0.9
Cadmium	0.0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.14	0.00	0.00	0.00
Calcium	220.0	328.9	176.3	218.0	319.2	225.5	1169.5	205.5	466.7	169.4	181.4	198.3
C.O.D.	45	93	56	9	143	212	635	8	1315	37	28	47
Chloride	20	128	64	29	59	156	201	76	32	36	18	210
Chromium (Total)	0.02	0.02	0.02	0.00	0.03	0.00	0.09	0.00	0.04	0.02	0.02	0.00
Copper	0.59	0.79	0.36	0.14	0.43	0.29	0.97	0.00	94.1	0.11	0.04	0.28
Cyanide	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.01
Hardness	554	1072	490	717	764	617	960	564	2144	447	530	486
Iron	30.4	16.5	20.8	1.4	60.8	67.5	172	0.3	198	19.1	10.1	18.9
Lead	0.17	0.08	0.00	0.00	0.07	0.00	0.32	0.00	0.00	0.00	0.00	0.00
Magnesium	48.2	78.0	46.3	49.1	73.6	49.1	288.1	34.3	184.4	43.5	37.9	54.0
Manganese	3.02	3.15	3.07	1.41	4.10	2.13	9.64	0.34	8.30	0.77	1.76	2.78
Mercury	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0004	0.0	0.0	0.0
Nickel	0.1	0.1	0.4	0.0	0.2	0.0	0.5	0.0	176	0.9	0.0	0.0
Nitrate-Nitrite	0.0	2.5	0.1	0.5	0.0	0.0	0.2	3.5	0.3	18	0.5	0.0
pH	7.0	7.0	7.1	7.2	7.0	6.9	6.9	7.1	4.1	6.9	7.0	6.9
Phenolics	0.0	0.0	0.0	0.0	0.0	1.46	0.5	0.01	1.86	0.02	0.015	0.05
Phosphorus	0.91	0.88	0.41	0.06	3.6	2.1	10	0.03	3.7	1.0	0.51	0.53
Potassium	6.4	12	8.8	6.0	13	6.2	20	16	18	7.5	4.2	20
Selenium	0.002	0.002	0.002	0.002	0.003	0.002	0.011	0.004	0.006	0.016	0.002	0.0
Silver	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Sodium	13	63	48	15	50	94	60	30	37	13	14	18
Sulfate	129	583	256	265	468	143	276	86	3371	57	153	212
Zinc	0.3	1.2	1.6	0.1	1.5	0.1	1.5	0.0	10.1	2.0	0.1	2.8
PCB (ppb)	0.22	3.9	-	0.3	-	-	0.4	-	-	-	-	-
Chlorobenzene (ppb)							6.3	-	-			2.5
Dichlorophenol (ppb)							560	-	-			-
Chloroaniline (ppb)							90	-	-			2.1

NOTE: All results in ppm unless otherwise noted.
Blanks indicate parameter not analyzed.
- indicates below detection limits.

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TABLE B-8: ANALYSIS OF GROUNDWATER SAMPLES FROM THE IEPA MONITORING WELLS
(COLLECTED 3-10-81 - 3-11-81)

PARAMETERS	SAMPLE LOCATIONS											
	G101	G102	G103	G104	G105	G106	G107	G108	G109	G110	G111	G112
Alkalinity	463	464	319	568	393	594	657	464	58	331	387	400
Ammonia	0.2	0.0	1.5	0.0	0.4	3.0	0.2	0.0	15	0.0	0.1	0.7
Arsenic	0.001	0.0	0.003	0.001	0.013	0.085	0.004	0.001	3.9	0.001	0.001	0.00
Barium	0.0	0.7	0.1	0.2	0.2	0.3	0.1	0.2	0.1	0.1	0.1	0.0
Boron	0.2	0.4	0.3	0.7	0.3	0.5	0.5	0.2	0.5	0.1	0.4	3.4
Cadmium	0.0	0.01	0.01	0.0	0.0	0.0	0.01	0.0	0.07	1.1	0.0	0.17
Calcium	154	333	161	205	218	175	186	148	431	121	164	207
BOD	10	24	47	9	23	146	47	12	930	10	9	52
Chloride	16	124	46	28	57	150	235	51	24	27	16	133
Chromium (Total)	0.0	0.0	0.0	0.01	0.0	0.0	0.0	0.0	0.01	0.0	0.0	0.0
Copper	0.04	0.06	0.08	0.02	0.02	0.01	0.01	0.03	67	0.02	0.07	0.48
Cyanide	0.0	0.0	0.0	0.01	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Hardness	542	1062	620	839	796	675	1096	479	1651	424	485	789
Iron	0.3	0.3	1.6	0.0	9.4	4.9	2.4	0.0	1.4	0.0	0.2	0.5
Lead	0.0	0.0	0.0	0.0	0.0	0.06	0.0	0.0	0.0	0.0	0.07	0.0
Magnesium	34.2	77.9	41.9	56.8	47	44.8	44.8	22.3	138	28.7	31.8	72
Manganese	2.0	2.98	3.51	0.61	2.32	1.62	2.12	0.23	6.22	0.14	1.02	2.1
Mercury	-	-	-	-	-	-	0.0002	-	0.0003	-	-	-
Nickel	0.0	0.3	1.1	0.0	0.2	0.0	0.0	0.1	123	1.2	0.0	0.4
Nitrate-Nitrite	0.0	1.1	0.0	2.3	0.0	0.0	0.0	0.3	0.3	15	2.7	0.2
pH	6.9	6.8	6.8	6.9	6.8	6.7	6.7	7.0	4.6	6.6	6.8	6.6
Phenolics	0.0	0.0	0.005	0.0	0.0	0.0	1.7	0.1	1.4	0.0	0.0	0.00
Phosphorus	0.0	0.08	0.03	0.02	0.1	1.5	0.03	0.02	2.2	0.01	0.01	0.03
Potassium	4.0	10.8	10.4	5.9	8.9	5.7	2.8	18.2	6.4	6.3	2.9	40.2
Selenium	0.0	0.0	0.001	0.003	0.0	0.0	0.0	0.001	0.003	0.018	0.001	0.0
Silver	0.01	0.02	0.0	0.0	0.02	0.01	0.01	0.0	0.0	0.01	0.01	0.01
Sodium	11	64	65.6	17.4	51.2	92.6	39.2	25.2	12.1	14.2	15.5	96.6
Sulfate	118	617	471	303	466	146	313	55	2629	61	147	544
Zinc	0.1	0.8	2.8	0.1	0.3	0.1	0.1	0.3	6.3	1.8	0.1	11.8
PCB (ppb)	0.13	0.46	-	0.1	-	2.4	0.37	-	-	0.9	-	2.0

NOTE: All results in ppm unless otherwise noted.
Blanks indicate parameter not analyzed.
- indicates below detection limits.

was 6.3, 4.1, and 4.6 during the three sampling events. This indicates an unidentified source was releasing acid to the groundwater. Other wells which exhibited significant inorganic contamination include G102, G103, G105, and G106, all of which are located adjacent to CS-B along the west side. The data indicates non-uniform ground water contamination in the area, likely resulting from a variety of pollutional sources.

Private wells in the area have been periodically sampled by the IEPA and the USEPA. These wells are no longer used for potable water, but they are used for watering lawns and gardens. Locations of private well samples in the Dead Creek area are shown in Figure B-2. IEPA sampled five residential wells and collected one basement seepage sample near Creek Sectors B and C. Analytical data for these samples are presented in Table B-9. G504, located east of CS-B on Judith Lane, exceeded the standard for copper. The wells all showed water quality similar to that found in IEPA monitoring well G108, indicative of background conditions in the area. The basement seepage sample was collected from a residence on Walnut Street, just east of Site M. Analysis of this sample indicated higher levels of barium and copper, when compared with the private well samples. The seepage sample (x301) also showed a measurable level of chlordane, which was likely due to the application of commercial pesticides.

In March, 1982 the USEPA collected ground water samples from four private wells (S01, S02, S03, and S06) and two IEPA monitoring wells (S04 and S05). Ground water samples S04 and S05 correspond to IEPA monitoring wells G102 and G101 respectively. In addition, soil samples (S07 S10, S11) were collected from three gardens where well water is used for watering. Soil Samples S07, S010, and S011 were collected from gardens at the locations of ground water samples S01, S02, and S03 respectively (see Figure B-2 for approximate sample locations). Water and soil blank samples, R09 and R12 respectively, were also collected and analyzed. Analytical data for these samples are presented in Tables B-10 and B-11.

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TABLE B-9: ANALYSIS OF RESIDENTIAL WELL AND SEEPAGE SAMPLES COLLECTED BY IEPA

SAMPLE DATES AND LOCATIONS

PARAMETERS	9/16/80 G501	9/16/80 G502	9/16/80 G503	9/23/80 G504	6/8/83 G505	1/5/83 x301
Arsenic	0.008	0.004	0.001		0.01	0.017
Barium	0.2	0.16	0.39	0.05	0.4	1.1
Boron	0.28	0.27	0.25	0.58	0.4	0.3
Cadmium						
Chromium						
Copper	0.02			0.06	0.01	0.03
Iron	4.6	19	17.7	0.73	26	31
Lead						0.03
Magnesium	33	39	36	30	35.3	54
Manganese	1.02	1.26	0.79	0.65	1.3	1.49
Mercury				0.0001		
Nickel				0.02		0.1
Phosphorus				0.02	0.62	1.2
Potassium	6.6	5.7	4.5	6	6.2	6.4
Silver						
Sodium	21	24	12	26	15.2	19
Zinc	0.85		0.18	0.8		0.7
PCBs	-	-	-			
Chlordane (ppb)	-	-	-	-		0.13

NOTE: All results in ppm unless otherwise noted
Blanks indicate below detection limit
- Indicates parameter not analyzed
Sample x301 was collected from basement seepage

MCA 0156859

MCO 6565835

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TABLE B-10: ANALYSIS OF IDENTIFIED ORGANICS IN GROUND WATER AND SOIL SAMPLES IN THE VICINITY OF CREEK SECTOR B (COLLECTED BY USEPA 3-3-82)

	SAMPLE LOCATION										
	Ground Water							Soil			
PARAMETERS	S01	S02	S03	S04	S05	S06	R09	S07	S010	S011	R012
bis(2-ethylhexyl) phthalate	64	62			19	a				a	0.44
di-n-butyl phthalate	a	a	a	a	11	a				a	a
diethyl phthalate	a	a	a	a			a				
3,4 benzofluoranthene	a										
benzo(k) fluoranthene	a										
butyl benzylphthalate				a			a				
methylene chloride	16	16	2300	3100	990	2000	19	1	0.1		0.75
1,2-dichlorobenzene				a							
1,4-dichlorobenzene				a							
chlorobenzene				a	a						
heptachlor				0.11b	0.146						
beta-BHC				0.18b	0.3b	4.04b					
gamma-BHC				0.16b	0.25b						
alpha-BHC					0.18b	0.25b					
aldrin				0.17b							
dieldrin								0.012		0.0046	
chlordane									0.11b		
heptachlorepoxide						1.46b					
delta-BHC						0.95b					
fluoranthene							a			a	
benzo(a) anthracene							a			a	
anthracene							a				
pyrene							a			a	
Chrysene										a	0.02b

NOTE: All results in ppb
Blanks indicate below detection limit
a - Compound detected at value below specified contract detection limit (compound identified as present, but not quantified)
b- value not confirmed by GCMS
Samples R09 and R012 are water and soil blanks, respectively

MCA 0156860
MCO 6565836
EPA/CERRO COPPER/EIL/PCB ATTORNEY WORK PRODUCT / ATTORNEY CLIENT PRIVILEGE

Protected Material: Monsanto Insurance Coverage Litigation

TABLE B-11: INORGANIC ANALYSIS OF GROUND WATER AND SOIL SAMPLES IN THE VICINITY OF CREEK SECTOR B (COLLECTED BY USEPA 3-3-82)

SAMPLE LOCATIONS

PARAMETERS	GROUND WATER - in PPB S01	S02	S03	S04	S05	S06	SOIL IN PPM S07	S010	S011	R012
Aluminum		400	390		940	1,200	750	600	430	
Antimony										
Arsenic	11			29			1.3	1.0		
Barium							80	80	80	
Beryllium										
Boron	10,500	11,000	8,000	1,800	140	110				
Cadmium	4.2	14	31	5.3		2.8	1.06	1.64	0.29	
Chromium	12						2.2			3.2
Cobalt	62	70	82	95						
Copper	65						16	24	13	
Iron	65,000	31,000	38,000	28,000	530	250	340	360	240	
Lead	570	97	74	9	11	10	(45)	(20)	(25)	
Manganese	1,600	1,100	1,500	5,100	460	80	120	630	134	
Mercury										
Mercury*	0.1	0.4	0.4	0.2	0.1					
Nickel							6.5	5.5	4	
Selenium										
Silver										
Thallium										
Tin									2	
Vanadium										
Zinc	107,000	109,000	40,000	1,900	260	350	96	77	130	

NOTE: Blanks indicate below detection limits
( ) - Results did not meet USEPA Quality Control criteria - Data unreliable
* Duplicate analysis performed by USEPA central regional laboratory
Samples R09 and R012 are water and soil blanks, respectively

MCA 0156861

MCO 6565637

EPA/CERRO COPPER/EIL/PCB ATTORNEY WORK PRODUCT / ATTORNEY CLIENT PRIVILEGE

Quantified levels of bis-(2-ethylhexyl) phthalate were found in wells S01, S02, and S05. In addition, seven compounds from the pesticide fraction were detected in Wells S04, S05 (IEPA wells), and S06. Diethyl phthalate, butyl benzylphthalate, and methylene chloride were detected in the water blank, indicating that values of these parameters found in other samples should be disregarded. Methylene chloride was used to decontaminate sampling equipment, and concentrations of this parameter in all samples should not be considered indicative of aquifer conditions. Water quality standards for lead and cadmium were exceeded in one or more wells.

The soil samples showed trace levels of chlordane and dieldrin. It could not be determined if levels of pesticides found in the gardens soils were attributable to the use of well water or application of commercial pesticide products to the gardens. Phthalates, methylene chloride, chrysene, and chromium were detected in the soil blank (R012), and these compounds should be disregarded in other samples.

In September and October, 1980 IEPA conducted preliminary air monitoring in CS-B. The survey included use of detector tubes (Drager) for halogenated hydrocarbons, and collection of air samples in charcoal tubes with subsequent laboratory analysis. The detector tubes showed positive readings for hydrocarbons in the northern portion of CS-B, adjacent to the former Waggoner Building. Results were not quantified, and negative readings were observed in all other areas surveyed. Air samples were collected from two locations in CS-B using charcoal tubes and sampling pumps. Two samples were collected from each location in order to monitor conditions for undisturbed and disturbed soil. Samples from the first location, 40 yards south of Queeny Avenue, showed no positive readings for volatile organic compounds (VOCs) for disturbed or undisturbed soil conditions. Xylene was detected for disturbed and undisturbed soil conditions at the second sampling location, which was 60 yards north of Judith Lane, adjacent to Site M. All samples were extracted and analyzed at IEPAs Springfield Laboratory.

A USEPA Field Investigation Team (FIT) contractor also performed an air monitoring survey in the creek bed in March, 1982. This survey involved the use of an organic vapor analyzer (OVA), an HNU photoionizer, and Drager detector tubes for phosgene gas. Results indicated that a small, but measurable, concentration of organic vapors were present in the breathing zone (5 feet above ground surface), with concentrations increasing closer to the creek bed. In the breathing zone, the OVA showed readings up to 0.5 ppm above background, and the HNU readings were as high as 9 ppm above background. The survey crew also observed a 3-inch effluent pipeline adjacent to the former Waggoner Building which was discharging a small stream of oily liquid. OVA and HNU readings were taken approximately 6 inches from the surface where this liquid had pooled. The OVA showed concentrations up to 350 ppm, and the HNU showed concentrations ranging from 400 to 900 ppm in this area. Phosgene gas was not detected in any area using the Drager tubes.

HRS scores have been calculated on two separate occasions for Dead Creek. The creek was first scored in July, 1982, by Ecology & Environment, Inc., with a final migration score of 18.48. The site was again scored in March, 1985 by IEPA in an attempt to increase the previous score. IEPAs assessment led to a final score of 29.23, however, this score has not been finalized by USEPA. Route scores for the 1982 assessment were as follows: ground water 4.24, surface water 7.55, and air 30.77. Corresponding route scores in the 1985 assessment were 5.65, 10.07, and 49.23. Observed releases were used for all route scores in both the 1982 and the 1985 scoring packages. The only difference in the assessments was in the value assigned for waste quantity in the three routes. The 1982 package listed waste quantity as unknown (assigned value - 0), while IEPA calculated an approximate volume of waste based on sample results and visual observations.

A significant amount of data has been developed showing a wide range of contaminants in and around CS-8. Review of existing file data indicates numerous possible sources of contamination in the area.

Prior to blocking the culvert at Queeny Avenue, Cerro Copper and Monsanto Chemical reportedly discharged process wastes directly into the creek. According to past IEPA inspection reports the former Waggoner Company, an industrial waste hauling operation, discharged wash waters from truck cleaning activities directly to CS-B. After IEPA order Waggoner to cease this practice, an unlined surface impoundment was apparently used for disposal of wash water. In the 1940s and 1950s sites H and I were used for disposal of various industrial wastes. These sites were actually a single, large disposal area prior to the construction of Queeny Avenue in the late 1940s. In the 1950s, the Midwest Rubber Company, located west of State Route 50 and south of Queeny Avenue, had an effluent pipeline which ran from their plant location to the northern portion of CS-B. Midwest Rubber Co. reportedly discharged process wastes, including oils and cooling water, to the creek. Site G is a surface/subsurface disposal area with corroded drums and other wastes exposed on the surface. Surface drainage for at least a portion of this site is directed to CS-B.

Data Assessment and Recommendations

The scope of field investigation work for CS-B during the Dead Creek Project includes collecting three surface water samples from the Creek in Sector B. This sampling program should be sufficient to characterize the water currently in the creek. Soil gas and ambient air monitoring will also be done in and around CS-B.

Although a great deal of data is available for CS-B, most of the data is 4-6 years old. Because of the dynamic nature of the creek and disposal activities in the area, existing conditions may not be accurately characterized by historical sampling data. Feasibility study activities for CS-B could be accomplished using existing data and applying assumptions concerning chemical profiles (contaminant distribution). However, to properly accomplish the feasibility study activities, a current chemical depth profile of the creek bed should be developed. This would consist of collecting

sediment and subsurface soil samples from several locations in the creek bed and along the banks. The hydrology of the area has not been well-defined and should be addressed further. It has not been established whether the ground water discharges to Dead Creek or the creek acts as a recharge conduit for the Henry Formation aquifer. If discharge to the creek is occurring, the subsurface disposal areas (Sites H and I in particular) may be major contributors to the contamination of the creek.

Accordingly, existing IEPA monitoring wells on both sides of the creek should be redeveloped to allow for accurate water level measurements. This, in conjunction with detailed surveying of the creek bed and water levels in the creek, would allow adequate assessment of the hydrology in the area. This would be best accomplished using continuous-recording water level instrumentation, and should be continued over a period of time sufficient to address seasonal fluctuations. In addition, records of industries in the area should be thoroughly reviewed to establish a profile of possible releases from each source.

CREEK SECTOR B - DEAD CREEK

Site Description

Creek Sector B (CS-B) includes the portion of Dead Creek lying between Queeny Avenue and Judith Lane in Sauget, Illinois. Three other sites in the Dead Creek Project are located adjacent to CS-B. These include Site G to the northwest, Site L to the northeast, and Site M to the southeast. All of these sites have been identified at one time or another as possible sources of pollution in CS-B. Presently, CS-B and Site M are enclosed by a chain link fence which was installed by the USEPA in 1982. The banks of the creek are heavily vegetated, and debris is scattered throughout the northern one-half of CS-B. Culverts at Queeny Avenue and Judith Lane have been blocked in order to prevent any release of contaminants to the remainder of the creek, although the adequacy of these blocks has been questioned several times. Water levels in the creek vary substantially depending on rainfall, and during extended periods of no precipitation, the creek becomes a dry ditch.

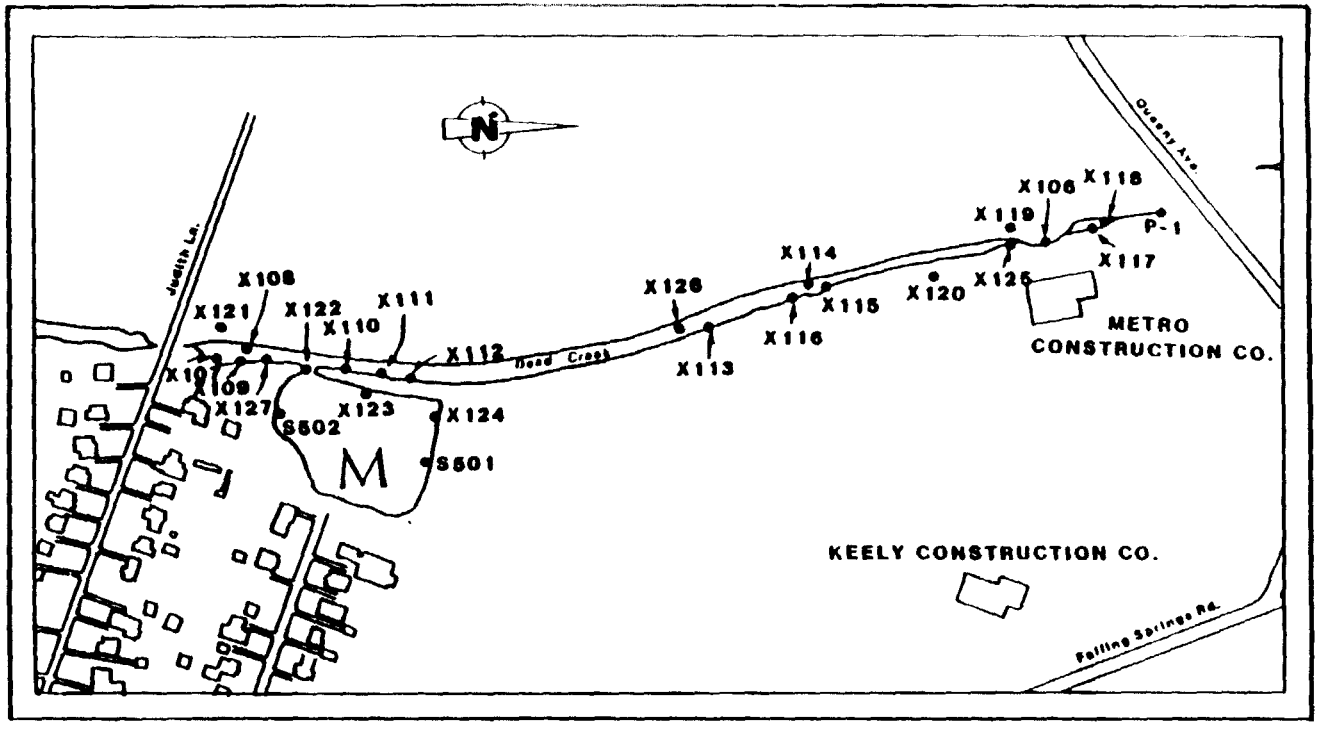
Site History and Previous Investigations

The IEPA initially became aware of environmental problems at CS-B in May, 1980 when several complaints were received concerning smouldering and fires observed the creek bed. In August, 1980, a local resident's dog died, apparently of chemical burns resulting from contact with materials in the ditch. Following this incident, the IEPA conducted preliminary sampling to determine the cause of these problems in CS-B. Chemical analysis of these samples indicated high levels of PCBs, phosphorus, and heavy metals, and the IEPA subsequently authorized the installation of fencing in order to prevent public access to the creek. In September 1980, the Illinois Department of Transportation (IDOT) completed installation of 7000 feet of snow fence with warning signs around CS-B and Site M. The IEPA subsequently performed a preliminary hydrogeological investigation in the area in an attempt to identify the sources of pollution

in Dead Creek. The results of this investigation are documented in the St. John Report. The snow fence was later replaced with a chain link and barbed wire fence. The installation of this fence was authorized by the USEPA, and was completed in October, 1982.

Prior to the IEPA investigation in 1980, the City of Cahokia Health Department received complaints from area residents concerning discharges from Cerro Copper Product (Cerro) entering CS-B. In 1975, IEPA visited the site in order to determine if these discharges were occurring. Investigators observed discoloration in the creek and along the banks similar to what was later observed in the holding ponds at Cerro. One water sample was collected by IEPA from the creek immediately south of Queeny Avenue. Analysis of this sample indicated the presence of copper (0.3 ppm), iron (3.2 ppm), and mercury (0.1 ppb). The culvert under Queeny Avenue was sealed sometime in the early 1970's by Cerro Copper and the Monsanto Chemical Company for the purpose of restricting flow from the holding ponds at Cerro (Creek Sector A). The holding ponds were also regraded to the north to direct their flow to an interceptor discharging to the Sauget Wastewater Treatment Plant. The investigators concluded that flow through the blocked culvert had occurred, although the direction of flow could not be determined because no flow was evident at the time of the inspection.

The IEPA hydrogeological study, conducted in 1980, included collecting 20 surface sediment samples for analysis from CS-B (Figure B-1). Analyses of samples from the northern portion of CS-B are presented in Table B-1. Samples x106, x119, x120, x125, and x126 showed PCBs in concentrations ranging from 1.1 to 10,000 parts per million (ppm). Sample x125, taken adjacent to the former Waggoner Company operation, contained additional organic contaminants, including alkylbenzenes (370 ppm), dichlorobenzene (660 ppm), trichlorobenzene (78 ppm), dichlorophenol (170 ppm), and hydrocarbons (21,000 ppm). These contaminants were not detected in other surface sediment samples in the northern portion of CS-B during this



LEGEND

X106	SEDIMENT SAMPLING LOCATION
S502	SURFACE WATER SAMPLING LOCATION
P-1	SUBSURFACE SOIL SAMPLING LOCATION

SCALE

0 150 600 800 FEET

FIGURE B-1
IEPA SAMPLING LOCATIONS AT CREEK SECTOR B AND SITE M

MCA 015,845

MCO 6565821

EPA/CERPO COPPER/EIL/PCB ATTORNEY WORK PRODUCT / ATTORNEY CLIENT PRIVILEGE

Protected Material: Monsanto Insurance Coverage Litigation

TABLE B-1: ANALYSIS OF SOIL SAMPLES IN THE NORTHERN PORTION OF CREEK SECTOR B (COLLECTED BY IEPA 9-8-80 THROUGH 10-25-80)

PARAMETERS	SAMPLE LOCATIONS										
	x106	x113	x114	x115	x116	x117	x118	x119	x120	x125	x126
Aluminum		10,000	6,400	9,000	9,000	1,300	1,200				
Arsenic		300	23	18	9	16	15				
Barium		2,400	1,600	3,400	300	400	1,600	510	1,200	2,500	5,000
Beryllium		-	-	-	-	-	-	1	1	-	2
Boron		-	-	-	-	-	6	-	-	-	76
Cadmium		400	-	120	-	-	-	7	3	6	70
Calcium		11,000	14,000	11,000	5,000	1,600	6,000	7,300	72,000	6,900	19,000
Chromium		250	400	120	130	-	-	36	38	50	100
Cobalt		100	-	40	-	-	-	9	10	9	50
Copper		3,800	4,800	22,000	270	160	1,000	100	150	1,000	44,800
Iron		365,000	55,000	40,000	12,000	2,400	4,300	17,500	16,200	7,000	107,000
Lead		3,600	2,000	3,200	80	-	100	43	60	260	2,000
Magnesium		4,000	2,800	5,000	2,600	1,200	1,000	4,500	4,300	380	3,700
Manganese		120	130	150	60	40	50	260	350	45	280
Mercury		30	1.7	4	0.2	2	2				
Nickel		2,500	1,700	2,400	140	-	-	-	80	130	3,000
Phosphorus										2,000	8,900
Potassium		1,400	1,300	1,500	2,300	850	1,200	1,800	1,200	770	860
Silver			-	-	-	50	-	-	-	-	100
Sodium		2,800	700	1,100	360	150	100	110	225	80	1,400
Strontium		180	140	200	40	-	-	42	140	50	300
Vanadium		-	-	150	-	-	-	27	27	13	85
Zinc		61,000	20,000	71,000	2,500	-	300	2,000	700	1,500	62,000
PCBs	5,200							1.1	80	10,000	350
Alkylbenzenes	-							-	-	370	-
Dichlorobenzene	-							-	-	660	-
Dichlorophenol	-							-	-	170	-
Hydrocarbons	-							-	-	21,000	-
Naphthalenes	-							-	-	650	-
Trichlorobenzene	-							-	-	78	-

NOTE: All results in ppm
Blank indicate parameter not analyzed
- Indicates below detection limits

MCO 6565822

MCA 11 56846

EPA/CERRO COPPER/EIL/PCB ATTORNEY WORK PRODUCT / ATTORNEY CLIENT PRIVILEGE

investigation. In general, inorganic analysis of these samples indicated high levels of several metals in comparison with background conditions (Table B-3, sample x121).

Subsurface soil samples were also collected by IEPA from one location in the northern portion of CS-B during the 1980 investigation. Analyses of samples from boring P-1 are included in Table B-2. Results indicated the presence of PCBs to a depth of seven feet, and other organic contaminants to a depth of three feet. PCB concentrations ranged from 9,200 ppm near the surface to 53 ppm at depths greater than 4 feet and up to 7 feet. Other organic contaminants were detected at concentrations ranging from 12,000 ppm near the surface to 240 ppm at 2.5 feet. These results indicate non-uniform contaminant deposition in the northern portion of CS-B, which is common in riverine systems. The above data indicate that historical release(s) of contaminants to the northern portion of CS-B did occur. However, the horizontal and vertical extent of the resulting contamination has not been fully defined.

Analyses of sediment samples from the southern portion of CS-B are summarized in Table B-3. Sample x121 was taken from soil outside the creek bed to establish background conditions. Samples x107, x122, and x127 contained PCBs at concentrations ranging from 73 to 540 ppm. Sample x122 also showed diclorobenzene (0.35 ppm). This was the only organic contaminant other than PCBs detected in samples from the southern portion of CS-B. Several metals, including arsenic, cadmium, chromium, copper, lead, and zinc, were detected at levels significantly above background concentrations in all samples. However, the metal concentrations were comparable to concentrations detected in samples of sediment taken in the northern portion of CS-B. All of the samples were collected from the creek bed adjacent to, or downstream from Site M, which is an old sand pit excavated by the H.H. Hall Construction Company in approximately 1950. Hazardous materials were not reported to have been disposed of at Site M.

In October, 1980 IEPA and Monsanto Chemical Company cooperatively

Protected Material: Monsanto Insurance Coverage Litigation

TABLE B-2: ANALYSIS OF SUBSURFACE SOIL SAMPLES AT BORING LOCATION P-1 IN CREEK SECTOR B. (COLLECTED BY IEPA 9-8-80)

PARAMETERS	SAMPLE DEPTH 0'-1'	1'-2'	2'-3'	3'-4'	4'-5'	5'-6	6'-7'
Biphenyl	6,000	9,000	1,100				
Chloronitrobenzene	200	240					
Dichlorobenzene	12,000	8,900	240				
PCBs	9,200	2,600	92B-6	240	53	53	54
Trichlorobenzene	380	3,700	590				
Xylene	540	250					

NOTE: All results in ppm
Blanks indicate below detection limits

MCO 6565824

MCA 1156848

EPA/CERRO COPPER/EIL/PCB ATTORNEY WORK PRODUCT / ATTORNEY CLIENT PRIVILEGE

TABLE B-3: ANALYSIS OF SOIL SAMPLES IN THE SOUTHERN PORTION OF CREEK SECTOR B (COLLECTED BY IEPA 9-8-80 THROUGH 10-25-80)

PARAMETERS	SAMPLE LOCATIONS								
	x107	x108	x109	x110	x111	x112	x121	x122	x127
Aluminum		8,000	9,100	7,000	8,000	6,600			
Arsenic	6,000	44	25	67	80	50			
Barium	4,800	3,800	1,600	4,300	1,800	8,000	230	5,500	2,500
Berylium	-	-	-	-	-	-	-	2	2
Boron	-	-	-	-	-	-	-	-	-
Cadmium	70	-	200	40	100	100	1	35	50
Calcium	11,000	10,000	24,000	16,000	13,000	30,000	11,000	15,000	8,000
Chromium	360	300	-	140	50	50	-	50	340
Cobalt	30	30	20	-	-	30	9	15	30
Copper	32,000	31,000	7,700	22,000	15,000	41,000	100	21,900	28,000
Iron	70,000	58,000	75,000	67,000	68,000	52,000	16,500	50,000	63,000
Lead	24,000	2,000	1,700	2,000	2,000	5,100	-	1,700	1,700
Magnesium	2,900	3,900	3,600	4,100	4,000	4,000	5,900	3,800	2,700
Manganese	150	150	300	200	160	300	370	190	150
Mercury	-	1.7	3	3.3	3.2	6	-	-	-
Nickel	3,500	3,000	900	1,900	2,000	2,700	120	1,700	
Phosphorus	7,040	-	-	-	-	-	-	-	4,700
Potassium	1,200	1,500	1,700	1,300	1,600	1,200	1,500	960	1,000
Silver	40	-	-	-	-	-	-	30	40
Sodium	1,700	900	900	700	1,000	1,600	80	630	700
Strontium	180	200	130	160	160	430	32	190	130
Vanadium	60	-	-	70	100	-	25	45	45
Zinc	25,000	22,000	27,000	25,000	47,000	52,000	230	19,900	28,000
PCBs	120	-	-	-	-	-	-	540	73
Dichlorobenzene	-	-	-	-	-	-	-	0.35	-

NOTE: All results in ppm
Blanks indicate that parameter not analyzed
- Indicates parameter is below detector limit

Protected Material: Monsanto Insurance Coverage Litigation

EPA/CERRO COPPER/EIL/PCB ATTORNEY WORK PRODUCT / ATTORNEY CLIENT PRIVILEGE

MCA vl 56849

MCO 6565825

collected three sediment samples from CS-B in order to confirm results of earlier sampling done by IEPA. SD-1 was collected from the creek bed 40 yards-south of Queeny Avenue. This location is adjacent to the former Waggoner Company building and also near an old outfall (effluent pipe) from the Midwest Rubber Company. Samples SD-2 and SD-3 were collected approximately 220 yards south of SD-1, in the central portion of CS-B. Results of these samples, including a blank soil sample collected from the Missouri Bottoms in St. Charles, Mo., are presented in Tables B-4 and B-5. PCBs (45-13,000 ppm) were found in all three samples from CS-B, as were several chlorinated benzenes. Chlorinated phenols and phosphate ester were detected in samples SD-1 and SD-3, but were not found in SD-2. The analysis of these samples for inorganic parameters detected generally higher levels of inorganic parameters in SD-2 and SD-3 than those for SD-1 and the soil blank. These results clearly indicate differential contamination in CS-B, with SD-1 showing high levels of PCBs and other organic compounds, whereas SD-2 and SD-3 contained higher levels of metals.

IEPA personnel also collected two sediment samples from CS-B in December, 1982, as part of an area-wide dioxin sampling effort managed by the USEPA which also included Site O. The first sample was collected along the east bank of the creek, approximately 80 yards south of Queeny Avenue. Previous sampling conducted by IEPA in this area had shown high concentrations of PCBs. The second sample was collected along the west bank of the creek, approximately 50 yards south of Queeny Avenue. Both samples were analyzed specifically for 2,3,7,8-tetrachlorodibenzo-p-dioxin (TCDD) by a USEPA contract laboratory. The first sample showed a quantified level (0.54 ppb) of TCDD, and the second sample was below the detection limit.

IEPAs Preliminary Hydrogeological Investigation of Dead Creek in 1980 was conducted for the purpose of determining possible sources of pollution observed in CS-B. The study included installation and

TABLE B-4: ORGANIC ANALYSIS OF SEDIMENT SAMPLES FROM DEAD CREEK, SECTOR 8 (SPLIT SAMPLES-IEPA AND MONSANTO COLLECTED 10-2-80)

PARAMETERS	SAMPLE LOCATIONS SD-1	SD-2	SD-3	Blank*
CHLOROBENZENES:				
Monochlorobenzene	(0.9)		(0.3)	
p-Dichlorobenzene	370	(0.3)	(0.4)	
o-Dichlorobenzene	80	(0.6)	1	
Trichlorobenzenes	85	1.6	(0.7)	
Tetrachlorobenzenes	6.1	2.4	(0.4)	
Pentacesorobenzene				
Hexachlorobenzene		1.2		
Nitrochlorobenzenes	120			
CHLOROPHENOLS:				
o-Chlorophenol	3.7			
p-Chlorophenol	6.6		(0.9)	
2,4-Dichlorophenol	1.2			
Pentachlorophenol	130		1.8	
PHOSPHATE ESTERS:				
Dibutylphenyl Phosphate	330		(0.8)	
Butyldiphenyl Phosphate			(0.8)	
Triphenyl Phosphate	2600			
2-Ethylhexyldiphenyl Phosphate			2.2	
Isodecyldiphenyl Phosphate				
T-Butylphenyldiphenyl Phosphate	28			
Di-t-butylphenyldiphenyl Phosphate				
Nonylphenyl Diphenyl Phosphate				
Cumylphenyldiphenl Phosphate	3.7			
PCBs (Cl_2 to Cl_6 Homologs)	13,000	240	45	

NOTE: All values in ppm
*Soil blank collected from Missouri Bottoms, St. Charles, Mo.
Blanks indicate below detection limits
( ) Semi-quantitative values

MCA 0156851

MCO 6565827

EPA/CERRO COPPER/EIL/PCB ATTORNEY WORK PRODUCT / ATTORNEY CLIENT PRIVILEGE

TABLE B-5: INORGANIC ANALYSIS OF SEDIMENT SAMPLES FROM DEAD CREEK, SECTOR B (SPLIT SAMPLES - IEPA AND MONSANTO COLLECTED 10-2-80)

PARAMETERS	SAMPLE LOCATIONS SD-1	SD-2	SD-3	Blank*
Aluminum	1,400	5,100	5,300	5,600
Antimony	13	240	160	29
Arsenic	210	40	55	5
Barium	770	1,200	1,300	130
Beryllium	-	-	-	-
Boron	28	160	100	27
Cadmium	5.1	60	55	3.3
Calcium	8,500	9,200	6,200	4,600
Chromium	25	110	240	19
Cobalt	15	180	120	33
Copper	460	28,000	18,000	19
Iron	4,700	53,000	30,000	9,900
Lead	180	2,000	1,600	50
Magnesium	460	2,200	2,000	2,300
Manganese	29	170	110	510
Molybdenum	6.1	92	68	11
Nickel	110	2,000	1,700	39
Phosphorus	2,500	13,000	9,400	610
Silicon	73	150	89	110
Silver	-	42	29	-
Sodium	400	540	410	320
Strontium	35	230	110	17
Tin	18	260	320	18
Titanium	32	110	80	37
Vanadium	34	140	130	130
Zinc	280	32,000	18,000	56

NOTE: All values in ppm
* Soil blank collected from Missouri Bottoms, St. Charles, MO.
- Indicates below detection limits.

MCA 0156852

MCO 6565828

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sampling of 12 monitoring wells in addition to the 1980 soil/sediment sampling described above. Residential wells were also sampled to determine ground water quality in the area. Locations of IEPA monitoring wells and residential well samples are shown in Figure B-2. All IEPA wells were screened in the Henry Formation sands, with screened interval elevations ranging between 366 and 402 feet Mean Sea Level. The hydraulic gradient in the vicinity of CS-B is very flat, with ground water flow generally to the west toward the Mississippi River.

Analytical data for three sets of samples from the IEPA monitoring wells, corresponding to three sampling events in 1980 and 1981, are presented in Tables B-6, B-7, and B-8. Well G108 can be considered a background well due to its location upgradient from the known disposal areas around CS-B. Organic contaminants were consistently found in Wells G107 and G112. These wells are in downgradient monitoring positions for sites G and I respectively. Certain organic contaminants were detected in Wells G102, G109 and G110 during the initial sample event, but these wells did not show any of the organics in subsequent samples. Well G102 is located immediately west of the northern portion of CS-B, and near the southeast corner of Site G. Well G109 is located approximately 150 feet west of the former Waggoner surface impoundment (Site L). Well G110 is located downgradient of Site H. PCBs were detected at one time or another in Wells G101, G102, G104, G106, G107, G110, and G112. Of these, only G101 and G102 showed PCBs in all three sets of samples.

Inorganic analyses of samples from the IEPA monitoring wells indicate several parameters at concentrations above background (G108) and water quality standards. Standards for iron, manganese, and phosphorus were exceeded in samples from the background well. Barium, cadmium and lead were detected at concentrations exceeding standards in one or more well(s). In general, wells G109, G110, and G112 showed the most significant inorganic contamination. When compared with data for other wells, G109 contained very high concentrations of arsenic, copper, nickel, and zinc. The pH for G109

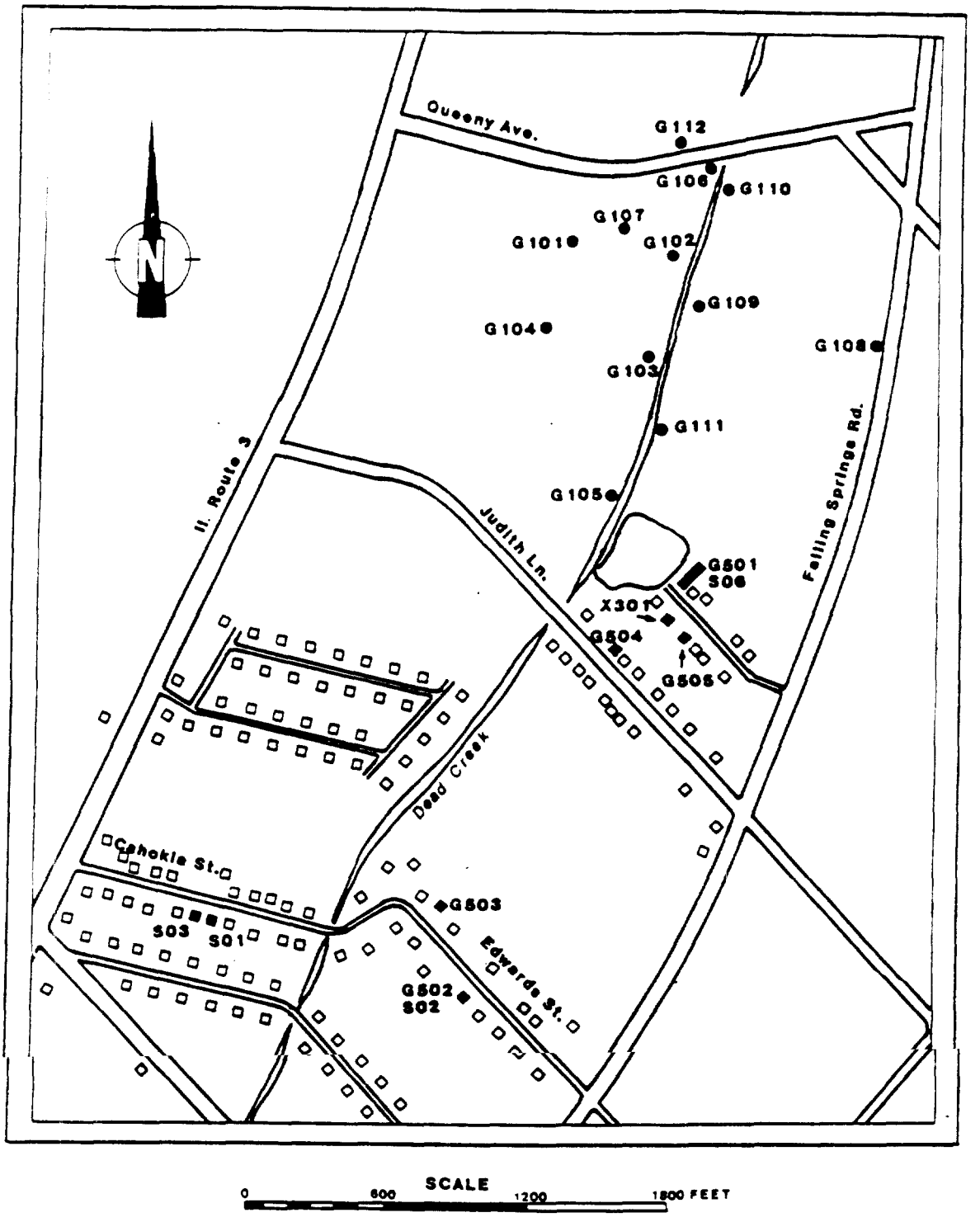

FIGURE B-2
LOCATIONS OF IEPA MONITORING WELLS AND RESIDENTIAL WELLS SAMPLED IN THE VICINITY OF DEAD CREEK

MCA 0156854

MCO 6565830

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TABLE B-6: ANALYSIS OF GROUNDWATER SAMPLES FROM THE IEPA MONITORING WELLS
(COLLECTED 10-23-80)

PARAMETERS	SAMPLE LOCATIONS											
	G101	G102	G103	G104	G105	G106	G107	G108	G109	G110	G111	G112
Alkalinity	362	410	336	406	271	387	552	375	287	210	302	699
Ammonia	0.3	1.0	1.7	0.4	0.9	2.9	0.5	0.3	4.5	1.2	0.1	1.5
Arsenic	0.023	0.023	0.043	0.049	0.067	0.16	0.043	0.008	0.055	0.053	0.008	0.019
Barium	1.3	0.8	2.9	2.2	2.0	0.6	2.1	0.3	0.2	0.5	0.2	0.5
Boron	0.5	0.4	0.5	0.6	0.4	0.5	0.5	0.4	0.4	0.5	0.5	5.6
Cadmium	0.0	0.0	0.03	0.0	0.0	0.0	0.0	0.0	0.0	1.5	0.0	0.06
Calcium	180	210	210	210	340	185	500	140	380	500	110	242
BOD	237	160	244	206	473	115	1070	298	275	780	79	162
Chloride	48	103	58	52	65	109	132	79	69	61	32	363
Chromium (Total)	0.04	0.02	0.09	0.04	0.12	0.01	0.07	0.0	0.0	0.38	0.0	0.01
Chromium (+6)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Copper	0.46	0.13	1.1	0.31	0.73	0.44	0.68	0.04	0.13	2.3	0.04	1.2
Cyanide												0.0
Fluoride	0.4	0.7	0.7	0.3	1.0	0.7	0.7	0.3	1.2	0.8	0.3	0.5
Hardness	501	884	549	630	528	637	777	496	1664	279	419	1080
Iron	51.0	30.5	86	90	18	62	13	4.1	39.0	340	5	18
Lead	0.10	0.15	0.26	0.2	0.31	0.0	0.27	0.0	0.0	7.3	0.07	0.44
Magnesium	0.09	90	79	72	100	49	205	24	100	209	24	82.5
Manganese	5.1	3.8	4.2	3.4	4.2	1.9	9.8	0.98	4.5	8.0	1.1	3.9
Mercury	0.0	0.0	0.0002	0.0	0.0	0.0	0.0	0.0001	0.0	0.0	0.0	0.0001
Nickel	0.1	0.1	0.9	0.1	0.8	0.1	0.3	0.0	0.5	1.9	0.0	0.3
Nitrate-Nitrite	0.1	0.1	0.1	0.4	0.0	0.1	0.1	1.1	0.0	0.4	0.5	0.0
pH	6.6	6.6	6.5	6.6	6.6	6.5	6.4	6.6	6.3	6.7	7.0	6.4
Phenolics	0.0	.01	0.0	0.005	0.0	0.065	2.5	0.01	0.45	0.015	0.0	0.875
Phosphorus	2.9	1.2	3.3	2.7	6.0	1.8	9.4	.18	.72	16	.24	.69
Potassium	10.6	13.1	13.4	12.3	22	7.7	15.2	13.7	14.9	29	4.9	58
R.O.E.	650	1230	765	790	824	1020	1230	704	2460	508	512	2130
Selenium	0.003	0.001	0.004	0.01	0.008	0.001	0.004	0.001	0.001	0.005	0.002	0.001
Silver	0.01	0.0	0.2	0.0	0.0	0.0	0.0	0.01	0.0	0.0	0.02	0.11
Sodium	24	60	40	29	57	96		40	40	53	24	260
S.C.	870	1500	1050	1080	1040	1340	1430	960	2470	720	490	
Sulfate	132	434	230	204	296	281	201	103	1348	93	104	518
Z	0.6	0.4	6.2	0.3	3.7	0.1	0.8	0.0	0.1	8.0	0.0	7.8
PCB (ppb)	1.0	1.2	-	-	-	-	-	-	-	2.7	-	-
Chlorophenol (ppb)	-	1200	-	-	-	-	630	-	19	-	-	-
Chlorobenzene (ppb)	-	-	-	-	-	-	19	-	-	-	-	100
Dichlorobenzene (ppb)	-	-	-	-	-	-	25	-	-	-	-	65
Dichlorophenol (ppb)	-	-	-	-	-	-	890	-	-	-	-	-
Cyclohexanone (ppb)	-	-	-	-	-	-	-	-	120	5.9	-	-
Chloroaniline (ppb)	-	-	-	-	-	-	-	-	-	-	-	3500

NOTE: All results in ppm unless otherwise noted.
Blanks indicate parameter not analyzed.
- indicates below detection limits.

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TABLE B-7: ANALYSIS OF GROUNDWATER SAMPLES FROM THE IEPA MONITORING WELLS
(COLLECTED 1-28-81)

	SAMPLE LOCATIONS											
PARAMETERS	G101	G102	G103	G104	G105	G106	G107	G108	G109	G110	G111	G112
Alkalinity	447	421	266	520	363	556	621	448	18	308	394	619
Ammonia	0.3	0.0	1.4	0.2	0.7	3.3	1.0	0.0	17	0.2	0.1	0.5
Arsenic	0.015	0.016	0.018	0.002	0.037	0.11	0.021	0.004	7.5	0.013	0.014	0.027
Barium	0.9	1.2	0.9	0.3	1.8	1.0	3.2	0.5	0.2	1.0	0.7	0.5
Boron	0.3	0.4	0.4	0.7	0.4	0.5	0.5	0.2	0.8	0.2	0.6	0.9
Cadmium	0.0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.14	0.00	0.00	0.00
Calcium	220.0	328.9	176.3	218.0	319.2	225.5	1169.5	205.5	466.7	169.4	181.4	198.3
C.O.D.	45	93	56	9	143	212	635	8	1315	37	28	47
Chloride	20	128	64	29	59	156	201	76	32	36	18	210
Chromium (Total)	0.02	0.02	0.02	0.00	0.03	0.00	0.09	0.00	0.04	0.02	0.02	0.00
Copper	0.59	0.79	0.36	0.14	0.43	0.29	0.97	0.00	94.1	0.11	0.04	0.28
Cyanide	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.01
Hardness	554	1072	490	717	764	617	960	564	2144	447	530	486
Iron	30.4	16.5	20.8	1.4	60.8	67.5	172	0.3	198	19.1	10.1	18.9
Lead	0.17	0.08	0.00	0.00	0.07	0.00	0.32	0.00	0.00	0.00	0.00	0.00
Magnesium	48.2	78.0	46.3	49.1	73.6	49.1	288.1	34.3	184.4	43.5	37.9	54.0
Manganese	3.02	3.15	3.07	1.41	4.10	2.13	9.64	0.34	8.30	0.77	1.76	2.78
Mercury	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0004	0.0	0.0	0.0
Nickel	0.1	0.1	0.4	0.0	0.2	0.0	0.5	0.0	176	0.9	0.0	0.0
Nitrate-Nitrite	0.0	2.5	0.1	0.5	0.0	0.0	0.2	3.5	0.3	18	0.5	0.0
pH	7.0	7.0	7.1	7.2	7.0	6.9	6.9	7.1	4.1	6.9	7.0	6.9
Phenolics	0.0	0.0	0.0	0.0	0.0	1.46	0.5	0.01	1.86	0.02	0.015	0.05
Phosphorus	0.91	0.88	0.41	0.06	3.6	2.1	10	0.03	3.7	1.0	0.51	0.53
Potassium	6.4	12	8.8	6.0	13	6.2	20	16	18	7.5	4.2	20
Selenium	0.002	0.002	0.002	0.002	0.003	0.002	0.011	0.004	0.006	0.016	0.002	0.0
Silver	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Sodium	13	63	48	15	50	94	60	30	37	13	14	18
Sulfate	129	583	256	265	468	143	276	86	3371	57	153	212
Zinc	0.3	1.2	1.8	0.1	1.5	0.1	1.5	0.0	10.1	2.0	0.1	2.8
PCB (ppb)	0.22	3.9	-	0.3	-	-	0.4	-	-	-	-	-
Chlorobenzene (ppb)							6.3	-	-			2.5
Dichlorophenol (ppb)							560	-	-			-
Chloroaniline (ppb)							90	-	-			2.1

NOTE: All results in ppm unless otherwise noted.
Blanks indicate parameter not analyzed.
- indicates below detection limits.

MCO 6365832

MCA 0150856

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TABLE B-8: ANALYSIS OF GROUNDWATER SAMPLES FROM THE IEPA MONITORING WELLS
(COLLECTED 3-10-81 - 3-11-81)

SAMPLE LOCATIONS

PARAMETERS	G101	G102	G103	G104	G105	G106	G107	G108	G109	G110	G111	G112
Alkalinity	463	464	319	568	393	594	657	464	58	331	387	400
Ammonia	0.2	0.0	1.5	0.0	0.4	3.0	0.2	0.0	15	0.0	0.1	0.7
Arsenic	0.001	0.0	0.003	0.001	0.013	0.085	0.004	0.001	3.9	0.001	0.001	0.00
Barium	0.0	0.7	0.1	0.2	0.2	0.3	0.1	0.2	0.1	0.1	0.1	0.0
Boron	0.2	0.4	0.3	0.7	0.3	0.5	0.5	0.2	0.5	0.1	0.4	3.4
Cadmium	0.0	0.01	0.01	0.0	0.0	0.0	0.01	0.0	0.07	1.1	0.0	0.17
Calcium	154	333	161	205	218	175	186	148	431	121	164	207
BOD	10	24	47	9	23	146	47	12	930	10	9	52
Chloride	16	124	46	28	57	150	235	51	24	27	16	133
Chromium (Total)	0.0	0.0	0.0	0.01	0.0	0.0	0.0	0.0	0.01	0.0	0.0	0.0
Copper	0.04	0.06	0.08	0.02	0.02	0.01	0.01	0.03	67	0.02	0.07	0.48
Cyanide	0.0	0.0	0.0	0.01	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Hardness	542	1062	620	839	796	675	1096	479	1651	424	485	789
Iron	0.3	0.3	1.6	0.0	9.4	4.9	2.4	0.0	1.4	0.0	0.2	0.5
Lead	0.0	0.0	0.0	0.0	0.0	0.06	0.0	0.0	0.0	0.0	0.07	0.0
Magnesium	34.2	77.9	41.9	56.8	47	44.8	44.8	22.3	138	28.7	31.8	72
Manganese	2.0	2.98	3.51	0.61	2.32	1.62	2.12	0.23	6.22	0.14	1.02	2.1
Mercury	-	-	-	-	-	-	0.0002	-	0.0003	-	-	-
Nickel	0.0	0.3	1.1	0.0	0.2	0.0	0.0	0.1	123	1.2	0.0	0.4
Nitrate-Nitrite	0.0	1.1	0.0	2.3	0.0	0.0	0.0	0.3	0.3	15	2.7	0.2
pH	6.9	6.8	6.8	6.9	6.8	6.7	6.7	7.0	4.6	6.6	6.8	6.6
Phenolics	0.0	0.0	0.005	0.0	0.0	0.0	1.7	0.1	1.4	0.0	0.0	0.00
Phosphorus	0.0	0.08	0.03	0.02	0.1	1.5	0.03	0.02	2.2	0.01	0.01	0.03
Potassium	4.0	10.8	10.4	5.9	8.9	5.7	2.8	18.2	6.4	6.3	2.9	40.2
Selenium	0.0	0.0	0.001	0.003	0.0	0.0	0.0	0.001	0.003	0.018	0.001	0.0
Silver	0.01	0.02	0.0	0.0	0.02	0.01	0.01	0.0	0.0	0.01	0.01	0.01
Sodium	11	64	65.6	17.4	51.2	92.6	39.2	25.2	12.1	14.2	15.5	96.6
Sulfate	118	617	471	303	466	146	313	55	2629	61	147	544
Zinc	0.1	0.8	2.8	0.1	0.3	0.1	0.1	0.3	6.3	1.8	0.1	11.8
PCB (ppb)	0.13	0.46	-	0.1	-	2.4	0.37	-	-	0.9	-	2.0

NOTE: All results in ppm unless otherwise noted.
Blanks indicate parameter not analyzed.
- indicates below detection limits.

was 6.3, 4.1, and 4.6 during the three sampling events. This indicates an unidentified source was releasing acid to the groundwater. Other wells which exhibited significant inorganic contamination include G102, G103, G105, and G106, all of which are located adjacent to CS-B along the west side. The data indicates non-uniform ground water contamination in the area, likely resulting from a variety of pollutional sources.

Private wells in the area have been periodically sampled by the IEPA and the USEPA. These wells are no longer used for potable water, but they are used for watering lawns and gardens. Locations of private well samples in the Dead Creek area are shown in Figure B-2. IEPA sampled five residential wells and collected one basement seepage sample near Creek Sectors B and C. Analytical data for these samples are presented in Table B-9. G504, located east of CS-B on Judith Lane, exceeded the standard for copper. The wells all showed water quality similar to that found in IEPA monitoring well G108, indicative of background conditions in the area. The basement seepage sample was collected from a residence on Walnut Street, just east of Site M. Analysis of this sample indicated higher levels of barium and copper, when compared with the private well samples. The seepage sample (x301) also showed a measurable level of chlordane, which was likely due to the application of commercial pesticides.

In March, 1982 the USEPA collected ground water samples from four private wells (S01, S02, S03, and S06) and two IEPA monitoring wells (S04 and S05). Ground water samples S04 and S05 correspond to IEPA monitoring wells G102 and G101 respectively. In addition, soil samples (S07 S10, S11) were collected from three gardens where well water is used for watering. Soil Samples S07, S010, and S011 were collected from gardens at the locations of ground water samples S01, S02, and S03 respectively (see Figure B-2 for approximate sample locations). Water and soil blank samples, R09 and R12 respectively, were also collected and analyzed. Analytical data for these samples are presented in Tables B-10 and B-11.

TABLE B-9: ANALYSIS OF RESIDENTIAL WELL AND SEEPAGE SAMPLES COLLECTED BY IEPA

SAMPLE DATES AND LOCATIONS

PARAMETERS	9/16/80 G501	9/16/80 G502	9/16/80 G503	9/23/80 G504	6/8/83 G505	1/5/83 x301
Arsenic	0.008	0.004	0.001		0.01	0.027
Barium	0.2	0.16	0.39	0.05	0.4	1.1
Boron	0.28	0.27	0.25	0.58	0.4	0.3
Cadmium						
Chromium						
Copper	0.02			0.06	0.01	0.03
Iron	4.6	19	17.7	0.73	26	31
Lead						0.03
Magnesium	33	39	36	30	35.3	54
Manganese	1.02	1.26	0.79	0.65	1.3	1.49
Mercury				0.0001		
Nickel				0.02		0.1
Phosphorus				0.02	0.62	1.2
Potassium	6.6	5.7	4.5	6	6.2	6.4
Silver						
Sodium	21	24	12	26	15.2	19
Zinc	0.85		0.18	0.8		0.7
PCBs	-	-	-			
Chlordane (ppb)	-	-	-	-		0.13

NOTE: All results in ppm unless otherwise noted
Blanks indicate below detection limit
- Indicates parameter not analyzed
Sample x301 was collected from basement seepage

MCA 0156859

MCO 6565835

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TABLE B-10: ANALYSIS OF IDENTIFIED ORGANICS IN GROUND WATER AND SOIL SAMPLES IN THE VICINITY OF CREEK SECTOR B (COLLECTED BY USEPA 3-3-82)

	SAMPLE LOCATION										
	Ground Water							Soil			
PARAMETERS	S01	S02	S03	S04	S05	S06	R09	S07	S010	S011	R012
bis(2-ethylhexyl) phthalate	64	62			19	a				a	0.44
di-n-butyl phthalate	a	a	a	a	11	a				a	a
diethyl phthalate	a	a	a	a			a				
3,4 benzofluoranthene	a										
benzo(k) fluoranthene	a										
butyl benzylphthalate				a			a				
methylene chloride	16	16	2300	3100	990	2000	19	1	0.1		0.75
1,2-dichlorobenzene				a							
1,4-dichlorobenzene				a							
chlorobenzene				a	a						
heptachlor				0.11b	0.146						
beta-BHC				0.18b	0.3b	4.04b					
gamma-BHC				0.16b	0.25b						
alpha-BHC					0.18b	0.25b					
aldrin				0.17b							
dieldrin								0.012		0.0046	
chlordane									0.11b		
heptachlorepoxide						1.46b					
delta-BHC						0.95b					
fluoranthene							a			a	
benzo(a) anthracene							a			a	
anthracene							a				
pyrene							a			a	
Chrysene										a	0.02b

NOTE: All results in ppb
Blanks indicate below detection limit
a - Compound detected at value below specified contract detection limit (compound identified as present, but not quantified)
b- value not confirmed by GCMS
Samples R09 and R012 are water and soil blanks, respectively

MCA 0156860
MCO 6565836
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TABLE B-11: INORGANIC ANALYSIS OF GROUND WATER AND SOIL SAMPLES IN THE VICINITY OF CREEK SECTOR B (COLLECTED BY USEPA 3-3-82)

SAMPLE LOCATIONS

PARAMETERS	GROUND WATER - in PPB S01	S02	S03	S04	S05	S06	SOIL IN PPM S07	S010	S011	R012
Aluminum		400	390		940	1,200	750	600	430	
Antimony										
Arsenic	11			29			1.3	1.0		
Barium							80	80	80	
Beryllium										
Boron	10,500	11,000	8,000	1,800	140	110				
Cadmium	4.2	14	31	5.3		2.8	1.06	1.64	0.29	
Chromium	12						2.2			3.2
Cobalt	62	70	82	95						
Copper	65						16	24	13	
Iron	65,000	31,000	38,000	28,000	530	250	340	360	240	
Lead	570	97	74	9	11	10	(45)	(20)	(25)	
Manganese	1,600	1,100	1,500	5,100	460	80	120	630	134	
Mercury										
Mercury*	0.1	0.4	0.4	0.2	0.1					
Nickel							6.5	5.5	4	
Selenium										
Silver										
Thallium										
Tin									2	
Vanadium										
Zinc	107,000	109.000	40,000	1,900	260	350	96	77	130	

NOTE: Blanks indicate below detection limits
( ) - Results did not meet USEPA Quality Control criteria - Data unreliable
* Duplicate analysis performed by USEPA central regional laboratory
Samples R09 and R012 are water and soil blanks, respectively

MCA 0156861

MCO 6565637

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Quantified levels of bis-(2-ethylhexyl) phthalate were found in wells S01, S02, and S05. In addition, seven compounds from the pesticide fraction were detected in Wells S04, S05 (IEPA wells), and S06. Diethyl phthalate, butyl benzylphthalate, and methylene chloride were detected in the water blank, indicating that values of these parameters found in other samples should be disregarded. Methylene chloride was used to decontaminate sampling equipment, and concentrations of this parameter in all samples should not be considered indicative of aquifer conditions. Water quality standards for lead and cadmium were exceeded in one or more wells.

The soil samples showed trace levels of chlordane and dieldrin. It could not be determined if levels of pesticides found in the gardens soils were attributable to the use of well water or application of commercial pesticide products to the gardens. Phthalates, methylene chloride, chrysene, and chromium were detected in the soil blank (R012), and these compounds should be disregarded in other samples.

In September and October, 1980 IEPA conducted preliminary air monitoring in CS-B. The survey included use of detector tubes (Drager) for halogenated hydrocarbons, and collection of air samples in charcoal tubes with subsequent laboratory analysis. The detector tubes showed positive readings for hydrocarbons in the northern portion of CS-B, adjacent to the former Waggoner Building. Results were not quantified, and negative readings were observed in all other areas surveyed. Air samples were collected from two locations in CS-B using charcoal tubes and sampling pumps. Two samples were collected from each location in order to monitor conditions for undisturbed and disturbed soil. Samples from the first location, 40 yards south of Queeny Avenue, showed no positive readings for volatile organic compounds (VOCs) for disturbed or undisturbed soil conditions. Xylene was detected for disturbed and undisturbed soil conditions at the second sampling location, which was 60 yards north of Judith Lane, adjacent to Site M. All samples were extracted and analyzed at IEPAs Springfield Laboratory.

A USEPA Field Investigation Team (FIT) contractor also performed an air monitoring survey in the creek bed in March, 1982. This survey involved the use of an organic vapor analyzer (OVA), an HNU photoionizer, and Drager detector tubes for phosgene gas. Results indicated that a small, but measurable, concentration of organic vapors were present in the breathing zone (5 feet above ground surface), with concentrations increasing closer to the creek bed. In the breathing zone, the OVA showed readings up to 0.5 ppm above background, and the HNU readings were as high as 9 ppm above background. The survey crew also observed a 3-inch effluent pipeline adjacent to the former Waggoner Building which was discharging a small stream of oily liquid. OVA and HNU readings were taken approximately 6 inches from the surface where this liquid had pooled. The OVA showed concentrations up to 350 ppm, and the HNU showed concentrations ranging from 400 to 900 ppm in this area. Phosgene gas was not detected in any area using the Drager tubes.

HRS scores have been calculated on two separate occasions for Dead Creek. The creek was first scored in July, 1982, by Ecology & Environment, Inc., with a final migration score of 18.48. The site was again scored in March, 1985 by IEPA in an attempt to increase the previous score. IEPAs assessment led to a final score of 29.23, however, this score has not been finalized by USEPA. Route scores for the 1982 assessment were as follows: ground water 4.24, surface water 7.55, and air 30.77. Corresponding route scores in the 1985 assessment were 5.65, 10.07, and 49.23. Observed releases were used for all route scores in both the 1982 and the 1985 scoring packages. The only difference in the assessments was in the value assigned for waste quantity in the three routes. The 1982 package listed waste quantity as unknown (assigned value - 0), while IEPA calculated an approximate volume of waste based on sample results and visual observations.

A significant amount of data has been developed showing a wide range of contaminants in and around CS-B. Review of existing file data indicates numerous possible sources of contamination in the area.

Prior to blocking the culvert at Queeny Avenue, Cerro Copper and Monsanto Chemical reportedly discharged process wastes directly into the creek. According to past IEPA inspection reports the former Waggoner Company, an industrial waste hauling operation, discharged wash waters from truck cleaning activities directly to CS-B. After IEPA order Waggoner to cease this practice, an unlined surface impoundment was apparently used for disposal of wash water. In the 1940s and 1950s sites H and I were used for disposal of various industrial wastes. These sites were actually a single, large disposal area prior to the construction of Queeny Avenue in the late 1940s. In the 1950s, the Midwest Rubber Company, located west of State Route 50 and south of Queeny Avenue, had an effluent pipeline which ran from their plant location to the northern portion of CS-B. Midwest Rubber Co. reportedly discharged process wastes, including oils and cooling water, to the creek. Site G is a surface/subsurface disposal area with corroded drums and other wastes exposed on the surface. Surface drainage for at least a portion of this site is directed to CS-B.

Data Assessment and Recommendations

The scope of field investigation work for CS-B during the Dead Creek Project includes collecting three surface water samples from the Creek in Sector B. This sampling program should be sufficient to characterize the water currently in the creek. Soil gas and ambient air monitoring will also be done in and around CS-B.

Although a great deal of data is available for CS-B, most of the data is 4-6 years old. Because of the dynamic nature of the creek and disposal activities in the area, existing conditions may not be accurately characterized by historical sampling data. Feasibility study activities for CS-B could be accomplished using existing data and applying assumptions concerning chemical profiles (contaminant distribution). However, to properly accomplish the feasibility study activities, a current chemical depth profile of the creek bed should be developed. This would consist of collecting

sediment and subsurface soil samples from several locations in the creek bed and along the banks. The hydrology of the area has not been well-defined and should be addressed further. It has not been established whether the ground water discharges to Dead Creek or the creek acts as a recharge conduit for the Henry Formation aquifer. If discharge to the creek is occurring, the subsurface disposal areas (Sites H and I in particular) may be major contributors to the contamination of the creek.

Accordingly, existing IEPA monitoring wells on both sides of the creek should be redeveloped to allow for accurate water level measurements. This, in conjunction with detailed surveying of the creek bed and water levels in the creek, would allow adequate assessment of the hydrology in the area. This would be best accomplished using continuous-recording water level instrumentation, and should be continued over a period of time sufficient to address seasonal fluctuations. In addition, records of industries in the area should be thoroughly reviewed to establish a profile of possible releases from each source.

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WORK PLAN
FOR A SITE INVESTIGATION
FOR DEAD CREEK SECTOR B, AND SITES L AND M, SAUGET - CAHOKIA, ILLINOIS

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August 1991

Prepared for

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WORK PLAN
FOR A SITE INVESTIGATION
FOR DEAD CREEK SECTOR B
AND SITES L AND M,
SAUGET-CAHOKIA, ILLINOIS

August 15, 1991

Geraghty & Miller, Inc. is submitting this Work Plan to Monsanto Company for a proposed site investigation at the Dead Creek Sites. The Work Plan was prepared in conformance with Geraghty & Miller's strict quality assurance/quality control procedures to ensure that the report meets the highest standards in terms of methods used and the information presented. If you have any questions or comments concerning this Work Plan, please contact one of the individuals listed below.

Respectfully submitted,

GERAGHTY & MILLER, INC.

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WORK PLAN
FOR A SITE INVESTIGATION
FOR DEAD CREEK SECTOR B
AND SITES L AND M, SAUGET-CAHOKIA, ILLINOIS

1.0 INTRODUCTION

At the request of Monsanto Company, St. Louis, Missouri, Geraghty & Miller, Inc. has prepared this work plan for a site investigation at Dead Creek Sector B and Sites L and M, Sauget-Cahokia, Illinois. The purpose of the study is to characterize conditions at the sites by determining the nature and extent of sediment/fill materials that are present and estimate the volume of material affected by organic compounds and/or metals. Throughout this work plan, the site(s) will be referred to as Sector B, Site L and Site M, which were identified by the Illinois Environmental Protection Agency (IEPA) as Dead Creek Sector B, Sauget Site L, and Sauget Site M (Ecology & Environment [E&E], 1988). The study area is shown on Figures 1 and 2.

This work plan describes the scope of work associated with the sites investigations. Three project operation plans are provided as appendices. A field sampling plan (FSP), describing the sampling protocols, is presented in Appendix A. The quality assurance project plan (QAPP), providing procedures for assuring the quality of the analytical data, is contained in Appendix B. The health and safety plan (HASP) is provided in Appendix C and describes procedures to protect the health and safety of the investigation team.

1.1 SCOPE OF WORK

A field investigation will be conducted which will consist of a focused boring and sampling program. Specific testing locations and the recommended analyses at each of the three sites have been selected based upon historical information and previous investigations discussed in Sections 1.2.2 and 1.2.3. The field program will be conducted in two phases.

A boring program will be conducted to characterize sediment/fill material at each of the sites and to determine its areal extent. After the nature and extent of the sediment/fill at each of the sites has been defined, a second phase of sampling will be undertaken to classify materials, reactivity, ignitability, corrosivity, and toxicity using the Toxicity Characteristic Leaching Procedure (TCLP).

1.2 SITE BACKGROUND

A description of the site locations, site histories, and previous investigations is presented in the following sections.

1.2.1 Site Location and Description

Dead Creek Sector B, and Sites L and M are located in Sauget and Cahokia, St. Clair County, Illinois. The sites are located on the north-central part of the Cahokia, Illinois-Missouri U.S. Geological Survey (USGS) topographic quadrangle (Figure 1). Dead Creek Sector B is about 2000 feet in length and lies between Queeny Avenue to the north and Judith Lane to the south. Sector B encompasses an area of about 230,000 square feet (ft^2)(Figure 2). In general, the creek area consists of a narrow channel that is about 5 feet wide. Water levels in the creek vary, depending on precipitation and water table fluctuations. During periods of little precipitation and low water table, the creek becomes a dry ditch. The channel of the creek bed is flanked by a low bank on either side which may often be under water. The channel and the low banks are enclosed by steeper, heavily vegetated banks. Standing water cannot drain out of Sector B to other parts of Dead Creek because both the influent (north) and effluent (south) ends of Sector B have been sealed.

Sites L and M are located adjacent to Creek Sector B (Figure 2). Site L is located on the east side of Sector B and approximately 700 feet south of Queeny Avenue. Based on a figure in a report prepared by the IEPA (St. John, 1981), the site's (L) approximate dimensions are 70 feet by 150 feet. The subsequent study by an IEPA consultant (E&E,

1988) indicates the dimensions of Site L to be 70 feet by 150 feet. The figures depict a site with dimensions of about 195 feet by 145 feet. This discrepancy is likely due to the site boundaries drawn by E&E, which included a larger area than the actual impoundment basin. Therefore, for the purposes of this study, the site boundaries are assumed to be those depicted on the E&E (1988) report figures. Site L includes a portion of the property owned by Metro Construction Company. The site is covered with black cinders and construction vehicles are parked across the area. Access to the site is not restricted.

Site M is adjacent to the southeast part of Sector B and it is about 200 feet north of Judith Lane. The site is a former pit that was formed by sand mining. Presently, the pit is filled with water at least 2 feet deep. Site M is connected to Creek Sector B by a drainage way which allows water to flow from the creek to the pit. The dimensions of Site M are about 335 feet by 235 feet. Site M, along with all of Creek Sector B, is surrounded by a chain-link fence which was installed by the U.S. Environmental Protection Agency (USEPA) to restrict access.

1.2.2 Site History

Formally, Dead Creek provided drainage for part of the Mississippi floodplain and water in the creek flowed in a southwesterly course to the Prairie Dupont Floodway which ultimately discharged to the Cahokia Chute of the Mississippi River. However, Dead Creek, particularly Sector A (immediately north of Sector B) and Sector B have been a concern since the early 1970s when area residents filed complaints with the Cahokia Health Department regarding discharges to the creek (Ecology & Environment, 1988). As a result of these concerns, culverts on the north and south ends of the Sector B portion of the creek were sealed to prevent surface water from flowing freely into or out of that part of the creek. Additionally, the creek may have been affected by former pits or excavations (e.g., Sites L and M) adjacent to its banks (St. John, 1981). Since that time, several federal and state agencies have conducted surveys, site inspections, and studies of Dead Creek and adjacent former pit/excavation areas.

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Site L was used as a disposal impoundment basin by Harrold Waggoner and Company, a trucking firm which operated at the site from 1964 to 1974. Discharges to the impoundment at Site L began after 1971, after Harrold Waggoner and Company was cited by the IEPA for discharges directly into Dead Creek within Sector B. Ruan Trucking Company also used the impoundment basin for disposal purposes after they purchased the operation in 1974. Disposal activity at site L ceased after 1978 when the property was sold to Metro Construction Company, the site's present owner (E&E, 1988). The site is covered with cinders and serves as a depot for large construction machinery, along with adjacent areas.

Site M was a sand mining area excavated in the 1940s by H.H. Hall Construction Company. This area was mined prior to any residential development along Walnut Avenue, east of Site M. The E&E Report (1988) reported the owner of the property as Thomas Owen.

1.2.3 Previous Investigations

In 1980, the IEPA initiated an investigation of Dead Creek and adjacent areas as a result of complaints from local area residents. The IEPA study (St. John 1981) consisted of analyzing 31 soil samples (19 from Sector B) to determine the affect of disposal practices. Information from five hand auger and 12 drill rig boring locations was used to characterize local geologic conditions. In addition, surface water samples and ground-water samples were collected and analyzed. The study concluded that sediment samples collected from Dead Creek contained polychlorinated biphenyls (PCBs), organic compounds and metals. The report also concluded that ground water and surface water were also affected by organic and inorganic constituents.

In 1986, E&E initiated a remedial investigation (RI) on behalf of the IEPA at several sites in the Sauget area, which included Sector B and Sites L and M. In Sector B, E&E collected two surface water samples and five sediment samples from the north and south

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ends of site. A summary of the soil and sediment analytical data collected by E&E is provided in Tables 1 through 4.

Four borings were used by E&E (1988) to characterize conditions at Site L. Data from the borings indicate that the impoundment basin was excavated approximately eight feet into a deposit chiefly composed of sand with silt. The excavation was filled with material consisting of black cinders, clay and concrete. The contact between fill material and the underlying sand and silt deposits are believed to be an indication of the impoundment basin's extent. E&E reported that past disposal activities have affected sediment and ground-water quality. Constituents detected include benzene, toluene, phenols, and arsenic. PCBs were not detected.

In 1986, E&E collected two surface water and five sediment samples in the excavated area of Site M. The results from these samples indicate that the site sediments have been impacted by past disposal activities. However, it is not clear whether or not Site M was a disposal area or was affected by surface water drainage from Dead Creek. Surface water samples did not exhibit constituent concentrations indicative of disposal impacts.

The Advendt Group, Inc. completed a site investigation/remedial alternatives evaluation for Creek Sector A (1990) which is located north of Sector B on property owned by Cerro Copper Products Co. The Advendt Group study consisted of a field program initiated in July 1989 to characterize and define the constituents in Creek Sector A and determine the volume of sediments requiring remedial action. Ninety nine sediment samples were collected from 34 soil borings along ten transects of Sector A. The report concluded that fill and creek channel sediments ranged in thickness from one to 15 feet and a half foot to 11 feet, respectively. These materials contained concentrations of organic compounds including PCBs as well as inorganic analytes (metals). It was estimated that approximately 19,500 cubic yards of creek bottom sediments was affected by chemical constituents.

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2.3 CLIMATE

The climate of the site(s) area is continental with hot, humid summers and mild winters. Periods of extreme cold are of short duration. The average annual rainfall in the area for the period from 1903 to 1983 was 35.4 inches; however, precipitation increased to 39.5 inches per year during the period from 1963 to 1988 (Southwestern Illinois Metropolitan and Regional Planning Commission (1983). The average annual temperature is 56°F; the highest average monthly temperature (79°F) occurs in July and the lowest average monthly temperature (32°F) occurs in January.

2.4 REGIONAL AND SITE GEOLOGY

The site(s) is situated on the flood plain of the Mississippi River (Figure 1). The flood plain is locally named the American Bottoms, and contains unconsolidated valley fill deposits composed of recent alluvium (Cahokia Alluvium) which overlies glacial material (Henry Formation). Published information indicates that these unconsolidated deposits are underlain by bedrock of Pennsylvanian and Mississippian age which consists of limestone and dolomite with lesser amounts of sandstone and shale.

The Cahokia Alluvium (recent deposits) consists of unconsolidated, poorly sorted, fine-grained materials with some local sand and clay lenses. These recent alluvium deposits unconformably overlie the Henry Formation which is Wisconsinian glacial outwash in the form of valley-train deposits. The Henry Formation is about 100 feet thick. These valley-train materials are generally medium to coarse sand and gravel and increase in grain size with depth.

During the various drilling programs conducted on-site, the alluvium underlying Dead Creek has been characterized as a silt with local clay and sand lenses (St John 1981). The deposits tend to become coarser with depth. The Advendt Group (1990) categorized the stratigraphy in Sector A as being comprised of the four following units in descending order:

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fill material, fluidized creek bottom sediments, Cahokia Formation, and Henry Formation. The fill material is composed of sand and silt matrix intermixed with concrete, bricks, road aggregate, rags, slag, and vitreous pellets. The fluidized creek bottom sediments are saturated silts with organic matter. The Cakohia and Henry formations have been described similar to that discussed above.

3.0 INVESTIGATION FIELD ACTIVITIES

A boring program will be conducted to characterize the sediment/fill at each of the sites. Described below are the different sampling strategies and rationales for Sector B, and Sites L and M. After the boring programs discussed below are complete, a phase II program will be initiated to classify the material.

Access to Sector B and Site M will be gained through lockable gates that will be installed at four locations. Gate locations will be chosen to facilitate movement into and out of the sites which is hindered by steep banks within Sector B and Site M. Gravel fill will be brought onto the site to aid in the construction of access ramps. Land clearing of small trees and underbrush will be required to move within Sector B.

3.1 SECTOR B BORING PROGRAM

Sediment/fill samples will be collected along ten profiles (transects) within the creek bed, spaced approximately 200 feet apart, throughout the 2,000-foot length of Sector B. As shown on Figure 3, three borings are proposed for each profile similar to the study conducted in Sector A (Advendt Group 1990). All borings will be drilled to determine the thickness of the sediment/fill in the creek and will be spaced, within a given transect, 15 to 20 feet apart. The limits of the creek bottom sediments/fill will be determined visually by a field geologist during the drilling operations. It is anticipated that the borings within the creek bed will be drilled to a maximum depth of about 7 feet. Samples will be collected using a 5-foot continuous tube sampler, and 3-inch diameter split spoons will be used if

recovery is poor in the fine sandy sediments. Both methods will provide a continuous record of the geology, as well as a sufficient volume of material for analysis. All samples will be described by the Geraghty & Miller field geologist who will record sample location, depth, grain size distribution, and color. Each sample will also be screened in the field for the presence of volatile organic compounds (VOCs) using a photoionization detection (PID) instrument.

Based on appearance and PID measurements, we propose to select one sediment/fill sample per borehole for chemical analysis. Each sample will be selected from a 2-foot interval that best characterizes sediment/fill in the creek. One sediment/fill sample per transient will be analyzed for the USEPA target compound list/ target analyte list (TCL/TAL) parameters. The remainder of the samples from the transect will be analyzed for TAL parameters (metals) and PCBs. Appropriate quality assurance/quality control (QA/QC) samples will also be collected. The analytical data from the sediment/fill will be used to delineate any impacted areas, as well as provide an estimate of the volume of sediment/fill present. Each borehole will be sealed with a mixture of drill cuttings and bentonite grout and the borehole's location and land surface elevation will be surveyed by a licensed land surveyor. All drilling equipment will be steam cleaned after each borehole and all sampling equipment will be decontaminated with a laboratory-grade detergent and potable water before the collection of each sample.

At present, we propose to use an all-terrain vehicle (ATV) drill rig for the entire program. However, in some areas, it may be necessary to pump off standing water to provide suitable sampling conditions. If there is a great deal of standing water, and it is not feasible to pump it off to another part of the creek, the drill rig can be mounted on a reinforced aluminum pontoon that can be anchored to the creek channel bank with steel cables. This drilling method was used in Creek Sector A by Advendt Group (1990).

3.2 SITE L BORING PROGRAM

To define the lateral and vertical extent of the fill material at Site L, additional borings are required to supplement the data collected previously (E&E 1988). Since this site is relatively small (70 feet by 150 feet), only six borings are necessary to categorize the nature and extent of the fill material. These borings will be drilled at strategic locations to supplement the existing borings drilled during the E&E investigation (1988) (Figure 4).

At each boring location, we propose to collect continuous samples, using a 5-foot tube sampler or a 3-inch diameter split-spoon, to delineate the bottom of the fill. Five borings will be drilled at the perimeter of the former impoundment (as identified by E&E) to determine its actual boundaries. A visual examination by the field geologist will be used to determine whether or not the boring is within the former impoundment basin. If necessary, boring locations will be adjusted to ascertain the former impoundment basin boundaries and characterize the fill material. The remaining boring will be drilled near the center of Site L to determine maximum fill thickness. One sample per borehole (six boreholes) will be submitted for laboratory analysis. The sample that best characterizes the fill material will be selected for analysis. The criteria for sample selection will be visual indicators such as discoloration and high PID readings. Each sample will be limited to a 2-foot section of the continuous core. At two of the six borings, the samples will be analyzed for TCL/TAL parameters. At the remaining four borings, samples will be analyzed for PCBs, TAL metals, and TCL VOCs. Each borehole will be sealed and surveyed as described for Dead Creek - Sector B.

3.3 SITE M BORING PROGRAM

At Site M, sediment samples will be collected from three locations from beneath the ponded water (Figure 5). To obtain the samples, a soil boring drill rig supported by the aluminum pontoon previously described in Section 3.1 may be used, or samples may be collected from a boat. This method of supporting a drill rig on surface water has been used

successfully at other sites (Advendt Group, Inc. 1990). If the samples are collected from a boat, 4-inch diameter steel casing will be driven into the pond sediments and split-spoon samples will be obtained from within the casing to determine the thickness of the sediments. One sample for laboratory analysis will be selected from each of the three locations at the 0 to 2-foot interval. At one location, the sample will be analyzed for TCL/TAL parameters, and at the other two locations, each sample will be analyzed for PCBs and TAL metals. We have assumed that the pit bottom is at a maximum depth of 10 feet below the pond level. Sample selection protocols and decontamination procedures will be the same as was described for Dead Creek - Sector B.

3.4 PHASE II INVESTIGATION

Once the chemical nature of the sediment/fill material has been determined, approximately five samples will be collected during a second phase of field work to classify the material. Each of these samples will be analyzed for reactivity, corrosivity, ignitability, and toxicity using the TCLP.

4.0 PROJECT ORGANIZATION AND SCHEDULING

All field activities will be conducted in accordance with specific field, analytical, and health and safety protocols outlined in the FSP (Appendix A), the QAPP (Appendix B), and the HASP (Appendix C), respectively. Primary responsibility for the study will be shared by the Geraghty & Miller project officer and project manager (see Figure 6). They will be responsible for the scheduling and coordination of all Geraghty & Miller personnel on the project and for providing technical assistance for all activities which are directly related to the study. The Geraghty & Miller QA/QC advisor will have the responsibility for all QA/QC review to ensure that work is performed in accordance with established protocols.

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The schedule for the sites investigation and evaluation is shown on Figure 7. The investigation will begin upon notice of approval of this work plan and authorization to proceed from Monsanto Company. A 30-week schedule is shown for performance of tasks and development/submittal of preliminary and final reports.

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TABLES

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Table 1. Summary of Volatile Organic Compounds Detected in Sediments and Soils from Dead Creek Sector B, and Sites L and M, Sauget - Cahokia, Illinois.

	Sector B				
Sample Identification:	DC-L1-02	DC-SD-14	DC-SD-18	DC-SD-19	DC-SD-20
Sample Depth:	(0-0.5')	(2-3')	(0-0.5')	(0-0.5')	(1.5-2')
Sample Date:	11/5/86	11/5/86	11/5/86	11/5/86	11/5/86
Parameter (concentrations in ppb)					
Methylene chloride	11000 B	2200	12000	13000	14000
Acetone	15000 B	820	4100	10000	6100
Chloroform	--	--	--	--	--
2-Butanone (MEK)	21000 B	510	14000	14000	10000
Benzene	--	87	--	--	--
4-Methyl-2-pentanone	--	220	--	--	--
2-Hexanone	--	--	--	52000	--
Toluene	--	810	--	--	--
Chlorobenzene	--	5200	--	--	--
Ethylbenzene	--	3600	--	--	--
Total Xylenes	--	990	--	--	--

Source of data - Ecology & Environment (1988).

B Compound detected in blank samples.
J Estimated value. Result is less than the specified detection limit, but greater than zero.
-- Not detected.
NA Not analyzed.
ppb Parts per billion.

DRAFT

GERAGHTY & MILLER, INC.

Protected Material: Monsanto Insurance Coverage Litigation

EPA/CERRO COPPER/EIL/PCB ATTORNEY WORK PRODUCT / ATTORNEY CLIENT PRIVILEGE

MCA 056886

Table 1. Summary of Volatile Organic Compounds Detected in Sediments and Soils from Dead Creek Sector B, and Sites L and M, Sauget - Cahokia, Illinois

	Site L				
Sample Identification:	DC-L1-02	DC-L2-03	DC-L3-04	DC-L4-09	DC-L4-10
Sample Depth:	(5-10')	(5-15')	(5-15')	(10-20')	(10-20')
Sample Date:	12/12/86	12/12/86	12/12/86	12/17/91	12/17/91
Parameter (concentrations in ppb)					
Methylene chloride	14 B	141 B	2278 B	8	5 J
Acetone	907 B	449 B	4557 B	32 B	81 B
Chloroform	--	--	20253	96	49
2-Butanone (MEK)	16	--	10000 B	16 B	--
Benzene	--	141	4177	7 J	4 J
4-Methyl-2-pentanone	8 J	167	--	68 B	49 B
2-Hexanone	--	--	--	--	--
Toluene	--	2179	26582	93	--
Chlorobenzene	--	--	--	--	--
Ethylbenzene	--	40 J	--	--	--
Total Xylenes	--	179	670 J	--	--

Source of data - Ecology & Environment (1988).

B Compound detected in blank samples.
J Estimated value. Result is less than the specified detection limit, but greater than zero.
-- Not detected.
NA Not analyzed.
ppb Parts per billion.

DRAFT

EPA/CERRO COPPER/EIL/PCB ATTORNEY WORK PRODUCT / ATTORNEY CLIENT PRIVILEGE

MCA 1156887

Protected Material: Monsanto Insurance Coverage Litigation

Table 1 Summary of Volatile Organic Compounds Detected in Sediments and Soils from Dead Creek Sector B, and Sites L and M, Sauget - Cahokia, Illinois

	Site M		
Sample Identification:	DC-SD-15	DC-SD-16	DC-SD-17
Sample Depth:	(0-0.5')	(0-0.5')	(0-0.5')
Sample Date:	11/5/86	11/5/86	11/5/86
Parameter (concentrations in ppb)			
Methylene chloride	7800 B	10000 B	8400 B
Acetone	4900 B	5100 B	5600 B
Chloroform	--	--	--
2-Butanone (MEK)	11000	14000	13000
Benzene	--	--	--
4-Methyl-2-pentanone	--	--	--
2-Hexanone	--	--	--
Toluene	--	--	--
Chlorobenzene	--	--	--
Ethylbenzene	--	--	--
Total Xylenes	--	--	--

Source of data - Ecology & Environment (1988).

B Compound detected in blank samples.
J Estimated value. Result is less than the specified detection limit, but greater than zero.
-- Not detected.
NA Not analyzed.
ppb Parts per billion.

DRAFT

Protected Material: Monsanto Insurance Coverage Litigation

EPA/CERRO COPPER/EIL/PCB ATTORNEY WORK PRODUCT / ATTORNEY CLIENT PRIVILEGE

MCA 1156888

Table 2. Summary of Semivolatile Organic Compounds Detected in Sediments and Soils from Dead Creek Sector B, and Sites L and M, Sauget - Cahokia, Illinois.

	Sector B				
Sample Identification:	DC-SD-13	DC-SD-14	DC-SD-18	DC-SD-19	DC-SD-20
Sample Depth:	(0-0.5')	(2-3')	(0-0.5')	(0-0.5')	(1.5-2')
Sample Date:	11/5/86	11/5/86	11/5/86	11/5/86	11/5/86
Parameter (concentrations in ppb)					
Acenaphthene	–	–	–	–	–
4-Nitrophenol	–	2600 J	–	–	–
Diethylphthalate	–	–	–	–	–
Flourene	–	3900 J	–	–	–
Hexachlorobenzene	–	–	–	1900	210 J
Pentachlorophenol	–	–	–	940 J	370 J
Phenanthrene	–	15000 J	–	–	–
Di-n-butyl phthalate	–	–	300 J	–	280 J
Fluoranthene	–	11000 J	–	–	–
Pyrene	–	13000 J	1400 J	–	91 J
Butyl Benzyl phthalate	–	–	830 J	–	–
Benzo (a) Anthracene	–	–	430 J	–	–
bis(2-Ethylhexyl) phthalate	9900 J	9500 J	5300	–	95 J
Chrysene	–	–	1200 J	–	180 J
Di-n-octyl phthalate	–	2600 J	940 J	–	96 J
Benzo (b) fluoranthene	–	3400 J	–	2400	–
Benzo (k) fluoranthene	720 J	–	1500 J	–	410 J
Benzo (a) pyrene	1100 J	1800 J	490 J	310 J	95 J
Ideno (1,2,3-cd)perylene	–	–	850 J	1400 J	200 J
Dibenz (a,h) anthracene	–	–	–	390 J	–
Phenol	–	–	1400 J	1800 J	210 J
2-Chlorophenol	–	–	–	–	–
1,4-Dichlorobenzene	–	220000	–	–	–
1,2-Dichlorobenzene	–	17000 J	–	130 J	–
4-Methylphenol	–	–	–	–	–
Nitrobenzene	–	–	–	–	–
1,2,4-Trichlorobenzene	–	5400 J	–	390 J	76 J
Napthalene	400 J	9500 J	190 J	120 J	–
2-Methylnapthalene	–	8400 J	–	–	–

Source of data - Ecology & Environment (1988).

B Compound detected in blank samples.
J Estimated value. Result is less than the specified detection limit, but greater than zero.
– Not detected.
NA Not analyzed.
ppb Parts per billion.

DRAFT

Table 2. Summary of Semivolatile Organic Compounds Detected in Sediments and Soils from Dead Creek Sector B, and Sites L and M, Sauget - Cahokia, Illinois.

	Site L				
Sample Identification:	DC-L1-02	DC-L2-03	DC-L3-04	DC-L4-09	DC-L4-10
Sample Depth:	(5-10')	(5-15')	(5-15')	(10-20')	(10-20')
Sample Date:	12/12/86	12/12/86	12/12/86	12/17/86	12/17/86
Parameter (concentrations in ppb)					
Acenaphthene	–	–	–	–	–
4-Nitrophenol	–	44 J	–	–	–
Diethylphthalate	–	–	–	–	310 J
Flourene	–	–	–	–	–
Hexachlorobenzene	–	–	–	–	–
Pentachlorophenol	–	11538	58228	–	–
Phenanthrene	–	602	1772 J	–	–
Di-n-butyl phthalate	171 J	372 J	2784	–	–
Fluoranthene	–	448	–	–	–
Pyrene	–	282 J	–	–	–
Butyl Benzyl phthalate	–	–	–	–	–
Benzo (a) Anthracene	–	–	911 J	–	–
bis(2-Ethylhexyl) phthalate	–	1217	–	750	1297
Chrysene	–	205 J	–	–	–
Di-n-octyl phthalate	–	–	–	–	–
Benzo (b) fluoranthene	–	–	–	–	–
Benzo (k) fluoranthene	–	–	–	–	–
Benzo (a) pyrene	–	–	–	–	–
Ideno (1,2,3-cd)perylene	–	–	–	–	–
Dibenz (a,h) anthracene	–	–	–	–	–
Phenol	–	346 J	1519 J	–	–
2-Chlorophenol	–	–	2152	–	–
1,4-Dichlorobenzene	–	–	215 J	–	–
1,2-Dichlorobenzene	–	–	–	–	–
4-Methylphenol	–	88 J	1089 J	–	–
Nitrobenzene	–	–	–	–	49 J
1,2,4-Trichlorobenzene	–	–	–	–	–
Napthalene	–	154 J	532 J	–	–
2-Methylnapthalene	–	333 J	1000 J	–	–

Source of data - Ecology & Environment (1988).

B Compound detected in blank samples.
J Estimated value. Result is less than the specified detection limit, but greater than zero.
-- Not detected.
NA Not analyzed.
ppb Parts per billion.

DRAFT

Table 2. Summary of Semivolatile Organic Compounds Detected in Sediments and Soils from Dead Creek Sector B, and Sites L and M, Sauget - Cahokia, Illinois.

	Site M		
Sample Identification:	DC-SD-15	DC-SD-16	DC-SD-17
Sample Depth:	(0-0.5')	(0-0.5')	(0-0.5')
Sample Date:	11/5/86	11/5/86	11/5/86
Parameter (concentrations in ppb)			
Acenaphthene	–	–	–
4-Nitrophenol	–	–	–
Diethylphthalate	–	–	–
Flourene	–	–	–
Hexachlorobenzene	–	–	–
Pentachlorophenol	–	–	–
Phenanthrene	–	–	–
Di-n-butyl phthalate	580 B	570 BJ	560 J
Fluoranthene	–	–	–
Pyrene	–	–	–
Butyl Benzyl phthalate	–	–	–
Benzo (a) Anthracene	–	–	–
bis(2-Ethylhexyl) phthalate	–	540 J	150 J
Chrysene	–	–	–
Di-n-octyl phthalate	120 J	270 J	–
Benzo (b) fluoranthene	–	–	–
Benzo (k) fluoranthene	–	–	–
Benzo (a) pyrene	–	–	–
Ideno (1,2,3-cd)perylene	–	–	–
Dibenz (a,h) anthracene	–	–	–
Phenol	–	–	–
2-Chlorophenol	–	–	–
1,4-Dichlorobenzene	–	–	–
1,2-Dichlorobenzene	–	–	–
4-Methylphenol	–	–	–
Nitrobenzene	–	–	–
1,2,4-Trichlorobenzene	–	–	–
Napthalene	–	–	–
2-Methylnapthalene	–	–	–

Source of data - Ecology & Environment (1988).

B Compound detected in blank samples.
J Estimated value. Result is less than the specified detection limit, but greater than zero.
– Not detected.
NA Not analyzed.
ppb Parts per billion.

DRAFT

MCA 0156891

SEMIDEAD XLS

Table 3. Summary of Pesticide and PCB Compounds Detected in Sediments and Soils from Dead Creek Sector B and Site M, Sauget - Cahokia, Illinois.

	Sector B				
Sample Identification:	DC-SD-13	DC-SD-14	DC-SD-18	DC-SD-19	DC-SD-20
Sample Depth:	(0-0.5')	(2-3')	(0-0.5')	(0-0.5')	1.5-2')
Sample Date:	11/5/86	11/5/86	11/5/86	11/5/86	11/5/86
Parameter (concentrations in ppb)					
Aroclor-1242	--	--	--	--	--
Aroclor-1248	--	480000 C	--	--	--
Aroclor-1254	--	--	--	141000 C	16000 C
Aroclor-1260	10300 J	66000 C	7700	94000 JC	5600 JC
PCBs (Total)	NA	NA	NA	NA	NA

Source of data - Ecology & Environment (1988).

C Result confirmed by GC/MS.
J Estimated value. Result is less than the specified detection limit, but greater than zero.
-- Not detected.
NA Not analyzed.
ppb Parts per billion.

DRAFT

Protected Material: Monsanto Insurance Coverage Litigation

EPA/CERRO COPPER/EIL/PCB ATTORNEY WORK PRODUCT / ATTORNEY CLIENT PRIVILEGE

MCA J156892

Table 3. Summary of Pesticide and PCB Compounds Detected in Sediments and Soils from Dead Creek Sector B and Site M, Sauget - Cahokia, Illinois

	Site M		
Sample Identification:	DC-SD-15	DC-SD-16	DC-SD-17
Sample Depth:	(0-0.5)	(0-0.5)	(0-0.5)
Sample Date:	11/5/86	11/5/86	11/5/86
Parameter (concentrations in ppb)			
Aroclor-1242	--	20000	--
Aroclor-1248	660	8830	5200
Aroclor-1254	670	--	4200
Aroclor-1260	430 J	--	2700 J
PCBs (Total)	--	--	--

Source of data - Ecology & Environment (1988).

C	Result confirmed by GC/MS.
J	Estimated value. Result is less than the specified detection limit, but greater than zero.
--	Not detected.
NA	Not analyzed.
ppb	Parts per billion.

DRAFT

EPA/CERRO COPPER/EIL/PCB ATTORNEY WORK PRODUCT / ATTORNEY CLIENT PRIVILEGE

MCA 0156893

Protected Material: Monsanto Insurance Coverage Litigation

Table 4. Summary of Inorganic Compounds Detected in Sediments and Soils from Dead Creek Sector B, and Sites L and M, Sauget - Cahokia, Illinois.

	Sector B				
Sample Identification:	DC-SD-13	DC-SD-14	DC-SD-18	DC-SD-19	DC-SD-20
Sample Depth:	(0-0.5')	(2-3')	(0-0.5')	(0-0.5')	(1.5-2')
Sample Date:	11/5/86	11/5/86	11/5/86	11/5/86	11/5/86
Parameter (concentrations in ppb)					
Aluminum	4800	6380	5380	9750	12900
Antimony	--	--	--	--	--
Arsenic	14 R	20 R	16 R	21	13 R
Barium	410	1110	467	17300	3120
Beryllium	--	--	--	--	--
Boron	--	--	--	--	--
Cadmium	22	36	24	30	8.2
Chromium, trivalent	62	153	79	118	113
Cobalt	6.6	9.2	6	11	6.9
Copper	8740 *	6700 *	8640 *	15300 *	2610 *
Iron	16400	19500	16300	58200	21300
Lead	853	931	983	1460	330
Magnesium	NA	NA	NA	NA	NA
Manganese	197	153	218	82	70
Mercury	0.73	1.3	0.9	1.68	0.89
Nickel	56 R*	502 R*	82	1520 R*	867 R*
Selenium	3.3	4.1	4	2	--
Silver	10	11	14	15	--
Thallium	--	--	--	4	--
Tin	32	28	--	16	--
Vanadium	23	27	24	48	25
Zinc	3310	6650	3410	11900	6610
Cyanide	--	3.8	--	--	--

Source of data - Ecology & Environment (1988).

*	Duplicate analysis not with in control limits.
R	Spike sample recovery not with in control limits.
--	Not detected.
NA	Not analyzed.
ppb	Parts per billion.

DRAFT

EPA/CERRO COPPER/EIL/PCB ATTORNEY WORK PRODUCT / ATTORNEY CLIENT PRIVILEGE

MCA 015680

Protected Material: Monsanto Insurance Coverage Litigation

Table 4. Summary of Inorganic Compounds Detected in Sediments and Soils from Dead Creek Sector B, and Sites L and M, Sauget - Cahokia, Illinois.

	Site L				
Sample Identification:	DC-L1-02	DC-L2-03	DC-L3-04	DC-L4-09	DC-L4-10
Sample Depth:	(5-10')	(5-15')	(5-15')	(10-20')	(10-20')
Sample Date:	12/12/86	12/12/86	12/12/86	12/12/86	12/12/86
Parameter (concentrations in ppb)					
Aluminum	10697	5205	7380	1120	1378
Antimony	–	32	–	–	–
Arsenic	5 *	–	172	55 *	68 *
Barium	197	192	192	114	142
Berylium	–	–	–	–	–
Boron	–	–	–	–	–
Cadmium	–	6	–	–	–
Chromium, trivalent	16	15	10	–	3
Cobalt	6	9	9	–	–
Copper	12	105	141	82	101
Iron	16053	5564	11899	1500	1446
Lead	9 *	106	41	5 *	5 *
Magnesium	NA	NA	NA	NA	NA
Manganese	255	44	149	10	10
Mercury	–	–	0.1	–	–
Nickel	21	408	2392	83	93
Selenium	–	–	–	–	–
Silver	–	–	–	–	–
Thallium	–	–	–	–	–
Tin	–	–	–	–	–
Vanadium	25	10	19	–	–
Zinc	59	144	166	11	10
Cyanide	NA	NA	NA	NA	NA

Source of data - Ecology & Environment (1988).

*	Duplicate analysis not with in control limits.
R	Spike sample recovery not with in control limits.
–	Not detected
NA	Not analyzed.
ppb	Parts per billion.

DRAFT

Protected Material: Monsanto Insurance Coverage Litigation

EPA/CERRO COPPER/EIL/PCB ATTORNEY WORK PRODUCT / ATTORNEY CLIENT PRIVILEGE

MCA 156895

Table 4. Summary of Inorganic Compounds Detected in Sediments and Soils from Dead Creek Sector B, and Sites L and M, Sauget - Cahokia, Illinois

	Site M		
Sample Identification:	DC-SD-15	DC-SD-16	DC-SD-17
Sample Depth:	(0-0.5')	(0-0.5')	(0-0.5')
Sample Date:	11/5/86	11/5/86	11/5/86
Parameter (concentrations in ppb)			
Aluminum	6560	2430	7510
Antimony	--	--	--
Arsenic	3.6 R	12 R	16 R
Barium	156	131	196
Beryllium	--	--	--
Boron	--	--	--
Cadmium	1.5	11	8
Chromium, trivalent	15	37	53
Cobalt	7.7	7.2	5
Copper	167 *	1270 *	1780 *
Iron	11100	26000	14400
Lead	26	65	71
Magnesium	NA	NA	NA
Manganese	100	97	139
Mercury	0.13	0.56	0
Nickel	356 R*	258 R*	309 R*
Selenium	--	--	--
Silver	--	--	--
Thallium	--	--	--
Tin	--	23	--
Vanadium	19	--	19
Zinc	868	872	1010
Cyanide	--	--	--

Source of data - Ecology & Environment (1988).

*	Duplicate analysis not with in control limits.
R	Spike sample recovery not with in control limits.
--	Not detected.
NA	Not analyzed.
ppb	Parts per billion.

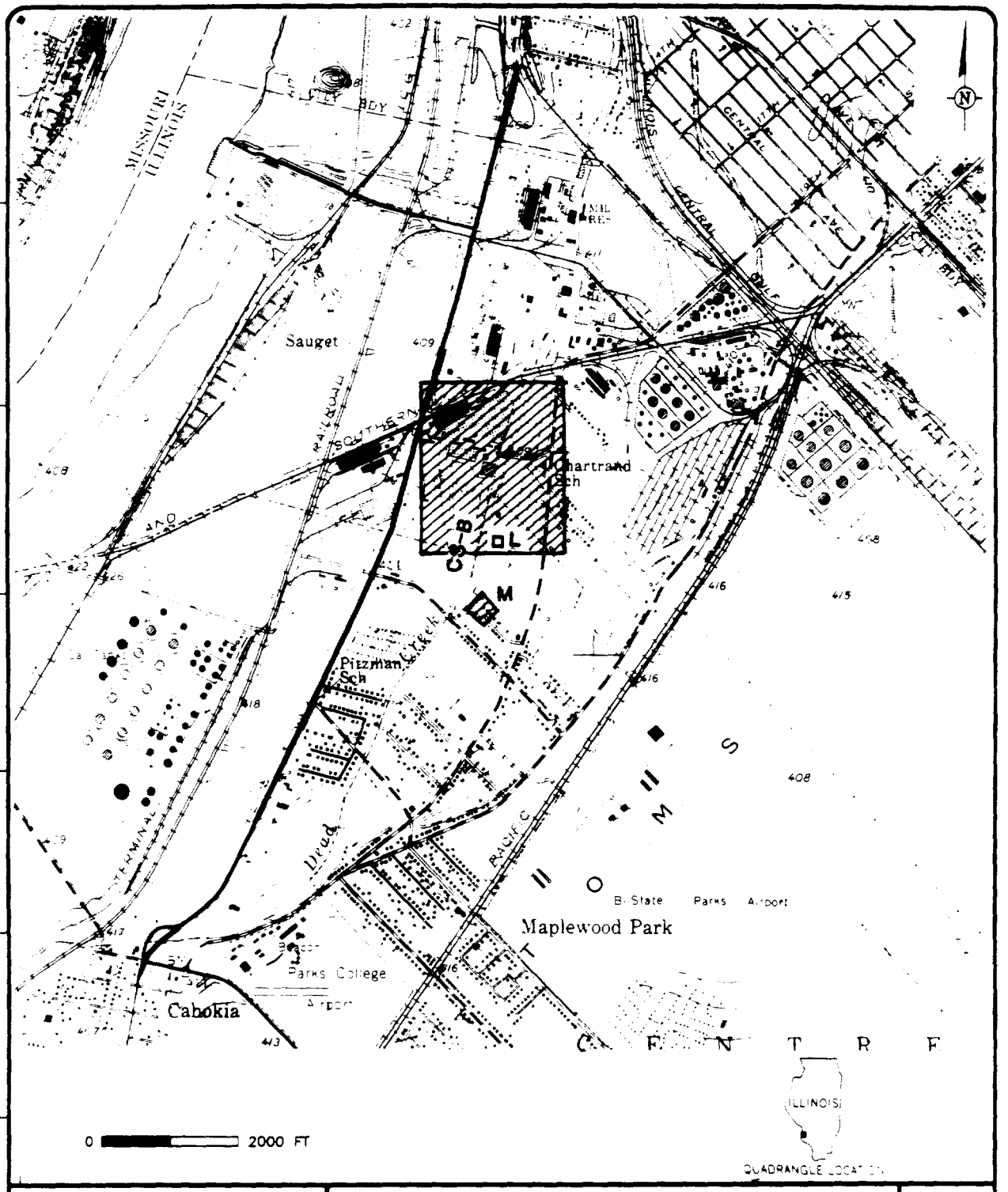
DRAFT

EPA/CERRO COPPER/EIL/PCB ATTORNEY WORK PRODUCT / ATTORNEY CLIENT PRIVILEGE

MCA 0156896

Protected Material: Monsanto Insurance Coverage Litigation

FIGURES



DRAFTER: V. CARUNCHO | APPROVED: B. BLUM | CHECKED: B. BLUM | DRAWING: TOPO | FILE NO.: | PRJCT NO.: NY80501 | DWG DATE: 8/91

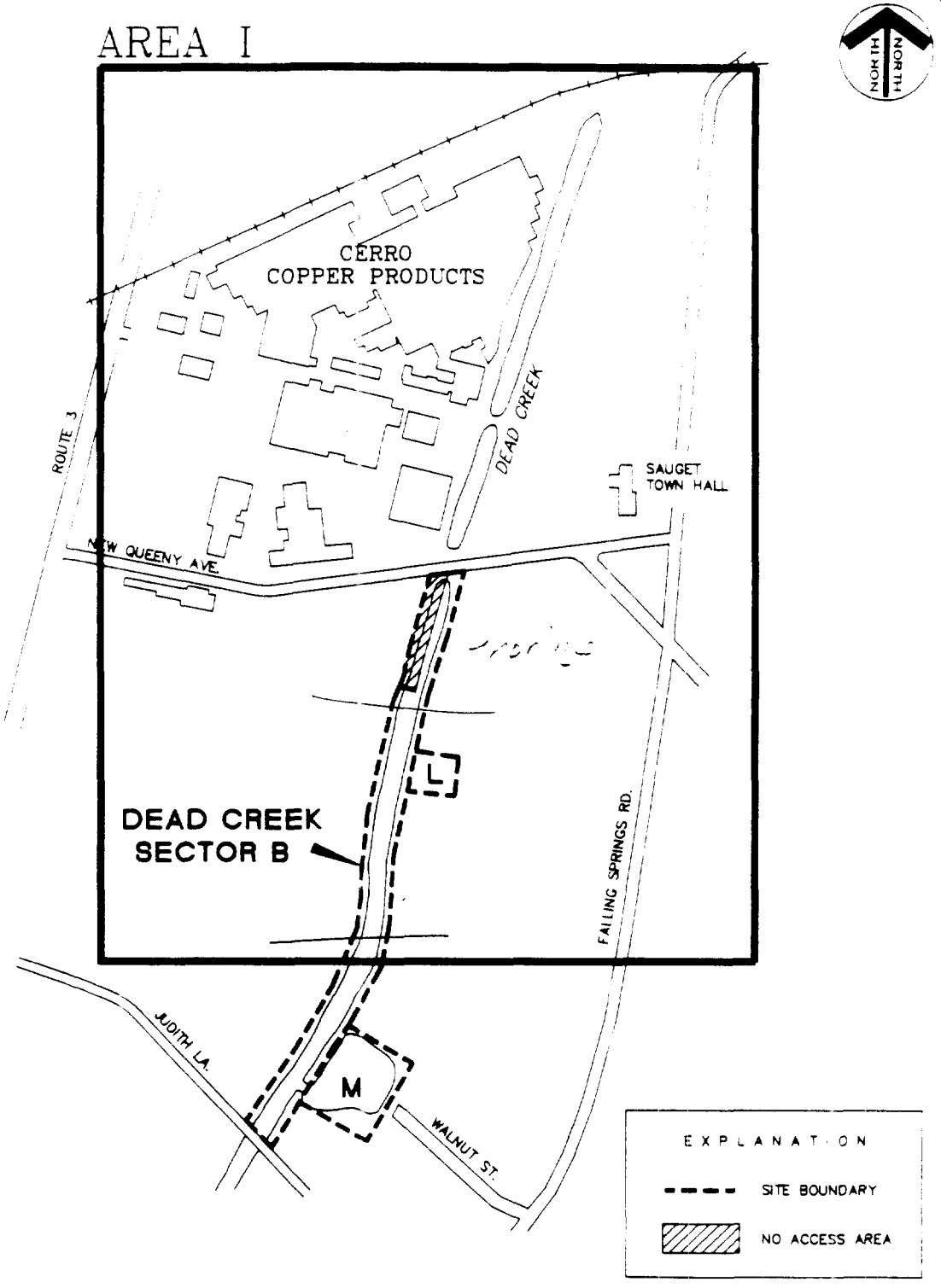
GERAGHTY & MILLER, INC.
Environmental Services

LOCATION OF DEAD CREEK SECTOR B, AND SITES L AND M, SAUGET–CAHOKIA, ILLINOIS

FIGURE 1

MCA 156898

Protected Material: Monsanto Insurance Coverage Litigation



DRAFTER: G.S | MGR.: D COLTON | COMPILER: D COLTON | CAD FILE: SDYAREA7 | FILE NO.: 1234 | PRJCT. NO.: NY80501 | DATE: 8-6-91

SCALE 0 500 FT

GERAGHTY & MILLER, INC.
Environmental Services

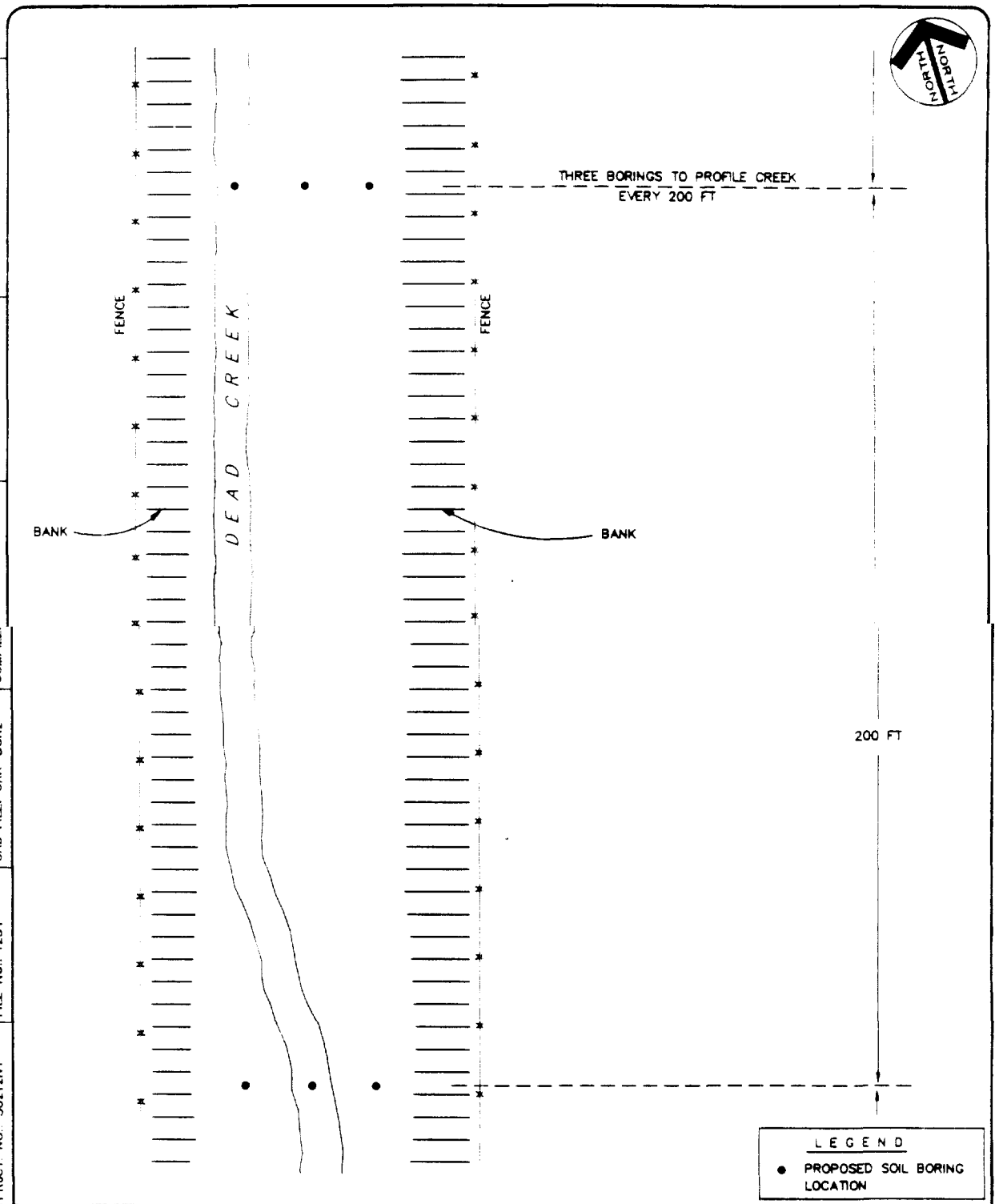
LOCATION OF STUDY AREAS, DEAD CREEK SECTOR B AND SITES L AND M, SAUGET-CAHOKIA, ILLINOIS

FIGURE 2

MCA .156899

EPA/CERRO COPPER/EIL/PCB ATTORNEY WORK PRODUCT / ATTORNEY CLIENT PRIVILEGE

Protected Material: Monsanto Insurance Coverage Litigation



DRAFTER: GS
MGR.: BA BLUM
COMPILER: BA BLUM
CAD FILE: CRK-BOR2
FILE NO.: 1234
PRJCT. NO.: 50212NY
DATE: 7-2-91

SCALE
0 30 FT (APPROX.)

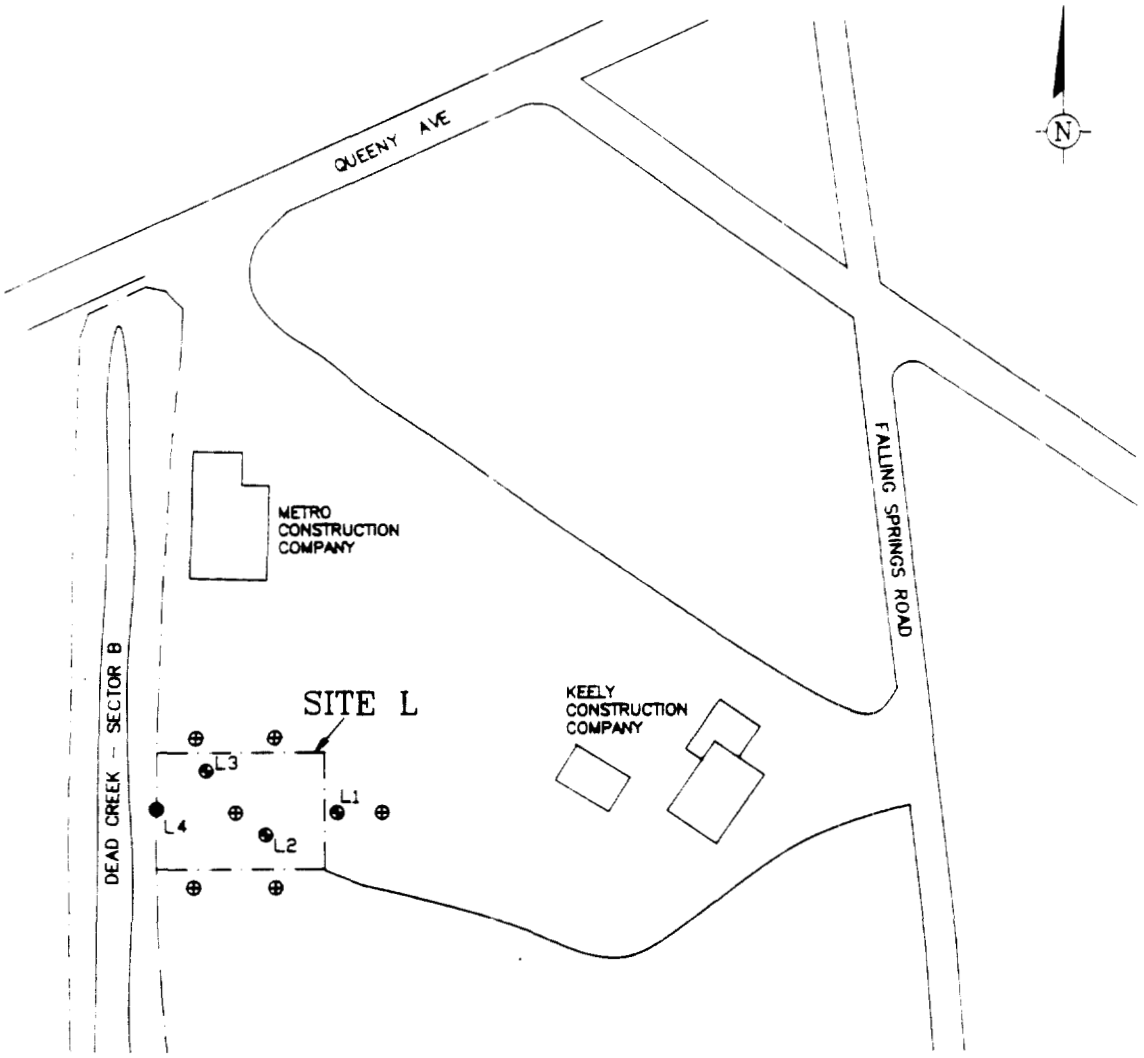
GERAGHTY & MILLER, INC.
Environmental Services

SCHEMATIC DIAGRAM OF PROPOSED SOIL BORING LOCATIONS AT DEAD CREEK SECTOR B, SAUGET-CAHOKIA, ILLINOIS

FIGURE 3

MCA 0156900

EPA/CERRO COPPER/EIL/PCB ATTORNEY WORK PRODUCT / ATTORNEY CLIENT PRIVILEGE



EXPLANATION

- L4 LOCATION OF EXISTING E&E WELL
- L1 LOCATION OF EXISTING E&E SOIL BORING
- PROPOSED G&M SOIL BORING LOCATION
- SITE BOUNDARY

0 200 FT

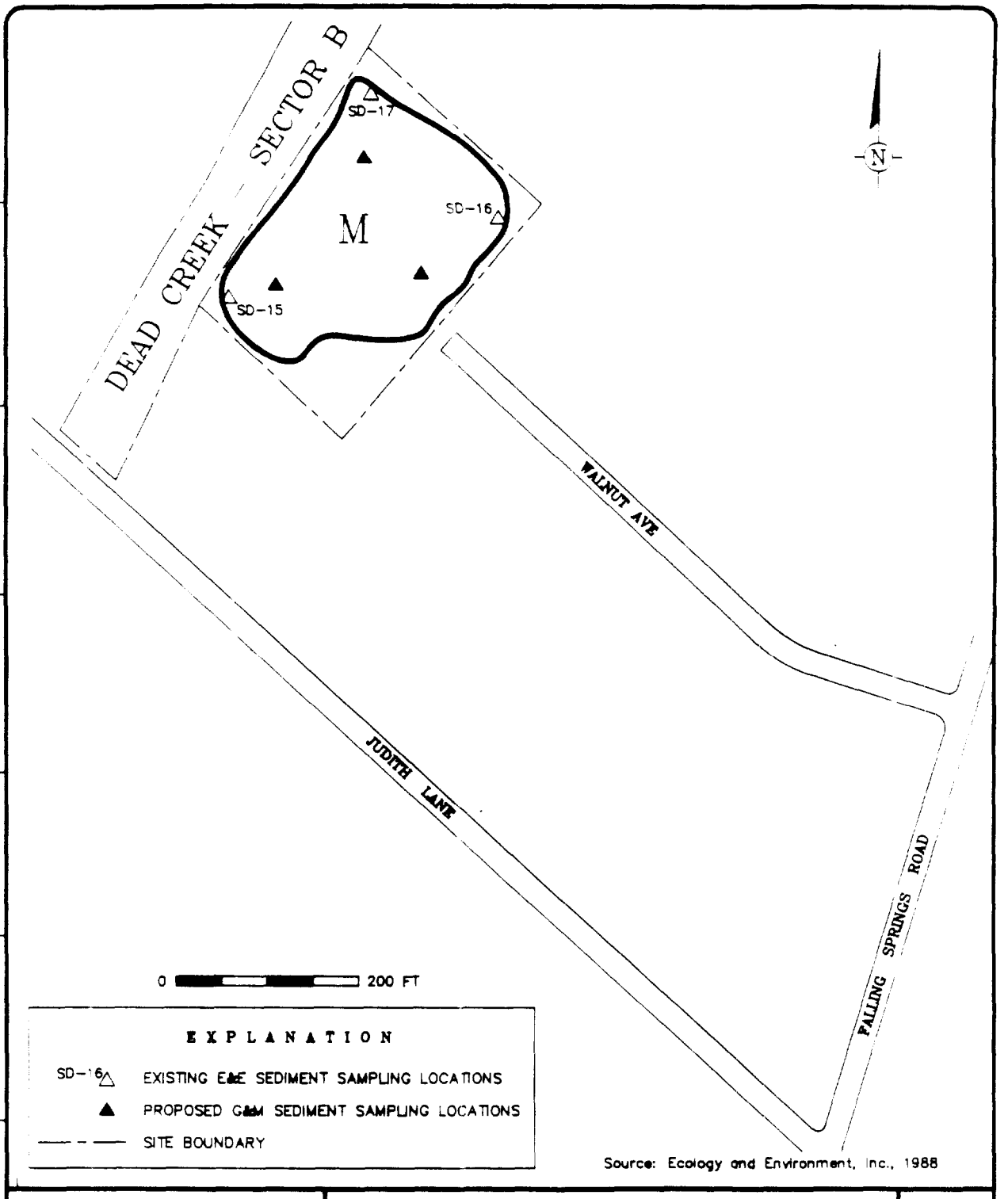
GERAGHTY & MILLER, INC.
Environmental Services

SEDIMENT SAMPLING LOCATIONS AT SITE L, SAUGET, ILLINOIS

FIGURE 4

DRAFTER: GS | APPROVED: BB | CHECKED: AN | DRAWING: SED-S-L | FILE NO.: 1444 | PRJCT NO.: NY80501 | DWG DATE: 8-8-91

MCA 0156901



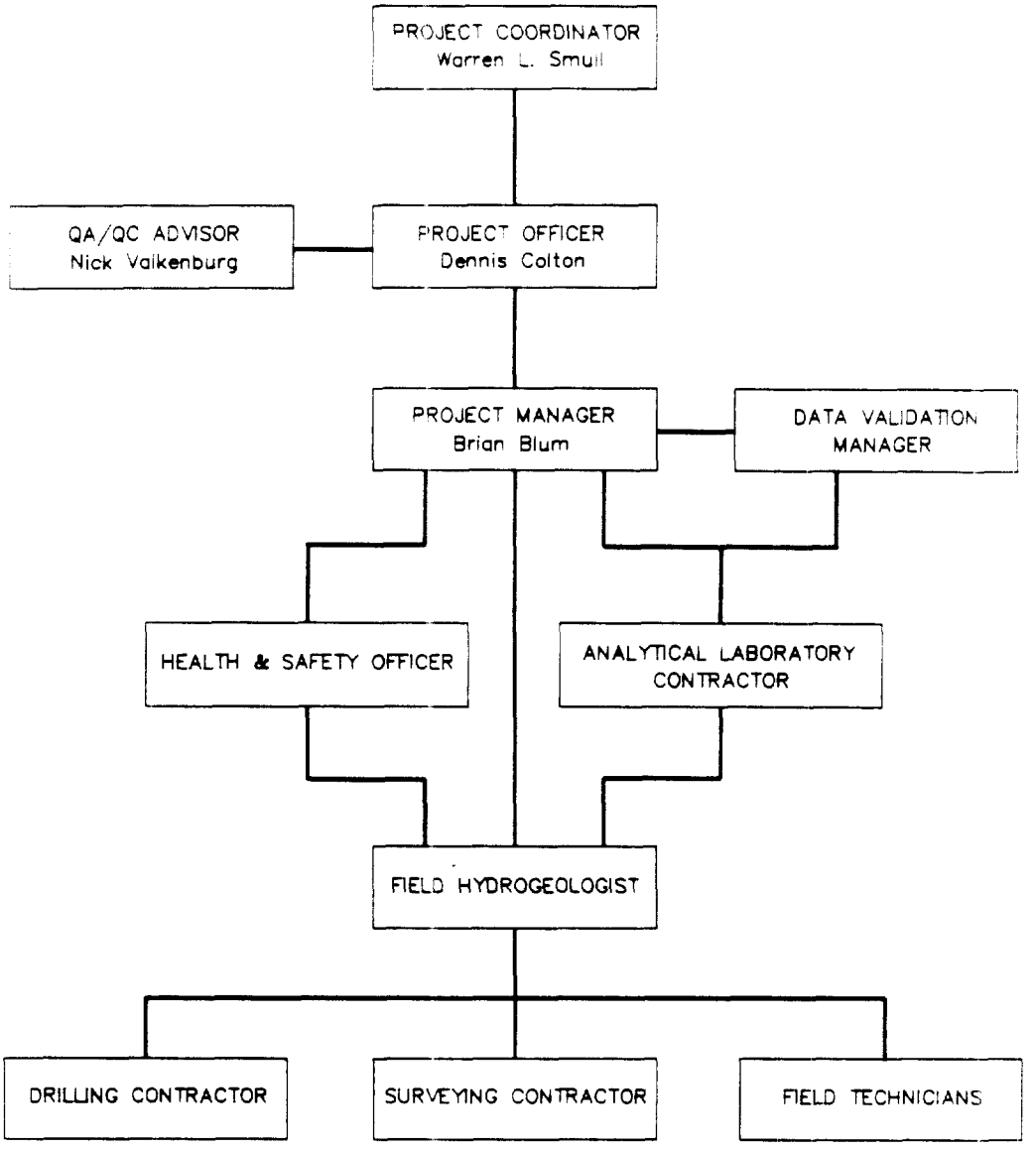
DRAFTER: GS | APPR: LD: BB | CHECKED: AN | DRAWING: SEDSMP | FILE NO.: 1444 | PRJCT NO.: NY60501 | DWG DATE: 8-6-91

GERAGHTY & MILLER, INC.
Environmental Services

SEDIMENT SAMPLING LOCATIONS AT SITE M, CAHOKIA, ILLINOIS

FIGURE 5

MCA 0156902



MCA 156903

DRAFTER: GS | APPROVED: BB | CHECKED: AN | DRAWING: DC-PD | FILE NO.: 1444 | PRJCT NO.: NY80501 | DWG DATE: 8-7-91

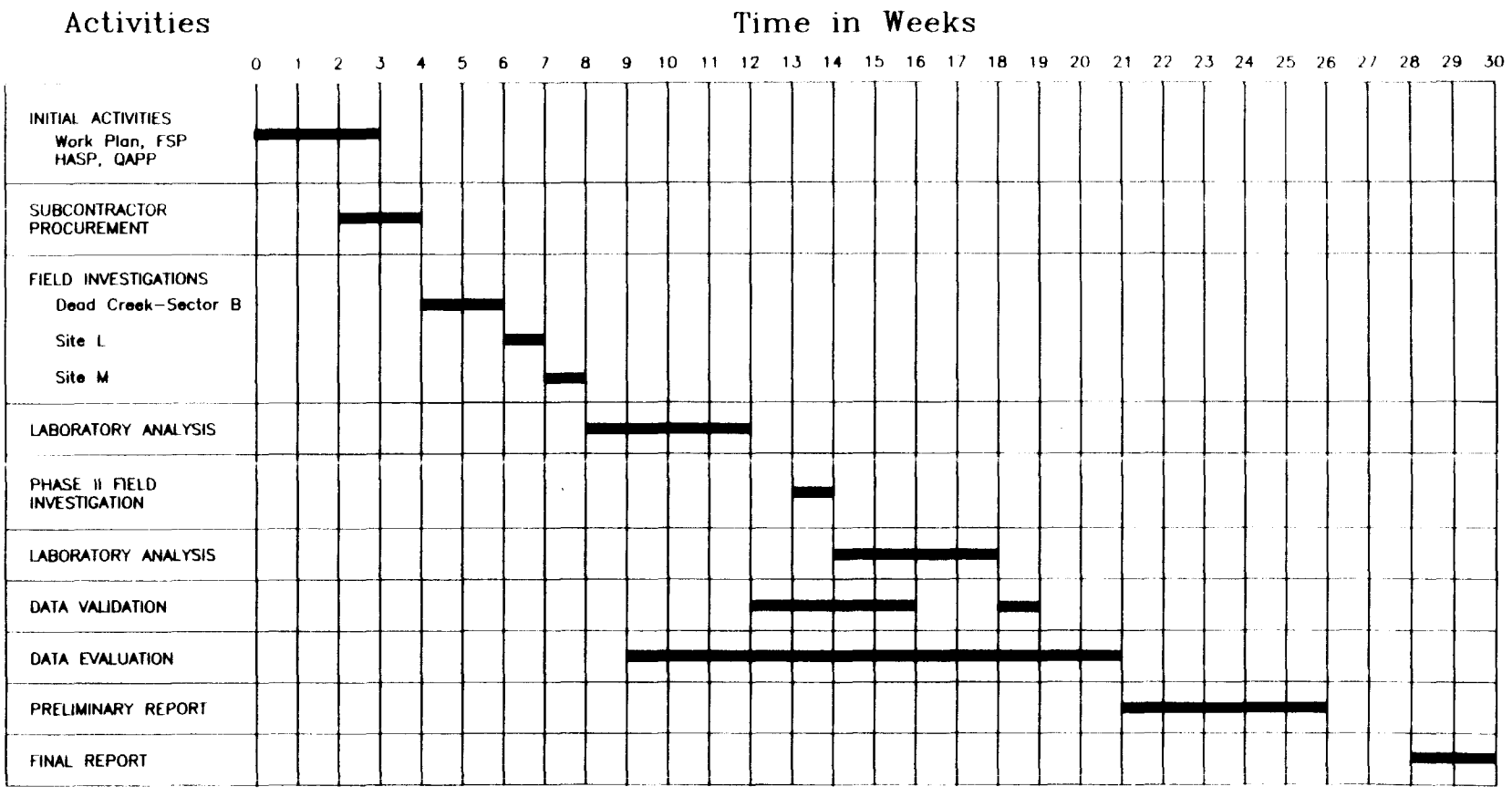
GERAGHTY & MILLER, INC.
Environmental Services

PROJECT ORGANIZATION

FIGURE 6

Protected Material: Monsanto Insurance Coverage Litigation

DWG DATE: 8 8-91	PRJCT NO.: NY60501	FILE NO.: 1444	DRAWING: SB-SCHD	CHECKED: AN	APPROVED: BB	DRAFTER: GS



GERAGHTY & MILLER, INC.
Environmental Services

PROPOSED SCHEDULE OF ACTIVITIES FOR THE SOIL BORING PROGRAM, SAUGET-CAHOKIA, ILLINOIS

FIGURE 7

EPA/CERRO COPPER/EIL/PCB ATTORNEY WORK PRODUCT / ATTORNEY CLIENT PRIVILEGE

MCA 015690

APPENDIX A

EPA/CERRO COPPER/EIL/PCB ATTORNEY WORK PRODUCT / ATTORNEY CLIENT PRIVILEGE

DRAFT

APPENDIX A

FIELD SAMPLING PLAN
FOR THE
SITE INVESTIGATION FOR
DEAD CREEK - SECTOR B, AND SITES L AND M,
SAUGET - CAHOKIA, ILLINOIS

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APPENDIX A

FIELD SAMPLING PLAN FOR THE SITE INVESTIGATION FOR DEAD CREEK - SECTOR B, AND SITES L AND M, SAUGET - CAHOKIA, ILLINOIS

1.0 INTRODUCTION

1.1 PURPOSE AND SCOPE

On behalf of the Monsanto Company, Geraghty & Miller, Inc. has prepared this Field Sampling Plan (FSP) for three selected sites associated with the area designated by the Illinois Environmental Protection Agency (IEPA) as Sauget Sites - Area I (Figure 1). These three sites are Dead Creek - Sector B, Site L, and Site M (Figure 2). The purpose of the investigation is to characterize the sites by determining the nature and extent of sediment/fill materials in the unsaturated zone in Sector B and Site L, and below the ponded water at Site M. This will be accomplished through the analysis of selected sediment/fill samples for the United States Environmental Protection Agency (USEPA) Target Compound List/Target Analyte List (TCL/TAL) and through analysis of the remaining samples for site specific compounds, such as polychlorinated biphenyls (PCBs), TAL metals, or TAL volatile organic compounds (VOCs). Once the nature and extent of the sediment/fill has been delineated, selected areas that best represent site conditions will be sampled and analyzed for reactivity, corrosivity, ignitability, and the list of constituents which are analyzed by the Toxicity Characteristic Leaching Procedure (TCLP) provided in Table 1.

The results from these analyses will be used to determine the volume of sediment/fill and whether it needs to be treated prior to disposal. The number of samples scheduled for

TCLP analysis will be based on the initial analytical (Phase I) results, however, it is anticipated that only about five samples will be required.

1.2 SITE DESCRIPTION AND BACKGROUND

A brief description of Dead Creek - Sector B, Site L, and Site M is provided below, along with a summary of prior investigations.

1.2.1 Dead Creek - Sector B

Dead Creek - Sector B is located between Queeny Avenue and Judith Lane (Figure 2). The culverts at both ends for Sector B have been sealed to prevent inflow or outflow from this area. The banks of the creek are heavily vegetated and debris is visible in the area. The site is enclosed within a chain-link fence without a gate. In general, the creek area consists of a narrow channel about 5 feet wide, which is flanked by low banks. The channel and low banks are enclosed by steeper banks on either side of the creek. Currently, the west side of the northern 400 feet of Sector B is not accessible due to the restrictions by the property's owner (see Figure 2).

In 1980, the IEPA conducted a study at Dead Creek which included the installation of monitoring wells and borings, and the collection of surface-water, ground-water and soil samples. A vertical profile of the creek sediments in the northern portion of Sector B, and soil samples collected at 17 other locations indicate the presence of metals, PCBs, and other organic compounds.

In 1986, Ecology & Environment, Inc. (E&E) conducted a Remedial Investigation (RI) for the IEPA at several sites in Sauget, including Sector B, and Sites L and M (see Figure 2). In Sector B, E&E collected two surface-water samples and five sediment samples; however, the sampling locations were restricted to the north and south ends of the study

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area. The data from these sampling points indicate that past uses of the creek have impacted the site. Constituents detected included metals and PCBs.

1.2.2 Site L

Site L is located on the east side of Dead Creek, approximately 700 feet south of Queeny Avenue (Figure 2). It is the former location of a surface impoundment used by a trucking company, who disposed of wash water from truck cleaning operations. Site L was determined by E&E to be located about 125 feet east of Dead Creek, and encompasses an area of approximately 70 feet by 150 feet. Currently, the site is covered with black cinders and is used for equipment storage by Metro Construction Equipment Company. Access to the site is not controlled. Surficial soil was not sampled by E&E.

In 1980, the IEPA installed a well downgradient of this area; however, due to faulty construction, it was replaced by E&E in 1986. In 1986, E&E drilled three soil borings, replaced the IEPA monitoring well, and conducted a soil-gas survey at Site L. The data from these sampling points indicate that past activities have impacted soil and ground water at the site. Compounds detected include benzene, toluene, phenols and arsenic. PCBs were not detected.

1.2.3 Site M

Site M is a former sand and gravel pit excavated between 1945 and 1950. The pit is approximately 275 feet by 300 feet and is filled with water. E&E estimated the pit's depth to be 40 feet. Site M is connected to Dead Creek - Sector B at the southwest corner of Site M (Figure 2). It is not known whether Site M was excavated into the water table. Other than miscellaneous trash, no other waste disposal was evident in the pit at the time of the E&E study. Access to the site is controlled by a chain-link fence.

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In 1986, E&E collected two surface-water samples, five sediment samples, and soil-gas samples from the perimeter of Site M. Neither the surface-water samples nor the soil-gas samples indicated the presence of constituents of concern. The PCB data from the sediment samples indicated that past site activities may have impacted the site. In 1980, the IEPA collected two, unfiltered, surface-water samples and PCBs were detected at 4.4 ppm and 0.9 ppm.

2.0 SUBCONTRACTOR PROCUREMENT

Discussed below are the procedures for determining the laboratory and driller subcontractors.

2.1 LABORATORY SUBCONTRACTOR

A laboratory subcontractor will provide the analytical services for the field investigation. Geraghty & Miller will select a laboratory from among the current participants in our Analytical Quality Assurance/Laboratory Contract Program (AQA/LCP), with Monsanto's approval, to perform these services. This program was developed by Geraghty & Miller to ensure that high-quality laboratory services will be obtained and that project data quality objectives are achieved. Laboratories participating in the Geraghty & Miller AQA/LCP were audited prior to incorporation into the program and the following information was obtained:

1. Facilities (Are the premises clean, large enough, well organized, and properly constructed?)

2. Personnel (Do the staff have the right training and experience?)

3. Sample receiving, storage, and handling procedures

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4. Sampling preparation procedures

5. Instrumentation and analytical procedures (Is there enough equipment and is it of the right type? Are procedures correct?)

6. Preventive maintenance

7. Data reduction and reporting (How are data generated, verified, and reported; what type of supervisory data review is in effect?)

8. QA/QC Procedures (Are they appropriate, and are they followed?)

9. Certifications (Does the laboratory participate in the USEPA Contract Laboratory Program [CLP] and/or state certification programs?)

10. Attitude (Has the laboratory indicated a willingness to provide attentive and timely service, are they flexible, and do they have a cooperative attitude?)

The laboratory selected to provide analytical services for the site investigation is Savannah Labs, Inc. of Savannah, Georgia.

2.2 DRILLING SUBCONTRACTOR

Three drilling subcontractors have been contacted to determine if they have adequate capabilities to conduct the field tasks in a timely manner. Based on their assessment of the sites and their estimated costs, one of these subcontractors will be selected. These drilling companies are John Mathes and Associates, Inc., Columbia, Illinois; Layne Western, Fenton, Missouri; and Hannibal Testing Laboratories, Inc., Hannibal, Missouri.

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3.0 SEDIMENT/FILL BORING PROGRAMS

The operating procedures for drilling the borings in sediment/fill at each of the sites is provided below.

3.1 INTRODUCTION

At Dead Creek - Sector B, sediment/fill samples will be collected across ten profiles spaced approximately 200 feet apart within the creek bed. Three borings will be drilled along each profile, as shown in Figure 3. All borings will be drilled to determine the thickness of the sediment/fill in the creek and will be spaced about 15 to 20 feet apart. It is anticipated that the borings within the creek bed will be drilled to a maximum depth of about 7 feet. Samples will be collected using a 5-foot continuous tube sampler, however 3-inch diameter split-barrel core (split-spoons) samplers will be used if recovery is poor in the fine sandy sediments. Both methods will provide a continuous record of the geology, as well as a sufficient volume of material for analysis. All samples will be described by a Geraghty & Miller field geologist who will record sample location, depth, grain size distribution, and color. Each sample will also be screened in the field for the presence of VOCs using a photoionization detection (PID) instrument.

One sediment/fill sample per borehole will be selected for chemical analysis based on appearance and PID measurements. Each sample will be selected from the 2-foot interval that best characterizes sediment/fill in the creek. One sediment/fill sample per profile will be analyzed for USEPA TCL/TAL parameters, and the other two samples from each profile will be analyzed for TAL metals and PCBs. Appropriate QA/QC samples will also be collected as discussed in Section 3.7 (Quality Control). The analytical data from the sediment/fill will be used to delineate any impacted areas and to provide an estimate of the volume of sediment/fill that may require remediation. Each borehole will be sealed with a mixture of drill cuttings and bentonite grout, and the borehole's location and land surface elevation will be surveyed by an Illinois licensed land surveyor. All drilling equipment will

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be steam cleaned after each borehole and all sampling equipment will be decontaminated with a laboratory-grade detergent and potable water before the collection of each sample.

An all-terrain (ATV) drill rig will be used for the entire program. To provide suitable sampling conditions, it may be necessary to pump standing water out of some areas should it be present at the time the study is conducted. If necessary, the dry boring locations will be sampled first, then the water will be pumped into the area of the creek where the boring program has been completed. If there is too much water to transfer, portable equipment may be used, such as a tripod. In addition, the installation of a gate within Sector B's chain-link perimeter fence will be necessary for the drill rig and field crew.

To define the lateral and vertical extent of the fill material in Site L, six borings will be required to supplement the existing borings installed during the 1986 E&E investigation (Figure 4). To delineate the bottom of the fill at each boring location, continuous samples will be collected using a 5-foot tube sampler or a 3-inch diameter split spoon, as previously described. Five borings will be drilled at the perimeter of the former impoundment (as identified by E&E) to determine its actual boundaries. A visual determination by the field geologist will be used to determine whether or not the boring is within the former impoundment basin. If necessary, boring locations will be moved to determine the former impoundment basin boundary and to characterize the fill material. One boring will be drilled near the center of Site L to determine maximum fill thickness. One sample from each of the six boreholes that best characterizes the fill material will be submitted for laboratory analysis. Each sample will be obtained from a 2-foot section of the continuous core. Selection for analysis will be based on appearance and PID readings. At two of the six borings, the samples will be analyzed for TCL/TAL parameters. Based on existing data, the remaining four borings will undergo analysis for PCBs, TAL metals, and VOCs to determine the chemical nature of the fill material. Each borehole will be sealed and surveyed as described for Dead Creek - Sector B.

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3. The field hydrogeologist will take the sampling device from the driller and place it on clean polyethylene sheeting.

4. The sampling device will be opened to expose the sample.

5. A clean spatula will be used to remove and discard the top 2 to 3 inches of the sample.

6. A stainless steel coring device will be used to collect two VOC samples. The coring device is a stainless steel barrel approximately 0.75-inches in diameter and 3-inches in length. The coring device will be inserted along the 2-foot length of the core selected for sampling. The sample will then be extruded into a 40 ml VOC vial. The 40 ml VOC vials will be filled to capacity sealed and placed on ice. This method of sample collection will ensure minimal disturbance of the sample.

7. The remainder of the core sample will be split down the middle. One-half of the sample will be placed in a jar, covered with aluminum foil and capped. The head space will be checked for total VOCs (TVOCs) as discussed in Section 3.3.1.

8. The remainder of the soil will be placed in a clean stainless steel pan and thoroughly mixed with a clean stainless steel spatula. The soil in the pan will be scraped from the sides, corners, and bottom of the pan, rolled to the middle of the pan, and mixed. The sample will then be quartered and moved to the four corners of the pan. Each quarter will then be mixed individually before being rolled to the center of the container and the entire sample mixed again. Once mixed, the sample will be placed in glass jars and stored on ice until the selection of samples for specific laboratory analysis is determined. The criteria for selection will be appearance, odor, and PID measurements, as described in Section 3.1. After the soil samples for laboratory analysis have been selected, the soil will be placed in the appropriate containers described in the QAPP (see Appendix B).

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9. The sample label will be completed (project, location, depth, date), attached to the sample container, and covered with transparent tape.

10. The Geraghty & Miller sample/core log form will be completed (see appropriate form in Attachment A).

11. Each sample scheduled for laboratory analysis will be stored on ice at 4°C, preserved and shipped to the laboratory via overnight courier.

12. The sampling equipment will be decontaminated as described in Section 3.6.

3.3.1 Field Screening for Total Volatile Organic Compounds and Soil Sample Selection

The head space in each sample jar will be checked for TVOCs by a PID instrument (HNU, or TIP) to aid in the selection of samples for laboratory analysis. The procedure will be to allow the sample to equilibrate to room temperature, remove the lid, pierce the aluminum foil, and take a reading. Readings will be recorded on the sample/core log (see Attachment A). The air monitoring instrument will be calibrated according to the manufacturer's instructions.

3.4 SAMPLE CONTAINERS

For a complete list of sample containers, matrices, method numbers, container preservative, and analysis holding times, please refer to Table B-4 in the QAPP.

3.5 RECORD KEEPING

All Geraghty & Miller personnel involved in drilling and sample collection will carefully document the day's events and the handling history of all sediment/fill samples and blanks collected. Standard Geraghty & Miller forms (see Attachment A) will be completed

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to document the field work, and the integrity of each sample, from the time the drilling crew and field crew enter the site through sample collection and shipment.

3.5.1 Daily Log

Daily logs will be used by the field team for QA/QC purposes to record all sampling events and field observations (see Attachment A). Entries in the daily logs will be dated by the person making the entry, and the logs will be kept in a secure, dry place. The following types of information will be included on the log forms:

1. Date and time of arrival at site.
2. Client.
3. Location.
4. Weather.
5. Field crew and drill crew members.
6. Work progress.
7. QC samples.
8. Departure time.

Other miscellaneous information will also be recorded on the Geraghty & Miller Daily Log forms. Examples are as follows:

1. Delays.

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2. Unusual situations.

3. Departure from established QA/QC field procedures.

4. Instrument problems.

5. Accidents.

3.5.2 Sample/Core Log

The field personnel will prepare a Geraghty & Miller Sample/Core Log for QA/QC purposes at the time of sampling to record information about each sample collected (see Attachment A). In addition to project information, the log will include the following information on sampling:

1. Date and time of sampling.

2. Physical appearance of samples.

3. Field observations.

4. Results of field analyses.

5. Sampling method and material.

6. Constituents sampled for.

7. Sample container and preservation.

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8. Sampling personnel.

3.5.3 Sample Labels and Chain-of-Custody Form

Sample labels are necessary for proper sample identification. The labels will be affixed to the sample containers prior to the time of sampling and will not be affixed to lids or caps. To track QA/QC handling protocols, the labels will be filled out by field personnel, and the Geraghty & Miller Chain-of-Custody form (Attachment A) will be completed in the field before the field crew leaves the site. Labels will include sample identification, project number, date and time collected, and analyses to be performed.

The field crew will be responsible for maintaining custody of the samples until they are delivered to the carrier or the laboratory. The Chain-of-Custody form will then be signed and custody formally relinquished. The containers (bearing custody seals) will be in view at all times or will be stored in a secure place restricted to authorized personnel.

3.6 DECONTAMINATION

The drill casings, rods, augers, samplers, tools, rig, and any piece of equipment that will come into contact (directly or indirectly) with the sediment/fill or geologic formation will be steam-cleaned on-site prior to drilling. The same steam-cleaning protocols will be followed at the completion of each borehole and before leaving the site at the end of the project. All on-site steam-cleaning activities will be monitored by the Geraghty & Miller hydrogeologist.

Equipment used to sample unconsolidated sediments (e.g., continuous tube samplers, split-spoon samplers, stainless-steel spatulas, stainless steel pan and stainless steel coring device) will be decontaminated prior to collecting each sample. Disposable gloves will be worn while equipment is cleaned to avoid contamination, and the gloves will be changed frequently. The procedure for cleaning this equipment is as follows:

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1. Prepare a 2-percent solution of Micro™ (low phosphate detergent) and distilled water in a bucket.

2. Disassemble the sampling device and coring device and immerse all parts along with the spatula and pan in the Micro™ solution.

3. Scrub all equipment in the bucket with a brush to remove any adhering particles.

4. Thoroughly rinse all equipment with tap water.

5. Rinse with deionized demonstrated analyte-free water.

6. Place clean equipment on a clean polyethylene sheet and allow to air dry.

7. Once dry, reassemble the cleaned core sampler.

8. Transfer the sampler to the driller (or helper) making sure that the individual is wearing clean, disposable gloves.

9. Equipment not used right after decontamination will be wrapped in aluminum foil until use.

3.7 QUALITY CONTROL

Quality-control samples will be used to monitor sampling and laboratory performance. The types of QC samples that will be included in the investigation are matrix spike/matrix spike duplicates (MS/MSD) and equipment blanks.

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To ensure unbiased handling and analysis by the laboratory, the identity of quality-control samples will be disguised by means of coding so that the laboratory does not know which samples are included for quality-control purposes.

3.7.1 Duplicate Analyses

Sediment/fill samples will not be duplicated due to the non-homogeneous nature of the samples and the high degree of variability routinely seen with results from duplicate sediment/fill analysis.

3.7.2 Equipment Blanks

An equipment blank will be collected to assess the decontamination procedures used during sample collection. The sample is prepared by pouring distilled deionized water into the sampling device (which has been decontaminated and is ready for sampling) and then into the sampling container(s). One equipment blank will be incorporated into the sampling program for every ten samples of sediment/fill and will be analyzed for the same suite of constituents as the sediment/fill.

3.8 BOREHOLE COMPLETION

At each boring location, drilling and sampling will cease upon determination of the vertical extent of sediment/fill material. The drill cuttings will be mixed with bentonite and put back into the borehole. A stake or marker will be placed in the borehole to serve as a reference point for the actual drilling location, and its approximate location will be sketched onto a site map. The borehole's location and land surface elevation will be surveyed by an Illinois licensed land surveyor.

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4.0 PHASE II FIELD WORK

Once the volume and chemical nature of the sediment/fill material has been determined, a small number of additional samples will be collected during a second phase of field work to determine if the material requires treatment prior to disposal. Geraghty & Miller anticipates that no more than five samples will be required to classify the material. Each of these samples will be analyzed for reactivity, corrosivity, ignitability, and the list of constituents which are analyzed by the TCLP (Table B-1). Sampling procedure for this phase will be the same as previously described in Section 3.3.

5.0 DATA VALIDATION

Geraghty & Miller will validate 10 percent of the samples collected according to the USEPA's 1990 "Data Reference Validation Functional Guidelines," and screen the remaining samples for completeness and technical compliance. The screening procedure requires much less time to complete. However, the laboratory will provide a CLP data package for all samples for possible future data validation, if required. The information to be screened for the remaining samples will include:

- Check to see if the field chain-of-custody form was filled out and if samples were properly logged.

- Review internal quality assurance/quality control (QA/QC) data. Confirm that blanks and spikes were analyzed on the minimum number of samples as specified in the QAPP.

- Review all equipment blank and MS/MSD data. If target compounds appear in blanks or if percent relative difference on duplicates is outside established limits, the reasons for these anomalies will be investigated. In such an event,

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sampling techniques will be discussed with the project manager and/or the laboratory manager and internal QA/QC data will be reviewed as appropriate.

- Check to see if holding times were met for each parameter.

- Check to see if parameters were analyzed by the methods identified in the QAPP.

- If data appears suspect, the specific data of concern will be investigated. Calculations will be traced back to the raw data. If the calculations did not agree with the prescribed limits, the cause will be determined and corrected, if possible.

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ATTACHMENT A

Geraghty & Miller, Inc. Forms

GERAGHTY & MILLER, INC.
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SAMPLE/CORE LOG

Boring/Well _____ Project/No. _____ Page _____ of _____

Site Location _____ Drilling Started _____ Drilling Completed _____

Total Depth Drilled _____ (feet)

Hole Diameter _____ (inches) Type of Sample/ Coring Device _____

Length and Diameter of Coring Device _____ Sampling Interval _____ feet

Drilling Fluid Used _____ Drilling Method _____

Drilling Contractor _____ Driller _____ Helper _____

Prepared By _____ Hammer Weight _____ Hammer Drop _____ inches

Sample/Core Depth (feet below land surface) From	To	Core Recovery (feet)	Time/Hydraulic Pressure or Blows per 6 inches	Sample/Core Description

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Environmental Services

DAILY LOG

Well(s) ________ Project/No ________________________ Page ______ of ______

Site Location ______________________________________

Prepared By ______________________________________

Date/Time	Description of Activities

G&M Form 02 6/86

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Environmental Services

Laboratory Task Order No. ....

CHAIN-OF-CUSTODY RECORD

Project Number ________

Project Location ________

Laboratory ________

Sampler(s)/Affiliation ________

SAMPLE BOTTLE / CONTAINER DESCRIPTION

SAMPLE IDENTITY	Code	Date/Time Sampled	Lab ID										TOTAL

Sample Code: L = Liquid; S = Solid; A = Air

Total No. of Bottles/ Containers ________

Relinquished by: ________	Organization: ________		Seal Intact?
Received by: ________	Organization: ________	Date __/__/__ Time ____	Yes No N/A
Relinquished by: ________	Organization: ________		Seal Intact?
Received by: ________	Organization: ________	Date __/__/__ Time ____	Yes No N/A

Special Instructions/Remarks: ________

Delivery Method: [ ] In Person [ ] Common Carrier ____ (SPECIFY) [ ] Lab Courier [ ] Other ____ (SPECIFY)

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LOCATION SKETCH

Well(s) _____ Project/No. _____ Page _____ of _____

Site Location _____

Observer _____

(Locate all wells, borings, etc. with reference to three permanent reference points; tape all distances; clearly label all wells, roads, and permanent features)

N

0 ft ft

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Ground-Water Consultants

UTILITIES AND STRUCTURES CHECKLIST

Project: _____ **Prepared by:** _____

Location: _____ **Date:** _____

Instructions. This checklist has to be completed by a G&M staff member as a safety measure to insure that all underground utility lines, other underground structures as well as above-ground power lines are clearly marked out in the area selected for boring or excavation. **DRILLING OR EXCAVATION WORK MAY NOT PROCEED UNTIL LINES ARE MARKED AND THIS CHECKLIST HAS BEEN COMPLETED.** Arrangements for underground utility markouts are best made at the time of the preliminary site visit to allow client and/or utility company sufficient time. Keep completed checklist and maps onsite, send copy to Project Manager.

Assignment of Responsibility. Client is responsible for having underground utilities and structures located and marked. Preferably, the utilities themselves should mark out the lines.

Drilling or Excavation Sites. Attach a map of the property showing the proposed drilling or excavation site (or if sites are widely separated, several maps) clearly indicating the area(s) checked for underground utilities or underground structures and the location of above-ground power lines.

Utilities and Structures

Type	Not Present	Present	How Marked?[1]
Petroleum products line			
Natural gas line			
Steam line			
Water line			
Sewer line			
Storm drain			
Telephone cable			
Electric power line			
Product tank			
Septic tank/drain field			
Overhead power line			

1) Flags, paint on pavement, wooden stakes, etc.

Name and affiliation of person who marked out underground lines or structures.

_____ NAME _____ ORGANIZATION _____ PHONE

Emergency Procedures

Persons at site or facility to contact in case of emergency

1. _____ Phone _____

2. _____ Phone _____

Fire Dept.: Phone _____ Ambulance: Phone _____

Utility: Phone _____ Utility: Phone _____

Utility: Phone _____ Utility: Phone _____

Directions to nearest hospital (describe or attach map).

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Environmental Services

WATER SAMPLING LOG

Project/No. _____ Page _____ of _____

Site Location _____

Site/Well No. _____ Coded/ Replicate No. _____ Date _____

Weather _____ Time Sampling Began _____ Time Sampling Completed _____

EVACUATION DATA

Description of Measuring Point (MP) _____

Height of MP Above/Below Land Surface _____ MP Elevation _____

Total Sounded Depth of Well Below MP _____ Water-Level Elevation _____

Held _____ Depth to Water Below MP _____ Diameter of Casing _____

Wet _____ Water Column in Well _____ Gallons Pumped/Bailed Prior to Sampling _____

Gallons per Foot _____

Gallons in Well _____ Sampling Pump Intake Setting (feet below land surface) _____

Evacuation Method _____

SAMPLING DATA/FIELD PARAMETERS

Color _____ Odor _____ Appearance _____ Temperature _____ °F/°C

Other (specific ion; OVA; HNU; etc.) _____

Specific Conductance, umhos/cm _____ pH _____

Sampling Method and Material _____

Constituents Sampled	Container Description From Lab ____ or G&M ____	Preservative

Remarks _____

Sampling Personnel _____

WELL CASING VOLUMES

GAL./FT				
	1-¼" = 0.06	2" = 0.16	3" = 0.37	4" = 0.65
	1-½" = 0.09	2-½" = 0.26	3-½" = 0.50	6" = 1.47

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G&M Form 2.6.86 Southprint 89-1473

Protected Material: Monsanto Insurance Coverage Litigation

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WATER LEVEL/PUMPING TEST RECORD

PROJECT ________ WELL ________ SITE ________

SCREEN SETTING ________ MEASURING POINT DESCRIPTION ________ HEIGHT ABOVE GROUND SURFACE ________

STATIC WATER LEVEL ________ MEASURED WITH ________ DATE/TIME ________

DRAWDOWN ☐ START OF TEST ________ PUMPING WELL ________

RECOVERY ☐ END OF TEST ________

DISTANCE FROM WELL MEASURED TO PUMPING WELL (r) ________ DISCHARGE RATE ________ ORIFICE ________

DATE & TIME	WELL OR t (mins)	HELD (ft)	WET (ft)	DEPTH TO WATER (ft)	s (ft)	DEW. [1] CORR. (ft)	ART. [2] s' (ft)		Q (gpm)	MANO-METER (in)	REMARKS [3]
											MCA C156934

1) Dewatering Correction 2) Equivalent Artesian Drawdown 3) pH, Spec. Cond., Temp., Weather, Sand, Turbidity, etc.

G&M Form 10 6 86

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GERAGHTY & MILLER, INC.
Environmental Services

TELEPHONE CONVERSATION RECORD

DATE: _____ TIME: _____ PROJECT: _____

FROM: _____ TO: _____

COMPANY: _____ COMPANY: _____

TELE NO: _____ TELE NO: _____

RE: _____

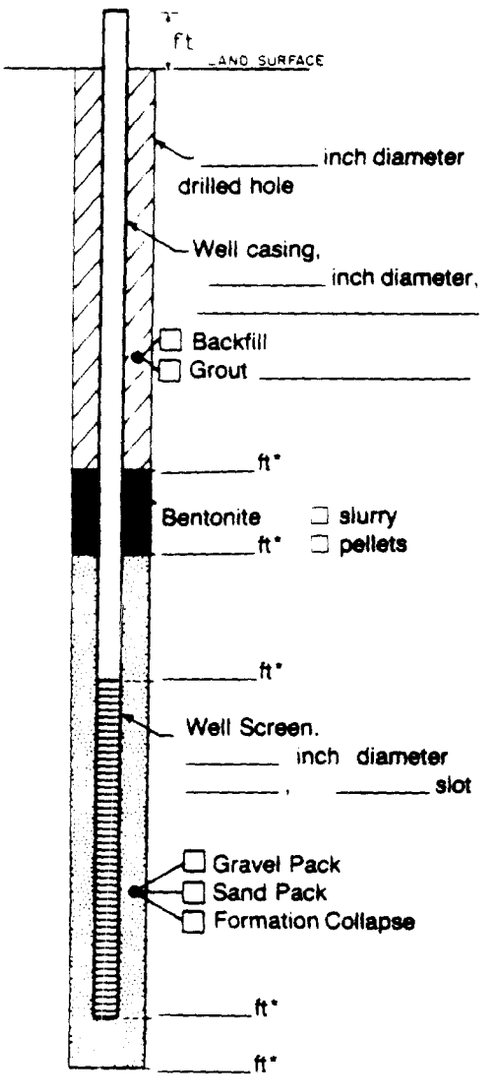
MCA 0156935

G&M Form :6 8-86

Southborne 89-1013

GERAGHTY & MILLER, INC.
Environmental Services

WELL CONSTRUCTION LOG
(UNCONSOLIDATED)



Measuring Point is Top of Well Casing Unless Otherwise Noted.

*Depth Below Land Surface

Project _____ Well _____

Town/City _____

County _____ State _____

Permit No. _____

Land-Surface Elevation and Datum _____ feet ☐ Surveyed ☐ Estimated

_____

Installation Date(s) _____

Drilling Method _____

Drilling Contractor _____

Drilling Fluid _____

_____

Development Technique(s) and Date(s)

_____

_____

_____

Fluid Loss During Drilling _____ gallons

Water Removed During Development _____ gallons

Static Depth to Water _____ feet below M.P.

Pumping Depth to Water _____ feet below M.P.

Pumping Duration _____ hours

Yield _____ gpm Date _____

Specific Capacity _____ gpm/ft

Well Purpose _____

_____

_____

Remarks _____

_____

_____

_____

_____

_____

Prepared by _____

G&M Form 05 12 88

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Southport 89-0978

GERAGHTY & MILLER, INC.
Ground-Water Consultants

DRILLING & INSTALLATION OF MONITORING WELLS DAILY CHECKLIST

PROJECT: _____ WELLS/BORINGS: _____

LOCATION: _____ DATE: _____

G&M PERSONNEL ON SITE: _____ TIME: _____

CHECKED BY: _____

ITEMS	OK/NA	COMMENTS
PRIOR TO DRILLING:		
Contractor has checked for underground utilities		
Well locations staked		
Well drilling permits secured		
G&M QA Manual/QA plan available		
Health & Safety plan (HASP) available		
Safety equipment on site		
Contractor equipment adequate		
Drilling equipment steam cleaned		
Drilling water source approved/sampled		
Drilling equipment water sample taken		
Drilling mud & additives approved		
Sand or gravel pack sample approved		
Grout composition approved		
DURING INSTALLATION:		
Formation samples properly taken and bottled or bagged		
Rock color chart used		
OVA monitoring during drilling & sampling		
Cores properly marked and stored		
Hard hat worn		
Proper safety procedures followed		
Hazardous soil, mud or water properly handled*		
Daily Log kept		
Sample/Core Log form filled out		
Well Construction Log prepared		
Materials/Cost Log prepared		
Location Sketch made		
Tremie pipe used in grouting		
Abandoned well/boring grouted & staked		
Protective casing/well cap/lock installed		
Well identification no. attached		
Well development adequate		
Well elevation and location surveyed in		

*See QA Manual, Drilling and Installation of Monitoring Wells, Sect. 2.16.2.

MCA C156937

Instructions: Original to Field Project File; copy to Project Manager and to QA Representative.

JUNE 1986

GERAGHTY & MILLER, INC.
Ground-Water Consultants

SAMPLE CONTAINER INVENTORY

Project _____

Shipped from _____ Shipped to _____
(laboratory) _____ _____
_____ _____

Phone _____ Attn. _____

SHIPMENT CONTENTS

Shipped			Received	
Bottle Size and Composition	Preservative	Quantity	Quantity	Condition/Comments

Packed by _____ Received by _____
Date _____ Date _____
Shipped by _____ Inspected by _____
Date _____ Date _____

Sealing Method _____ Seal Intact? _____

Remarks:

MCA C156938

G&M Form 08 1 87 Southprint 87 1783

GERAGHTY & MILLER, INC.
Environmental Services

SAMPLING OF MONITORING WELLS DAILY CHECKLIST

PROJECT _____ WELL(S): _____

LOCATION _____ DATE: _____

G&M PERSONNEL ON SITE: _____ TIME: _____

CHECKED BY: _____

ITEMS	OK/NA	COMMENTS
PRIOR TO SAMPLING: Health & safety precautions (HASP) received; equipment ready.		
Sample containers, coolers, received from laboratory; ice or ice packs ready.		
Sampling equipment and supplies inventoried, clean and operational.		
Check in with client at site.		
Integrity of well noted.		
Well area prepared for sampling; plastic placed around well; gasoline-powered pumps placed downwind.		
Well and water-level measurements made and recorded along with other pertinent field information on water sampling log.		
Field instruments calibrated.		
Sample containers labelled; preservatives added, if necessary.		
DURING AND AFTER SAMPLING: Well purged three to five times its volume.		
Sample collected using a bailer or pump as per sampling plan.		
Measurement of field parameters recorded on sampling log.		
Sample containers filled according to collection protocol of analyses.		
Field and trip blanks collected; replicates or split samples collected as per sampling plan.		
Samples stored at 4°C in coolers for transport to lab.		
Water sampling log and chain-of-custody form completed.		
Reusable equipment decontaminated; non-reusable equipment disposed of in appropriate manner.		
Well secured and locked.		
Laboratory contacted to confirm receipt and condition of samples.		

Additional Comments:

MCA C156939

Instructions: Original to Field Project File; copy to Project Manager and to QA Representative.

G&M Form 13 11/90

Southpoint 90-2349

GERAGHTY & MILLER, INC.
Ground Water Consultants

MATERIALS/COST LOG

Page ____ of ____

Wells: ____ Project/No.: ____
Site Location: ____ Calculated By: ____ Checked By: ____

Well	Footage Drilled (ft)	Split Spoons (ea)	Screen Diam/Length (ft)	Casing Diam/Length (ft)	Sand or Gravel (bag)	Bentonite Pellets (lb)	Bentonite Powder (bag)	Cement (bag)	Developing Time (hrs)	Rig time (hrs)	Other Items*
Totals											
Unit Cost	$	$	$	$	$	$	$	$	$	$	$
Cost Totals	$	$	$	$	$	$	$	$	$	$	$

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MCA C156540

Protected Material: Monsanto Insurance Coverage Litigation

Protected Material: Monsanto Insurance Coverage Litigation

APPENDIX B

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APPENDIX B

TITLE AND SIGNATURE PAGE

QUALITY ASSURANCE PROJECT PLAN FOR THE SITE INVESTIGATION FOR DEAD CREEK SECTOR B, AND SITES L AND M, SAUGET - CAHOKIA, ILLINOIS

Prepared by Geraghty & Miller, Inc. Date:_____

Approved:_____ Date:_____
Monsanto Coordinator

Approved:_____ Date:_____
Geraghty & Miller, Inc. Project Officer

Approved:_____ Date:_____
Geraghty & Miller, Inc. Project Manager

Approved:_____ Date:_____
Geraghty & Miller, Inc. Quality Assurance Officer

Approved:_____ Date:_____
IEPA Quality Officer

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APPENDIX B

QUALITY ASSURANCE PROJECT PLAN FOR THE SITE INVESTIGATION FOR DEAD CREEK SECTOR B, AND SITES L AND M, SAUGET - CAHOKIA, ILLINOIS

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INTRODUCTION

At the request of Monsanto Company, Geraghty & Miller, Inc. has prepared this Quality Assurance Project Plan (QAPP) for the Site Investigation to be carried out at Dead Creek Sector B, and Sites L and M in Sauget - Cahokia, Illinois (Figure 1). The overall objective of the investigation is to characterize the sites by determining the nature and extent of sediment/fill materials in the unsaturated zone in Sector B and Site L, and below the ponded water at Site M.

The United States Environmental Protection Agency (USEPA) requires that all environmental monitoring and measurement efforts mandated or supported by USEPA participate in a centrally managed quality assurance (QA) program. Under this program, Geraghty & Miller has the responsibility to implement minimum procedures to assure that the precision, accuracy, completeness, and representativeness of its data are known and documented. To ensure the responsibility is met uniformly, Geraghty & Miller has prepared a written QAPP.

This QAPP presents the organization, objectives, functional activities, and specific QA and quality control (QC) activities associated with the Site Investigation. This QAPP also describes the specific protocols which will be followed for sampling, sample handling and storage, chain of custody, and laboratory analysis.

All QA/QC procedures will be in accordance with applicable professional technical standards, USEPA requirements, government regulations and guidelines, and specific project goals and requirements. This QAPP is prepared by Geraghty & Miller in accordance with all USEPA QAPP guidance documents entitled "Interim Guidelines and Specifications for Preparing Quality Assurance Project Plans (QAMS-005/80)," and the "Region V Model Superfund Quality Assurance Project Plan QAPjP (1991)."

1.0 PROJECT DESCRIPTION

1.1 SITE HISTORY/BACKGROUND INFORMATION

Dead Creek - Sector B

Dead Creek Sector B is located between Queeny Avenue and Judith Lane (Figure 2). The culverts at both ends for Sector B have been sealed to prevent inflow or outflow from this area. The banks of the creek are heavily vegetated and debris is visible in the area. The site is enclosed within a chain-link fence without a gate. In general, the creek area consists of a narrow channel about 5 feet wide which is flanked by low banks. The channel and banks are enclosed by steeper banks on either side of the creek. Precipitation that collects in the creek recharges the ground water below.

In 1980, the IEPA conducted a study at Dead Creek which included the installation of monitoring wells and borings, and the collection of surface-water, ground-water, and soil samples. A vertical profile of the creek sediments in the northern portion of Sector B and soil samples collected at 17 other locations indicate the presence of metals, PCBs, and other organic compounds.

In 1986, Ecology & Environment, Inc. (E&E) conducted a Remedial Investigation (RI) for the IEPA at several sites in Sauget, including Sector B, Sites L and M (Figure 2). In Sector B, E&E collected two surface-water samples and five sediment samples; however,

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the sampling locations were restricted to the north and south ends of the study area. The data from these sampling points indicate that past uses of the creek have impacted the site. Constituents detected included metals and PCBs.

Site L

Site L is located on the east side of Dead Creek, approximately 700 feet south of Queeny Avenue (Figure 2). It is the former location of a surface impoundment used by a hazardous waste hauler who disposed of wash water from truck cleaning operations. Site L was determined by E&E to be about 125 feet east of Dead Creek and encompasses an area approximately 145 feet by 195 feet. Currently, the site is covered with black cinders and is used for equipment storage by Metro Construction Equipment Company. Waste material is not visible at the surface and access to the site is not controlled. Surficial soil was not sampled by E&E.

In 1980, the IEPA installed a well downgradient of this area; however, due to its faulty construction, it was replaced by E&E in 1987.

In 1986, E&E drilled three soil borings, replaced the IEPA monitoring well, and conducted a soil-gas survey at Site L. The data from these sampling points indicates that past activities have impacted soil and ground water at the site. Compounds detected include benzene, toluene, phenols and arsenic. PCBs were not detected.

Site M

Site M is a former sand and gravel pit excavated between 1945 and 1950. The pit is approximately 335 feet by 235 feet and is filled with water. E&E estimated the pit's depth to be 40 feet. Site M is connected to Dead Creek Sector B at the southwest corner of Site M (Figure 2). It is not known whether Site M was excavated into the water table, although water is present in the pit year round. Other than miscellaneous trash, no other waste

disposal was evident in the pit at the time of the E&E study. Access to the site is controlled by a chain-link fence.

In 1986, E&E collected two surface-water samples, five sediment samples, and soil-gas samples from the perimeter of Site M. Neither the surface-water samples nor the soil-gas samples indicated the presence of contamination. The PCB data from the sediment samples indicate that past site activities may have impacted the site. In 1980, the IEPA collected two, unfiltered, surface-water samples and PCBs were detected at 4.4 ppm and 0.9 ppm.

1.2 PROJECT OBJECTIVES AND SCOPE

The Site Investigation will be performed to obtain representative environmental data necessary for determining the conditions at the three sites. These data will be used to classify the material and assess the feasibility of removal. It will also be necessary to determine whether the sediment/fill is hazardous, and whether treatment will be required prior to disposal. The details of the investigation such as the selection of drilling locations, and sample collection activities are described below. A summary of sample matrices and parameters can be found in Table B-1.

The existing data available for Dead Creek Sector B are not sufficient to determine the extent of the sediment/fill, nor will it satisfy the requirements for a characteristic waste determination. Therefore, Geraghty & Miller will collect samples of sediment/fill across ten profiles, spaced approximately 200 feet apart, within the creek bed throughout the 2,000-foot length of Sector B. Three borings will be drilled along each profile, as shown on Figure 3. All borings will be drilled to determine the thickness of the sediment/fill in the creek and will be spaced about 15 to 20 feet apart. It is anticipated that the borings within the creek bed will be drilled to a maximum depth of about 7 feet. Samples will be collected using a 5-foot continuous tube sampler, with 3-inch diameter split spoons used if recovery is poor in the fine sandy sediments. Both methods will provide a continuous record of geology, as well as

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a sufficient volume of material for analysis. All samples will be described by a Geraghty & Miller field geologist who will record sample location, depth, grain size distribution, and color. Each sample will also be screened in the field for the presence of volatile organic compounds (VOCs) using a photoionization detection (PID) instrument.

Geraghty & Miller will select one sediment/fill sample per borehole for chemical analysis based on appearance and PID measurements. Each sample will be selected from a 2-foot interval that best characterizes sediment/fill in the creek. One sediment/fill sample per profile will be analyzed for USEPA Target Compound List/Target Analyte List (TCL/TAL) parameters, and the other two samples from each profile will be analyzed for TAL metals and PCBs. Appropriate QA/QC samples will also be collected as discussed in Section 3.1 (Level of Quality Control Effort). The analytical data from the sediment/fill will be used to delineate any impacted areas, as well as provide an estimate of the volume of sediment/fill that may require remediation. Each borehole will be sealed with a mixture of drill cuttings and bentonite grout. The borehole's location and land surface elevation will be surveyed by an Illinois licensed land surveyor. All drilling equipment will be steam cleaned after each borehole, and all sampling equipment will be decontaminated with a laboratory-grade detergent and potable water before the collection of each sample.

An all-terrain (ATV) drill rig will be used for the entire program. In some areas it may be necessary to pump off standing water (if present) to provide suitable sampling conditions. Alternatively, if a direct discharge is not possible, the boring program will be completed up to the area where the standing water is located, then the water may be pumped into the area of the creek where the boring program was completed. If there is too much water to transfer, portable equipment may be used, such as a tripod. In addition, a gate(s) will be installed within Sector B's chain-link perimeter fence to provide access for the drill rig and field crew.

To define the lateral and vertical extent of the fill material in Site L, six borings will be required to supplement the existing borings installed during the E&E investigation

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(Figure 4). Previous soil sampling programs conducted by E&E in 1986 consisted of composite sampling over zones of inconsistent thickness, including both saturated and unsaturated soil in the same composite sample. The existing data are not sufficient to determine the extent of the fill material in this area.

At each boring location, Geraghty & Miller will collect continuous samples using a 5-foot tube sampler or a 3-inch diameter split-spoon, to delineate the bottom of the fill. The sample from each borehole that best characterizes the fill material will be submitted for laboratory analysis. Each sample will be obtained from a 2-foot section of the continuous core with the interval selected for analysis based on appearance and PID readings. At two of the six borings, the samples will be analyzed for TCL/TAL parameters. Based on existing data, PCBs, TAL metals, and VOCs have been selected for analysis at the remaining four borings, to determine the chemical nature of the fill material. Each borehole will be sealed and surveyed as described for Dead Creek Sector B.

1.2.1 Phase II Field Work

Once the chemical nature of the sediment/fill material has been determined, several additional samples will be collected for hazardous characteristics. An estimated five samples will be required to classify the material. Each of these samples will be analyzed for reactivity, corrosivity, ignitability, and the list of toxicity characteristic leaching procedure (TCLP) constituents (Table B-2). The results of these analyses will be used to determine whether the sediment/fill material is a hazardous waste and whether it needs treatment prior to disposal.

1.3 DATA COLLECTION ACTIVITIES

Data collection activities are discussed in detail in the Work Plan and the Field Sampling Plan (FSP) in Appendix A.

1.3.1 Sample Network Design and Rationale

The sample network design and rationale for sample locations is described in detail in Sections 3.1, 3.2, and 3.3 of the Work Plan.

1.3.2 Sample Matrices/Parameters

A list of sediment/fill sample matrices/parameters is found in Table B-1. This table describes the matrices, analytical parameters, total number of samples to be collected, equipment blanks, and the total number of matrix spike and matrix spike duplicate samples. Information concerning sediment/fill sampling protocols are provided in the FSP in Appendix A.

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1.4 DATA QUALITY OBJECTIVES

Data Quality Objectives (DQOs) are qualitative and quantitative statements which specify the quality of the data required to support decisions made during the project and are based on the end uses of the data to be collected. As such, different data uses may require different levels of data quality. There are five analytical levels which address various data uses and the QA/QC effort and methods are required to achieve the desired level of quality. These levels are:

- Screening (DQO Level 1): This level provides the lowest data quality but the most rapid results. It is often used for health and safety monitoring at the site, preliminary comparison to applicable or relevant and appropriate requirements (ARARs), initial site characterization to locate areas for subsequent and more accurate analyses, and for engineering screening of alternatives (bench-scale tests).

- Field Analyses (DQO Level 2): This level provides rapid results and better quality than in Level 1. This level may include mobile lab generated data depending on the level of quality control exercised.

- Engineering (DQO Level 3): This level provides an intermediate level of data quality and is used for site characterization. Engineering analyses may include mobile lab generated data and some analytical lab methods (e.g., laboratory data with quick turnaround used for screening but without full quality control documentation.

- Confirmational (DQO Level 4): This level provides the highest level of data quality and is used for purposes of risk assessment, evaluation of remedial alternatives and PRP determination. These analyses require full CLP

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analytical and data validation procedures in accordance with USEPA recognized protocol.

- Non-Standard (DQO Level 5): This level refers to analyses by non-standard protocols, for example, when exacting detection limits or when analysis of an unusual chemical compound is required. These analyses often require method development or adaptation. The level of quality control is usually similar to DQO Level 4 data.

The USEPA has developed a standard series of analytical support levels to demote types of analyses and the associated level of quality control effort.

Level 1 - Field screening or analysis using portable instrumentation.
Level 2 - Field analysis using more sophisticated instruments.
Level 3 - Non-CLP laboratory methods.
Level 4 - CLP routine analytical services methods.
Level 5 - CLP non-standard services analytical methods.

The analytical support levels which will be used to generate the project data fall within (Levels 1, 3 and 4). A PID instrument will be used to screen samples (Level 1). Several samples will be analyzed for non-CLP parameters (Level 3) and TCL/TAL parameters by the Routine Analytical Services (RAS) methodology in the CLP Statement of Work (SOW) for Organic Analysis (2/88) and CLP SOW for Inorganic Analysis (ILM01.0) (Level 4). The non-CLP parameters and CLP parameters are listed in Table B-2 and B-3, respectively.

2.0 PROJECT ORGANIZATION AND RESPONSIBILITIES

Geraghty & Miller will be responsible for the overall management of the project, including the field inspection of all drilling, sampling activities, and the evaluation of

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remedial alternatives, if required. Responsibilities of key project personnel are explained in Section 4.0 of the work plan. Personnel from Monsanto will be actively involved in the investigation, and will coordinate with personnel from Geraghty & Miller.

2.1 PROJECT ORGANIZATION

The project organizational chart is shown on Figure 6. The following sections contain the definitions of responsibilities of the key project personnel.

Primary responsibility for project management is shared between the Geraghty & Miller Project Officer and the Project Manager. They will be responsible for providing technical assistance for all activities which are directly related to the determination of the geologic conditions and the environmental quality of the site.

Responsibility for all quality assurance/quality control review lies with the QA/QC Advisor. Data processing will be overseen and reviewed by the Field Hydrogeologist and QA/QC Advisor. A stringent review of the data, including 10 percent fully validated, will be performed by the Data Validator. The review of all data will be conducted by the Project Officer and Project Manager. If quality assurance problems or deficiencies requiring special action are identified, the Project Officer, Project Manager, and Project QA/QC Advisor will determine the appropriate corrective action.

2.2 FIELD ORGANIZATION

The Geraghty & Miller field team will be organized according to the planned activity. For this off-site investigation, the field crew will consist of the Field Hydrogeologist and the drilling subcontractor.

The Field Hydrogeologist will be responsible for the coordination of all personnel on site, and for providing technical assistance when required. The Field Hydrogeologist, or

his/her designee, will be present during all sampling activities. He/she will keep a general site log describing activities conducted on site, which will include the identification of personnel entering the site, and the recording of general observations regarding site activities. The Field Hydrogeologist will be responsible for providing technical supervision of the drilling subcontractor. In addition, he/she will be responsible for the geologic logging performed during the soil boring program.

The Field Hydrogeologist will also be responsible for coordination of all sampling efforts and will assure the availability and maintenance of the necessary shipping and packing materials, and sampling equipment. The Field Hydrogeologist will (1) supervise the completion of all sampling documentation, (2) ensure the proper handling and shipping of all the samples, and (3) be responsible for the accurate completion of the field notebook. The Field Hydrogeologist will also assume custody of all samples and will be responsible for (1) the completion of all chain-of-custody forms, (2) maintaining communication with on-site personnel, (3) logging all communications, and (4) site entries and departures during sampling.

The Field Hydrogeologist, in conjunction with the QA/QC Advisor, will be responsible for the adherence of all QA/QC guidelines as defined in this QAPP. Strict adherence to these procedures is critical to the collection of acceptable and representative data.

The Data Validator is responsible for review of laboratory data for compliance with the precision, accuracy, representativeness, comparability, and completeness (the "PARCC" parameters), and notifications to the Project Manager of any QC deficiencies.

The project Health and Safety Manager will be responsible for assuring that all field crew adhere to the site health and safety requirements. Additional responsibilities of the project Health and Safety Manager are as follows:

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- Updating equipment or procedures based upon new information gathered during the site operation.

- Modifying the levels of protection based upon information from the Field Hydrogeologist.

- Determining and supplying locations and routes to medical facilities, including poison control centers, and arranging for emergency transportation to medical facilities.

- Notifying local public emergency officers, including police and fire departments, of the nature of the team's operation and for supplying these department's telephone numbers.

- Examining work-party members for symptoms of exposure or stress.

- Providing emergency medical care and first aid as necessary on site. The Field Hydrogeologist also has the responsibility to stop any field operation that threatens the health or safety of the team or the surrounding populace.

Tasks which will be performed by subcontractors include drilling, surveying, and analytical (laboratory) testing. Subcontractor managers have overall responsibility for the performance of their tasks in accordance with the project plans and specifications, interaction with the project manager, and adherence to the project schedule.

2.3 LABORATORY OPERATIONS

Laboratory chemical analyses of all sediment/fill samples will be performed by Savannah Labs, Inc. of Savannah, Georgia. An analytical QAPP is on file with the laboratory.

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3.0 QUALITY ASSURANCE OBJECTIVES

The overall QA objective is to develop and implement procedures for field sampling, chain-of-custody, laboratory analysis, and reporting that will provide environmental monitoring data of known and acceptable quality. Specific procedures to be used for sampling, chain-of-custody, calibration of field instruments, laboratory analysis, reporting, internal quality control, audits, preventative maintenance, and corrective actions are described in later sections of this QAPP. The purpose of this section is to address the data quality objectives in terms of accuracy, precision, quantitation limits, representativeness, comparability, and completeness.

3.1 LEVEL OF QUALITY CONTROL EFFORT

Equipment blanks and matrix spike samples will be analyzed to assess the quality of the data resulting from the field sampling program. Equipment blanks consisting of distilled water will be submitted to the analytical laboratories to provide the means to assess the quality of the data resulting from the field sampling program. Equipment blank samples are analyzed to check for procedural contamination at the site, which may cause sample contamination. Matrix spikes provide information about the effect of the sample matrix on the digestion and measurement methodology. All matrix spikes are performed in duplicate and are hereinafter referred to as MS/MSD samples. One matrix spike/matrix spike duplicate will be collected for every 20 or fewer investigative samples. The general level of the QC effort will be one equipment blank for every 10 or fewer investigative samples.

MS/MSD samples are investigative samples. Soil MS/MSD samples require no extra volume for VOCs or extractable organics. One MS/MSD sample will be collected/designated for every 20 or fewer investigative samples per sample matrix (i.e., sediment/fill). The number of MS/MSD samples and equipment blank samples to be collected are listed in Table B-1. Sampling procedures are specified in the FSP (Appendix A).

The level of QC effort provided by the laboratory will be equivalent to the level of QC effort specified under the CLP program for the RAS. The level of QC effort for testing TAL inorganics (metals and cyanide) will conform to the protocols of the CLP SOW for inorganics (ILM01.0). The level of QC effort for testing of TCL organics (volatiles, semivolatiles, and pesticides/PCBs) will conform to the protocols of the CLP SOW for organics (2/88). The quantitation levels for the TCL/TAL parameters are listed in Table B-3.

The level of QC effort for testing of TCLP parameters in soil samples will conform to protocols in USEPA SW-846. The quantitation levels for the TCLP parameters are listed in Table B-2.

3.2 ACCURACY

Accuracy is the relationship of the reported data to the "true" value. The accuracy of the methods used for sediment/fill samples will be determined from the analysis of MS/MSDs and surrogate spikes. MS/MSDs will be analyzed at a rate of one per every 20 or fewer samples. Surrogate spikes are added to each sample, MS/MSD, blank and standard. The compounds used and their accuracy limits are set by the CLP SOWs. Outside evaluation standards such as USEPA reference check standards and Performance Evaluation samples are also periodically analyzed by the laboratory to determine accuracy.

Additional sample material will be provided for each MS/MSD analysis. These samples will be indicated on the appropriate chain-of-custody form. Accuracy for the analyses using methodology not specified in the CLP SOW will be assured through standard laboratory QA/QC methods.

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3.3 PRECISION

Measurements of the data precision are necessary to demonstrate the reproducibility of the data. Precision for the TCL/TAL analyses will be determined from the analysis of MS/MSD samples as specified in the CLP SOWs. Precision of the analyses using methodology not specified in the CLP SOWs will be assured through standard laboratory QA/QC methods.

3.4 COMPLETENESS

Completeness is a measure of the amount of valid data obtained from the measurement program, compared to the total amount collected. The validity of the collected data will be evaluated with QA/QC guidelines. Explanation of the completeness measurement and percent completeness is described in the laboratory QAPP. The laboratory should provide data that meet QC acceptance criteria for 90 percent or more of the requested determinations. If the percent completion limits are not met, the laboratory may be required to re-analyze samples or re-sampling may be required.

3.5 REPRESENTATIVENESS

All data obtained should be representative of actual conditions at the sampling location. The sediment/fill sampling network was designed to provide data representative of site conditions. Considerations for evaluating the representativeness of the data include, but are not limited to, the location being sampled, the methods used to obtain environmental samples at the site, and the appropriateness of the analytical method to the type of sample obtained. The rationale of the sampling network is described in detail in the Work Plan. All field activities will be performed according to the protocols discussed in detail in the FSP (Appendix A).

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3.6 COMPARABILITY

Comparability expresses the confidence with which one data set can be compared with another. The extent to which existing and planned analytical data will be comparable depends on the similarity of sampling and analytical methods. The procedures used to obtain the planned and analytical data, as documented in the QAPP, are expected to provide comparable data. These new analytical data, however, may not be directly comparable to existing data because of difference in procedures and QA objectives.

3.7 QUANTITATION LIMITS

Quantitation limits for the TCL/TAL analyses are provided in the CLP SOWs, and are also listed in Table B-3 unless dilution or interference effects make it necessary to raise them. The laboratory will make every effort to achieve quantitation limits as low as practicable and will report estimate concentration values at less than the detection limit by flagging the value with a J.

4.0 SAMPLING PROCEDURES

Procedures to collect all samples at the site are described in the FSP (Appendix A). This plan includes information on sampling procedures, equipment decontamination, sample documentation, sample shipping, and chain-of-custody. Preservation, container, and holding-time requirements for the parameters to be analyzed are presented in Table B-4. Samples to be analyzed for the TCLP parameters will be prepared for analysis by the laboratory following USEPA SW-846 Method 1311.

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5.0 SAMPLE CUSTODY

Sample custody procedures are designed to provide documentation of preparation, handling, storage, and shipment of all collected samples. An example of the chain-of-custody form is attached to Appendix A.

Samples collected during the site investigation will be the responsibility of identified persons from the time they are collected until they, or their derived data, are incorporated into the final report. Stringent chain-of-custody procedures will be followed to document sample possession.

5.1 FIELD CHAIN-OF-CUSTODY PROCEDURES

A sample is under custody if it is in your possession, or it is in your view after being in your possession, or it was in your possession and you locked it up, or it is in a designated secure area.

1. The Field Hydrogeologist is responsible for the care and custody of the samples collected until they are delivered to the analyzing laboratory or entrusted to a carrier. As few people as possible should handle the samples.

2. Geraghty & Miller Sample/Core logs will be used to document the data collection activities. All entries will be made in ink with no erasures. A single stroke will be used to cross out incorrect information; corrections will be dated and initialed. The Sample/Core log will be used to record a variety of information including date, start and end of time of activities, names of all sampling team members, weather conditions, sample location, equipment used to collect sample, depth of sample, time of collection, sample description, sample identification number, and the volume and number of containers.

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3. Chain-of custody sample forms will be completed in the field to the fullest extent possible prior to sample shipment. They will include the following information: sample number, time collected, source of sample and location, depth from which sample was taken, preservative, and name of sampler. These forms will be filled out in a legible manner, using water-proof ink, and will be signed by the sampler. Similar information will be provided on the sample label which will be securely attached to the sample bottle. In addition, sampling forms will be used to document collection, filtration (if required), and preparation procedures.

4. The Project Manager will review all field activities to determine whether proper custody procedures were followed during the field work, and decide if additional samples are required.

5.2 TRANSFER OF CUSTODY AND SHIPMENT

The following procedures will be used when transferring custody of samples:

1. Samples will always be accompanied by a chain-of-custody record completed according to the protocols outlined in the previous sub-section. When transferring samples, the individuals relinquishing and receiving them will sign, indicate the date, and note the time on the record. This record documents the sample custody transfer from the sampler to the laboratory, often through another person or agency. Upon arrival at the laboratory, internal custody procedures will be followed, in accordance with the laboratory QAPP.

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2. Samples will be packaged properly for shipment, and dispatched to the laboratory for analysis with individual custody records accompanying each shipment. Shipping containers will be sealed for shipment to the laboratory. The method of shipment, courier name, and other pertinent information, will be entered in the remarks section of the custody record.

3. All shipments will be accompanied by the chain-of-custody record identifying the contents. The original record will accompany the shipment; a copy will be retained by the field sampler.

4. Proper documentation will be maintained for shipments by common carrier.

5.3 SAMPLE SHIPMENT PROCEDURES

The following procedures will be followed when shipping samples for laboratory analysis:

1. Samples requiring refrigeration will be promptly chilled with ice or "Blue Ice" to a temperature of 4°C and packed in an insulated cooler for transport to the analyzing laboratory.

2. Only shipping containers which meet all applicable state and federal standards for safe shipment will be used.

3. To provide a means of detecting any potential tampering during shipment, all shipment containers (coolers) will be affixed with signed Geraghty & Miller sample seals. Two seals will be affixed to each cooler, on opposite ends. In addition, 2-inch wide transparent tape will be wrapped entirely around the cooler.

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4. The field chain-of-custody document will be placed inside the shipping container in a sealed plastic envelope after the courier has signed the document.

5. Shipment will be made by overnight courier.

5.4 FIELD DOCUMENTATION RESPONSIBILITIES

Field daily log forms will provide the means of recording data collecting activities performed. Entries will be described in as much detail as possible so that persons going to the site can reconstruct a particular situation without reliance upon memory. It will be the responsibility of the Field Hydrogeologist to secure all documents produced in the field (i.e., geologist's daily logs, lithologic and sampling logs, communications, etc.) at the end of each work day.

The data generated by the laboratory will be sent to Geraghty & Miller, validated, and stored by Geraghty & Miller until completion and acceptance of the investigation report.

5.5 LABORATORY CHAIN-OF-CUSTODY PROCEDURES

The chain-of-custody procedures for the CLP laboratory are described in the SOW for RAS. The same custody procedure applies to the samples to be analyzed for TCLP parameters. These custody procedures along with the holding time requirements for samples to be analyzed for the TCL/TAL parameters are described in the CLP SOWs.

5.6 FINAL EVIDENCE FILES CUSTODY PROCEDURES

Geraghty & Miller is the custodian of the evidence file and maintains the contents of evidence files for the Site Investigation, including all relevant records, reports, logs, field notebooks, pictures, subcontractor reports, correspondence, laboratory logbooks, chain-of-

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custody form, and Laboratory Scientific Support Section (LSSS) of CLP's data reviews in a secured, limited access area and under custody of the project manager.

6.0 CALIBRATION PROCEDURES AND FREQUENCY

This section describes procedures for maintaining the accuracy of all the instruments and measuring equipment which are used for conducting field tests and laboratory analyses. These instruments and equipment should be calibrated prior to each use or on a scheduled, periodic basis.

6.1 FIELD INSTRUMENTS/EQUIPMENT

Instruments and equipment used to gather, generate, or measure environmental data will be calibrated with sufficient frequency and in such a manner that accuracy and reproducibility of results are consistent with the manufacturer's specifications.

Equipment to be used doing the field sampling will be examined to certify that it is in operating condition. This includes checking the manufacturer's operating manual and the instructions for each instrument to ensure that all maintenance requirements are being observed. Field notes from previous sampling trips will be reviewed so that the notations of any prior equipment problem are not overlooked, and all necessary repairs have been made.

Calibration of field instruments is governed by the specific Standard Operation Procedure (SOP) for the applicable field analysis method, and such procedures take precedence over the following general discussion.

Calibration of field instruments will be performed at the intervals specified by the manufacturer or more frequently as conditions dictate. A log book will be kept documenting

calibration results for each field instrument. The log book will include the date, standards, personnel, and calibration results.

6.2 LABORATORY INSTRUMENTS

Calibration procedures and frequencies for laboratory equipment used in the analysis of environmental samples will be performed in accordance with those specified in the CLP SOWs and the laboratory QAPP.

7.0 ANALYTICAL PROCEDURES

All soil and sediment samples collected during field sampling activities for the Sauget Sites - Area 1 investigation will be analyzed by Savannah Laboratories, Inc.

7.1 LABORATORY ANALYSIS

All samples for TCL/TAL parameters will be analyzed according to analytical procedures set forth in the CLP SOW (2/88) for organics analysis and the CLP SOW (ILM01.0) for inorganic analysis. All samples for TCLP parameters will be analyzed according to the analytical procedures set forth in USEPA SW-846. Listed in Table B-4 are the sample container types, required preservation, analysis holding times, and sample preservatives for these parameters.

8.0 DATA REDUCTION, VALIDATION AND REPORTING

All data collected during the Site Investigation, including field and laboratory (chemical and geotechnical) results, will be reduced, validated (10 percent - see Section 8.2), summarized, and reported according to specifications outlined in the CLP SOW (2/88) for organic analysis and CLP SOW (ILM01.0) for inorganic analysis.

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8.1 DATA REDUCTION

The reduction of the field data will consist of summarizing the raw field data. They will be presented in the form of tables, logs, illustrations, and graphs, as deemed appropriate by the Project Manager.

The analytical data from the laboratory will be reduced to appropriate forms as determined by the Project Manager. The original data and reduced form will be maintained at the Geraghty & Miller office until acceptance of final reports. The reduced data will be checked against original data to determine if transcription or calculation errors have occurred.

8.2 DATA VALIDATION

Data validation consists of a stringent review of an analytical chemical data package with respect to sample receipt and handling, analytical methods, data reporting and deliverables, and document control. The quality of data generated by a laboratory is extremely important; it is an integral part of the investigation and should be clearly tied to the project goals. Data used to develop qualitative trends, for example, will not have the same data validation requirements as data used for litigation purposes.

A qualified Geraghty & Miller chemist will validate 10 percent of the samples collected according to the procedures described in "Laboratory Data Validation Functional Guidelines for Evaluating Chemical Data" prepared for the Hazardous Site Evaluation Division of the USEPA (Inorganics - July 1988, Organics - February 1988).

The remaining samples collected will be screened for completeness and technical compliance. The screening procedure requires much less time to complete. However, the laboratory will provide a CLP data package for all samples for possible future data

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validation, if required. The information to be screened for the remaining samples will include:

- Check to see if the field chain-of-custody form was filled out and if samples were properly logged.

- Check to see if parameters were analyzed by the methods identified in the QAPP.

- Check to see if holding times were met for each parameter.

- Review internal quality assurance/quality control (QA/QC) data. Confirm that blanks and spikes were analyzed on the minimum number of samples as specified in the QAPP.

- Review all equipment blanks and MS/MSD data. If target compounds appear in blanks or if percent relative difference on duplicates is outside established limits, the reasons for these anomalies will be investigated. In such an event, sampling techniques will be discussed with the project manager and/or the laboratory manager and internal QA/QC data will be reviewed as appropriate.

- If data appears suspect, the specific data of concern will be investigated. Calculations will be traced back to the raw data. If the calculations did not agree with the prescribed limits, the cause will be determined and corrected, if possible.

After the data is reviewed and/or validated, a listing of nonconformities is generated and used to determine whether the data can be utilized for its intended purpose (assessment, enforcement, litigation, etc.). Non-conformities require data qualifiers, which are used to alert the data user to inaccurate or imprecise data. For example, if holding times are

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exceeded, the Data Validator must qualify all positive results as estimated and all sample quantitation limits as estimated. The reviewer may make professional judgments and/or comments on the validity of the overall data package for a sampling event. This is particularly appropriate for sampling events in which there are several quality control criteria out of specification with regard to the limits specified in "Laboratory Data Validation Functional Guidelines for Evaluating Chemical Data". In these cases, it may be required that the sample be re-analyzed.

The net result is data which has been carefully reviewed and 10 percent validated for its adherence to prescribed requirements and its suitability for its intended use.

8.3 DATA REPORTING

The analytical data, including quality control samples, will be reported in tabular form with identification of sample number, matrix, parameters, detection limits, and concentrations detected. The data tabulations will be sorted by classes of constituents (e.g., volatile compounds, semivolatile compounds).

The tables and logs will be compiled whenever feasible by the Field Hydrogeologist, who will inform the Project Manager of any problems encountered during data collection, identify apparent inconsistencies, and provide opinions on the data quality and limitations. The tables and logs will be used as the basis for data interpretation and will be checked against the original field documentation prior to use by an independent reviewer.

9.0 INTERNAL QUALITY CONTROL CHECKS

The Field Hydrogeologist will make use of the equipment blanks to ensure and document the integrity of sample collection, sample handling procedures and the validity of the measurement data. Sediment/fill samples will not be duplicated due to the non-homogeneous nature of the samples and the high degree of variability routinely seen with

results from duplicate sediment/fill analysis. The frequencies for collecting the QC samples are specified in Section 3.1. The procedures for collecting the QC samples are specified in the FSP.

There are two types of quality assurance mechanisms used to ensure the production of analytical data of known and documented quality, analytical method QC, and program QA. The internal quality control procedures for the analytical services on environmental samples to be provided are specified in the CLP SOWs. These specifications include the types of control samples required (calibration standards, sample spikes, surrogate spikes, internal standards, controls, blanks), the frequency of each control, the compounds to be used for sample spikes and surrogate spikes, and the quality control acceptance criteria. It will be the laboratory's responsibility to document in each package that both initial and on-going instrument and analytical QC criteria are met. This documentation will be included in the packages generated by the selected laboratories.

The field-collected quality control sample results will also be compared to acceptance criteria, and documentation will be performed showing that criteria have been met. Any samples in non-conformance with the QC criteria will be identified and re-analyzed by the laboratory, if possible. The following procedures will be employed by the laboratory for the Site Investigation:

- Proper storage of samples.
- Use of qualified and/or certified technicians.
- Use of calibrated equipment traceable to National Bureau of Standards or USEPA standards.
- Formal independent confirmation of all computation and reduction of laboratory data and results.
- Use of standardized test procedures.

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10.0 PERFORMANCE AND SYSTEM AUDITS

System audits will be performed on a semi-continuous basis, as appropriate, to assure that the work is being implemented in accordance with the FSP and in an overall satisfactory manner.

- The Field Hydrogeologist will supervise and check on a daily basis that field measurements are made accurately, equipment is thoroughly decontaminated, samples are collected and handled properly, and that the field work is accurately and neatly documented. QC checklists will be filled out daily during sampling as described in the FSP (Appendix A).

- On a timely basis, the Data Validator will review the data packages submitted by the laboratory to check that the data has been obtained through the approved methodology with the appropriate level of QC effort and reporting, holding times were met, and that the results are in conformance with the QC criteria. On the basis of these factors, the Data Validator will evaluate the data quality and limitations.

- The Project Manager will oversee the Field Hydrogeologist and Data Validator, and check that management of the acquired data proceeds in an organized and expeditious manner.

- System audits for the laboratory are performed on a regular basis by USEPA, as well as by various state agencies. These audits are discussed in the laboratory QAPP.

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Performance audits of laboratories participating in the CLP are performed quarterly in accordance with the procedures and frequencies established by USEPA for the CLP. The laboratory performance evaluation audits are discussed in the laboratory QAPP.

11.0 PREVENTATIVE MAINTENANCE

Geraghty & Miller has established a program for the maintenance of field equipment to ensure the availability of equipment in good working order when and where it is needed:

- The Equipment Manager keeps an inventory of the equipment in terms of items (model and serial number) quantity and condition. Each item of equipment is signed out when in use, and its operating condition and cleanliness checked upon return. The Equipment Manager conducts routine checks on the status of equipment, and is responsible for the stocking of spare parts and equipment readiness. The Equipment Manager maintains the equipment manual library and trains field personnel in the proper use and care of equipment.

- The Field Hydrogeologist is responsible for working with the Equipment Manager to make sure that the equipment is tested, cleaned, charged, and calibrated in accordance with the manufacturer's instructions before being taken to the job site.

The laboratory follows a well-defined program to prevent the failure of laboratory equipment and instrumentation. This preventative program is described in the laboratory QAPP.

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12.0 DATA ASSESSMENT PROCEDURES

The field and laboratory generated data in the investigation will be assessed for its precision, accuracy representativeness, completeness and comparability. Both qualitative and quantitative procedures will be used for these assessments.

Field measurements will be assessed on the basis that the measurements were made properly using calibrated instruments. The assessment of the sampling data with respect to field performance will be based on the criteria that the samples were properly collected and handled. The field QC sample results will also be used in assessing the representativeness and comparability of the samples collected. The Project Manager will have the overall responsibility for assessment of the data and integrating the results of the assessment into data use and interpretation.

The laboratory will calculate and report in the data packages the precision, accuracy, completeness, and sensitivity of the analytical data. Precision will be expressed as the relative percent difference (RPD) between values for MS/MSD samples. Accuracy will be expressed as percent recoveries (%R) for surrogate standards and matrix spike compounds. The precision and accuracy results will be compared to the prescribed QC acceptance criteria. The QC acceptance criteria prescribed for each test method are presented in the laboratory QAPP. For the TCL/TAL parameters, these criteria conform to the control limits established in the CLP SOWs for Organic and Inorganics Analyses.

Completeness is expressed as the percentage of valid data, based on the total amount of data intended to be collected. The laboratory will make every attempt to generate completely valid data.

The assessment of data representativeness with respect to laboratory performance will be based on the criteria that the samples were properly handled and analyzed within the holding times and the method blank results. Data comparability will be assessed based on

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the criteria that analyses were performed in strict adherence with the CLP and other standard USEPA analytical protocols.

The achievement of method detection limits depend on instrument sensitivity and matrix effects. Therefore, it is important to monitor the instrumental sensitivity to ensure the data quality through constant instrument performance. The instrumental sensitivity will be monitored through the analysis of method blanks, calibration check samples, and laboratory control samples.

13.0 CORRECTIVE ACTIONS

Corrective actions may be required for analytical and equipment problems and noncompliance problems. Analytical and equipment problems may occur during sampling and sample handling, sample preparation, laboratory instrumental analysis, and data review.

For noncompliance problems, a formal corrective action program will be determined and implemented at the time the problem is identified. The person who identifies the problem is responsible for notifying the Project Manager. If the problem is analytical in nature, information on these problems will be promptly communicated to the USEPA Quality Assurance Section. Implementation of corrective action will be confirmed in writing through these same channels.

Any nonconformance with the established quality control procedures in the QAPP or FSP will be identified and corrected in accordance with the QAPP. If warranted, the Project Manager, or his designee, will issue a written statement for each nonconformance condition.

Corrective actions will be implemented and documented in the field log. No staff member will initiate corrective action without going through the proper channels. Additional

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work which is dependent upon an unacceptable activity will not be performed until the problem has been eliminated.

The laboratory maintains a corrective action system which is described in the laboratory QAPP.

14.0 QUALITY ASSURANCE REPORTS

The QA/QC Advisor will review all aspects of the implementation of the QAPP on a regular basis and prepare a summary report. Reviews will be performed at the completion of each field activity and reports will be completed at this time. These reports will include an assessment of data quality; the results of system and/or performance audits; changes in QA project plan; summary of QA/QC programs, training and accomplishments; significant QA/QC problems, recommended solutions, and results of corrective actions; and limitations on use of the measurement data. Any significant QA deficiencies will be reported and identified, and corrective action possibilities discussed.

The final report will contain QA sections summarizing data quality information collected during the project.

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Table B-1. Summary of Sampling Activity and Parameters for Sector B, and Sites L and M, Sauget - Cahokia, Illinois.

Site	Sample Matrix	Parameters	Total Number of Samples	MS/MSD	Aqueous Equipment Blanks
Dead Creek Sector B	Sediment/Fill	TCL VOCs, TCL SVOCs, TCL Pest/PCBs, TAL Metals	10	1	1
		TAL Metals, TCL PCBs	20	1	2
Site L	Sediment/Fill	TCL VOCs, TCL SVOCs, TCL Pest/PCBs, TAL Metals	2	1	1
		TAL Metals, TCL Vocs, TCL SVOCs	4	–	–
Site M	Sediment/Fill	TCL VOCs, TCL SVOCs, TCL Pest/PCBs, TAL Metals	1	1	1
		TAL Metals, TCL PCBs	2	–	–
Phase II (All Sites)	Sediment/Fill	TCLP, Reactivity, Corrosivity, Ignitability	To Be Determined	1	–

TCL Target compound list.
TAL Target analyte list.
VOCs Volatile organic compounds.
SVOCs Semivolatile organic compounds.
Pest/PCBs Pesticides/PCB Compounds.
TCLP Toxicity characteristic leaching procedure.

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Table B-2. RCRA Hazardous Characteristic Parameters to be Analyzed for Sector B, and Sites L and M, Sauget - Cahokia, Illinois.

Parameter	Method Reference Number	Quantitation Limit	Regulatory Limit
Ignitability	1010 M (a)	-	-
Corrosivity	9045	-	-
Reactivity	9010/9030 (b)	1.0/2.5 mg/kg	-
TOXICITY CHARACTERISTIC LEACHING PROCEDURE			
Volatiles	8240		
Benzene		0.020 mg/L	0.5 mg/L
Carbon Tetrachloride		0.020 mg/L	0.5 mg/L
Chlorobenzene		0.020 mg/L	100 mg/L
Chloroform		0.020 mg/L	6 mg/L
2-Butanone		0.040 mg/L	200 mg/L
Tetrachloroethlene		0.020 mg/L	0.7 mg/L
Trichloroethlene		0.020 mg/L	0.5 mg/L
Vinyl chloride		0.040 mg/L	0.2 mg/L
1,2-Dichloroethane		0.020 mg/L	0.5 mg/L
1,1-Dichloroethene		0.020 mg/L	0.7 mg/L
Semi-Volatiles	8270		
1,4-Dichlorobenzene		0.050 mg/L	7.5 mg/L
Hexachloroethane		0.050 mg/L	3 mg/L
Nitrobenzene		0.050 mg/L	2 mg/L
Hexachlorobutadiene		0.050 mg/L	0.5 mg/L
2,4,6-Trichlorophenol		0.050 mg/L	2 mg/L
2,4,5-Trichlorophenol		0.25 mg/L	400 mg/L
2,4-Dinitrotoluene		0.050 mg/L	0.13 mg/L
Hexachlorobenzene		0.050 mg/L	0.13 mg/L
Pentachlorophenol		0.25 mg/L	100 mg/L
2-Methylphenol		0.050 mg/L	200 mg/L
3 & 4-Methylphenol*		0.050 mg/L	200 mg/L
Pyridine		0.25 mg/L	5 mg/L
* Cannot be separated			
Pesticides	8080		
Chlorodane		0.0050 mg/L	0.03 mg/L
Endrin		0.0010 mg/L	0.02 mg/L
Heptachlor		0.00050 mg/L	0.008 mg/L
Heptachlor Epoxide		0.00050 mg/L	0.008 mg/L
Lindane		0.00050 mg/L	0.4 mg/L
Methoxychlor		0.025 mg/L	10 mg/L
Toxaphene		0.050 mg/L	0.5 mg/L

(a) 1010 M Modified by the laboratory for solid samples.
(b) 7010 Reactivity for Cyanide. Quantitation limit is 0.100 milligrams per kilogram (mg/kg).
9050 Reactivity for Sulfide. Quantitation limit is 10 mg/kg.
mg/L Micrograms per liter.
mg/kg Micrograms per kilogram.
RCRA Resource Conservatives and Recovery Act.

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Table B-2. RCRA Hazardous Characteristic Parameters to be Analyzed for Sector B, and Sites L and M, Sauget - Cahokia, Illinois.

Parameter	Method Reference Number	Quantitation Limit	Regulatory Limit
TOXICITY CHARACTERISTIC LEACHING PROCEDURE			
Herbicides			
2,4-D	8150	0.050 mg/L	10 mg/L
Silvex		0.010 mg/L	1 mg/L
Metals	6010 7410		
Arsenic		0.20 mg/L	5 mg/L
Barium		1.0 mg/L	100 mg/L
Cadmium		0.010 mg/L	1 mg/L
Chromium		0.050 mg/L	5 mg/L
Lead		0.50 mg/L	5 mg/L
Mercury		0.020 mg/L	0.2 mg/L
Selenium		0.50 mg/L	1 mg/L
Silver		0.010 mg/L	5 mg/L

(a) 1010 M Modified by the laboratory for solid samples.
(b) 7010 Reactivity for Cyanide. Quantitation limit is 0.100 milligrams per kilogram (mg/kg).
9050 Reactivity for Sulfide. Quantitation limit is 10 mg/kg.
mg/L Micrograms per liter.
mg/kg Micrograms per kilogram.
RCRA Resource Conservatives and Recovery Act.

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Table B-3. Target Compound List/Target Analyte List Parameters to be Analyzed for Sector B, and Sites L and M, Sauget - Cahokia, Illinois.

Parameter	CAS Number	Estimated Quantitation Limit* Water** (ug/L)	Estimated Quantitation Limit* Soil** (ug/kg)
Volatiles			
Chloromethane	74-87-3	10	10
Bromomethane	74-83-9	10	10
Vinyl chloride	75-01-4	10	10
Chloroethane	75-00-3	10	10
Methylene chloride	75-09-2	5	5
Acetone	67-64-1	10	10
Carbon disulfide	75-15-0	5	5
1,1-Dichloroethene	75-35-4	5	5
1,1-Dichloroethane	75-34-3	5	5
1,2-Dichloroethene (total)	540-59-0	5	5
Chloroform	67-66-3	5	5
1,2-Dichloroethane	107-06-2	5	5
2-Butanone	78-93-3	10	10
1,1,1-Trichloroethane	71-55-6	5	5
Carbon tetrachloride	56-23-5	5	5
Vinyl acetate	108-05-4	10	10
Bromodichloromethane	75-27-4	5	5
1,2-Dichloropropane	78-87-5	5	5
cis-1,3-Dichloropropene	10061-01-5	5	5
Trichloroethene	79-01-6	5	5
Dibromochloromethane	124-48-1	5	5
1,1,2-Trichloroethane	79-00-5	5	5
Benzene	71-43-2	5	5
trans-1,3-Dichloropropene	10061-02-6	5	5
Bromoform	75-25-2	5	5
4-Methyl-2-pentanone	108-10-1	10	10
2-Hexanone	591-78-6	10	10
Tetrachloroethene	127-18-4	5	5
Toluene	108-88-3	5	5
1,1,2,2-Tetrachloroethane	79-34-5	5	5
Chlorobenzene	108-90-7	5	5
Ethyl benzene	100-41-4	5	5
Styrene	100-42-5	5	5
Xylenes (total)	1330-20-7	5	5

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CAS Chemical abstract service.

** Analysis by USEPA Contract Laboratory Program Statement of Work for Organic Analysis, 2/88.

*** Analysis by USEPA Contract Laboratory Program Statement Work for Inorganic Analysis, Document Number ILMO1.0, 3/90.

ug/L Microgram per liter.

ug/kg Microgram per kilogram.

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Table B-3. Target Compound List/Target Analyte List Parameters to be Analyzed for Sector B, and Sites L and M, Sauget - Cahokia, Illinois.

Parameter	CAS Number	Estimated Quantitation Limit* Water** (ug/L)	Estimated Quantitation Limit* Soil** (ug/kg)
Semivolatiles			
Phenol	108-95-2	10	330
bis(2-Chloroethyl)ether	111-44-4	10	330
2-Chlorophenol	95-57-8	10	330
1,3-Dichlorobenzene	541-73-1	10	330
1,4-Dichlorobenzene	106-46-7	10	330
Benzyl alcohol	100-51-6	10	330
1,2-Dichlorobenzene	95-50-1	10	330
2-Methylphenol	95-48-7	10	330
2,2-oxybis(1-Chloropropane)	108-60-1	10	330
4-Methylphenol	106-44-5	10	330
N-Nitroso-di-n-dipropylamine	621-64-7	10	330
Hexachloroethane	67-72-1	10	330
Nitrobenzene	98-95-3	10	330
Isophorone	78-59-1	10	330
2-Nitrophenol	88-75-5	10	330
2,4-Dimethylphenol	105-67-9	10	330
Benzoic acid	65-85-0	50	1600
bis(2-Chloroethoxy)methane	111-91-1	10	330
2,4-Dichlorophenol	120-83-2	10	330
1,2,4-Trichlorobenzene	120-82-1	10	330
Naphthalene	91-20-3	10	330
4-Chloroaniline	106-47-8	10	330
Hexachlorobutadiene	87-68-3	10	330
4-Chloro-3-methylphenol	59-50-7	10	330
2-Methylnapthalene	91-57-6	10	330
Hexachlorocyclopentadiene	77-47-4	10	330
2,4,6-Trichlorophenol	88-06-2	10	330
2,4,5-Trichlorophenol	95-95-4	50	1600
2-Chloronaphthalene	91-58-7	10	330
2-Nitroaniline	88-74-4	50	1600
Dimethylphthalate	131-11-3	10	330
Acenaphthylene	208-96-8	10	330
2,6-Dinitrotoluene	606-20-2	10	330
3-Nitroaniline	99-09-2	50	1600
Acenaphthene	83-32-9	10	330
2,4-Dinitrophenol	51-28-5	50	1600
4-Nitrophenol	100-02-7	50	1600

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CAS Chemical abstract service.

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ug/L Microgram per liter.

ug/kg Microgram per kilogram.

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Table B-3. Target Compound List/Target Analyte List Parameters to be Analyzed for Sector B, and Sites L and M, Sauget - Cahokia, Illinois.

Parameter	CAS Number	Estimated Quantitation Limit* Water** (ug/L)	Estimated Quantitation Limit* Soil** (ug/kg)
Semivolatiles Con't			
Dibenzofuran	132-64-9	10	330
2,4-Dinitrotoluene	121-14-2	10	330
Diethylphthalate	84-66-2	10	330
4-Chlorophenyl-phenylether	7005-72-3	10	330
Fluorene	86-73-7	10	330
4-Nitroaniline	100-01-6	50	1600
4,6-Dinitro-2-methylphenol	534-52-1	50	1600
N-nitrosodiphenylamine	86-30-6	10	330
4-Bromophenyl-phenylether	101-55-3	10	330
Hexachlorobenzene	118-74-1	10	330
Pentachlorophenol	87-86-5	50	1600
Phenanthrene	85-01-8	10	330
Anthracene	120-12-7	10	330
Di-n-butylphalate	84-74-2	10	330
Fluoranthene	206-44-0	10	330
Pyrene	129-00-0	10	330
Butylbenzylphthalate	85-68-7	10	330
3,3-Dichlorobenzidine	91-94-1	10	660
Benzo(a)anthracene	56-55-3	10	330
Chrysene	218-01-9	10	330
bis(2-Ethylhexyl)phthalate	117-81-7	10	330
Di-n-octylphthalate	117-84-0	10	330
Benzo(b)fluoranthene	205-99-2	10	330
Benzo(k)fluoranthene	207-08-9	10	330
Benzo(a)pyrene	50-32-8	10	330
Indeno(1,2,3-cd)pyrene	193-39-5	10	330
Dibenz(a,h)anthracene	53-70-3	10	330
Benzo(g,h,i)perylene	191-24-2	10	330

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Quantitation limits listed for soil/sediment are based on wet weight. The quantitation limits calculated by the laboratory for soil/sediment, are calculated on a dry weight basis as required by the contract, and may be higher.

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ug/L Microgram per liter.

ug/kg Microgram per kilogram.

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Table B-3. Target Compound List/Target Analyte List Parameters to be Analyzed for Sector B, and Sites L and M, Sauget - Cahokia, Illinois.

Parameter	CAS Number	Estimated Quantitation Limit* Water** (ug/L)	Soil** (ug/kg)
Pesticides/PCBs			
alpha-BHC	319-84-6	0.05	8.0
beta-BHC	319-85-7	0.05	8.0
delta-BHC	319-86-8	0.05	8.0
gamma-BHC (Lindane)	58-89-9	0.05	8.0
Heptachlor	76-44-8	0.05	8.0
Aldrin	309-00-2	0.05	8.0
Heptachlor epoxide	1024-57-3	0.05	8.0
Endosulfan I	959-98-8	0.05	8.0
Dieldrin	60-57-1	0.10	16.0
4,4'-DDE	72-55-9	0.10	16.0
Endrin	72-20-8	0.10	16.0
Endosulfan II	33213-65-9	0.10	16.0
4,4'-DDD	72-54-8	0.10	16.0
Endosulfan sulfate	1031-07-8	0.10	16.0
4,4'-DDT	50-29-3	0.10	16.0
Methoxychlor	72-43-5	0.50	80.0
Endrin ketone	53494-70-5	0.10	16.0
alpha-Chlordane	5103-71-9	0.05	80.0
gamma-Chlordane	5103-74-2	0.05	80.0
Toxaphene	8001-35-2	1.00	160.0
Aroclor-1016	12674-11-2	0.50	80.0
Aroclor-1221	11104-28-2	0.50	80.0
Aroclor-1232	11141-16-5	0.50	80.0
Aroclor-1242	53469-21-9	0.50	80.0
Aroclor-1248	12672-29-6	0.50	80.0
Aroclor-1254	11097-69-1	1.00	160.0
Aroclor-1260	11096-82-5	1.00	160.0

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Quantitation limits listed for soil/sediment are based on wet weight. The quantitation limits calculated by the laboratory for soil/sediment, are calculated on a dry weight basis as required by the contract, and may be higher.

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ug/L Microgram per liter.

ug/kg Microgram per kilogram.

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Table B-3: Target Compound List/Target Analyte List Parameters to be Analyzed for Sector B, and Sites L and M, Sauget - Cahokia, Illinois

Parameter	Estimated Quantitation Limit*** (ug/L)
Analyte	
Aluminium	200
Antimony	60
Arsenic	10
Barium	200
Beryllium	5
Cadmium	5
Calcium	5000
Chromium	10
Cobalt	50
Copper	25
Iron	100
Lead	3
Magnesium	5000
Manganese	15
Mercury	0.2
Nickel	40
Potassium	5000
Selenium	5
Silver	10
Sodium	5000
Thallium	10
Vanadium	50
Zinc	20
Cyanide	10

* Specific quantitation limits are highly matrix dependent. The quantitation limits listed herein are provided for guidance and may not always be achievable.
Quantitation limits listed for soil/sediment are based on wet weight. The quantitation limits calculated by the laboratory for soil/sediment, are calculated on a dry weight basis as required by the contract, and may be higher.

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ug/L Microgram per liter.

ug/kg Microgram per kilogram.

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Table B-4. Sample Containers and Preservation for Target Compound List/Target Analyte List (TCL/TAL) and Toxicity Characteristics Leaching Procedure (TCLP) Parameters for Sector B, and Sites L and M, Sauget - Cahokia, Illinois.

Matrix	Parameter	Analytical Method	Sample Container(s) (a)	Chemical Preservative (b)	Holding Time (c)
Water	Volatiles	CLP	(4) 40 ml glass vial.	Hydrochloric acid, pH<2	10 days
Water	Semivolatiles, Pesticides/PCBs	CLP	(3) 1 liter glass bottle.	Unpreserved.	Extraction-5 days Analysis-40 days following extraction
Water	Metals	CLP	(1) 500 ml plastic bottle.	Nitric acid, pH<2	Mercury-26 days Metals (other than Mercury) 180 days
Water	Cyanide	CLP	(1) 1 liter plastic bottle.	Sodium hydroxide, pH>12	12 days
Sediment/Fill	Volatile Organic Compounds	CLP	(2) 40 ml glass vial.	Unpreserved.	10 days
Sediment/Fill	Semivolatiles, Pesticides/ PCBs,	CLP	(1) 500 ml glass jar.	Unpreserved.	Extraction-10 days Analysis-40 days following extraction
Sediment/Fill	Metals	CLP	(1) 500 ml plastic jar.	Unpreserved.	Mercury-26 days Metals (other than Mercury) 180 days
Sediment/Fill	Cyanide	CLP	(1) 500 ml plastic jar.	Unpreserved.	12 days
Sediment/Fill	Ignitability	SW-846 Method 1010 M(d)	(1) 500 ml glass jar.	Unpreserved	–
	Corrositivity	SW-846 Method 9045	(1) 500 ml plastic jar.	Unpreserved	–
	Reactivity	SW-846 Method 9010/9030	(1) 500 ml plastic jar.	Unpreserved	–

(a) Sample containers will be of demonstrated cleanliness as described in the laboratory QAPP.
(b) Samples will be cooled to approximately 4 C.
(c) Starts from verified time of sample receipt except where noted.
(d) Method 1010 is modified by the laboratory for solid samples.
SW Solid Waste.
CLP Contract Laboratory Protocols.

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Table B-4. Sample Containers and Preservation for Target Compound List/Target Analyte List (TCL/TAL) and Toxicity Characteristics Leaching Procedure (TCLP) Parameters for Sector B, and Sites L and M, Sauget - Cahokia, Illinois.

Matrix	Parameter	Analytical Method	Sample Container(s) (a)	Chemical Preservative (b)	Holding Time (c)
Sediment/Fill	TCLP Volatiles	SW-846 Method 8240	(2) 4 oz amber glass container.	Unpreserved	TCLP Extraction-14 days from time of collection Analysis-14 days following extraction
Sediment/Fill	TCLP Semivolatiles	SW-846 Method 8270	(1) 500 ml glass jar.	Unpreserved	TCLP Extraction-7 days from time of collection Preparation Extraction-7 days following TCLP Extraction Analysis-40 days following preparation extraction
Sediment/Fill	TCLP Pesticides	SW-846 Method 8080	(1) 500 ml glass jar.	Unpreserved	TCLP Extraction-7 days from time of collection Preparation Extraction-7 days following TCLP Extraction Analysis-40 days following preparation extraction
Sediment/Fill	TCLP Herbicides	SW-846 Method 8150	(1) 500 ml glass jar.	Unpreserved	TCLP Extraction-7 days from time of collection Preparation Extraction-7 days following TCLP Extraction Analysis-40 days following preparation extraction
Sediment/Fill	TCLP Metals	SW-846 Method 6010 and 7470	(1) 500 ml glass jar.	Unpreserved	Mercury-TCLP Extraction-28 days from time of collection Analysis-28 days following Extraction Metals (other than Mercury) TCLP Extraction-180 days from time of collection Analysis-180 days following extraction

(a) Sample containers will be of demonstrated cleanliness as described in the laboratory QAPP.
(b) Samples will be cooled to approximately 4 C.
(c) Starts from verified time of sample receipt except where noted.
(d) Method 1010 is modified by the laboratory for solid samples.
SW Solid Waste.
CLP Contract Laboratory Protocols.

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Protected Material: Monsanto Insurance Coverage Litigation

APPENDIX C

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Protected Material: Monsanto Insurance Coverage Litigation

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APPENDIX C

HEALTH AND SAFETY PLAN FOR THE SITE INVESTIGATION FOR DEAD CREEK - SECTOR B, AND SITES L AND M, SAUGET-CAHOKIA, ILLINOIS

MCA 0156988

GERAGHTY & MILLER, INC

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HEALTH AND SAFETY PLAN FOR THE SITE INVESTIGATION FOR DEAD CREEK - SECTOR B, AND SITES L AND M, SAUGET-CAHOKIA, ILLINOIS

INTRODUCTION

Geraghty & Miller, Inc. has been authorized by Monsanto Company to conduct a site investigation for Dead Creek - Sector B, Site L, and Site M. The purpose of this investigation is to characterize the sites by determining the nature and extent of sediment/fill materials Sector B and Site L, and below the ponded water at Site M. This Health and Safety Plan (HASP) has been developed to address the potential physical and chemical hazards that the workers may face while performing the planned field activities. It establishes procedures to minimize worker's exposures though personal protective equipment and safe work practices. This HASP has been developed to meet the requirements of the Occupational Safety and Health Administration (OSHA) regulation, Title 29, Code of Federal Regulations, Part 1910.120 (20 CFR 1910.120), "Hazardous Waste Operations and Emergency Response." It is intended for the protection of our workers. Anyone else, such as subcontractors, client, and visitors may review our HASP and follow its procedures if they decide to do so freely.

RESPONSIBILITIES

The on-site hydrogeologist will be designated as the Site Safety Officer (SSO). He/she will be responsible for implementing the procedures and safe work practices established in this HASP. In the event that the SSO must leave the site while the work is in progress, an alternate SSO will be designated to ensure that the HASP will continued to be followed. The SSO will report all health and safety matters to the project manager, Brian Blum, who has responsibility for overseeing the planned activities. Tom Eng, Northeast Health and Safety Manager, will be available on an as needed basis. Dennis Colton is the Project Director for this investigation and has overall responsibility.

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SITE DESCRIPTION

Dead Creek - Sector B

Dead Creek - Sector B is located between Queeny Avenue and Judith Lane. The culverts at both ends of Sector B have been sealed to prevent inflow and outflow. The creek area consists of a narrow channel about 5 feet wide. The creek is flanked by banks on both sides. The banks are heavily vegetated and debris is visible in the area. The entire site is enclosed within a chain link fence. Previous studies conducted by IEPA in 1980 and Ecology & Environment, Inc. in 1986, indicated the presence of metals, organic compounds, and PCBs.

Site L

Site L was formerly used as a surface impoundment area by a trucking company. Site L is located approximately 700 feet south of Queeny Avenue and 125 feet east of Dead Creek. It encompasses an area of approximately 145 feet by 195 feet. Currently, the site is covered by black cinders and is used for equipment storage by Metro Construction Equipment. Previous studies conducted by IEPA in 1980 and Ecology & Environment,Inc. in 1986, indicated the presences of compounds such as benzene, toluene, phenols, and arsenic.

Site M

Site M is a former sand excavation pit. The pit is approximately 235 feet by 335 feet and is filled with water estimated to be 10 feet in depth. The pit is located on the east side of Dead Creek - Sector B, slightly north of Judith Lane. The site is enclosed by a chain link fence. While there is no evidence of waste disposal at this site, previous studies conducted by IEPA in 1980 and Ecology & Environment in 1986, indicated that PCBs were found in surface water and sediments.

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For additional information and details of each site, refer to the Work Plan, Section 1.2.1, Site Location and Description.

PLANNED FIELD ACTIVITIES

The following is a brief description of the planned field activities for Dead Creek - Sector B, Sites L and M:

Dead Creek: Sector B: Sediment/fill boring program for the collection of samples throughout the 2,000 foot length of sector B.

Site L: Boring program for the collection of fill material samples.

Site M: Boring program for the collection of sediment samples at the bottom of the pond.

For additional details of the planned field activities at each site, refer to the Field Sampling Plan, Appendix A.

HAZARD EVALUATION

The potential hazards, physical and chemical, associated with the planned field activities for the three sites listed above have been evaluated. Existing information such as the task which will be performed, past site experience, site history, and past sampling results, were all used in this evaluation process.

The physical hazards associated with the planned field activities included the potential for being struck by flying and falling objects while working near the drill rig. Being splashed

with potentially harmful liquids. Slips and falls due to wet or uneven surfaces. Heat Stress may also be a factor as portions of the planned field activities may occur when ambient temperatures are high.

The chemical hazards associated with this site are based on the past sampling results obtained from the IEPA Study (St. John 1981) and the Ecology & Environment, Inc. Study (E&E 1988). The studies state that Volatile Organic Compounds (VOCs) such as Benzene, Toluene, were found at Dead Creek - Sector B and Site L. Metals were also found at both of these sites. PCBs were found in Dead Creek - Sector B and Site M.

Phosphorus is a compound that has been reported at the Dead Creek - Sector B site in the past (St. John 1981). The associated health hazards of this compound are addressed through the use of personal protective equipment and safe work practices. In addition, phosphorus will autoignite, at 86°F (30°C). As a precautionary measure, a thermometer will be present at the site at all times, and should ambient temperatures meet or exceed 80°F (27°C). Work will be permitted in wet areas only.

Based upon this information, the following exposure pathways have been identified in order to minimize potential worker's exposure:

- Inhalation of vapors and gasses.
- Direct skin contact with vapors, liquids, soil, and sediments.
- Accidental ingestion of contaminants.
- Absorption through the skin due to the presences of compounds such as PCBs and phenol.

AIR MONITORING

Air monitoring will be conducted at these site during all planned field activities in order to ensure that the workers are appropriately protected from the potential chemical

hazards. An intrinsically safe Photo-Ionization Detector (PID) will be used. This instrument is designed to measure trace quantities of VOCs in air and has a parts per million (PPM) sensitivity range. This instrument will be calibrated each morning, before field use, and calibration records will be kept. In addition, Draeger tubes for Benzene will also be available to confirm this compounds concentration at the sites.

ACTION LEVELS

Based upon our knowledge of these site and it's constituents, the following action level procedure has been established for all planned field activities in order to evaluate whether actual field conditions will require an upgrade in the level of protection. For each task, air monitoring using the PID instrument will be conducted. An action level of 1 PPM needle deflection above background for a sustained period of 5 minutes in the worker's breathing zone has been established based on the presences of Benzene. Table 1, Current Occupational Airborne Contaminant Standards and Guidelines, provides a listing of the predominant VOCs found at these sites and their current occupational exposure limits. If the action level is exceeded, a second step using a Draeger tube for Benzene be drawn to confirm whether Benzene concentrations meet or exceed 1 PPM in the worker's breathing zone. If the action level is exceeded, work will be discontinued, the work area will be permitted to vent and the workers moving to an area up wind, work will not resume until the Benzene concentrations fall below the action level. If after a maximum of 30 minutes, the concentration of Benzene does not fall below the action level, then the work will resume with the level of protection upgrade to level C using a full face air purifying respirator equipped with an organic vapor cartridges. Once in level C, Benzene tubes will be drawn every 30 minutes to monitor its presences. When this monitoring indicates that the concentration is below the action level, then downgrading to Level D is possible. The level of protection will also be upgraded to Level C when the PID instrument measures 5 PPM above background for a sustained period of 5 minutes for total VOC concentrations when benzene concentrations are below 1 PPM. The work will also be stop if Benzene concentrations meet or exceed 50 PPM, work cannot resume until benzene concentrations fall below 50 PPM.

LEVELS OF PROTECTION

Based upon the hazard evaluation results, all tasks will be performed in level D protection. In the event that the established action level for Benzene is exceeded, the level of protection will be upgrade to level C. The following is a description of the personal protective equipment required for each level:

Level D

- Hard Hat
- Disposable coveralls (optional)
- Safety glasses, goggles, or faceshield
- Steel-toe and shank, work boots
- Chemically resistant outer boots
- Chemical-resistant gloves (necessary when handling soil, sediment or surface water)
- Hearing protection, NRR of 35 decibels (optional)
- Life vest must be worn when working in the pond at Site M.

Level C

- Full face air purifying respirator equipped with organic vapor cartridges
- Hard hat
- Disposable coveralls (optional)
- Safety glasses, goggles, or faceshield
- Steel-toe and shank, boots
- Chemically resistant outer boots
- Chemical-resistant gloves (optional except when handling soil, sediment or surface water)

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- Hearing protection, NRR of 35 decibels (optional)
- Life vest must be worn when working in the pond at Site M.

SITE CONTROL

Prior to the start of the field activities, the SSO will be responsible for the designation of the work, support, and clean zones. The work zone will be an area surrounding the immediate work being performed where the greatest potential hazards exist. Only the necessary workers required to performed the work will be permitted in this zone. A support zone will be established for the storage of equipment and personnel decontamination. A clean zone will be established for site control of visitors, equipment deliveries, and communications.

Dead Creek - Sector B and Site M have perimeter fencing and therefore, site access by authorized and unauthorized personnel will be controlled. Site L has no perimeter fencing and so the SSO will take additional measures to secure the work area, such as roping off the immediate work area and/or postings warnings signs, in order to deter unauthorized personnel from gaining access to the work area.

DECONTAMINATION

A personnel decontamination station will be established in the support zone. Personnel decontamination will consist of brush cleaning potentially contaminated items, such as boots and gloves with a mild soap and water solution and a water rinse. All personnel leaving the work zone will go though the decontamination process before leaving the work area.

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SAFE WORK PRACTICES

- All Geraghty & Miller site personnel will be participants of the company's health and safety program. This includes 40 hours of initial training, annual 8 hour refresher training and 8 hour manager and supervisor training.

- All Geraghty & Miller site personnel are participants of the company's medical surveillance program.

- A copy of the HASP will be available for reference at the site during the planned field activities.

- Dust suppression, using a water spray, will be used when needed to reduce airborne particulates during the field activities. If a water spray cannot be used or is ineffective, workers will use particle respirators or particle/mist cartridges and their full face respirators.

- A pre-entry, tailgate safety meeting will be conducted prior to the start of each task to discuss the associated hazards.

- The SSO will inform all subcontractors of the potential hazards associated with the site and the planned field activities. A copy of the HASP will be made available for their review.

- No eating, drinking, and smoking will be permitted in the work and support zones.

- No sources of ignition, such as matches or lighters will be permitted in the work and support zones.

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- The buddy system will be used in all work areas.

- During hazardous weather conditions, such as lightning and thunder storms, work will cease immediately.

Heat Stress

As portions of this job may be conducted during the summer months when ambient temperatures may be high, the following procedures will be followed to recognize and prevent heat stress. The SSO will monitor the activities of the workers and the conditions of the work environment. The SSO will monitor the workers for initial signs of heat stress which include: dizziness, nausea, inability to concentrate, impaired performance, and loss of coordination. The following preventive measures will be taken:

- Increase the number of rest periods. Rest areas will be designated by the SSO in shaded areas and when possible in air conditioned environments, such as trailers, and cars.

- Potable water will be available and all workers will be encouraged to drink throughout the day.

- Adjustment of the work schedule will be made, when possible, to conduct labor intensive tasks during the early morning or later afternoon hours.

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EMERGENCY PLAN

Verbal communications may be difficult at times due to personal protective equipment and noise. A universal set of hand signals will then be used. They are as follows:

Hand gripping throat:	Can't breath
Grip partner's wrist or place hands around waist:	Leave work area immediately
Hand on top of head:	Need assistance
Thumbs up:	Ok, I'm all right
Thumbs down:	No, Negative

All job-related injuries and illnesses will be reported to the SSO. If medical attention is needed, the injured worker will be decontaminated, if possible, prior to leaving the site. The SSO will investigate the cause of the accident and corrective measures will be taken before the work can resume. It will be the responsibility of the SSO to complete the accident reporting form, OSHA 101, included in this report for all injuries. The completed OSHA 101 should be forwarded to the office health and safety manager within six days for recording into the OSHA 200 log. In the event of a fatality or 5 or more workers hospitalized as a result of a single incident, the SSO will contact the office health and safety manager immediately for OSHA reporting purposes.

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EMERGENCY TELEPHONE NUMBERS

Police	-	(618) 277-3500
Fire	-	(618) 332-6600
Ambulance	-	(618) 332-6793
Gateway Community Hospital	-	(618) 874-7076

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DIRECTIONS TO THE HOSPITAL

Leave the work site and proceed north on Falling Springs Road via Judith Lane or Walnut Avenue. Proceed on Falling Springs Road into East St. Louis (turns into 19th Street). Proceed north on 19th Street to Bond Avenue, west on Bond Avenue to 15th Street, proceed north on 15th Street to King Drive. Go east on King Drive to Gateway Community Hospital.

1A:BLMHASP

DRAFT

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Table C-1. Current Occupational Airborne Contaminants Standards and Guidelines

	ACGIH-TLV (PPM)		OSHA-PEL (ppm)	
	TWA	STEL	TWA	STEL
Benzene	10		1	
Phenol	5		5	
Toluene	100	150	100	125
Trichloroethylene	50	200	50	200
Tetrachlorothylene	50	200	25	--
Chlorobenzene	75	--	75	--
Ethylbenzene	100	125	100	125
Xylene	100	150	100	150

ACGIH - American Conference of Governmental Industrial Hygienists, 1990-1991
OSHA - Occupational Safety and Health Administration, 1989
TLV - Threshold Limit Value
PEL - Permissible Exposure Limit
TWA - 8 Hour Time Weighted Average
STEL - 15 Minute Short Term Exposure Limit
PPM - Parts Per Million

DRAFT

DRAFT

ATTACHMENT C-A

SITE VISITORS LOG

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VISITOR REVIEW OF SITE HEALTH AND SAFETY PLAN

THE UNDERSIGNED VISITORS REQUIRE ENTRANCE TO THE EXCLUSION ZONE AND HAVE THOROUGHLY READ THE HEALTH AND SAFETY PLANS, UNDERSTAND THE POTENTIAL HAZARDS AT THE SITE AND THE PROCEDURES TO MINIMIZE EXPOSURE TO THE HAZARDS, WILL FOLLOW THE DIRECTION OF THE SITE HEALTH AND SAFETY OFFICER, AND WILL ABIDE BY THE HEALTH AND SAFETY PLAN.

NAME (PRINT)	COMPANY	DATE	SIGNATURE
			MCA 0157003

DRAFT

ATTACHMENT C-B

TAILGATE SAFETY MEETING FORM

Geraghty & Miller

TAILGATE SAFETY MEETING

Prepared by _____

Client _____ Project _____

Date _____ Project Number _____

Work Location _____

Type of Work to be Done _____

SAFETY TOPICS PRESENTED

Chemical Hazards _____

_____

Physical Hazards/Underground Utilities _____

_____

Protective Clothing/Equipment _____

_____

Special Equipment _____

Emergency Procedures _____

_____

Hospital/Clinic _____ Phone ( ) _____

Paramedic Phone ( ) _____

Hospital Address _____

Other _____

ATTENDEES

NAME PRINTED	SIGNATURE

Meeting Conducted By _____ _____

Name Printed Signature

Note: This tailgate safety form must be completed daily.

DRAFT

ATTACHMENT C-C

ACCIDENT REPORTING FORM, OSHA 101

Protected Material: Monsanto Insurance Coverage Litigation

OSHA No. 101
Case or File No. .....

Form approved
OMB No. 44R 1453

Supplementary Record of Occupational Injuries and Illnesses

EMPLOYER

1. Name .....
2. Mail address .....
   (No. and street) (City or town) (State)
3. Location, if different from mail address .....

INJURED OR ILL EMPLOYEE

4. Name ..... Social Security No. .....
   (First name) (Middle name) (Last name)
5. Home address .....
   (No. and street) (City or town) (State)
6. Age ..... 7. Sex: Male..... Female..... (Check one)
8. Occupation .....
   (Enter regular job title, *not* the specific activity he was performing at time of injury.)
9. Department .....
   (Enter name of department or division in which the injured person is regularly employed, even though he may have been temporarily working in another department at the time of injury.)

THE ACCIDENT OR EXPOSURE TO OCCUPATIONAL ILLNESS

10. Place of accident or exposure .....
    (No. and street) (City or town) (State)
    If accident or exposure occurred on employer's premises, give address of plant or establishment in which it occurred. Do not indicate department or division within the plant or establishment. If accident occurred outside employer's premises at an identifiable address, give that address. If it occurred on a public highway or at any other place which cannot be identified by number and street, please provide place references locating the place of injury as accurately as possible.
11. Was place of accident or exposure on employer's premises? ..... (Yes or No)
12. What was the employee doing when injured? .....
    (Be specific. If he was using tools or equipment or handling material, ...
    name them and tell what he was doing with them.) .....
13. How did the accident occur? .....
    (Describe fully the events which resulted in the injury or occupational illness. Tell what .....
    happened and how it happened. Name any objects or substances involved and tell how they were involved. Give .....
    full details on all factors which led or contributed to the accident. Use separate sheet for additional space.)

OCCUPATIONAL INJURY OR OCCUPATIONAL ILLNESS

14. Describe the injury or illness in detail and indicate the part of body affected. .....
    (e.g.: amputation of right index finger .....
    at second joint; fracture of ribs; lead poisoning; dermatitis of left hand, etc.)
15. Name the object or substance which directly injured the employee. (For example, the machine or thing he struck against or which struck him; the vapor or poison he inhaled or swallowed; the chemical or radiation which irritated his skin; or in cases of strains, hernias, etc., the thing he was lifting, pulling, etc.) .....
    .....
16. Date of injury or initial diagnosis of occupational illness .....
    (Date)
17. Did employee die? ..... (Yes or No)

OTHER

18. Name and address of physician .....
19. If hospitalized, name and address of hospital .....
    .....

Date of report ..... Prepared by .....
Official position .....

MCA 0157007

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GERAGHTY & MILLER, INC.
Environmental Services

Ground Water Engineering Hydrocarbon Remediation Education

July 23, 1991

VIA TELECOPIER

Mr. Warren Smull
Monsanto Company
800 N. Lindbergh Boulevard - G4WM
St. Louis, Missouri 63167

Re: Proposal for a Soil Boring Program in Sauget Sites-Area I at Dead Creek - Sector B, Site L, and Site M, Sauget, Illinois (Proposal No. 50212NY).

Dear Warren:

As requested, Geraghty & Miller, Inc. is providing this proposal for an investigation in Sauget Sites Area I at Dead Creek - Sector B, Site L, and Site M in Sauget, Illinois (Figure 1). The purpose of the study is to characterize conditions at the sites by determining the nature and extent of sediment/fill materials that may be present and estimate the volume of material that may be affected by organic compounds and metals.

To assess the feasibility of removal, it will be necessary to classify the material prior to disposal. Since these sites are not on Monsanto property, it is unlikely that the IEPA or USEPA would consider the soil or sediment at these sites as RCRA listed wastes. For RCRA "land ban" purposes, the material will probably be regarded as "soil and debris". Therefore, it is necessary to determine whether the sediment/fill is hazardous because of its characteristics and whether treatment will be required prior to disposal. Once the chemical nature of the sediment/fill material has been determined, which will be done in the first phase of the project, a small number of additional soil samples will be selected during a second phase of fieldwork (1 day) which will be tested for hazardous characteristics. Each of these samples will be analyzed for reactivity, corrosivity, ignitabilty, and the list of constituents which are analyzed by the Toxicity Characteristic Leaching Procedure (TCLP) (Table 1). The results from these analyses will be used to determine whether the sediment/fill is a hazardous waste and whether it needs to be treated prior to disposal.

MCA 015700 8

125 East Bethpage Road • Plainview, New York 11803 • (516) 249-7600 • FAX (516) 249-7610

We have revised the list of parameters for soil analysis from our previous proposal based on our review of the Dead Creek - Sector A report submitted to the IEPA by Cerro Copper Products Company. Cerro chose to analyze all samples for PCBs, PCB precursors, and RCRA metals and selected samples for Appendix IX compounds, metals, EP Toxicity, reactivity, corrosivity, and ignitabilty. We specified the USEPA TCL/TAL parameters for selected samples because the areas of investigation are not RCRA facilities. The remainder of the samples have been proposed for either PCBs, metals, or VOCs. In addition, we have adjusted our boring locations from our September 1990 proposal based on the work conducted in Sector A.

If you have any questions or if you require any additional information, please call us.

Sincerely,

GERAGHTY & MILLER, INC.

Dennis Colton
Project Officer

Nicholas Valkenburg
Vice President

DC/NV:ml

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SCOPE OF WORK
FOR A SOIL BORING PROGRAM
SELECTED SAUGET SITES - AREA I
SAUGET, ILLINOIS

INTRODUCTION

This proposal includes a scope of work for three selected sites in the area designated by the Illinois Environmental Protection Agency (IEPA) as Sauget Sites - Area I (Figure 1). These three sites are Dead Creek - Sector B, Site L, and Site M; however, access is not available in a small area in the northwestern portion of Dead Creek - Sector B. The purpose of the investigation is to characterize the sites by determining the nature and extent of sediment/fill materials in the unsaturated zone in Sector B and Site L and below the pond at Site M. This will be accomplished through the analysis of selected sediment/fill samples for the USEPA Target Compound List/Target Analyte List (TCL/TAL) and through analysis of the remaining samples for site specific compounds, such as PCBs, TAL metals, or TAL volatile organic compounds (VOCs). Once the nature and extent of the sediment/fill has been delineated, selected areas that best represent site conditions will be sampled and analyzed for reactivity, corrosivity, ignitability, and the list of constituents which are analyzed by the Toxicity Characteristic Leaching Procedure (TCLP) provided in Table 1.

The results from these analyses will be used to determine whether the fill or sediment is a hazardous waste and whether it needs to be treated prior to disposal. The number of samples scheduled for TCLP analysis will be based on the Phase I results, however, it is anticipated that only a limited number of samples (about five) will be required.

SOIL BORING PROGRAMS

Boring programs will be conducted in the Sauget Sites - Area I project area at Dead Creek - Sector B, and at Sites L and M (Figure 1). A description of past studies and proposed work for each site is presented below.

Dead Creek - Sector B

Dead Creek - Sector B is located between Queeny Avenue and Judith Lane. The culverts at both ends for Sector B have been sealed to prevent inflow or outflow from this area. The banks of the creek are heavily vegetated and debris is visible in the area. The site is enclosed within a chain-line fence without a gate. In general, the creek area consists of a narrow channel about 5 feet wide which is flanked by a low bank on either side. The channel and low banks are enclosed by steeper banks on either side of the creek. Precipitation that collects in the creek recharges the ground water below.

In 1980, the IEPA conducted a study at Dead Creek which included the installation of monitoring wells and borings, and the collection of surface water, ground water and soil samples. A vertical profile of the creek sediments in the northern portion of Sector B and soil samples collected at 17 other locations indicate the presence of mostly metals and PCBs with some other organic compounds present.

In 1987, Ecology & Environment, Inc. (E&E) conducted a remedial investigation (RI) for the IEPA at all of the Sauget sites, some of which are not shown on Figure 1. In Sector B, E&E collected two surface water samples and five sediment samples; however, the sampling locations were restricted to the north and south ends of the study area. The data from these sampling points indicate that past uses of the creek have impacted the site. Constituents detected included metals and PCBs.

The existing data are not sufficient to determine the extent of the sediment/fill, nor will it satisfy the requirements for a characteristic waste determination. Therefore, we propose to collect soil samples across ten profiles within the creek bed, spaced approximately 200 feet apart, throughout the 2,000-foot length of Sector B. Three borings are proposed for each profile, as shown on Figure 2, similar to the study conducted in Sector A. All borings will be drilled to determine the thickness of the sediment/fill in the creek and will be spaced 15 to 20 feet apart. It is anticipated that the borings within the creek bed will be drilled to a maximum depth of about seven feet. Samples will be collected using a 5-foot continuous tube sampler, and 3-inch diameter split spoons will be used if recovery is poor in the fine sandy sediments. Both methods will provide a continuous record of the geology, as well as a sufficient volume of material for analysis. All samples will be described by a Geraghty & Miller field geologist who will record sample location, depth, grain size distribution, and color. Each sample will also be screened in the field for the presence of VOCs using a photoionization detection (PID) instrument.

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We propose to select one sediment/fill samples per borehole for chemical analysis based on appearance, odor, and PID measurements. Each sample will be selected from a 2-foot interval that best characterizes sediment/fill in the creek. One sediment/fill sample per profile will be analyzed for USEPA TCL/TAL parameters. The remainder of the samples will be analyzed for TAL metals and PCBs. Appropriate QA/QC samples will also be collected. The analytical data from the sediment/fill will be used to delineate any impacted areas as well as provide an estimate of the volume of sediment/fill that may require remediation. Each borehole will be sealed with a mixture of drill cuttings and bentonite grout and the borehole's location and land surface elevation will be surveyed by a licensed land surveyor. All drilling equipment will be steam cleaned after each borehole and all sampling equipment will be decontaminated with a laboratory grade detergent and potable water before the collection of each sample.

At present, we propose to use an all-terrain vehicle (ATV) drill rig for the entire program. However, in some areas it may be necessary to pump off standing water in some areas to provide suitable sampling conditions. Assuming that the water can be pumped to a sewer and an access point is relatively near, direct pumping is recommended. Alternatively, if a direct discharge is not possible, we could start the boring program and work up to the area where the standing water is located, then transfer the water into the area of the creek where the boring program has been completed. If there is too much water to transfer, the drill rig can be mounted on a reinforced aluminum pontoon that can be anchored to the creek channel bank with steel cables. This drilling method was used in

Seal
borings
before pumping
begins

MCA 0157013.01

portions of Sector A. In addition, a gate will have to be installed within Sector B's chain-link perimeter fence to provide access for the drill rig and field crew.

Site L

Site L is located on the east side of Dead Creek, approximately 700 feet south of Queeny Avenue. It is a former location of a surface impoundment used by a hazardous waste hauler who disposed of wash water from truck cleaning operations. Site L was determined by E&E to be approximately 70 feet by 150 feet and located about 125 feet east of Dead Creek. Currently, the site is covered with black cinders and is used for equipment storage by Metro Construction Equipment Company. Waste material is not visible at the surface and access to the site in not controlled. Surficial soil was not sampled by E&E; however, the site is covered with cinder material.

In 1987, E&E installed a shallow well, drilled three soil borings, and conducted a soil-gas survey at Site L. The data from these sampling points indicates that past activities have impacted soils and ground water at the site. Compounds detected include benzene, toluene, phenols and arsenic. No PCBs were detected. In 1980, the IEPA installed a well downgradient of this area; however, due to its construction, it was replaced and sampled by E&E during the 1987 investigation.

To define the lateral and vertical extent of the fill material in this area, additional soil borings are required. Previous soil sampling programs conducted by E&E in 1987 consisted of composite sampling over zones of 5 to 10 feet thick, which were not consistent from boring to boring, and also included both saturated and unsaturated soil in the same composite sample. The existing data are not sufficient to determine the extent of the fill material in this area. Since this site is relatively small (70 feet by 150 feet), only six borings are necessary and will be installed using a 50-foot grid spacing to supplement the existing borings installed during the E&E investigation.

At each boring location, we propose to collect continuous samples to delineate the bottom of the fill using a continuous 5-foot tube sampler or a 3-inch diameter split-spoon, as previously described. One sample will be submitted for laboratory analysis per borehole that best characterizes the fill material. Each sample will be limited to a 2-foot section of the continuous core and the intervals selected for analysis will be based on appearance, odor, and PID readings. At two of the six borings, the samples will be analyzed for TCL/TAL parameters. At the remaining four borings, PCBs, TAL, metals, and VOCs have been selected for analysis, based on existing data, to determine the chemical nature of the fill material. Each borehole will be sealed and surveyed as described for Dead Creek - Sector B.

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Site M

Site M is a former sand and gravel pit excavated between 1945 and 1950. The pit is approximately 275 feet by 300 feet and is filled with water. E&E estimated the pit's depth to be 40 feet. Site M is connected to Dead Creek - Sector B at the southwest corner of Site M; however, it is not known whether Site M was excavated into the water table. This probably was the case since water is present in the pit year round. Other than miscellaneous trash, no other waste disposal was evident in the pit at the time of the E&E study. Access to the site is controlled by a chain-link fence.

In 1987, E&E collected two surface water samples and five sediment samples from the pit, and soil-gas samples were collected from the pit's banks, although it is not clear where the sediment samples were collected. It appears that the sediment samples were collected from the pit perimeter based on the location map. The data from these sampling points indicates that past site activities may have impacted the area. The surface-water samples were not contaminated, however, the sediment data indicate some impact from previous site use may have occurred, based on PCB results up to 28.8 parts per million (ppm). In 1980, the IEPA collected two, unfiltered, surface-water samples and PCBs were also detected (4.4 ppm and 0.9 ppm).

The existing data are not sufficient to determine the extent of the impacted sediment, nor will it satisfy the requirements for a characteristic waste determination. Therefore, we

propose to collect sediment samples from three locations from beneath the ponded water using a soil boring drill rig supported by the aluminum pontoon previously described. This method of supporting a drill rig on surface water has been used successfully at other sites. Sediment samples will be collected using a split-spoon sampler. One sample for laboratory analysis will be selected from each of the three locations at the 0 to 2-foot interval. At one location, the sample will be analyzed for TCL/TAL parameters, and at the other two locations, each sample will be analyzed for PCBs and TAL metals. For costing purposes, we will assume that the pit bottom is at a maximum distance of 10 feet below the pond level. Sample selection protocols and decontamination procedures will be the same as was described for Dead Creek - Sector B.

PHASE II FIELD WORK

Once the chemical nature of the sediment/fill material has been determined, a small number of additional samples will be selected during a second phase of fieldwork, probably one day, which will be collected for hazardous characteristics. We anticipate that no more than five samples will be required to classify the material. Each of these samples will be analyzed for reactivity, corrosivity, ignitability, and the list of constituents which are analyzed by the TCLP (Table 1). The results of these analyses will be used to determine whether the sediment/fill material is a hazardous waste and whether it needs treatment prior to disposal.

DATA VALIDATION

It does not appear that the Dead Creek - Sector A data was validated during Cerro's study. We propose to validate 10 percent of the samples according to the USEPA's "Data Reference Validation Functional Guidelines," and screen the remaining samples for completeness and technical compliance. The screening procedure requires much less time to complete. However, the laboratory could provide a CLP data package for all samples for possible future data validation, if required. The information to be screened would include:

- Check to see if the field chain-of-custody form was filled out and if samples were logged in properly.

- Review internal quality assurance/quality control (QA/QC) data. Make sure duplicates, blanks, and spikes were analyzed on the minimum number of samples as specified in the QAPP.

- Review all blank/duplicate data. If target compounds appear in blanks or if percent relative difference on duplicates is outside established limits, the reasons for these anomalies will be investigated. In such an event, sampling techniques will be discussed with the project manager and/or the lab manager and internal QA/QC data will be reviewed as appropriate.

- Check to see if holding times were met for each parameter.

- Check to see if parameters were analyzed by the methods identified in the QAPP.

- If data appears suspect, the specific data of concern will be investigated. Calculations will be traced back to the raw data. If the calculations did not agree with the prescribed limits, the cause will be determined and corrected, if possible.

WORK PLAN DEVELOPMENT/COST ESTIMATE

Prior to the start of the field investigation, Geraghty & Miller will develop the necessary work plans including a Quality Assurance Project Plan (QAPP), Field Sampling Plan (FSP), and Health and Safety Plan (HASP). It should be possible to prepare these documents within three weeks after receiving authorization to proceed.

Estimated costs for the project are provided in Table 2 which includes costs for preparing the work plans, completing the field investigation, and preparing a report detailing the sampling and analytical program. The estimates assume that the work can be completed in level D protective equipment. We have also assumed that the field geologists will be supplied by our St. Louis office to minimize travel and expense costs.

If you have any questions or require additional information, please do not hesitate to call us.

Sincerely,

GERAGHTY & MILLER, INC.

Dennis Colton
Project Officer

Nicholas Valkenburg
Vice President

DC/NV:ml
Senull.rpt

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Table 1. Federal Toxicity Characteristic Constituents and Regulatory Levels

METALS

CONSTITUENT	REGULATORY LIMIT* (mg/L)
Arsenic	5.0
Barium	100.0
Cadmium	1.0
Chromium	5.0
Lead	5.0
Mercury	0.2
Selenium	1.0
Silver	5.0

VOLATILE ORGANICS

CONSTITUENT	REGULATORY LIMIT* (mg/L)
Benzene	0.5
Carbon tetrachloride	0.5
Chlorobenzene	100.0
Chloroform	6.0
1,4-Dichlorobenzene	7.5
1,2-Dichloroethane	0.5
1,1-Dichloroethylene	0.7
Methyl ethyl ketone	200.0
Tetrachloroethylene	0.7
Trichloroethylene	0.5
Vinyl chloride	0.2

*Federal Register, March 29, 1990

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Table 1. Federal Toxicity Characteristic Constituents and Regulatory Levels

SEMIVOLATILES

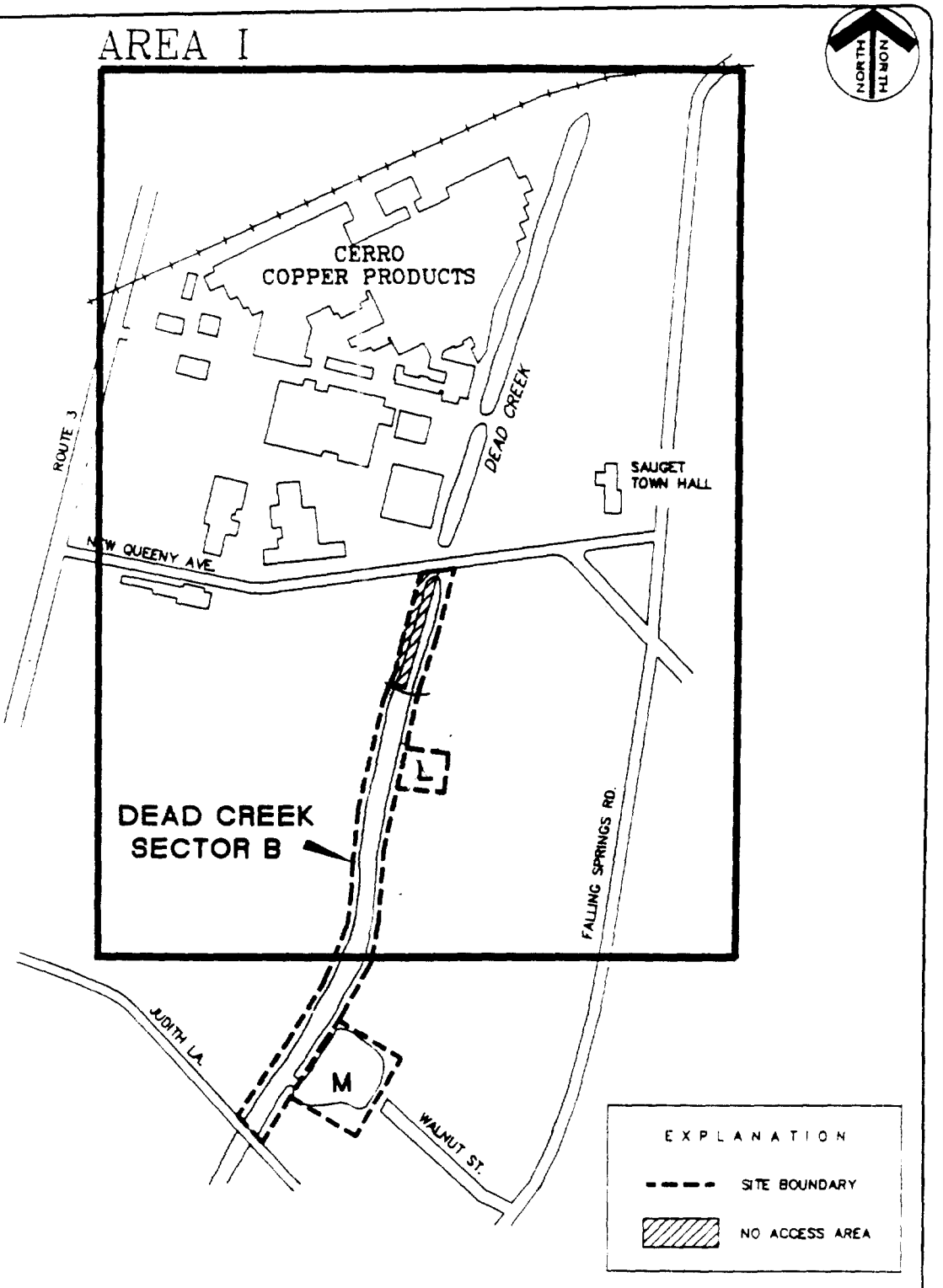
CONSTITUENT	REGULATORY LIMIT* (mg/L)
o-Cresol	200.0
m-Cresol	200.0
p-Cresol	200.0
Cresol (total)	200.0
2,4-Dinitrotoluene	0.13
Hexachlorobenzene	0.13
Hexachloro-1,3-butadiene	0.5
Hexachloroethane	3.0
Nitrobenzene	2.0
Pentachlorophenol	100.0
Pyridine	5.0
2,4,5-Trichlorophenol	400.0
2,4,6-Trichlorophenol	2.0

PESTICIDES/HERBICIDES

CONSTITUENT	REGULATORY LIMIT* (mg/L)
Chlordane	0.03
2,4-D	10.0
Endrin	0.02
Heptachor (and its hydroxide)	0.008
Lindane	0.4
Methoxychlor	10.0
Toxaphene	0.5
2,4,5-TP (Silvex)	1.0

*Federal Register, March 29, 1990

MCA C157022



DRAFTER: G.S
MGR.: D COLTON
COMPILER: D COLTON
CAD FILE: SDYAREA7
FILE NO.: 1234
PRJCT. NO.: 50212NY
DATE: 6-27-91

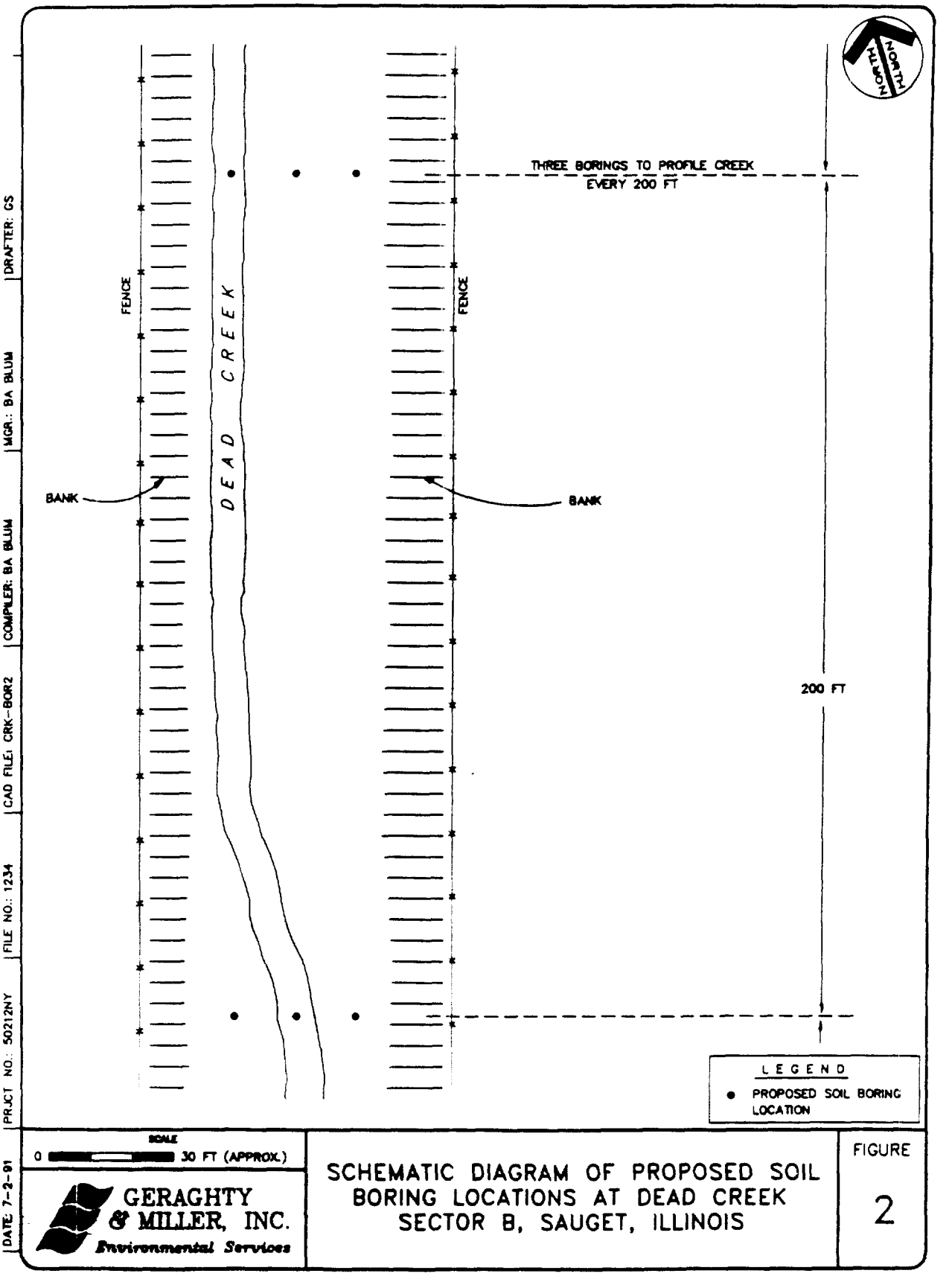
SCALE
0 500 FT

GERAGHTY & MILLER, INC.
Environmental Services

LOCATION OF STUDY AREAS,
SAUGET SITES, AREA I
SAUGET, ILLINOIS

FIGURE
1

MCA C157023


NORTH
THREE BORINGS TO PROFILE CREEK
EVERY 200 FT
FENCE
FENCE
DEAD CREEK
BANK
BANK
200 FT
LEGEND
PROPOSED SOIL BORING LOCATION
SCALE
0
30 FT (APPROX.)
GERAGHTY & MILLER, INC.
Environmental Services
SCHEMATIC DIAGRAM OF PROPOSED SOIL BORING LOCATIONS AT DEAD CREEK SECTOR B, SAUGET, ILLINOIS
FIGURE
2
DATE: 7-2-91
PRJCT NO.: 50212NY
FILE NO.: 1234
CAD FILE: CRK-BOR2
COMPILER: BA BLUM
MGR.: BA BLUM
DRAFTER: GS

MCA C157024

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Protected Material: Monsanto Insurance Coverage Litigation

Table 2. Cost Estimate for a Soil Boring Program at Dead Creek - Sector B, Site L, and Site M at Sauget Sites - Area I, Monsanto Company, Sauget, Illinois.

	Rate/Hour	Task 1 Prepare Work Plan, FSP, QAPP, HASP	Task 2 Dead Creek - Sector B Field Investigation	Task 3 Site L Field Investigation	Task 4 Site M Field Investigation	Task 5 Phase II Field work	Task 6 Data Validation	Task 7 Data Evaluation	Task 8 Report Preparation	Total Hours	Total Costs
LABOR											
Senior Project Advisor	$135	24	16	2	3	2	12	8	24	91	$12,285
Principal: Scientist II/Engineer II	$110	–	–	–	–	–	–	–	–	–	$0
Principal: Scientist I/Engineer I	$105	8	–	–	–	–	–	–	–	8	$840
Senior: Scientist II/Engineer II	$98	60	32	3	5	2	16	24	60	202	$19,796
Senior: Scientist I/Engineer I	$90	–	–	–	–	–	–	–	–	–	$0
Project: Scientist II/Engineer II	$84	–	–	–	–	–	–	–	–	–	$0
Project: Scientist I/Engineer I	$79	–	–	–	–	–	–	–	–	–	$0
Staff: Scientist II/Engineer II	$75	–	–	–	–	–	60	–	–	60	$4,500
Staff: Scientist I/Engineer I	$70	60	60	20	30	12	60	24	60	326	$22,820
Scientist III/Engineer III	$63	–	–	–	–	–	–	–	–	–	$0
Scientist II/Engineer II	$55	10	–	–	–	–	–	–	–	10	$550
System Designer	$53	–	–	–	–	–	–	–	–	–	$0
Staff Technician II	$48	–	–	–	–	–	–	–	–	–	$0
Scientist I/Engineer I	$44	–	–	–	–	–	–	–	–	–	$0
Staff Technician I	$40	–	–	–	–	–	–	–	–	–	$0
Technician	$34	–	–	–	–	–	–	–	–	–	$0
Technical Editor	$52	8	–	–	–	–	–	–	8	16	$832
Senior Draftsperson	$52	–	–	–	–	–	–	–	–	–	$0
Draftsperson	$40	8	–	–	–	–	–	–	16	24	$960
Research Assistant	$37	–	–	–	–	–	–	–	–	–	$0
Admin. Support/Clerical	$32	24	8	2	2	2	3	4	24	69	$2,208
TOTAL HOURS		202	116	27	40	18	151	60	192	806	
LABOR SUBTOTAL		$16,214	$9,752	$2,028	$3,059	$1,370	$11,984	$5,240	$15,144		$64,791
EXPENSES											
Communications/Shipping		250	2,500	500	400	500	50	–	250		$4,450
Meals and Hotel		–	120	30	45	15	–	–	–		$210
Transportation		–	1,500	100	150	50	–	–	–		$1,800
Copying		250	25	5	5	5	50	–	250		$590
Other		–	–	–	–	–	–	–	–		$0
SUBTOTAL EXPENSES		$500	$4,145	$635	$600	$570	$100	$0	$500		$7,050
MARK UP	–	$0	$0	$0	$0	$0	$0	$0	$0		$0
TOTAL EXPENSES		$500	$4,145	$635	$600	$570	$100	$0	$500		$7,050

MCA 6157625

COSTSAUG.XLS

Table 2: Cost Estimate for a Soil Boring Program at Dead Creek - Sector B, Site L, and Site M at Sauget Sites - Area I, Monsanto Company, Sauget, Illinois.

		Task 1 Prepare Work Plan, FSP, QAPP, HASP	Task 2 Dead Creek - Sector B Field Investigation	Task 3 Site L Field investigation	Task 4 Site M Field investigation	Task 5 Phase II Field work	Task 6 Data validation	Task 7 Data Evaluation	Task 8 Report Preparation	Total Costs
EQUIPMENT										
Computer Equipment		100	75	25	25	25	100	100	400	$850
Safety Equipment		--	300	60	90	30	--	--	--	$480
Field Instruments		--	600	200	300	100	--	--	--	$1,200
Sampling Van & Mileage		--	--	--	--	--	--	--	--	$0
Supplies		--	200	25	50	25	--	--	--	$300
Other		--	--	--	--	--	--	--	--	$0
SUBTOTAL EQUIPMENT		$100	$1,175	$310	$465	$180	$100	$100	$400	$2,830
MARK UP	--	$0	$0	$0	$0	$0	$0	$0	$0	$0
TOTAL EQUIPMENT		$100	$1,175	$310	$465	$180	$100	$100	$400	$2,830
SUBCONTRACTOR COSTS										
Driller		--	12,000	3,000	7,000	1,500	--	--	--	$23,500
Surveyor		--	1,500	200	200	--	--	--	--	$1,900
Laboratory		--	42,000	12,500	7,000	8,000	--	--	--	$69,500
Other		--	--	--	--	--	--	--	--	$0
SUBTOTAL SUBCONTRACTOR		$0	$55,500	$15,700	$14,200	$9,500	$0	$0	$0	$94,900
MARK UP	5%	$0	$2,775	$785	$710	$0	$0	$0	$0	$4,745
TOTAL SUBCONTRACTOR COSTS		$0	$58,275	$16,485	$14,910	$9,500	$0	$0	$0	$99,645
TOTAL EXPENSES, EQUIPMENT & SUBCONTRACTOR SUBTOTAL		$600	$63,595	$17,430	$15,975	$10,250	$200	$100	$900	$109,525
GRAND TOTAL		$16,814	$73,347	$19,458	$19,034	$11,620	$12,184	$5,340	$16,044	$174,316

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MCA 0157026

Protected Material: Monsanto Insurance Coverage Litigation

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MIC ENVIRONMENTAL SCIENCES
(CO./DIV./DEPT./LOCATION)

SPECIAL STUDY REPORT
(TYPE OF REPORT)

47

REPORT NO.: ES-81-SS-17

JOB/PROJECT NO.: 43-000-760.26-8723045
transfer to 02-003-913.41-610

DATE: February 27, 1981

TITLE: MEASUREMENT OF POLYCHLORINATED BIPHENYLS IN SOIL CORES FROM W. G. KRUMMRICH PLANT

AUTHORS: R. G. Kaley, O. Hicks, and P. R. Michael

ABSTRACT: Seven soil cores were sectioned by depth and analyzed for PCBs. Concentrations ranged from none detected, <1 ppm, to 200 ppm with no clear pattern of leaching or migration. Because these concentrations are significantly lower than most of the soil samples from the Dead Creek site, the W. G. Krummrich plant does not appear to be the major source of contamination.

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MCO 0323707

REPT. NO.: ES-81-SS-17 AUTHORS: R. G. Kaley, O. Hicks, and P. R. Michael
TITLE: MEASUREMENT OF POLYCHLORINATED BIPHENYLS IN SOIL CORES FROM W. G. KRUMMRICH PLANT
COPY NO.:

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R 1088 A
R-1088 B

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MEASUREMENT OF POLYCHLORINATED BIPHENYLS IN SOIL CORES FROM W. G. KRUMMRICH PLANT

INTRODUCTION

Earlier analyses of surface soil samples from the Dead Creek site near Sauget, Illinois found high levels (29-13000 ppm) of polychlorinated biphenyls (PCBs) (1,2). As a follow up to determine if the W. G. Krummrich plant was a source of the contamination, soil cores were taken on plant property from a location believed to be part of the old Dead Creek bed. The bed on plant property had been landfilled, which required the cores to be taken 12-19 feet below the present surface level. This special study reports the results of our analysis of the soil cores for PCBs.

SUMMARY

Seven soil cores were sectioned by depth and analyzed for PCBs. Concentrations ranged from none detected, <1 ppm, to 200 ppm with no clear pattern of leaching or migration. Because these concentrations are significantly lower than most of the soil samples from the Dead Creek site, the W. G. Krummrich plant does not appear to be the major source of contamination.

DETAILS

Sampling

Core samples were taken by Shannon & Wilson, Inc., Geotechnical Consultants. Seven cores in stainless steel tubes and an additional sample in a glass jar were received by the Environmental Analysis Group on 1/21/81. Our sample log numbers, description, and condition of the tubes as received are listed in Table I. Samples 1012101 and 1012102 were taken from locations that "could not possibly be contaminated" and served as sampling and analysis blanks.

All of the tubes had large gaps that did not contain any soil. Two additional samples in glass jars were received on 1/26/81. Sample 1012601 was reported to be the middle section of core 1012105 and sample 1012602 was reported to be the bottom section of core 1012103.

All of the cores were divided into three 6-8" sections and labeled TOP, MIDDLE, and BOTTOM. (Tops of the stainless steel tubes had holes drilled in the sides.) The samples were air dried and processed according to standard operating procedure (3).

ANALYSIS

MCU 0323708

All of the soils were analyzed for PCBs by GC/MS using a validated analytical method (4).

RESULTS

The results for this study are contained in Table II. The concentrations were calculated in ppm (µg/g) on a dry weight basis. The "none detected" level (<1 ppm) is the lowest level at which the analytical method was validated. Numbers in parentheses are below the lowest validated level but do represent positive detection of PCBs.

Only about half of the soil samples contained measurable levels of PCBs. Because of the poor condition of the cores (gaps and empty sections) it is difficult to draw conclusions about PCBs leaching through the soil. However, there does not seem to be any systematic increase or decrease of concentration as a function of depth.

In comparing these results to earlier samples from the Dead Creek site, seven of the eleven Dead Creek soils had higher levels of PCBs (ranging from 1.2 to 65 times higher) than the most contaminated soil from the Krummrich plant. Therefore, it appears that the Krummrich plant is not a source of PCB contamination for the Dead Creek site.

QUALITY ASSURANCE

Two of the soil samples, 1012103 TOP and 1012106 MID, were analyzed in triplicate. Precision was 61% and 74% respectively, calculated as relative standard deviation. The poor precision is due to the very low levels of PCBs found in those two soil samples.

Accuracy (recovery) was evaluated by spiking the soil samples with known amounts of Aroclor® 1242 and 1254. Results of the spiking experiments are shown in Table III.

No PCBs were detected in any of the subsamples from either of the two blank samples, 1012101 and 1012102.

MCO 6323709

Table I. Description of Soil samples from W. G. Krummrich Plant

Environmental Analysis Log No.	Sample Description*	Condition of Tube as Received
1012101	Boring #4 #1 12-13.5'	top 10.5" empty
1012102	Boring #4 #2 15-17'	top 7.5" empty
1012103	Boring B-1 #1 12-14'	top 4" empty, bottom 15.5" empty
1012104	Boring B-1 #2 15-17'	top 5" empty, bottom 15.5" empty
1012105	Boring B-2A #1 12-14.5'	tube completely empty except for 2" plug at top and 2" plug at bottom
1012106	Boring B-2B #2 15-17'	top 8" empty
1012107	Glass jar B-3 #1A 15-16.5'	-
1012108	Boring B-3 #2 17-19'	top 7.5 empty
1012601	Glass jar B2B-1 12-14'	-
1012602	Glass jar B1-1 12-14'	-

*All borings 3" o.d. and 30" long except for sample 1012105 which was 36" long.

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MCU 6323710

Table II. Concentrations in ppm of PCBs in Soils from W. G. Krummrich Plant.

Sample Number		PCBs (Cl_2 to Cl_7 Homologs)
1012101	TOP	ND
	MIDDLE	ND
	BOTTOM	ND
1012102	TOP	ND
	MIDDLE	ND
	BOTTOM	ND
1012103	TOP	(0.9)
	MIDDLE	9.6
1012602	BOTTOM	(0.7)
1012104	TOP	(0.8)
	MIDDLE	ND
	BOTTOM	no sample
1012105	TOP	ND
1012601	MIDDLE	1.4
1012105	BOTTOM	(0.6)
1012106	TOP	(0.7)
	MIDDLE 4S WEST 2T	12
	BOTTOM	ND
1012107	- SKD 15-16.5' 4' EAST OF 2S	130
1012108	TOP SKD 17-19' 4' EAST OF 2S	200
	MIDDLE	11
	BOTTOM	(0.6)

ND - None detected, lowest validated level = 1 ppm.

MCO 0323711

( ) Numbers in parentheses represent positive detection of PCBs, however, precision and recovery values have not been established for the method at these levels.

Table III. Recovery of PCBs from Soils

Soil Sample		Spiking Level (ppm) of Aroclor® 1242 and 1254	% Recovery
1012103	TOP	2	61
1012106	MID	10	56
1012106	TOP	100	66

MCO 6323712

REFERENCES

1. R. G. Kaley, Special Study ES-80-SS-24, Measurement of Selected Chemicals in Soil from the Dead Creek Site - Illinois EPA Split Samples.

2. R. G. Kaley, Special Study ES-80-SS-26, Measurement of Selected Chemicals in Soil from the Dead Creek Site - W. G. Krummrich Plant Samplings.

3. O. Hicks, Standard Operating Procedure EAN-80-SOP-006, Homogenizing, Subdividing and Preserving Sediment Samples.

4. R. G. Kaley and O. Hicks, Method ES-80-M-28, Determination of Polychlorinated Biphenyls (PCBs) in Soil and Sediment.

OH NBP 1805266-68

RGK NBP 1914859

MCO 6323713

Submitted by:

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MCU 6323714

Monsanto

FROM (NAME – LOCATION – PHONE): C. Sullivan - WGK

DATE : January 26, 1981

CC:

SUBJECT : SOIL SAMPLES

REFERENCE :

TO : Dick Sinise

Sample borings were taken south of Department 245 between sewer box 2-T and 2-S on Fifth Street. The first boring was taken on 1-19-81 at 10:00 a.m., 25 feet west of sewer box 2-T. A sample was collected at the 12 to 15 foot level and another at the 15 to 17 foot level.

The second boring was taken 45 feet west of sewer box 2-T. On this second hole, problems developed that caused us to make three separate borings before we could obtain a sample. The only level we collected a sample was at the 15 to 17 foot level on the third boring. Water was found at the 11 foot level along with loose material (chat, cinders, and sand) which caused material not to collect in sampling tubes.

The third boring was taken 4 feet east of sewer box 2-S. We encountered the sample problems here as we did on the second boring. The only sample we collected was at the 15 to 17 foot level which looked like sand and clay.

The fourth sample was collected at the southwest borner of BZ storeroom. No problem with retrieving sample which contained mostly sand and some silt. Water was found at the 16 foot level but presented no problems.

Attached is a copy of the drilling data from Shannon & Wilson, Inc.

C. Sullivan

C. Sullivan

dg

Attachment

MCO 0323715

IN - 10 (REV 8/77)

SHANNON & WILSON, INC.

JOB TITLE: MONSANTO KRUMMURCH PLANT

JOB NO.	CLIENT	LOCATION
M-443		Sauget, ILL.

DRILLING METHOD: CME 45, flight auger

SAMPLING METHOD: ST

BORING NO. B-1

SHEET 1 OF 1

					DRILLING START	DRILLING FINISH
WATER LEVEL	~11'					
TIME	10:15				TIME 10:00	TIME 10:30
DATE	1-19-81				DATE 1/19/81	DATE 1/19/81
CASING DEPTH	0					

LOCATION OF BORING:

DATUM ELEVATION

DRILLING CONTR. ARD Drilling Inc. Jude House

BY Tom Hrp DATE 1-19-81 CHK'D BY

SURFACE CONDITIONS/REMARKS: asphalt roadway

SAMPLER TYPE	INCHES DRIVEN / INCHES RECOVERED	DEPTH OF CASING	SAMPLE NO / SAMPLE DEPTH	BLOWS/6"	% RECOVERY / RQD	DEPTH IN FEET	DEPTH IN METERS	SOIL GRAPH	SURFACE CONDITIONS/REMARKS
						0	0		asphalt
						1	.25		
						2	.50		gray to black cinder w/ gray silty CLAY, fine gravel, sandy. FILL
							.75		
						3	1		
						4			
						5			
						6	2		
						7			
						8			
						9			
						10	3		MCG 0323710
					1				
						11			- becoming moist ~11'
						12			
ST	24"/15.5"	0	1/12'-14'			13	4		TV = .1 tsf, PP = .25 tsf — Soft, dk. gray, silty, sandy CLAY, w abundant organic (wood) particles
						14			
						15			TV - N/A, PP - N/A — brown, silty, clayey, sandy GRAVEL
ST	24"/9"	0'	2/15'-17'			16	5		
						17			Finish hole 10:30 hrs. 1/19/81
						18			Bottom hole - 17'
						19	6		Samples - ST-2
					2	20			Ft. of Casing - 0

625-1 (Rev. 4-79)

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SHANNON & WILSON, INC.

JOB TITLE: MONSANTO KRUMMURCH PLANT

JOB NO.	CLIENT	LOCATION
M-443		Sauget, Ill.

DRILLING METHOD: CME 45, 3" flight auger

BORING NO. B-2

SHEET 1 OF 1

SAMPLING METHOD: ST

					DRILLING START	DRILLING FINISH
WATER LEVEL	~11.0				TIME	TIME
TIME	10:45				10:35	11:25
DATE	1-19-81				DATE	DATE
CASING DEPTH	0				1-19-81	1-19-81

LOCATION OF BORING:

DATUM

ELEVATION

SURFACE CONDITIONS/REMARKS: asphalt roadway

SAMPLER TYPE	INCHES DRIVEN / INCHES RECOVERED	DEPTH OF CASING	SAMPLE NO / SAMPLE DEPTH	BLOWS/6"	% RECOVERY / RQD	DEPTH IN FEET	DEPTH IN METERS	SOIL GRAPH	
						0	0		asphalt
						1	.25		
						2	.50		
							.75		
						3	1		gray to black, silty clayey, gravelly CINDERS (Fill)
						4			
						5			
						6			
						7	2		
						8			
						9			
					1	10	3		MCO 6323717
						1		▽	- encounter water ~11.0'
ST	24" / 0'	0	1 / 12'-14'			2			attempt w/ Shelby tube - No recovery - will attempt
						3	4		an osterberg sample - 12'-14.5'
									- No recovery w/ osterberg
OST	30" / 0"	0'	1-A / 12'-14.5'			4			- augered to 15' - dk. gray, slightly silty, sandy CLAY
						5			w/ gravel
OST	30" / 0	0'	1-B / 15'-17.5'			6	5		attempt osterberg at 15' - No recovery.
						7			attempt Shelby tube 15' - No recovery.
									- abandon hole - offset ~2.5' East.
									- re-drill hole -
						8			
						9	6		Finish hole 11:25 hrs. 1-19-81
					2	0			Bottom of hole 17.5'
									Samples - 0

DRILLING CONTR. ARD Drilling

BY Tom Hoop DATE 1-19-81 CHK'D BY

625-1 (Rev. 4-78)

SHANNON & WILSON, INC.

JOB TITLE: MONSANTO KRUMMURCH PLANT

LOCATION OF BORING:

DATUM

ELEVATION

JOB NO.	CLIENT	LOCATION
M-443		Sauget, ILL.

DRILLING METHOD: CME 45, 3" flight auger

BORING NO. B-2A

SHEET 1 OF 1

SAMPLING METHOD: OSTERBURG, SHELBY TUBE, SPT.

WATER LEVEL				
TIME				
DATE				
CASING DEPTH				

DRILLING	START	FINISH
TIME	11:35	13:25
DATE	1-19-81	1-19-81

SURFACE CONDITIONS/REMARKS: asphalt roadway

SAMPLER TYPE	INCHES DRIVEN / INCHES RECOVERED	DEPTH OF CASING	SAMPLE NO / SAMPLE DEPTH	BLOWS/6"	% RECOVERY / RQD	DEPTH IN FEET	DEPTH IN METERS	SOIL GRAPH	
						0	0		Asphalt
						1	.25		
						2	.50		
							.75		lt. gray, silty CLAY 2.5'
						3	1		
						4			
						5			encounter gray black silty, clayey, gravelly CINDERS ~5' (fill)
						6			
						7	2		
						8			
						9			
					1	0	3		MCU 6323718
						1			
						2			gray black, silty, clayey, GRAVEL w/ cinders
OST.	30 / 3"	0'	1 / 12'-14.5'			3	4		TV - N/A PP/2 - N/A
						4			
						5			No recovery w/either Osterberg or Shelby tube samplers.
OST	30" / 0	0'	2 / 15'-17.5'			6	5		- Clean hole to 17.5' w/auger
						7			
SPT	18" / 11"	0'	2-A / 17.5'-19'	3/3/2		8			Med stiff, gray very silty CLAY w/ fine sand
						9	6		No recovery - w/ Shelby tube sampler.
ST	24" / 5"	0'	3 / 19'-21'		2	0			- abandon hole - Finish hole 13:25 hrs 1/19/81 Bottom of hole - 21'

DRILLING CONTR. ARD Drilling Inc

BY Tom Kopp DATE 1-19-81 CHK'D BY

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SHANNON & WILSON, INC.

JOB TITLE: MONSANTO KRUMMURCH PLANT

NOTE: – OFF-SET FROM BORING B-2A 2.0' NORTH

LOCATION OF BORING:

DATUM

ELEVATION

JOB NO.	CLIENT	LOCATION
M-443		Sauget, ILL.

DRILLING METHOD: CME 45, 3" flight auger, A-rod rotary wash w/ 4" casing

BORING NO. B-2B

SHEET 1 OF 1

SAMPLING METHOD: Ost., SPT, ST

					DRILLING START	DRILLING FINISH
WATER LEVEL	11.0'				TIME 13:35	TIME 15:20
TIME	13:50					
DATE	1-19-81				DATE 1-19-81	DATE 1-19-81
CASING DEPTH	10'					

SURFACE CONDITIONS/REMARKS: asphalt roadway

SAMPLER TYPE	INCHES DRIVEN / INCHES RECOVERED	DEPTH OF CASING	SAMPLE NO / SAMPLE DEPTH	BLOWS/6"	% RECOVERY / RQD	DEPTH IN FEET	DEPTH IN METERS	SOIL GRAPH	
						0	.0		Asphalt
									gravel fill
						1	.25		
									mottled gray w/ brown, slightly sandy, silty CLAY
							.50		
						2	.75		
						3	.1		→ set 4" casing at 3.5' - go to rotary wash w/ H_2O return
						4			
						5			
						6			
							.2		
						7			Black clayey gravelly CINDER 98% return
						8			
						9			
					1	0	.3		
						1		▽	MCO 0323719
						2			– No recovery w/ Osterberg sampler
OST.	30" / 0"	10'	1 / 12'-14.5'			3	.4		Take SPT sample 12' -
SPT	24" / 2"	10'	1-A / 12'-14'	1/1		4			very loose black, slightly silty clayey, coarse sand to med. GRAVEL to very soft gray, sandy, silty CLAY in tip of sampler.
						5			TV. = .28 tsf
ST	24" / 19"	15'	2 / 15'-17'			6	.5		PP/2 = .4 tsf
									med. stiff, gray very silty CLAY
						7			
						8			Finish hole 15:05 hrs. 1-19-81
									Bottom of hole - 17'
						9	.6		Samples - SPT - 1
					2	0			ST - 1
									End of casing - 15'

DRILLING CONTR. ARD Drilling

BY [signature] DATE 1-19-81 CHK'D BY

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SHANNON & WILSON, INC.

JOB TITLE: MONSANTO KRUMMURCH PLANT

JOB NO.	CLIENT	LOCATION
M-443		Sauget, ILL.

DRILLING METHOD: CME 45, 3" flight auger

BORING NO. B-3

SHEET 1 OF 1

SAMPLING METHOD: ST

					DRILLING START	DRILLING FINISH
WATER LEVEL	11.0'				TIME	TIME
TIME	15:25				15:22	16:12
DATE	1-19-81				DATE	DATE
CASING DEPTH	0				1-19-81	1-19-81

LOCATION OF BORING:

DATUM

ELEVATION

SURFACE CONDITIONS/REMARKS: asphalt roadway

SAMPLER TYPE	INCHES DRIVEN / INCHES RECOVERED	DEPTH OF CASING	SAMPLE NO. / SAMPLE DEPTH	BLOWS/6"	% RECOVERY / RQD	DEPTH IN FEET	DEPTH IN METERS	SOIL GRAPH	
						0	.0		↓ Asphalt ↓ gravel fill
						1	.25		
						2	.50		
							.75		- Lt. gray, silty CLAY cuttings
						3	.1		
						4			↓ becoming black gray, silty clayey, gravelly CINDERS (Fill)
						5			
						6	.2		
						7			
						8			
						9			
					1	10	.3		
						1		▽	MCU 6323720
						2			No Recovery - will attempt SPT sample -
ST	24" / 0"	0	1 / 10-14'			3	.4		weight of drop hammer pushed sampler to 15.0' depth - will sample from there.
SPT	18" / 8"	0'	1-A / 15'-16.5	1/2		4			
						5			very loose, gray, silty, clayey, sandy med. GRAVEL to very soft, gray, sandy, very silty CLAY saturated in chemical solution. (w/odor)
						6	.5		
						7			T.V. = .25 tsf. 14½ = .3 tsf
ST	24" / 21"	0'	1 / 17-19'			8			Med. Stiff, gray, silty CLAY
						9	.6		Finish hole - 16:12 hrs 1-19-81
					2	10			Bottom of hole - 19' Samples - SPT-1

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BY Tom Klop DATE 1-19-81 CHK'D BY

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MIC ENVIRONMENTAL SCIENCES
(CO./DIV./DEPT./LOCATION)

SPECIAL STUDY REPORT
(TYPE OF REPORT)

REPORT NO.: ES-80-SS-26

JOB/PROJECT NO.: 43-000-760.26-8623045
Transfer to 02-003-913.41-610

DATE: October 28, 1980

TITLE: MEASUREMENT OF SELECTED CHEMICALS IN SOIL FROM THE DEAD CREEK SITE - W. G. KRUMMRICH PLANT SAMPLINGS

AUTHORS: Robert G. Kaley, II

CONTRIBUTORS: D. Guerry, O. Hicks and R. G. Hord

ABSTRACT: Eight sediment samples were taken on August 29 (1), September 15 (2), and September 18 (5), 1980 by Monsanto W. G. Krummrich plant representatives. The samples were transferred to our laboratory for analysis. The samples were analyzed for polychlorinated biphenyls, elemental phosphorus, chlorobenzenes, chlorophenols, phosphate esters, and metals (including arsenic and inorganic phosphorus). No elemental phosphorus was detected in any of the samples, which implies that phosphorus is not responsible for the "smoking earth" reported at the site. Varying amounts of the organic chemicals and metals were measured in the soil samples. The results clearly indicate non-uniform contamination at the Dead Creek site.

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REPT. NO.: ES-80-SS-26 AUTHORS: R. G. Kaley, II
TITLE: MEASUREMENT OF SELECTED CHEMICALS IN SOIL FROM THE DEAD CREEK SITE - W. G. KRUMMRICH PLANT SAMPLINGS
COPY NO.:

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MEASUREMENT OF SELECTED CHEMICALS IN SOIL FROM THE DEAD CREEK SITE
W. G. KRUMMRICH PLANT SAMPLINGS

INTRODUCTION

Following media reports and subsequent Illinois EPA concern about the hazardous chemicals at the Dead Creek site near Sauget, Illinois, personnel from Monsanto's W. G. Krummrich Plant sampled several areas at the site. Samples were submitted to Environmental Sciences for characterization. Monsanto's concerns about the site arose from reports of high levels of polychlorinated biphenyls and phosphorus, as well as the reported presence of other chemicals, and the proximity of the site to the Krummrich Plant. These samples were taken to give Monsanto opportunity to confirm the reported levels found in earlier samplings by the Illinois EPA. In addition to polychlorinated biphenyls and phosphorus, several other "families" of chemicals were measured to try to identify or eliminate possible sources of the chemicals at the site.

SUMMARY

Eight sediment samples were taken on August 29 (1), September 15 (2), and September 18 (5), 1980 by Monsanto W. G. Krummrich plant representatives. The samples were transferred to our laboratory for analysis. The samples were analyzed for polychlorinated biphenyls, elemental phosphorus, chlorobenzenes, chlorophenols, phosphate esters, and metals (including arsenic and inorganic phosphorus). No elemental phosphorus was detected in any of the samples, which implies that phosphorus is not responsible for the "smoking earth" reported at the site. Varying amounts of the organic chemicals and metals were measured in the soil samples. The results clearly indicate non-uniform contamination at the Dead Creek site.

DETAILS

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Sampling

The eight soil samples were collected by Monsanto W. G. Krummrich plant personnel. The Monsanto samples were transferred to the Environmental Analysis Group. In our laboratory, the sediment samples were handled according to Standard Operating Procedure (SOP) EAN-80-SOP-6, Homogenizing, Subdividing and Preserving Sediment Samples. Portions of the soil samples were transferred to Applied Sciences for the determination of metals and arsenic.

Analytical Procedures

The eight soil samples were analyzed for a variety of chemicals using established procedures or methods developed and validated for the chemicals of interest in soil. The following list tabulates the methods which were used.

Analyte	Method No.	Title
Polychlorinated Biphenyls	ES-80-M-28	Determination of Polychlorinated Biphenyls in Soil and Sediment
Chlorinated Benzenes	ES-80-M-29	Determination of Chlorinated Benzenes in Soil and Sediment
Chlorinated Phenols	ES-80-M-30	Determination of Chlorinated Phenols in Soil and Sediment
Elemental Phosphorus (P_4)	ES-80-M-24	Determination of Elemental Phosphorus (P_4) in Soil and Sediment
Phosphate Esters	ES-80-M-5	Determination of Group I Compounds in Sediments. . .
Metals	Ref. 1, 2	Inductively Coupled Plasma (ICP). . . Method for Trace Element Analysis of Water and Wastes
Arsenic	Ref. 3	Methods for Chemical Analysis of Water and Wastes - Arsenic

All determinations were carried out in strict accordance with these methods, except that the polychlorinated biphenyls, chlorinated benzenes and phosphate esters were measured in extracts from acidified samples to facilitate determination of chlorinated phenols in the same extracts.

Results

The analytical results for this study are tabulated in Tables I-VI. Each table contains the results for all of the samples for a specific group of compounds. All results for the soils are in ppm (parts per million or $\mu g/g$). In general, the stated detection limits are the lowest level at which a given measurement was validated. Levels which are apparently real, but which are below the validated detection limit are presented in parentheses.

Quality Assurance

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The quality assurance results (i.e., recovery and precision evaluations) for these samples have been compiled along with those of similar samples analyzed concurrently. These results are reported in Special Study ES-80-SS-27, Measurement of Selected Chemicals in Soil from the Dead Creek Site - Quality Assurance.

REFERENCES

1. Methods for Chemical Analysis of Waters and Wastes, EPA-600/4-79-020, page: Metals - 6, Section 4.1.3.

2. Federal Register, Vol. 44, No. 233, December 3, 1979.

3. Methods for Chemical Analysis of Waters and Wastes, EPA-600/4-79-020, Method 206 - Arsenic, pages: 206.2-1 to 206.5-2.

TABLE I. PPM LEVELS OF PCBs AND ELEMENTAL PHOSPHORUS (P_4) IN DEAD CREEK SOIL SAMPLES

ANALYTE	ES LOG NO. DATE SAMPLED LOCATION	1 0091541 8/29/80 100' from Judith Ln.	2 0091542 9/15/80 North Start	3 0091543 9/15/80 300' from start	4 0091907 9/18/80 #9	5 0091908 9/18/80 #10	6 0091909 9/18/80 #11	7 0091911 9/18/80 #14	8 0041701 ~~4/16/80~~ #15 9/18/80	9/16/80 Soil Blank Mo. Bottoms St.Charles,MO.
PCB's (Cl_2 to Cl_6 Homologs)		29	5000	190	4600	150	730	400	280	ND<1
P_4		ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1

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TABLE II. PPM LEVELS OF CHLOROBENZENES IN DEAD CREEK SOIL SAMPLES

ANALYTE	ES LOG NO. DATE SAMPLED LOCATION	0091541 8/29/80 100' from Judith Ln.	0091542 9/15/80 North Start	0091543 9/15/80 300' from start	0091907 9/18/80 #9	0091908 9/18/80 #10	0091909 9/18/80 #11	0091910 9/18/80 #14	0091911 9/18/80 #15	0041701 4/16/80 Soil Blank Mo. Bottoms St.Charles,MO.
MONOCHLOROBENZENE		NA	NA	NA	(0.9)	2.0	(0.2)	ND<1	(0.1)	ND<1
P-DICHLOROBENZENE		NA	NA	NA	34	4.0	3.4	2.5	(0.7)	ND<1
O-DICHLOROBENZENE		NA	NA	NA	14	(0.5)	1.1	2.3	(0.2)	ND<1
TRICHLOROBENZENES (3)		NA	NA	NA	22	2.0	5.3	3.5	1.1	ND<1
TETRACHLOROBENZENES (3)		NA	NA	NA	4.0	(0.5)	2.1	(0.7)	(0.6)	ND<1
PENTACHLOROBENZENE		NA	NA	NA	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1
HEXACHLOROBENZENE		NA	NA	NA	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1
NITROCHLOROBENZENES (O-, P-)		NA	NA	NA	ND<5	ND<1	1.2	ND<1	ND<1	ND<1

NA = Not Analyzed

( ) Values in parentheses are below the validated detection limit. However, they represent levels detected with a S/N >2.5 and can be considered semi-quantitative.

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TABLE III. PPM LEVELS OF CHLOROPHENOLS IN DEAD CREEK SOIL SAMPLES

ANALYTE	ES LOG NO.	0091541	0091542	0091543	0091907	0091908	0091909	0091910	0091911	0041701
	DATE SAMPLED	8/29/80	9/15/80	9/15/80	9/18/80	9/18/80	9/18/80	9/18/80	9/18/80	4/16/80
	LOCATION	100' from Judith Ln.	North Start	300' from start	#9	#10	#11	#14	#15	Soil Blank Mo. Bottoms St.Charles,MO.
O-CHLOROPHENOL		NA	NA	NA	17	ND<1	1.7	ND<1	ND<1	ND<1
P-CHLOROPHENOL		NA	NA	NA	20	ND<1	1.7	1.4	ND<1	ND<1
2,4-DICHLOROPHENOL		NA	NA	NA	4.6	ND<1	ND<1	ND<1	ND<1	ND<1
PENTACHLOROPHENOL		NA	NA	NA	32	ND<1	1.1	ND<1	ND<1	ND<1

NA = Not analyzed

( ) Values in parentheses are below the validated detection limit. However, they represent levels detected with a S/N >2.5 and can be considered semi-quantitative.

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TABLE IV. PPM LEVELS OF PHOSPHATE ESTERS IN DEAD CREEK SOIL SAMPLES

ANALYTE \ ES LOG NO. / DATE SAMPLED / LOCATION	0091541 8/29/80 100' from Judith Ln.	0091542 9/15/80 North Start	0091543 9/15/80 300' from start	0091907 9/18/80 #9	0091908 9/18/80 #10	0091909 9/18/80 #11	0091910 9/18/80 #14	0091911 9/18/80 #15	0041701 4/16/80 Soil Blank Mo. Bottoms St.Charles,MO.
DIBUTYLPHENYL PHOSPHATE	ND<1	ND<100	ND<10	60	ND<1	ND<1	1.0	ND<1	ND<1
BUTYLDIPHENYL PHOSPHATE	NA	NA	NA	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1
TRIPHENYL PHOSPHATE	(0.3)	150	18	200	3.0	ND<1	ND<1	ND<1	ND<1
2-ETHYLHEXYLDIPHENYL PHOSPHATE	3.5	17	11	ND<1	ND<1	1.0	(0.5)	ND<1	ND<1
ISODECYLDIPHENYL PHOSPHATE	ND<1	ND<100	ND<10	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1
T-BUTYLPHENYLDIPHENYL PHOSPHATE	ND<1	ND<100	ND<10	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1
DI-T-BUTYLPHENYLPHENYL PHOSPHATE	NA	NA	NA	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1
NONYLPHENYLDIPHENYL PHOSPHATE	ND<2	ND<200	ND<20	ND<1	1.0	ND<1	ND<1	ND<1	ND<1
CUMYLPHENYLDIPHENYL PHOSPHATE	ND<1	ND<100	ND<10	2.6	2.4	2.4	2.2	2.6	ND<1

NA = Not analyzed

( ) Values in parentheses are below the validated detection limit. However, they represent levels detected with a S/N >2.5 and can be considered semi-quantitative.

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TABLE V. PPM LEVELS OF METALS IN DEAD CREEK SOIL SAMPLES

ANALYTE	ES LOG NO. / DATE SAMPLED / LOCATION	0091541 8/29/80 100' from Judith Ln.	0091542 9/15/80 North Start	0091543 9/15/80 300' from start	0091907 9/18/80 #9	0091908 9/18/80 #10	0091909 9/18/80 #11	0091910 9/18/80 #14	0091911 9/18/80 #15	0041701 4/16/80 Soil Blank Mo. Bottoms St.Charles,MO.
SILVER		17	ND<1	3.3	ND<1	20	20	19	4.2	ND<1
ALUMINUM		2300	720	720	2700	2400	3100	3600	3900	5600
BARIUM		210	2000	640	2400	230	940	1000	1100	120
BERYLLIUM		ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1
BORON		68	13	21	36	100	78	76	72	27
CALCIUM		2500	2700	2200	13,000	14,000	6200	9200	5600	4600
CADMIUM		60	5.9	17	5.1	40	42	45	53	3.9
COBALT		67	8.2	13	30	120	85	89	81	33
CHROMIUM		44	19	61	29	88	110	130	51	19
COPPER		25,000	2700	16,000	590	8900	13,000	12,000	14,000	19
IRON		24,000	2000	2600	8700	31,000	28,000	28,000	28,000	9900
MAGNESIUM		1000	400	310	1300	1700	1700	2400	2100	2300
MANGANESE		45	15	9.3	60	210	91	140	90	510
MOLYBDENUM		63	9.5	38	11	54	39	38	47	11
SODIUM		350	690	710	420	510	400	440	360	320
NICKEL		950	140	260	120	1100	900	1100	1400	39
LEAD		1000	390	1400	150	1200	1000	1100	1500	50
PHOSPHORUS		4400	770	2400	1900	7400	7000	6500	6700	610
ANTIMONY		130	23	54	22	160	93	88	120	29
SILICON		210	320	270	94	83	91	63	95	110
TIN		76	27	71	19	71	78	91	62	18
STRONTIUM		64	35	42	24	130	120	110	81	17
TITANIUM		49	60	94	36	56	50	47	51	37
VANADIUM		46	13	14	67	120	92	100	110	130
ZINC		20,000	1400	5900	380	19,000	11,000	10,000	18,000	56
ARSENIC (By AA)		NA	NA	NA	180	50	90	50	30	5

NA = Not analyzed

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TABLE VI. SUMMARY OF PHOSPHORUS CONTENT (PPM) OF DEAD CREEK SOIL SAMPLES

ANALYTE	ES LOG NO.	0091541	0091542	0091543	0091907	0091908	0091909	0091910	0091911	0041701
	DATE SAMPLED	8/29/80	9/15/80	9/15/80	9/18/80	9/18/80	9/18/80	9/18/80	9/18/80	4/16/80
	LOCATION	100' from Judith Ln.	North Start	300' from start	#9	#10	#11	#14	#15	Soil Blank Mo. Bottoms St.Charles,MO
P - ELEMENTAL, By GC/MS		ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1
P-INORGANIC, By ICP		4400	770	2400	1900	7400	7000	6500	6700	610
TOTAL PHOSPHATE ESTERS, By GC/MS		4	170	29	260	6.4	3.4	3.7	2.6	ND<10

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SPECIAL STUDY REPORT
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TITLE: MEASUREMENT OF SELECTED CHEMICALS IN SOIL FROM THE DEAD CREEK SITE - ILLINOIS EPA SPLIT SAMPLES

AUTHORS: Robert G. Kaley, II

CONTRIBUTORS: D. Guerry
O. Hicks
R. G. Hord

ABSTRACT: Three sediment samples and one well water sample were taken on October 2, 1980 by Monsanto and IEPA representatives. The Monsanto samples were transferred to our laboratory and analyzed for polychlorinated biphenyls, elemental phosphorus, chlorobenzenes, chlorophenols, phosphate esters, and metals (including arsenic and inorganic phosphorus). No elemental phosphorus was detected in any of the samples, which implies that phosphorus is not responsible for the "smoking earth" reported at the site. In addition, no organic chemicals were detected above the detection limits in the well water sample. However, varying amounts of the organic chemicals and metals were measured in the soil samples. One sample contained higher levels of polychlorinated biphenyls and other organic compounds, while the other two samples contained higher levels of metals. The results clearly indicate non-uniform contamination at the Dead Creek site.

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REPT NO. ES-80-SS-24 AUTHORS: R. G. Kaley, II
TITLE: MEASUREMENT OF SELECTED CHEMICALS IN SOIL FROM THE DEAD CREEK SITE - ILLINOIS EPA SPLIT SAMPLES

COPY NO.:

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MEASUREMENT OF SELECTED CHEMICALS IN SOIL FROM THE DEAD CREEK SITE ILLINOIS EPA SPLIT SAMPLES

INTRODUCTION

Following media reports and subsequent Illinois EPA concern about hazardous chemicals at the Dead Creek site near Sauget, Illinois, personnel from Monsanto's W. G. Krummrich Plant and the Illinois EPA sampled several areas at the site and split the samples. The Monsanto samples were submittted to Environmental Sciences for characterization. Monsanto's concerns about the site arose from reports of high levels of polychlorinated biphenyls and phosphorus, as well as the reported presence of other chemicals, and the proximity of the site to the Krummrich Plant. These samples were taken to give both Monsanto and the Illinois EPA opportunity to confirm the reported levels found in earlier samplings by the Illinois EPA. In addition to polychlorinated biphenyls and phosphorus, several other "families" of chemicals were measured to try to identify or eliminate possible sources of the chemicals at the site.

SUMMARY

Three sediment samples and one well water sample were taken on October 2, 1980 by Monsanto and IEPA representatives. The Monsanto samples were transferred to our laboratory and analyzed for polychlorinated biphenyls, elemental phosphorus, chlorobenzenes, chlorophenols, phosphate esters, and metals (including arsenic and inorganic phosphorus). No elemental phosphorus was detected in any of the samples, which implies that phosphorus is not responsible for the "smoking earth" reported at the site. In addition, no organic chemicals were detected above the detection limits in the well water sample. However, varying amounts of the organic chemicals and metals were measured in the soil samples. One sample contained higher levels of polychlorinated biphenyls and other organic compounds, while the other two samples contained higher levels of metals. The results clearly indicate non-uniform contamination at the Dead Creek site.

DETAILS

Sampling

The three soil and one water samples were collected by Monsanto W. G. Krummrich plant personnel and IEPA personnel and split at the site. The Monsanto samples were transferred to the Environmental Analysis Group. In our laboratory, the sediment samples were handled according to Standard Operating Procedure (SOP) EAN-80-SOP-6, Homogenizing, Subdividing and Preserving Sediment Samples. Portions of the soil samples were transferred to Applied Sciences for the determination of metals and arsenic.

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Analytical Procedures

The three soil samples were analyzed for a variety of chemicals using established procedures or methods developed and validated for the chemicals of interest in soil. The following list tabulates the methods which were used.

Analyte	Method No.	Title
Polychlorinated Bipnenyls	ES-80-M-28	Determination of Polychlorinated Biphenyls in Soil and Sediment
Chlorinated Benzenes	ES-80-M-29	Determination of Chlorinated Benzenes in Soil and Sediment
Chlorinated Phenols	ES-80-M-30	Determination of Chlorinated Phenols in Soil and Sediment
Elemental Phosphorus (P_4)	ES-80-M-24	Determination of Elemental Phosphorus (P_4) in Soil and Sediment
Phosphate Esters	ES-80-M-5	Determination of Group I Compounds in Sediments . . .
Metals	Ref. 1, 2	Inductively Coupled Plasma (ICP) . . . Method for Trace Element Analysis of Water and Wastes
Arsenic	Ref. 3	Methods for Chemical Analysis of Water and Wastes-Arsenic

All determinations were carried out in strict accordance with these methods, except that the polychlorinated biphenyls, chlorinated benzenes and phosphate esters were measured in extracts from acidified samples to facilitate determination of chlorinated phenols in the same extracts.

The water sample was extracted in accordance with SOP EAN-80-SOP-19, Extraction of Semivolatile Organic Compounds from Water. The levels of polychlorinated biphenyls and phosphorus were determined using the analytical conditions specified in the respective method for soils listed above.

Results

The analytical results for this study are tabulated in Tables I-VI. Each table contains the results for all of the samples for a specific group of compounds. All results for the soils are in ppm (parts per million or µg/g). The results for the water sample are in ppb (parts per billion, ng/g). In general, the stated detection limits are the lowest level at which a given measurement was validated. Levels which are apparently real, but which are below the validated detection limit are presented in parentheses.

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Quality Assurance

The quality assurance results (i.e., recovery and precision evaluations) for these samples have been compiled along with those of similar samples analyzed concurrently. These results are reported in Special Study ES-80-SS-27, Measurement of Selected Chemicals in Soil from the Dead Creek Site - Quality Assurance.

REFERENCES

1. Methods for Chemical Analysis of Waters and Wastes, EPA-600/4-79-020, page: Metals-6, Section 4.1.3.

2. Federal Register, Vol. 44, No. 233, December 3, 1979.

3. Methods for Chemical Analysis of Waters and Wastes, EPA-600/4-79-020, Method 206-Arsenic, pages: 206.2-1 to 206.5-2.

TABLE I. PPM LEVELS OF PCBs AND ELEMENTAL PHOSPHORUS (P_4) IN DEAD CREEK SOIL AND WATER SAMPLES

ANALYTE \ ES LOG NO. / DATE SAMPLED / LOCATION	0100301 10/2/80 40 yds south of Queeny Ave. Center of Creek	0100303 10/2/80 268 paces south of 0100301	0100305 10/2/80 270 paces south of 0100303	(Water) 0100307 10/2/80 Well at Theresa's Greenhouse, 101 Walnut, Sauget, IL.	0041701 4/16/80 Soil Blank Mo. Bottoms St.Charles, MO.
PCB's (Cl_2 to Cl_6 Homologs)	13,000	240	45	ND < 1 ppb	ND < 1
P_4	ND < 1	ND < 1	ND < 1	ND < 1 ppb	ND < 1

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TABLE II. PPM LEVELS OF CHLOROBENZENES IN DEAD CREEK SOIL SAMPLES

ANALYTE \ ES LOG NO. / DATE SAMPLED / LOCATION	0100301 10/2/80 40 yds south of Queeny Ave. Center of Creek	0100303 10/2/80 268 paces south of 0100301	0100305 10/2/80 270 paces south of 0100303	0041701 4/16/80 Soil Blank Mo. Bottoms St. Charles, MO.
MONOCHLOROBENZENE	(0.9)	ND < 1	(0.3)	ND < 1
P-DICHLOROBENZENE	370	(0.3)	(0.4)	ND < 1
O-DICHLOROBENZENE	80	(0.6)	1.0	ND < 1
TRICHLOROBENZENES (3)	85	1.6	(0.7)	ND < 1
TETRACHLOROBENZENES (3)	6.1	2.4	(0.4)	ND < 1
PENTACHLOROBENZENE	ND < 1	ND < 1	ND < 1	ND < 1
HEXACHLOROBENZENE	ND < 1	1.2	ND < 1	ND < 1
NITROCHLOROBENZENES (O-, P-)	120	ND < 1	ND < 1	ND < 1

( ) Values in parentheses are below the validated detection limit. However, they represent levels detected with a S/N >2.5 and can be considered semi-quantitative.

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TABLE III. PPM LEVELS OF CHLOROPHENOLS IN DEAD CREEK SOIL SAMPLES

ANALYTE \ ES LOG NO. / DATE SAMPLED / LOCATION	0100301 10/2/80 40 yds south of Queeny Ave. Center of Creek	0100303 10/2/80 268 paces south of 0100301	0100305 10/2/80 270 paces south of 0100303	0041701 4/16/80 Soil Blank Mo. Bottoms St.Charles,MO.
O-CHLOROPHENOL	3.7	ND < 1	ND < 1	ND < 1
P-CHLOROPHENOL	6.6	ND < 1	(0.9)	ND < 1
2,4-DICHLOROPHENOL	1.2	ND < 1	ND < 1	ND < 1
PENTACHLOROPHENOL	130	ND < 1	1.8	ND < 1

( ) Values in parentheses are below the validated detection limit. However, they represent levels detected with a S/N >2.5 and can be considered semi-quantitative.

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TABLE IV. PPM LEVELS OF PHOSPHATE ESTERS IN DEAD CREEK SOIL SAMPLES

ANALYTE \ ES LOG NO. / DATE SAMPLED / LOCATION	0100301 10/2/80 40 yds south of Queeny Ave. Center of Creek	0100303 10/2/80 268 paces south of 0100301	0100305 10/2/80 270 paces south of 0100303	0041701 4/16/80 Soil Blank Mo. Bottoms St. Charles, MO.
DIBUTYLPHENYL PHOSPHATE	330	ND < 1	(0.8)	ND < 1
BUTYLDIPHENYL PHOSPHATE	ND < 1	ND < 1	(0.8)	ND < 1
TRIPHENYL PHOSPHATE	2600	ND < 1	ND < 1	ND < 1
2-ETHYLHEXYLDIPHENYL PHOSPHATE	ND < 1	ND < 1	2.2	ND < 1
ISODECYLDIPHENYL PHOSPHATE	ND < 1	ND < 1	ND < 1	ND < 1
T-BUTYLPHENYLDIPHENYL PHOSPHATE	28	ND < 1	ND < 1	ND < 1
DI-T-BUTYLPHENYLDIPHENYL PHOSPHATE	ND < 1	ND < 1	ND < 1	ND < 1
NONYLPHENYLDIPHENYL PHOSPHATE	ND < 1	ND < 1	ND < 1	ND < 1
CUMYLPHENYLDIPHENYL PHOSPHATE	3.7	ND < 1	ND < 1	ND < 1

( ) Values in parentheses are below the validated detection limit. However, they represent levels detected with a S/N >2.5 and can be considered semi-quantitative.

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TABLE V. PPM LEVELS OF METALS IN DEAD CREEK SOIL SAMPLES

ANALYTE / ES LOG NO. / DATE SAMPLED / LOCATION	0100301 10/2/80 40 yds south of Queeny Ave. Center of Creek	0100303 10/2/80 268 paces south of 0100301	0100305 10/2/80 270 paces south of 0100303	0041701 4/16/80 Soil Blank Mo. Bottoms St.Charles,MO.
SILVER	ND <1	42	29	ND < 1
ALUMINUM	1400	5100	5300	5600
BARIUM	770	1200	1300	130
BERYLLIUM	ND < 1	ND < 1	ND < 1	ND < 1
BORON	28	160	100	27
CALCIUM	8500	9200	6200	4600
CADMIUM	5.1	60	55	3.9
COBALT	15	180	120	33
CHROMIUM	25	110	240	19
COPPER	460	28,000	18,000	19
IRON	4700	53,000	30,000	9900
MAGNESIUM	460	2200	2000	2300
MANGANESE	29	170	110	510
MOLYBDENUM	6.1	92	68	11
SODIUM	400	540	410	320
NICKEL	110	2000	1700	39
LEAD	180	2000	1600	50
PHOSPHORUS	2500	13,000	9400	610
ANTIMONY	13	240	160	29
SILICON	73	150	89	110
TIN	18	260	220	18
STRONTIUM	35	230	110	17
TITANIUM	32	110	80	37
VANADIUM	34	140	130	130
ZINC	280	32,000	18,000	56
ARSENIC (By AA)	210	40	55	5

MCO 7644392
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TABLE VI. SUMMARY OF PHOSPHORUS CONTENT (PPM) OF DEAD CREEK SOIL SAMPLES

ANALYTE \ ES LOG NO. / DATE SAMPLED / LOCATION	0100301 10/2/80 40 yds south of Queeny Ave. Center of Creek	0100303 10/2/80 268 paces south of 0100301	0100305 10/2/80 270 paces south of 0100305	0041701 4/16/80 Soil Blank Mo. Bottoms St.Charles,MO.
P - ELEMENTAL, By GC/MS	ND < 1	ND < 1	ND < 1	ND < 1
P-INORGANIC, By ICP	2500	13,000	9400	610
TOTAL PHOSPHATE ESTERS, By GC/MS	3000	ND < 10	4	ND < 10

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Submitted by:

Monsanto Industrial Chemicals Company
Environmental Sciences Section - NIE
800 North Lindbergh Boulevard
St. Louis, Missouri 63166

Prepared by:

Robert G. Kaley, II
Research Group Leader

Approved by:

James P. Mieure
Manager, Environmental Sciences

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Monsanto

MIC ENVIRONMENTAL SCIENCES
(CO./DIV./DEPT./LOCATION)

NOV 6 1980

SPECIAL STUDY REPORT 47
(TYPE OF REPORT)

REPORT NO.: ES-80-SS-26

JOB/PROJECT NO.: 43-000-760.26-8623045
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DATE: October 23, 1980

TITLE: MEASUREMENT OF SELECTED CHEMICALS IN SOIL FROM THE DEAD CREEK SITE - W. G. KRUMMRICH PLANT SAMPLINGS

AUTHORS: Robert G. Kaley, II

CONTRIBUTORS: D. Guerry, O. Hicks and R. G. Hord

ABSTRACT: Eight sediment samples were taken on August 29 (1), September 15 (2), and September 18 (5), 1980 by Monsanto W. G. Krummrich plant representatives. The samples were transferred to our laboratory for analysis. The samples were analyzed for polychlorinated biphenyls, elemental phosphorus, chlorobenzenes, chlorophenols, phosphate esters, and metals (including arsenic and inorganic phosphorus). No elemental phosphorus was detected in any of the samples, which implies that phosphorus is not responsible for the "smoking earth" reported at the site. Varying amounts of the organic chemicals and metals were measured in the soil samples. The results clearly indicate non-uniform contamination at the Dead Creek site.

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REPT NO ES-80-SS-26 AUTHORS: R. G. Kaley, II
TITLE: MEASUREMENT OF SELECTED CHEMICALS IN SOIL FROM THE DEAD CREEK SITE - W. G. KRUMMRICH PLANT SAMPLINGS
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MEASUREMENT OF SELECTED CHEMICALS IN SOIL FROM THE DEAD CREEK SITE
W. G. KRUMMRICH PLANT SAMPLINGS

INTRODUCTION

Following media reports and subsequent Illinois EPA concern about the hazardous chemicals at the Dead Creek site near Sauget, Illinois, personnel from Monsanto's W. G. Krummrich Plant sampled several areas at the site. Samples were submitted to Environmental Sciences for characterization. Monsanto's concerns about the site arose from reports of high levels of polychlorinated biphenyls and phosphorus, as well as the reported presence of other chemicals, and the proximity of the site to the Krummrich Plant. These samples were taken to give Monsanto opportunity to confirm the reported levels found in earlier samplings by the Illinois EPA. In addition to polychlorinated biphenyls and phosphorus, several other "families" of chemicals were measured to try to identify or eliminate possible sources of the chemicals at the site.

SUMMARY

Eight sediment samples were taken on August 29 (1), September 15 (2), and September 18 (5), 1980 by Monsanto W. G. Krummrich plant representatives. The samples were transferred to our laboratory for analysis. The samples were analyzed for polychlorinated biphenyls, elemental phosphorus, chlorobenzenes, chlorophenols, phosphate esters, and metals (including arsenic and inorganic phosphorus). No elemental phosphorus was detected in any of the samples, which implies that phosphorus is not responsible for the "smoking earth" reported at the site. Varying amounts of the organic chemicals and metals were measured in the soil samples. The results clearly indicate non-uniform contamination at the Dead Creek site.

DETAILS

Sampling

The eight soil samples were collected by Monsanto W. G. Krummrich plant personnel. The Monsanto samples were transferred to the Environmental Analysis Group. In our laboratory, the sediment samples were handled according to Standard Operating Procedure (SOP) EAN-80-SOP-6, Homogenizing, Subdividing and Preserving Sediment Samples. Portions of the soil samples were transferred to Applied Sciences for the determination of metals and arsenic.

Analytical Procedures

The eight soil samples were analyzed for a variety of chemicals using established procedures or methods developed and validated for the chemicals of interest in soil. The following list tabulates the methods which were used.

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Analyte	Method No.	Title
Polychlorinated Biphenyls	ES-80-M-28	Determination of Polychlorinated Biphenyls in Soil and Sediment
Chlorinated Benzenes	ES-80-M-29	Determination of Chlorinated Benzenes in Soil and Sediment
Chlorinated Phenols	ES-80-M-30	Determination of Chlorinated Phenols in Soil and Sediment
Elemental Phosphorus (P_4)	ES-80-M-24	Determination of Elemental Phosphorus (P_4) in Soil and Sediment
Phosphate Esters	ES-80-M-5	Determination of Group I Compounds in Sediments. . .
Metals	Ref. 1, 2	Inductively Coupled Plasma (ICP). . . Method for Trace Element Analysis of Water and Wastes
Arsenic	Ref. 3	Methods for Chemical Analysis of Water and Wastes - Arsenic

All determinations were carried out in strict accordance with these methods, except that the polychlorinated biphenyls, chlorinated benzenes and phosphate esters were measured in extracts from acidified samples to facilitate determination of chlorinated phenols in the same extracts.

Results

The analytical results for this study are tabulated in Tables I-VI. Each table contains the results for all of the samples for a specific group of compounds. All results for the soils are in ppm (parts per million or $\mu g/g$). In general, the stated detection limits are the lowest level at which a given measurement was validated. Levels which are apparently real, but which are below the validated detection limit are presented in parentheses.

Quality Assurance

The quality assurance results (i.e., recovery and precision evaluations) for these samples have been compiled along with those of similar samples analyzed concurrently. These results are reported in Special Study ES-80-SS-27, Measurement of Selected Chemicals in Soil from the Dead Creek Site - Quality Assurance.

REFERENCES

1. Methods for Chemical Analysis of Waters and Wastes, EPA-600/4-79-020, page: Metals - 6, Section 4.1.3.

2. Federal Register, Vol. 44, No. 233, December 3, 1979.

3. Methods for Chemical Analysis of Waters and Wastes, EPA-600/4-79-020, Method 206 - Arsenic, pages: 206.2-1 to 206.5-2.

TABLE I. PPM LEVELS OF PCBs AND ELEMENTAL PHOSPHORUS (P_4) IN DEAD CREEK SOIL SAMPLES

ANALYTE \ ES LOG NO. / DATE SAMPLED / LOCATION	0091541 8/29/80 100' from Judith Ln.	0091542 9/15/80 North Start	0091543 9/15/80 300' from start	0091907 9/18/80 #9	0091908 9/18/80 #10	0091909 9/18/80 #11	0091911 9/18/80 #14	0041701 4/16/80 #15	Soil Blank Mo. Bottoms St.Charles,MO.
PCB's (Cl_2 to Cl_6 Homologs)	29	5000	190	4600	150	730	400	280	ND<1
P_4	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1

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TABLE II. PPM LEVELS OF CHLOROBENZENES IN DEAD CREEK SOIL SAMPLES

ANALYTE \ ES LOG NO. / DATE SAMPLED / LOCATION	0091541 8/29/80 100' from Judith Ln.	0091542 9/15/80 North Start	0091543 9/15/80 300' from start	0091907 9/18/80 #9	0091908 9/18/80 #10	0091909 9/18/80 #11	0091910 9/18/80 #14	0091911 9/18/80 #15	0041701 4/16/80 Soil Blank Mo. Bottoms St.Charles,MO.
MONOCHLOROBENZENE	NA	NA	NA	(0.9)	2.0	(0.2)	ND<1	(0.1)	ND<1
P-DICHLOROBENZENE	NA	NA	NA	34	4.0	3.4	2.5	(0.7)	ND<1
O-DICHLOROBENZENE	NA	NA	NA	14	(0.5)	1.1	2.3	(0.2)	ND<1
TRICHLOROBENZENES (3)	NA	NA	NA	22	2.0	5.3	3.5	1.1	ND<1
TETRACHLOROBENZENES (3)	NA	NA	NA	4.0	(0.5)	2.1	(0.7)	(0.6)	ND<1
PENTACHLOROBENZENE	NA	NA	NA	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1
HEXACHLOROBENZENE	NA	NA	NA	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1
NITROCHLOROBENZENES (O-, P-)	NA	NA	NA	ND<5	ND<1	1.2	ND<1	ND<1	ND<1

NA = Not Analyzed

( ) Values in parentheses are below the validated detection limit. However, they represent levels detected with a S/N >2.5 and can be considered semi-quantitative.

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TABLE III. PPM LEVELS OF CHLOROPHENOLS IN DEAD CREEK SOIL SAMPLES

ANALYTE	ES LOG NO.	0091541	0091542	0091543	0091907	0091908	0091909	0091910	0091911	0041701
	DATE SAMPLED	8/29/80	9/15/80	9/15/80	9/18/80	9/18/80	9/18/80	9/18/80	9/18/80	4/16/80
	LOCATION	100' from Judith Ln.	North Start	300' from start	#9	#10	#11	#14	#15	Soil Blank Mo. Bottoms St.Charles,MO.
O-CHLOROPHENOL		NA	NA	NA	17	ND<1	1.7	ND<1	ND<1	ND<1
P-CHLOROPHENOL		NA	NA	NA	20	ND<1	1.7	1.4	ND<1	ND<1
2,4-DICHLOROPHENOL		NA	NA	NA	4.6	ND<1	ND<1	ND<1	ND<1	ND<1
PENTACHLOROPHENOL		NA	NA	NA	32	ND<1	1.1	ND<1	ND<1	ND<1

NA = Not analyzed

( ) Values in parentheses are below the validated detection limit. However, they represent levels detected with a S/N >2.5 and can be considered semi-quantitative.

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TABLE IV. PPM LEVELS OF PHOSPHATE ESTERS IN DEAD CREEK SOIL SAMPLES

ANALYTE \ ES LOG NO. / DATE SAMPLED / LOCATION	0091541 8/29/80 100' from Judith Ln.	0091542 9/15/80 North Start	0091543 9/15/80 300' from start	0091907 9/18/80 #9	0091908 9/18/80 #10	0091909 9/18/80 #11	0091910 9/18/80 #14	0091911 9/18/80 #15	0041701 4/16/80 Soil Blank Mo. Bottoms St.Charles,MO.
DIBUTYLPHENYL PHOSPHATE	ND<1	ND<100	ND<10	60	ND<1	ND<1	1.0	ND<1	ND<1
BUTYLDIPHENYL PHOSPHATE	NA	NA	NA	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1
TRIPHENYL PHOSPHATE	(0.3)	150	18	200	3.0	ND<1	ND<1	ND<1	ND<1
2-ETHYLHEXYLDIPHENYL PHOSPHATE	3.5	17	11	ND<1	ND<1	1.0	(0.5)	ND<1	ND<1
ISODECYLDIPHENYL PHOSPHATE	ND<1	ND<100	ND<10	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1
T-BUTYLPHENYLDIPHENYL PHOSPHATE	ND<1	ND<100	ND<10	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1
DI-T-BUTYLPHENYLPHENYL PHOSPHATE	NA	NA	NA	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1
NONYLPHENYLDIPHENYL PHOSPHATE	ND<2	ND<200	ND<20	ND<1	1.0	ND<1	ND<1	ND<1	ND<1
CUMYLPHENYLDIPHENYL PHOSPHATE	ND<1	ND<100	ND<10	2.6	2.4	2.4	2.2	2.6	ND<1

NA = Not analyzed

( ) Values in parentheses are below the validated detection limit. However, they represent levels detected with a S/N >2.5 and can be considered semi-quantitative.

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MCO 7644402

TABLE V. PPM LEVELS OF METALS IN DEAD CREEK SOIL SAMPLES

ANALYTE \ ES LOG NO. / DATE SAMPLED / LOCATION	0091541 8/29/80 100' from Judith Ln.	0091542 9/15/80 North Start	0091543 9/15/30 300' from start	0091907 9/18/80 #9	0091908 9/18/80 #10	0091909 9/18/80 #11	0091910 9/18/80 #14	0091911 9/18/80 #15	0041701 4/16/80 Soil Blank Mo. Bottoms St.Charles,MO.
SILVER	17	ND<1	3.3	ND<1	20	20	19	4.2	ND<1
ALUMINUM	2300	720	720	2700	2400	3100	3600	3900	5600
BARIUM	210	2000	640	2400	230	940	1000	1100	120
BERYLLIUM	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1
BORON	68	13	21	36	100	78	76	72	27
CALCIUM	2500	2700	2200	13,000	14,000	6200	9200	5600	4600
CADMIUM	60	5.9	17	5.1	40	42	45	53	3.9
COBALT	67	8.2	13	30	120	85	89	81	33
CHROMIUM	44	19	61	29	88	110	130	51	19
COPPER	25,000	2700	16,000	590	8900	13,000	12,000	14,000	19
IRON	24,000	2000	2600	8700	31,000	28,000	28,000	28,000	9900
MAGNESIUM	1000	400	310	1300	1700	1700	2400	2100	2300
MANGANESE	45	15	9.3	60	210	91	140	90	510
MOLYBDENUM	63	9.5	38	11	54	39	38	47	11
SODIUM	350	690	710	420	510	400	440	360	320
NICKEL	950	140	260	120	1100	900	1100	1400	39
LEAD	1000	390	1400	150	1200	1000	1100	1500	50
PHOSPHORUS	4400	770	2400	1900	7400	7000	6500	6700	610
ANTIMONY	130	23	54	22	160	93	88	120	29
SILICON	210	320	270	94	83	91	63	95	110
TIN	76	27	71	19	71	78	91	62	18
STRONTIUM	64	35	42	24	130	120	110	81	17
TITANIUM	49	60	94	36	56	50	47	51	37
VANADIUM	46	13	14	67	120	92	100	110	130
ZINC	20,000	1400	5900	380	19,000	11,000	10,000	18,000	56
ARSENIC (By AA)	NA	NA	NA	180	50	90	50	30	5

NA = Not analyzed

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MCO 7644403

TABLE VI. SUMMARY OF PHOSPHORUS CONTENT (PPM) OF DEAD CREEK SOIL SAMPLES

ANALYTE	ES LOG NO. DATE SAMPLED LOCATION	0091541 8/29/80 100' from Judith Ln.	0091542 9/15/80 North Start	0091543 9/15/80 300' from start	0091907 9/18/80 #9	0091908 9/18/80 #10	0091909 9/18/80 #11	0091910 9/18/80 #14	0091911 9/18/80 #15	0041701 4/16/80 Soil Blank Mo. Bottoms St.Charles,MO
P - ELEMENTAL, By GC/MS		ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1
P-INORGANIC, By ICP		4400	770	2400	1900	7400	7000	6500	6700	610
TOTAL PHOSPHATE ESTERS, By GC/MS		4	170	29	260	6.4	3.4	3.7	2.6	ND<10

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MCO 7644404

Submitted by:

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Prepared by:

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Research Group Leader

Approved by:

James P. Mieure
Manager, Environmental Sciences

EPA/CERRO COPPER/EIL/PCB ATTORNEY WORK PRODUCT / ATTORNEY CLIENT PRIVILEGE

J. W. Molloy - WGK Plant

DATE September 5, 1980

cc J. J. Spano - G4NH
J. R. Thurrott - G4NH

47

XC: SGC
DRB

TO E. M. Brasfield - G4NE
R. W. Flint - G4NE
W. B. Papageorge - G4WA

Recently there has been a question concerning a specific ditch located in Cahokia which has been smoking. This ditch is located approximately 3/4 of a mile south of the Krummrich Plant, and 150' east of Route 3. It is south of Cerro Copper.

We do not find any association of the smoking ground which ties to Monsanto.

At this point in time, we know of no reason to suspect that anything associated with this incident is a result of our present or past operations or actions. In following up on this particular situation, we have uncovered the following items:

1) This whole area was a part of a drainage ditch where Midwest Rubber and Cerro Copper waste flowed.

2) There is evidence of a spongy-like material under the earth which appears to be rubber type compounds; perhaps rubber dust.

3) Analysis indicated no significant evidence of Phosphorus compounds of a sample taken at the spot. We also detected heavy oil-like material which on heating did emit fumes. There was no evidence of organic chemicals from WGK.

4) There is a suspected midnight dumper operation which occurred in this ditch area approximately one year ago for several months time period. It was stopped 12 to 14 months ago.

5) Recently the brush in and around the area was cut, piled in the ditch and set on fire. This occurred about 2-1/2 weeks ago.

MCO 7644430

We do plan to communicate to the EPA our data on analysis of the one sample we took. I'm sure it is not conclusive by any means, but it should erase from people's minds that it was Monsanto oriented.

At this time we plan no further follow up.

Jack

Jack W. Molloy

ap

47

From the desk of
W. B. PAPAGEORGE

SEP 17 1980

J. H. Craddock

MCO 7644423

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Monsanto

M.E. Webb, WGK

September 8, 1980

SOIL SAMPLE ANALYSIS

W. Smull
H. Horner
~~J. Gloeckner~~
R. Sinise
T. Berner
K. Schutzenhofer
File

cc J. W. Molco
N. Curtis
W. Papageorch

TO : Paul Heisler, Safety Dept.

This report summarizes our analytical investigation of the soil sample that was taken from an area of "Dead Creek" near Judith Lane in Cahokia on 8/29/80. The sample was taken in an area where there were reported incidents of sustained smoking and burning of the soil.

I. General Appearance

The sample is moist, dark brown soil with a "musty" type odor but no distinctive chemical odor. The moisture content, determined as loss on drying at 110 C, is 19.5%.

II. Burning Characteristics

A portion of the dry sample was placed in a crucible and slowly heated with a gas burner. The sample started to smoke as it was being heated but no spontaneous ignition occurred. On applying an open flame to the sample, ignition occurred and a self-sustaining combustion continued for several seconds.

After burning subsided the sample was heated with the full heat of the burner for several minutes. Total weight loss on ignition was 33.6%.

III. Phosphorus Analysis

The question arose as to the possibility of elemental phosphorus being the initiator of combustion in the area where the sample was taken. If this were the case, significant amounts of P_2O_5 should be present in the sample.

To test for phosphate, a portion of the original sample was extracted by boiling in water for 1/2 hour. The aqueous extract was tested for phosphate by ion chromatography. None was detected. The lower limit of detection was 10 ppm PO_4 on an original sample basis.

A sulfuric acid-persulfate digestion procedure for total phosphorus (all form of phosphorus) was performed. Total phosphorus was found to be 0.04% (as P). This low level is probably attributable to normal soil background.

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IV. Solvent Extraction and Analysis

A portion of the original sample was extracted with methylene chloride using a SOXHLET extraction apparatus.

A gas chromatographic analysis of the extract was made on a Varian 3700 using a 6 ft. column of 5% Dexil 410 and flame ionization detection. The chromatogram showed an "envelope" of unresolved peaks eluting at high temperature typical of high boiling, high molecular weight, oil.

On evaporation of the methylene chloride from an aliquot of the extract, a dark brown, viscous oil comprising 9.2% by weight of the sample, was recovered.

An infrared analysis of the oil phase gave a spectrum that is typical of long chain aliphatic hydrocarbon. While the oil cannot be identified specifically, it is possible a waste lubricating or crank case oil, etc.

V. Ignition Residue Analysis

The residue remaining after ignition is a fine, brown powder. A semi-quantitative emission spectrographic analysis for metals was run on the residue.

The elements detected and approximate concentrations are as follows:

>1%	0.1 to 1%	<0.1%
Si, Fe, Cu	Al, Ca, Mg, Ni Sn, Pb, Ti, Zn	Mn, Cr

Because the copper concentration was felt to be unusually high, a quantitative analysis was made for copper by atomic absorption spectroscopy. The copper concentration was found to be 3.9%

Conclusions

The high concentration of oil found in the sample readily explains the combustible nature of the soil.

There were no indications of any organic chemicals or phosphorus in the sample that might associate it with a WGK origin.

The high level of copper found in the sample could be a clue to the source of the oil.

WGK Notebook Ref. p. 1770639, 1770837

M. E. Webb
M.E. Webb
AR&D

MCO 7644425

4-20-90

Sector B
Work Plan

discuss on Monday
w/ G&M

look at E&E procedures
used in Dead Creek
sampling. Make sure
same as proposed

MCO 7683586

1. PHOTOGRAPH EACH CORE SAMPLE. WHITE BKGD W/ SCALE, 35mm SLIDES

2. IS ESC EQUIPPED TO DO CA LIST & NECESSARY QA/QC?

3. WHY ASSYMETRIC SAMPLE PATTERN? WHY NOT EVEN SPACING ACROSS CHANNEL BOTTOM

4. ANALYSIS MINIMIZATION PROCEDURES AT EACH BORING SITE

GERAGHTY & MILLER, INC.
Environmental Services

DRAFT

125 East Bethpage Road
Plainview, New York 11803
516-[illegible]
FAX 516-[illegible]

February 12, 1990

VIA TELECOPIER

Mr. Warren Smull
Monsanto Company
800 N. Lindbergh Blvd.
Mail Code G4WM
St. Louis, MO 63167

Re: Proposal for a Soil Boring Program at Dead Creek, Sector B, Sauget, Illinois (50212NY).

Dear Mr. Smull:

As requested, Geraghty & Miller, Inc. is providing this proposal for an investigation in "Sector B" of Dead Creek. The purpose of the study is to physically and chemically characterize soil conditions and estimate the volume of material above the water table that may be affected by hazardous organic compounds and metals. The data generated from the study will be used to determine the feasibility of excavating the material and disposing of it offsite.

To assess the feasibility of removal, it will be necessary to determine if the material can be disposed offsite in accordance with the USEPA's "land ban" requirements. Physical testing, to determine whether the material is a liquid or solid, and chemical analyses to determine the concentrations of specific compounds are required.

In general, the Creek area consists of a narrow channel about 5 feet wide which is flanked by a low bank on either side (see Figure 1). The channel and low banks are enclosed by steep banks on either side of the Creek. Because water is likely to have occupied the area nearest the channel most of the time, the majority of the proposed borings will be drilled near

the channel in the pattern shown on Figures 1 and 2. Our field investigation will consist of drilling approximately 60 boreholes and collecting and analyzing of about 180 soil samples. Approximately 20 soil borings will be drilled in the center of the bed itself with the remainder drilled 5 to 20 feet from the channel. Additional boreholes may be drilled if field conditions indicate that additional data is required in a particular area.

Our initial field reconnaissance of the site indicates that the material in the Creek is soil which can be cored. Soil samples will be collected continuously with a split barrel core at each location to the water table which is at approximately 7 feet below grade. All soil samples will be described by a Geraghty & Miller field geologist record sample location, depth, grain size distribution, and color. In addition, each sample will be screened for the presence of volatile organic compounds using a photoionization detection instrument as part of our health and safety protocols.

Although the material in the Creek appears to be "solid", approximately 20 samples chosen by the field geologist will be subjected to the point filter liquids test (USEPA Method 9095) either in the field or laboratory to document that the material is not a liquid. Three core samples from each boring, collected from 0 - 2, 2 to 4 and 4 to 6 feet below grade will be collected for analysis of the "California List" of compounds by the appropriate USEPA method to determine the areal and vertical distribution of chemicals. In addition, approximately 20 samples will be analyzed for reactivity, corrosivity, flammability and EP Toxicity to determine if the material is hazardous according to the RCRA definition. Upon completion of the drilling, each borehole will be sealed will a cement/bentonite grout and the final borehole locations will be surveyed relative to a permanent landmark.

Prior to the start of the field investigation, Geraghty & Miller will develop the necessary work plans including a Quality Assurance Project Plan (QAPP), Field Sampling Plan

(FSP), and Health and Safety Plan (HASP). It should be possible to prepare these documents within 3 weeks after receiving authorization to proceed.

Table 1 provides a cost estimate for preparing the work plans, completing the field investigation and preparing a report detailing the soil boring and analytical program. The estimates in Table 1 assume that the site is accessible to an all terrain vehicle, the work can be done in level C protective equipment and we are not required to hire union personnel. We have also assumed that the field geologist would be supplied by our St. Louis office to minimize travel and expense costs and that Monsanto's ESC would analyze the soil samples.

It will probably be necessary to pump off standing water in the Creek in some areas but we have not had an opportunity to determine costs for this task. Assuming that the water can be pumped to the sewer, and an access point is relatively near, direct pumping is recommended. Alternatively, if a direct discharge is not possible, we could start the boring program and work up to the area where the standing water is located, then transfer the water into the area of the Creek where the boring program has been completed.

If you have any questions or require additional information, please do not hesitate to call.

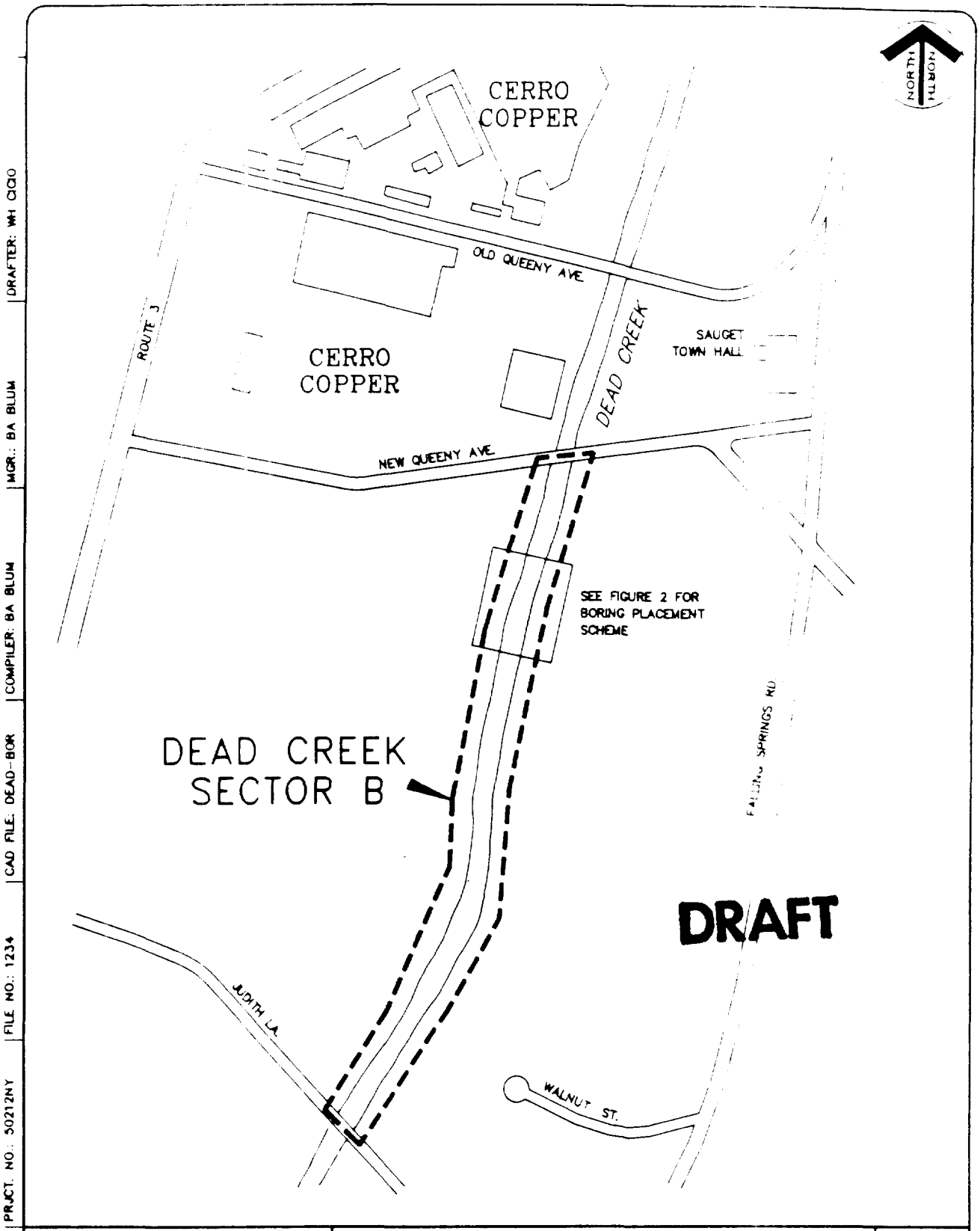
Respectfully submitted,

GERAGHTY & MILLER, INC

DRAFT

Nicholas Valkenburg
Vice President/Project Officer

NV:th
SMUL0212.LTR



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GERAGHTY & MILLER, INC.
Environmental Services

LOCATION OF PROPOSED BORINGS AT DEAD CREEK SECTOR B, SAUGET, ILLINOIS

MONSANTO COMPANY SAUGET, ILLINOIS

FIGURE 1

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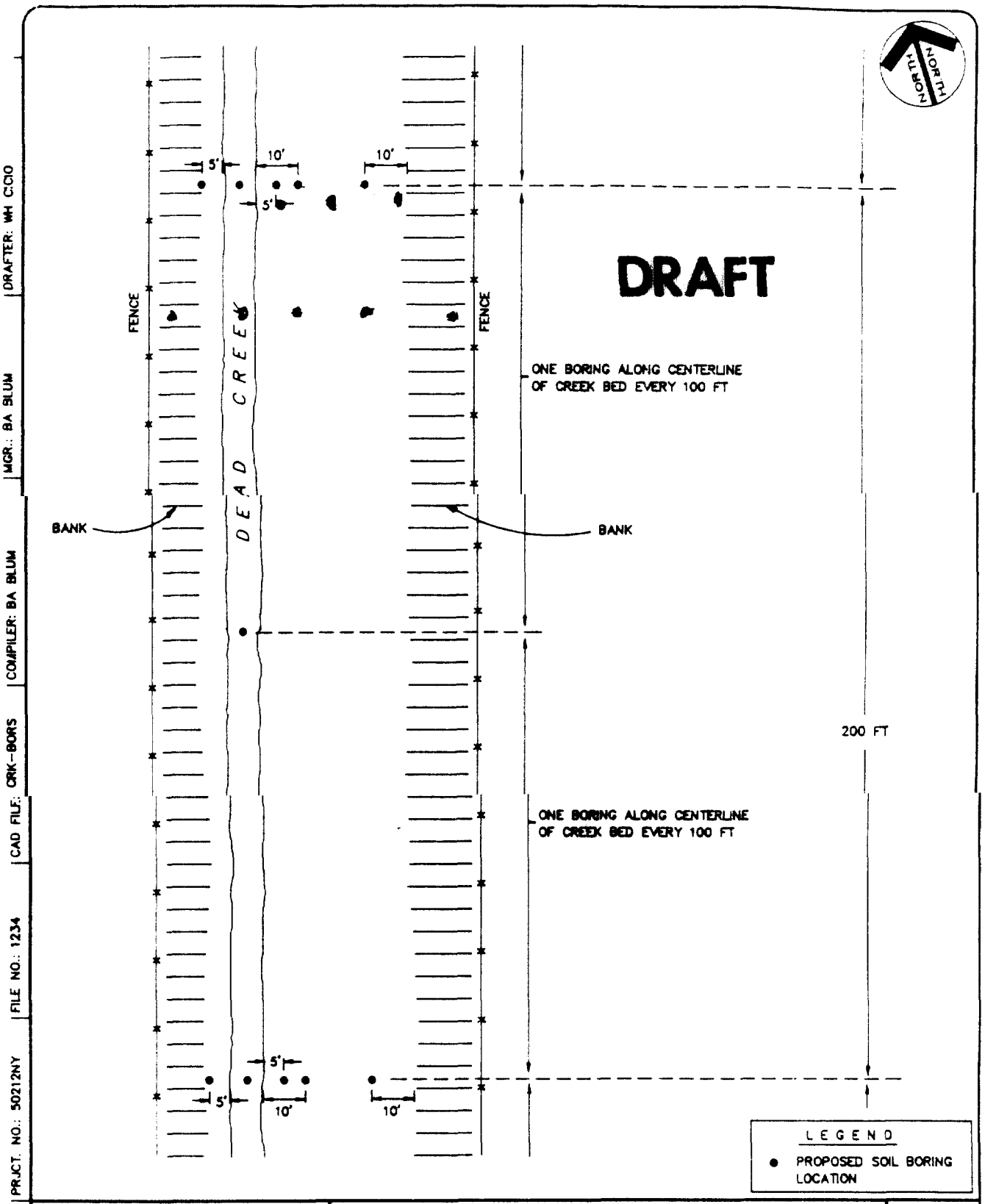

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GERAGHTY & MILLER, INC.
Environmental Services

SCHEMATIC DIAGRAM OF PROPOSED SOIL BORING LOCATIONS AT DEAD CREEK SECTOR B

MONSANTO COMPANY SAUGET, ILLINOIS

FIGURE 2

MCO 7683592

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Table 1. **Estimated Costs for a Soil Boring Program, Monsanto Company, Sauget, Illinois.**

TASK 1: DEVELOPMENT OF QAPP, FSP, AND HASP

Geraghty & Miller, Inc. Fees	
Senior Project Advisor 24 hours at $115 per hour	$ 2,760
Senior Scientist I 100 hours at $83 per hour	8,300
Staff Scientist I 100 hours at $65 per hour	6,500
Admin. Support/Clerical 24 hours at $30 per hour	720
Technical Editor 8 hours at $49 per hour	392
Draftsperson 8 hours at $39 per hour	312
Geraghty & Miller, Inc. Expenses	
(reproduction, telephone, facsimile)	500
Total Task 1	$ 19,484

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TASK 2: FIELD INVESTIGATION AND PROJECT MANAGEMENT

Geraghty & Miller, Inc. Fees

Senior Project Advisor 24 hours at $115 per hour	$ 2,760
Senior Scientist I 40 hours at $83 per hour	3,320
Scientist III 200 hours at $59 per hour	11,800

Geraghty & Miller, Inc. Expenses

Airfare - 1 round trip at $625 per trip	625
Ground Transportation - 1 round trip at $80 per trip	80
Hotel - 1 day at $85 per day	85
Meals - 1 day at $35 per day	35
- 12 days at $5 per day	60
Car Rental - 1 day at $75 per day	75
Mileage (Personal Car)	315
Supplies: - Miscellaneous (shipping, telephone, facsimilie, safety gear, field supplies)	$ 1,000
Subtotal:	$20,155

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Drilling Subcontractor

Mobilization		$ 350
Drilling (Rig, Man power 150 hours x $158/hr		23,700
Materials (cement and bentonite) $5.50 per 47 lb. bag x 100 bags		550
Water Tank and Steam Cleaner $90 per day x 12 days		1,080
Level C Protection $80 per man per day x 2 men x 12 days		1,920
	Subtotal:	$27,600
	5% Service Charge:	$ 1,380
	Subtotal	$28,980

Construction Subcontractor*

Bulldozer (to prepare access) 2 days @ $1500/day)		3,000
Install Gate and repair fence		2,500
	Subtotal:	$ 5,500
	5% Service Charge:	$ 275
	Subtotal	$ 5,775

Task 2 Cost Estimate: $ 54,910

* Note: These estimates are preliminary. More accurate Task 2 Total estimates will be obtained after contacting contractors.

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TASK 3: REPORT PREPARATION

Geraghty & Miller, Inc. Fees

Senior Project Advisor 40 hours at $115 per hour	$ 4,600
Senior Scientist I 80 hours at $83 per hour	$ 6,640
Scientist III 100 hours at $59 per hour	$ 5,900
Draftsman 16 hours at $48 per hour	$ 768
Technical Editor 8 hours at $49 per hour	$ 392
Technician 16 hours at $38 per hour	$ 608
Administrative Support/Clerical 30 hours at $30 per hour	$ 900
Expenses (reproduction, telephone, facsimile)	1,000
Total Task 3	$ 20,808
PROJECT TOTAL	95,000

SAUGET SITES - DEAD CREEK, SECTOR B

GOAL: Define If A Removal Of Contaminated Sediments To The Chemical Waste Management Landfill At Emelle Is Possible And, If So, Implement Same.

1. IEPA Position Definition

*Contact IEPA (McCombs) and determine approval status of Cerro Removal.
If Negative - Terminate Project
If Positive - Set up meeting with IEPA for Varnado, Smull and McCombs to discuss a similar project. Contact Gilhousen to determine if Enviro. Law wishes to be represented in this and possible future meetings. Also if we should contact the IAG relative to this project and when and how.

*Meet with IEPA, express our concern that the community reaction to a removal on sector A, an industrial area, and no action on sector B, a commercial/residential area, can be expected to be severely negative towards local industries and the Agencies. Additionally it is our perception that there is not a strong technical base on which to defend the situation. Define if IEPA has a positive interest in doing a similar removal on Sector B, if Monsanto would agree to fund and manage the project.

If Negative - Terminate Project
If Positive - Define and Detail Basis in this and future meetings. Major issues are:

a. Access, can IEPA use existing agreement for sampling and removal access.

b. What form of agreement will IEPA require for the work. We need to develop our proposal, letter agreement? or whatever.

c. Regulatory hurdles, PCB content averaging, disposal of dewatering water, etc.

d. Define Agency waste definition analytical requirements (CMW may have additional requirements). At this time we would expect to need PCB, 2,3,7,8 TCDD, landban organics, metals, moisture content. (Also need to define moisture level required to pass paint filter test.

e. Timing. The 11/8/90 landban deadline is a desirable, if not necessary, project completion date.

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2. Funding

Prepare EEAR against the Executive Division for $400k to cover funding for study. Issue second EEAR, now anticipated to be in the $10M range for actual removal.

3. Removal Feasibility and Scope Definition

Request G & M to prepare proposal for defining the project, including coring and sampling. Use a fast track basis.

Define laboratory for analytical work including doing same via EASC if necessary to achieve rapid turnarounds.

Define via McCombs ability of plant to provide field supervision of contractors. If not possible, arrange for Engineering or contract support.

Define CMW capability, pricing, and requirements to transport and handle the material at Emelle. At this time the actual removal work would be held out separately as a lump sum bid contract.

4. Community Relations

Meet with MCC and WGK community relations and develop CR plan.

CREEK SECTOR B - DEAD CREEK

Site Description

Creek Sector B (CS-B) includes the portion of Dead Creek lying between Queeny Avenue and Judith Lane in Sauget, Illinois. Three other sites in the Dead Creek Project are located adjacent to CS-B. These include Site G to the northwest, Site L to the northeast, and Site M to the southeast. All of these sites have been identified at one time or another as possible sources of pollution in CS-B. Presently, CS-B and Site M are enclosed by a chain link fence which was installed by the USEPA in 1982. The banks of the creek are heavily vegetated, and debris is scattered throughout the northern one-half of CS-B. Culverts at Queeny Avenue and Judith Lane have been blocked in order to prevent any release of contaminants to the remainder of the creek, although the adequacy of these blocks has been questioned several times. Water levels in the creek vary substantially depending on rainfall, and during extended periods of no precipitation, the creek becomes a dry ditch.

Site History and Previous Investigations

The IEPA initially became aware of environmental problems at CS-B in May, 1980 when several complaints were received concerning smouldering and fires observed the creek bed. In August, 1980, a local resident's dog died, apparently of chemical burns resulting from contact with materials in the ditch. Following this incident, the IEPA conducted preliminary sampling to determine the cause of these problems in CS-B. Chemical analysis of these samples indicated high levels of PCBs, phosphorus, and heavy metals, and the IEPA subsequently authorized the installation of fencing in order to prevent public access to the creek. In September 1980, the Illinois Department of Transportation (IDOT) completed installation of 7000 feet of snow fence with warning signs around CS-B and Site M. The IEPA subsequently performed a preliminary hydrogeological investigation in the area in an attempt to identify the sources of pollution

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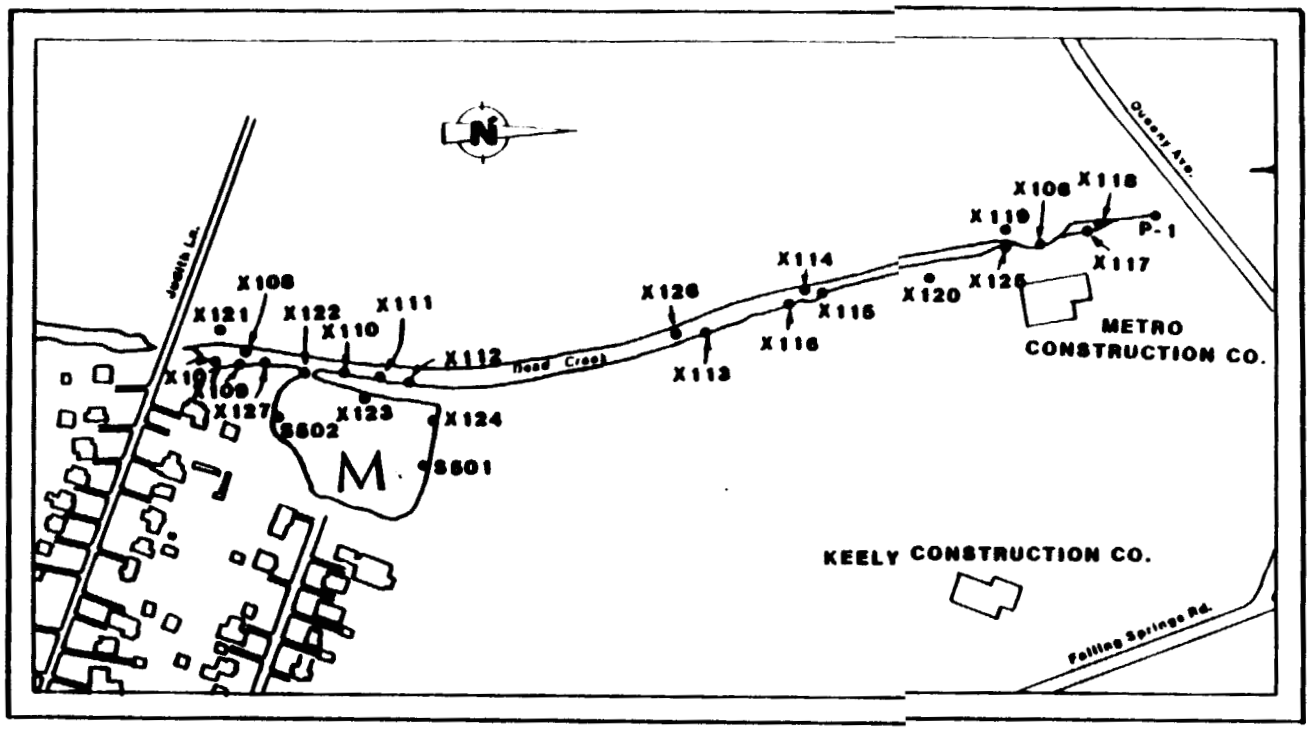
in Dead Creek. The results of this investigation are documented in the St. John Report. The snow fence was later replaced with a chain link and barbed wire fence. The installation of this fence was authorized by the USEPA, and was completed in October, 1982.

Prior to the IEPA investigation in 1980, the City of Cahokia Health Department received complaints from area residents concerning discharges from Cerro Copper Product (Cerro) entering CS-B. In 1975, IEPA visited the site in order to determine if these discharges were occurring. Investigators observed discoloration in the creek and along the banks similar to what was later observed in the holding ponds at Cerro. One water sample was collected by IEPA from the creek immediately south of Queeny Avenue. Analysis of this sample indicated the presence of copper (0.3 ppm), iron (3.2 ppm), and mercury (0.1 ppb). The culvert under Queeny Avenue was sealed sometime in the early 1970's by Cerro Copper and the Monsanto Chemical Company for the purpose of restricting flow from the holding ponds at Cerro (Creek Sector A). The holding ponds were also regraded to the north to direct their flow to an interceptor discharging to the Sauget Wastewater Treatment Plant. The investigators concluded that flow through the blocked culvert had occurred, although the direction of flow could not be determined because no flow was evident at the time of the inspection.

The IEPA hydrogeological study, conducted in 1980, included collecting 20 surface sediment samples for analysis from CS-B (Figure B-1). Analyses of samples from the northern portion of CS-B are presented in Table B-1. Samples x106, x119, x120, x125, and x126 showed PCBs in concentrations ranging from 1.1 to 10,000 parts per million (ppm). Sample x125, taken adjacent to the former Waggoner Company operation, contained additional organic contaminants, including alkylbenzenes (370 ppm), dichlorobenzene (660 ppm), trichlorobenzene (78 ppm), dichlorophenol (170 ppm), and hydrocarbons (21,000 ppm). These contaminants were not detected in other surface sediment samples in the northern portion of CS-B during this



LEGEND

X106	SEDIMENT SAMPLING LOCATION
S502	SURFACE WATER SAMPLING LOCATION
P-1	SUBSURFACE SOIL SAMPLING LOCATION

SCALE

0 150 300 600 FEET

FIGURE B-1
IEPA SAMPLING LOCATIONS AT CREEK SECTOR B AND SITE M

Protected Material: Monsanto Insurance Coverage Litigation

TABLE B-1: ANALYSIS OF SOIL SAMPLES IN THE NORTHERN PORTION OF CREEK SECTOR B (COLLECTED BY IEPA 9-8-80 THROUGH 10-25-80)

PARAMETERS	SAMPLE LOCATIONS										
	x106	x113	x114	x115	x116	x117	x118	x119	x120	x125	x126
Aluminum		18,000	6,400	9,000	9,000	1,300	1,200				
Arsenic		300	23	18	9	16	15				
Barium		2,400	1,600	3,400	300	400	1,600	510	1,200	2,500	5,000
Beryllium		-	-	-	-	-	-	1	1	-	2
Boron		-	-	-	-	-	6	-	-	-	76
Cadmium		400	-	120	-	-	-	7	3	6	70
Calcium		11,000	14,000	11,000	5,000	1,600	6,000	7,300	72,000	6,900	19,000
Chromium		250	400	120	130	-	-	36	38	50	100
Cobalt		100	-	40	-	-	-	9	10	9	50
Copper		3,800	4,800	22,000	270	160	1,000	100	150	1,000	44,800
Iron		365,000	55,000	40,000	12,000	2,400	4,300	17,500	16,200	7,000	107,000
Lead		3,600	2,000	3,200	80	-	100	43	60	260	2,000
Magnesium		4,000	2,800	5,000	2,600	1,200	1,000	4,500	4,300	380	3,700
Manganese		120	130	150	60	40	50	260	350	45	280
Mercury		30	1.7	4	0.2	2	2				
Nickel		2,500	1,700	2,400	140	-	-	-	80	130	3,000
Phosphorus										2,000	8,900
Potassium		1,400	1,300	1,500	2,300	850	1,200	1,800	1,200	770	860
Silver			-	-	-	50	-	-	-	-	100
Sodium		2,800	700	1,100	360	150	180	110	225	80	1,400
Strontium		180	140	200	40	-	-	42	140	50	300
Vanadium		-	-	150	-	-	-	27	27	13	85
Zinc		61,000	20,000	71,000	2,500	-	300	2,000	700	1,500	62,000
PCBs	6,200							1.1	80	10,000	350
Alkylbenzenes	-							-	-	370	-
Dichlorobenzene	-							-	-	660	-
Dichlorophenol	-							-	-	170	-
Hydrocarbons	-							-	-	21,000	-
Naphthalenes	-							-	-	650	-
Trichlorobenzene	-							-	-	78	-

NOTE: All results in ppm
Blank indicate parameter not analyzed
- Indicates below detection limits

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MCO 7683602

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investigation. In general, inorganic analysis of these samples indicated high levels of several metals in comparison with background conditions (Table B-3, sample x121).

Subsurface soil samples were also collected by IEPA from one location in the northern portion of CS-B during the 1980 investigation. Analyses of samples from boring P-1 are included in Table B-2. Results indicated the presence of PCBs to a depth of seven feet, and other organic contaminants to a depth of three feet. PCB concentrations ranged from 9,200 ppm near the surface to 53 ppm at depths greater than 4 feet and up to 7 feet. Other organic contaminants were detected at concentrations ranging from 12,000 ppm near the surface to 240 ppm at 2.5 feet. These results indicate non-uniform contaminant deposition in the northern portion of CS-B, which is common in riverine systems. The above data indicate that historical release(s) of contaminants to the northern portion of CS-B did occur. However, the horizontal and vertical extent of the resulting contamination has not been fully defined.

Analyses of sediment samples from the southern portion of CS-B are summarized in Table B-3. Sample x121 was taken from soil outside the creek bed to establish background conditions. Samples x107, x122, and x127 contained PCBs at concentrations ranging from 73 to 540 ppm. Sample x122 also showed diclorobenzene (0.35 ppm). This was the only organic contaminant other than PCBs detected in samples from the southern portion of CS-B. Several metals, including arsenic, cadmium, chromium, copper, lead, and zinc, were detected at levels significantly above background concentrations in all samples. However, the metal concentrations were comparable to concentrations detected in samples of sediment taken in the northern portion of CS-B. All of the samples were collected from the creek bed adjacent to, or downstream from Site M, which is an old sand pit excavated by the H.H. Hall Construction Company in approximately 1950. Hazardous materials were not reported to have been disposed of at Site M.

In October, 1980 IEPA and Monsanto Chemical Company cooperatively

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Protected Material: Monsanto Insurance Coverage Litigation

TABLE B-2: ANALYSIS OF SUBSURFACE SOIL SAMPLES AT BORING LOCATION P-1 IN CREEK SECTOR B. (COLLECTED BY IEPA 9-8-80)

PARAMETERS	SAMPLE DEPTH 0'-1'	1'-2'	2'-3'	3'-4'	4'-5'	5'-6	6'-7'
Biphenyl	6,000	9,000	1,100				
Chloronitrobenzene	200	240					
Dichlorobenzene	12,000	8,900	240				
PCBs	9,200	2,600	92B-6	240	53	53	54
Trichlorobenzene	380	3,700	590				
Xylene	540	250					

NOTE: All results in ppm
Blanks indicate below detection limits

MCA 0156815
MCO 7683604
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Protected Material: Monsanto Insurance Coverage Litigation

TABLE B-3: ANALYSIS OF SOIL SAMPLES IN THE SOUTHERN PORTION OF CREEK SECTOR B (COLLECTED BY IEPA 9-8-80 THROUGH 10-25-80)

PARAMETERS	SAMPLE LOCATIONS								
	x107	x108	x109	x110	x111	x112	x121	x122	x127
Aluminum		8,000	9,100	7,000	8,000	6,600			
Arsenic	6,000	44	25	67	80	50			
Barium	4,800	3,800	1,600	4,300	1,800	8,000	230	5,500	2,500
Beryllium	-	-	-	-	-	-	-	2	2
Boron	-	-	-	-	-	-	-	-	-
Cadmium	70	-	200	40	100	100	1	35	50
Calcium	11,000	10,000	24,000	16,000	13,000	30,000	11,000	15,000	8,000
Chromium	360	300	-	140	50	50	-	50	340
Cobalt	30	30	20	-	-	30	9	15	30
Copper	32,000	31,000	7,700	22,000	15,000	41,000	100	21,900	28,000
Iron	70,000	58,000	75,000	67,000	68,000	52,000	16,500	50,000	63,000
Lead	24,000	2,000	1,700	2,000	2,000	5,100	-	1,700	1,700
Magnesium	2,900	3,900	3,600	4,100	4,000	4,000	5,900	3,800	2,700
Manganese	150	150	300	200	160	300	370	190	150
Mercury	-	1.7	3	3.3	3.2	6	-	-	-
Nickel	3,500	3,000	900	1,900	2,000	2,700	120	1,700	
Phosphorus	7,040	-	-	-	-	-	-	-	4,700
Potassium	1,200	1,500	1,700	1,300	1,600	1,200	1,500	960	1,000
Silver	40	-	-	-	-	-	-	30	40
Sodium	1,700	900	900	700	1,000	1,600	80	630	700
Strontium	180	200	130	160	160	430	32	190	130
Vanadium	60	-	-	70	100	-	25	45	45
Zinc	25,000	22,000	27,000	25,000	47,000	52,000	230	19,900	28,000
PCBs	120	-	-	-	-	-	-	540	73
Dichlorobenzene	-	-	-	-	-	-	-	0.35	-

NOTE: All results in ppm
Blanks indicate that parameter not analyzed
- Indicates parameter is below detector limit

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collected three sediment samples from CS-B in order to confirm results of earlier sampling done by IEPA. SD-1 was collected from the creek bed 40 yards-south of Queeny Avenue. This location is adjacent to the former Waggoner Company building and also near an old outfall (effluent pipe) from the Midwest Rubber Company. Samples SD-2 and SD-3 were collected approximately 220 yards south of SD-1, in the central portion of CS-B. Results of these samples, including a blank soil sample collected from the Missouri Bottoms in St. Charles, Mo., are presented in Tables B-4 and B-5. PCBs (45-13,000 ppm) were found in all three samples from CS-B, as were several chlorinated benzenes. Chlorinated phenols and phosphate ester were detected in samples SD-1 and SD-3, but were not found in SD-2. The analysis of these samples for inorganic parameters detected generally higher levels of inorganic parameters in SD-2 and SD-3 than those for SD-1 and the soil blank. These results clearly indicate differential contamination in CS-B, with SD-1 showing high levels of PCBs and other organic compounds, whereas SD-2 and SD-3 contained higher levels of metals.

IEPA personnel also collected two sediment samples from CS-B in December, 1982, as part of an area-wide dioxin sampling effort managed by the USEPA which also included Site O. The first sample was collected along the east bank of the creek, approximately 80 yards south of Queeny Avenue. Previous sampling conducted by IEPA in this area had shown high concentrations of PCBs. The second sample was collected along the west bank of the creek, approximately 50 yards south of Queeny Avenue. Both samples were analyzed specifically for 2,3,7,8-tetrachlorodibenzo-p-dioxin (TCDD) by a USEPA contract laboratory. The first sample showed a quantified level (0.54 ppb) of TCDD, and the second sample was below the detection limit.

IEPAs Preliminary Hydrogeological Investigation of Dead Creek in 1980 was conducted for the purpose of determining possible sources of pollution observed in CS-B. The study included installation and

TABLE B-4: ORGANIC ANALYSIS OF SEDIMENT SAMPLES FROM DEAD CREEK, SECTOR B (SPLIT SAMPLES-IEPA AND MONSANTO COLLECTED 10-2-80)

PARAMETERS	SAMPLE LOCATIONS SD-1	SD-2	SD-3	Blank*
CHLOROBENZENES:				
Monochlorobenzene	(0.9)		(0.3)	
p-Dichlorobenzene	370	(0.3)	(0.4)	
o-Dichlorobenzene	80	(0.6)	1	
Trichlorobenzenes	85	1.6	(0.7)	
Tetrachlorobenzenes	6.1	2.4	(0.4)	
Pentacesorobenzene				
Hexachlorobenzene		1.2		
Nitrochlorobenzenes	120			
CHLOROPHENOLS:				
o-Chlorophenol	3.7			
p-Chlorophenol	6.6		(0.9)	
2,4-Dichlorophenol	1.2			
Pentachlorophenol	130		1.8	
PHOSPHATE ESTERS:				
Dibutylphenyl Phosphate	330		(0.8)	
Butyldiphenyl Phosphate			(0.8)	
Triphenyl Phosphate	2600			
2-Ethylhexyldiphenyl Phosphate			2.2	
Isodecyldiphenyl Phosphate				
T-Butylphenyldiphenyl Phosphate	28			
Di-t-butylphenyldiphenyl Phosphate				
Nonylphenyl Diphenyl Phosphate				
Cumylphenyldiphenl Phosphate	3.7			
PCBs (Cl_2 to Cl_6 Homologs)	13,000	240	45	

NOTE: All values in ppm
*Soil blank collected from Missouri Bottoms, St. Charles, Mo.
Blanks indicate below detection limits
( ) Semi-quantitative values

MCA 156822

MCD 7683607

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TABLE B-5: INORGANIC ANALYSIS OF SEDIMENT SAMPLES FROM DEAD CREEK, SECTOR B (SPLIT SAMPLES - IEPA AND MONSANTO COLLECTED 10-2-80)

	SAMPLE LOCATIONS			
PARAMETERS	SD-1	SD-2	SD-3	Blank*
Aluminum	1,400	5,100	5,300	5,600
Antimony	13	240	160	29
Arsenic	210	40	55	5
Barium	770	1,200	1,300	130
Beryllium	-	-	-	-
Boron	28	160	100	27
Cadmium	5.1	60	55	3.9
Calcium	8,500	9,200	6,200	4,600
Chromium	25	110	240	19
Cobalt	15	180	120	33
Copper	460	28,000	18,000	19
Iron	4,700	53,000	30,000	9,900
Lead	180	2,000	1,600	50
Magnesium	460	2,200	2,000	2,300
Manganese	29	170	110	510
Molybdenum	6.1	92	68	11
Nickel	110	2,000	1,700	39
Phosphorus	2,500	13,000	9,400	610
Silicon	73	150	89	110
Silver	-	42	29	-
Sodium	400	540	410	320
Strontium	35	230	110	17
Tin	18	260	320	18
Titanium	32	110	80	37
Vanadium	34	140	130	130
Zinc	280	32,000	18,000	56

NOTE: All values in ppm
* Soil blank collected from Missouri Bottoms, St. Charles, MO.
- Indicates below detection limits.

MCA 0156823

MCO 7683608

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sampling of 12 monitoring wells in addition to the 1980 soil/sediment sampling described above. Residential wells were also sampled to determine ground water quality in the area. Locations of IEPA monitoring wells and residential well samples are shown in Figure B-2. All IEPA wells were screened in the Henry Formation sands, with screened interval elevations ranging between 366 and 402 feet Mean Sea Level. The hydraulic gradient in the vicinity of CS-B is very flat, with ground water flow generally to the west toward the Mississippi River.

Analytical data for three sets of samples from the IEPA monitoring wells, corresponding to three sampling events in 1980 and 1981, are presented in Tables B-6, B-7, and B-8. Well G108 can be considered a background well due to its location upgradient from the known disposal areas around CS-B. Organic contaminants were consistently found in Wells G107 and G112. These wells are in downgradient monitoring positions for sites G and I respectively. Certain organic contaminants were detected in Wells G102, G109 and G110 during the initial sample event, but these wells did not show any of the organics in subsequent samples. Well G102 is located immediately west of the northern portion of CS-B, and near the southeast corner of Site G. Well G109 is located approximately 150 feet west of the former Waggoner surface impoundment (Site L). Well G110 is located downgradient of Site H. PCBs were detected at one time or another in Wells G101, G102, G104, G106, G107, G110, and G112. Of these, only G101 and G102 showed PCBs in all three sets of samples.

Inorganic analyses of samples from the IEPA monitoring wells indicate several parameters at concentrations above background (G108) and water quality standards. Standards for iron, manganese, and phosphorus were exceeded in samples from the background well. Barium, cadmium and lead were detected at concentrations exceeding standards in one or more well(s). In general, wells G109, G110, and G112 showed the most significant inorganic contamination. When compared with data for other wells, G109 contained very high concentrations of arsenic, copper, nickel, and zinc. The pH for G109

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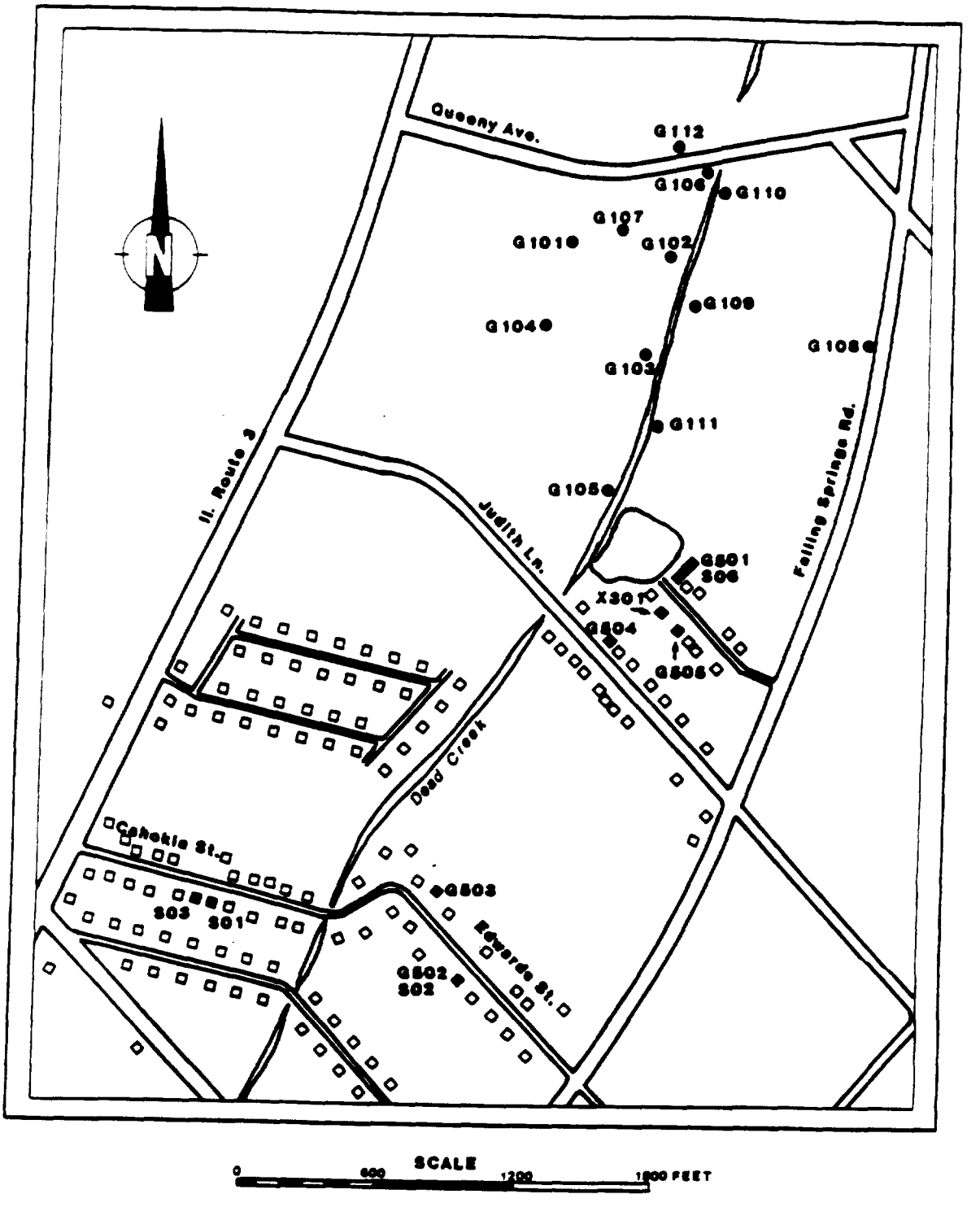
Queeny Ave.
G112
G106
G110
G107
G101
G102
G109
G104
G108
G103
G111
G105
Ill. Route 3
Judith Ln.
Falling Springs Rd.
G501
S06
XS01
G504
G505
Dead Creek
Cahokia St.
G503
S03
S01
Edwards St.
G502
S02
SCALE
0
600
1200
1800 FEET

Protected Material: Monsanto Insurance Coverage Litigation

TABLE B-6: ANALYSIS OF GROUNDWATER SAMPLES FROM THE IEPA MONITORING WELLS
(COLLECTED 10-23-80)

SAMPLE LOCATIONS

PARAMETERS	G101	G102	G103	G104	G105	G106	G107	G108	G109	G110	G111	G112
Alkalinity	382	410	336	406	271	387	552	375	287	210	302	699
Ammonia	0.3	1.0	1.7	0.4	0.9	2.9	0.5	0.3	4.5	1.2	0.1	1.5
Arsenic	0.023	0.023	0.043	0.049	0.067	0.16	0.043	0.008	0.055	0.053	0.008	0.019
Barium	1.3	0.8	2.9	2.2	2.0	0.6	2.1	0.3	0.2	0.5	0.2	0.5
Boron	0.5	0.4	0.5	0.6	0.4	0.5	0.5	0.4	0.4	0.5	0.5	5.6
Cadmium	0.0	0.0	0.03	0.0	0.0	0.0	0.0	0.0	0.0	1.5	0.0	0.06
Calcium	180	210	210	210	340	185	580	140	380	500	110	242
BOD	237	160	244	206	473	115	1070	298	275	780	79	162
Chloride	48	103	58	52	65	109	132	79	69	61	32	363
Chromium (Total)	0.04	0.02	0.09	0.04	0.12	0.01	0.07	0.0	0.0	0.38	0.0	0.01
Chromium (+6)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Copper	0.46	0.13	1.1	0.31	0.73	0.44	0.68	0.04	0.13	2.3	0.04	1.2
Cyanide												0.0
Fluoride	0.4	0.7	0.7	0.3	1.0	0.7	0.7	0.3	1.2	0.8	0.3	0.5
Hardness	501	804	549	630	528	637	777	496	1664	279	419	1080
Iron	51.0	30.5	86	90	18	62	13	4.1	39.0	340	5	18
Lead	0.10	0.15	0.26	0.2	0.31	0.0	0.27	0.0	0.0	7.3	0.07	0.44
Magnesium	0.09	90	79	72	100	49	205	24	100	209	24	82.5
Manganese	5.1	3.8	4.2	3.4	4.2	1.9	9.8	0.98	4.5	8.0	1.1	3.9
Mercury	0.0	0.0	0.0002	0.0	0.0	0.0	0.0	0.0001	0.0	0.0	0.0	0.0001
Nickel	0.1	0.1	0.9	0.1	0.0	0.1	0.3	0.0	0.5	1.9	0.0	0.3
Nitrate-Nitrite	0.1	0.1	0.1	0.4	0.0	0.1	0.1	1.1	0.0	0.4	0.5	0.0
pH	6.6	6.6	6.5	6.6	6.6	6.5	6.4	6.6	6.3	6.7	7.0	6.4
Phenolics	0.0	.01	0.0	0.005	0.0	0.065	2.5	0.01	0.45	0.015	0.0	0.875
Phosphorus	2.9	1.2	3.3	2.7	6.0	1.8	9.4	.18	.72	16	.24	.69
Potassium	10.6	13.1	13.4	12.3	22	7.7	15.2	13.7	14.9	29	4.9	58
R.O.E.	650	1230	765	790	824	1020	1230	704	2460	508	512	2130
Selenium	0.003	0.001	0.004	0.01	0.008	0.001	0.004	0.001	0.001	0.005	0.002	0.001
Silver	0.01	0.0	0.2	0.0	0.0	0.0	0.0	0.01	0.0	0.0	0.02	0.11
Sodium	24	60	40	29	57	96		40	40	53	24	260
S.C.	870	1500	1050	1000	1040	1300	1430	900	2470	720	490	
Sulfate	132	434	230	204	296	201	201	103	1340	93	104	518
Z	0.6	0.4	6.2	0.3	3.7	0.1	0.8	0.0	0.1	8.0	0.0	7.8
PCB (ppb)	1.0	1.2	-	-	-	-	-	-	-	2.7	-	-
Chlorophenol (ppb)	-	1200	-	-	-	-	630	-	19	-	-	-
Chlorobenzene (ppb)	-	-	-	-	-	-	19	-	-	-	-	100
Dichlorobenzene (ppb)	-	-	-	-	-	-	25	-	-	-	-	65
Dichlorophenol (ppb)	-	-	-	-	-	-	890	-	-	-	-	-
Cyclohexanone (ppb)	-	-	-	-	-	-	-	-	120	5.9	-	-
Chloroaniline (ppb)	-	-	-	-	-	-	-	-	-	-	-	3500

NOTE: All results in ppm unless otherwise noted.
Blanks indicate parameter not analyzed.
- indicates below detection limits.

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MCA 015682 6
MCO 7683611

TABLE B-7: ANALYSIS OF GROUNDWATER SAMPLES FROM THE IEPA MONITORING WELLS
(COLLECTED 1-28-81)

SAMPLE LOCATIONS

PARAMETERS	G101	G102	G103	G104	G105	G106	G107	G108	G109	G110	G111	G112
Alkalinity	447	421	266	520	363	556	621	448	18	308	394	619
Ammonia	0.3	0.0	1.4	0.2	0.7	3.3	1.0	0.0	17	0.2	0.1	0.5
Arsenic	0.015	0.016	0.018	0.002	0.037	0.11	0.021	0.004	7.5	0.013	0.014	0.027
Barium	0.9	1.2	0.9	0.3	1.8	1.0	3.2	0.5	0.2	1.0	0.7	0.5
Boron	0.3	0.4	0.4	0.7	0.4	0.5	0.5	0.2	0.8	0.2	0.6	0.9
Cadmium	0.0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.14	0.00	0.00	0.00
Calcium	220.8	320.9	176.3	218.0	319.2	225.5	1169.5	205.5	466.7	169.4	181.4	198.3
C.O.D.	45	93	56	9	143	212	635	8	1315	37	28	47
Chloride	20	128	64	29	59	156	201	76	32	36	18	210
Chromium (Total)	0.02	0.02	0.02	0.00	0.03	0.00	0.09	0.00	0.04	0.02	0.02	0.00
Copper	0.59	0.79	0.36	0.14	0.43	0.29	0.97	0.00	94.1	0.11	0.04	0.28
Cyanide	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.01
Hardness	554	1072	490	717	764	617	960	564	2144	447	530	486
Iron	30.4	16.5	20.8	1.4	60.8	67.5	172	0.3	198	19.1	10.1	18.9
Lead	0.17	0.00	0.00	0.00	0.07	0.00	0.32	0.00	0.00	0.00	0.00	0.00
Magnesium	48.2	78.0	46.3	49.1	73.6	49.1	288.1	34.3	184.4	43.5	37.9	54.0
Manganese	3.02	3.15	3.07	1.41	4.10	2.13	9.64	0.34	8.30	0.77	1.76	2.78
Mercury	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0004	0.0	0.0	0.0
Nickel	0.1	0.1	0.4	0.0	0.2	0.0	0.5	0.0	176	0.9	0.0	0.0
Nitrate-Nitrite	0.0	2.5	0.1	0.5	0.0	0.0	0.2	3.5	0.3	18	0.5	0.0
pH	7.0	7.0	7.1	7.2	7.0	6.9	6.9	7.1	4.1	6.9	7.0	6.9
Phenolics	0.0	0.0	0.0	0.0	0.0	1.46	0.5	0.01	1.86	0.02	0.015	0.05
Phosphorus	0.91	0.88	0.41	0.06	3.6	2.1	10	0.03	3.7	1.0	0.51	0.53
Potassium	6.4	12	8.8	6.0	13	6.2	20	16	18	7.5	4.2	20
Selenium	0.002	0.002	0.002	0.002	0.003	0.002	0.011	0.004	0.006	0.016	0.002	0.0
Silver	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Sodium	13	63	48	15	50	94	60	30	37	13	14	18
Sulfate	129	583	256	265	468	143	276	86	3371	57	153	212
Zinc	0.3	1.2	1.8	0.1	1.5	0.1	1.5	0.0	10.1	2.0	0.1	2.8
PCB (ppb)	0.22	3.9	-	0.3	-	-	0.4	-	-	-	-	-
Chlorobenzene (ppb)							6.3	-	-			2.5
Dichlorophenol (ppb)							560	-	-			-
Chloroaniline (ppb)							90	-	-			2.1

NOTE: All results in ppm unless otherwise noted.
Blanks indicate parameter not analyzed.
- indicates below detection limits.

MCO 7683612

MCA 015827

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TABLE B-8: ANALYSIS OF GROUNDWATER SAMPLES FROM THE IEPA MONITORING WELLS
(COLLECTED 3-10-81 - 3-11-81)

SAMPLE LOCATIONS

PARAMETERS	G101	G102	G103	G104	G105	G106	G107	G108	G109	G110	G111	G112
Alkalinity	483	464	319	568	393	594	657	464	58	331	387	400
Ammonia	0.2	0.0	1.5	0.0	0.4	3.0	0.2	0.0	15	0.0	0.1	0.7
Arsenic	0.001	0.0	0.003	0.001	0.013	0.005	0.004	0.001	3.9	0.001	0.001	0.00
Barium	0.0	0.7	0.1	0.2	0.2	0.3	0.1	0.2	0.1	0.1	0.1	0.0
Boron	0.2	0.4	0.3	0.7	0.3	0.5	0.5	0.2	0.5	0.1	0.4	3.4
Cadmium	0.0	0.01	0.01	0.0	0.0	0.0	0.01	0.0	0.07	1.1	0.0	0.17
Calcium	154	333	161	205	218	175	186	148	431	121	164	207
BOD	10	24	47	9	23	146	47	12	930	10	9	52
Chloride	16	124	46	28	57	150	235	51	24	27	16	133
Chromium (Total)	0.0	0.0	0.0	0.01	0.0	0.0	0.0	0.0	0.01	0.0	0.0	0.0
Copper	0.04	0.06	0.08	0.02	0.02	0.01	0.01	0.03	67	0.02	0.07	0.48
Cyanide	0.0	0.0	0.0	0.01	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Hardness	542	1062	620	839	796	675	1096	479	1651	424	485	789
Iron	0.3	0.3	1.6	0.0	9.4	4.9	2.4	0.0	1.4	0.0	0.2	0.5
Lead	0.0	0.0	0.0	0.0	0.0	0.06	0.0	0.0	0.0	0.0	0.07	0.0
Magnesium	34.2	77.9	41.9	56.8	47	44.8	44.8	22.3	138	28.7	31.8	72
Manganese	2.0	2.98	3.51	0.61	2.32	1.62	2.12	0.23	6.22	0.14	1.02	2.1
Mercury	-	-	-	-	-	-	0.0002	-	0.0003	-	-	-
Nickel	0.0	0.3	1.1	0.0	0.2	0.0	0.0	0.1	123	1.2	0.0	0.4
Nitrate-Nitrite	0.0	1.1	0.0	2.3	0.0	0.0	0.0	0.3	0.3	15	2.7	0.2
pH	6.9	6.8	6.8	6.9	6.8	6.7	6.7	7.0	4.6	6.6	6.8	6.6
Phenolics	0.0	0.0	0.005	0.0	0.0	0.0	1.7	0.1	1.4	0.0	0.0	0.00
Phosphorus	0.0	0.08	0.03	0.02	0.1	1.5	0.03	0.02	2.2	0.01	0.01	0.03
Potassium	4.0	10.8	10.4	5.9	8.9	5.7	2.8	18.2	6.4	6.3	2.9	40.2
Selenium	0.0	0.0	0.001	0.003	0.0	0.0	0.0	0.001	0.003	0.018	0.001	0.0
Silver	0.01	0.02	0.0	0.0	0.02	0.01	0.01	0.0	0.0	0.01	0.01	0.01
Sodium	11	64	65.6	17.4	51.2	92.6	39.2	25.2	12.1	14.2	15.5	96.6
Sulfate	118	617	471	383	466	146	313	55	2629	61	147	544
Zinc	0.1	0.8	2.8	0.1	0.3	0.1	0.1	0.3	6.3	1.8	0.1	11.8
PCB (ppb)	0.13	0.46	-	0.1	-	2.4	0.37	-	-	0.9	-	2.0

NOTE: All results in ppm unless otherwise noted.
Blanks indicate parameter not analyzed.
- indictes below detection limits.

was 6.3, 4.1, and 4.6 during the three sampling events. This indicates an unidentified source was releasing acid to the groundwater. Other wells which exhibited significant inorganic contamination include G102, G103, G105, and G106, all of which are located adjacent to CS-B along the west side. The data indicates non-uniform ground water contamination in the area, likely resulting from a variety of pollutional sources.

Private wells in the area have been periodically sampled by the IEPA and the USEPA. These wells are no longer used for potable water, but they are used for watering lawns and gardens. Locations of private well samples in the Dead Creek area are shown in Figure B-2. IEPA sampled five residential wells and collected one basement seepage sample near Creek Sectors B and C. Analytical data for these samples are presented in Table B-9. G504, located east of CS-B on Judith Lane, exceeded the standard for copper. The wells all showed water quality similar to that found in IEPA monitoring well G108, indicative of background conditions in the area. The basement seepage sample was collected from a residence on Walnut Street, just east of Site M. Analysis of this sample indicated higher levels of barium and copper, when compared with the private well samples. The seepage sample (x301) also showed a measurable level of chlordane, which was likely due to the application of commercial pesticides.

In March, 1982 the USEPA collected ground water samples from four private wells (S01, S02, S03, and S06) and two IEPA monitoring wells (S04 and S05). Ground water samples S04 and S05 correspond to IEPA monitoring wells G102 and G101 respectively. In addition, soil samples (S07 S10, S11) were collected from three gardens where well water is used for watering. Soil Samples S07, S010, and S011 were collected from gardens at the locations of ground water samples S01, S02, and S03 respectively (see Figure B-2 for approximate sample locations). Water and soil blank samples, R09 and R12 respectively, were also collected and analyzed. Analytical data for these samples are presented in Tables B-10 and B-11.

TABLE B-9: ANALYSIS OF RESIDENTIAL WELL AND SEEPAGE SAMPLES COLLECTED BY IEPA

SAMPLE DATES AND LOCATIONS

PARAMETERS	9/16/80 G501	9/16/80 G502	9/16/80 G503	9/23/80 G504	6/8/83 G505	1/5/83 x301
Arsenic	0.008	0.004	0.001		0.01	0.027
Barium	0.2	0.16	0.39	0.05	0.4	1.1
Boron	0.28	0.27	0.25	0.58	0.4	0.3
Cadmium						
Chromium						
Copper	0.02			0.06	0.01	0.03
Iron	4.6	19	17.7	0.73	26	31
Lead						0.03
Magnesium	33	39	36	30	35.3	54
Manganese	1.02	1.26	0.79	0.65	1.3	1.49
Mercury				0.0001		
Nickel				0.02		0.1
Phosphorus				0.02	0.62	1.2
Potassium	6.6	5.7	4.5	6	6.2	6.4
Silver						
Sodium	21	24	12	26	15.2	19
Zinc	0.85		0.18	0.8		0.7
PCBs	-	-	-			
Chlordane (ppb)	-	-	-	-		0.13

NOTE: All results in ppm unless otherwise noted
Blanks indicate below detection limit
- Indicates parameter not analyzed
Sample x301 was collected from basement seepage

MCA 0156830

MCO 7683615

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TABLE B-10: ANALYSIS OF IDENTIFIED ORGANICS IN GROUND WATER AND SOIL SAMPLES IN THE VICINITY OF CREEK SECTOR B (COLLECTED BY USEPA 3-3-82)

	SAMPLE LOCATION										
	Ground Water							Soil			
PARAMETERS	S01	S02	S03	S04	S05	S06	R09	S07	S010	S011	R012
bis(2-ethylhexyl) phthalate	64	62			19	a				a	0.44
di-n-butyl phthalate	a	a	a	a	11	a				a	a
diethyl phthalate	a	a	a	a			a				
3,4 benzofluoranthene	a										
benzo(k) fluoranthene	a										
butyl benzylphthalate				a			a				
methylene chloride	16	16	2300	3100	990	2000	19	1	0.1		0.75
1,2-dichlorobenzene				a							
1,4-dichlorobenzene				a							
chlorobenzene				a	a						
heptachlor				0.11b	0.146						
beta-BHC				0.18b	0.3b	4.04b					
gamma-BHC				0.16b	0.25b						
alpha-BHC					0.18b	0.25b					
aldrin				0.17b							
dieldrin								0.012		0.0046	
chlordane									0.11b		
heptachlorepoxide						1.46b					
delta-BHC						0.95b					
fluoranthene							a			a	
benzo(a) anthracene							a			a	
anthracene							a				
pyrene							a			a	
Chrysene										a	0.02b

NOTE: All results in ppb
Blanks indicate below detection limit
a - Compound detected at value below specified contract detection limit (compound identified as present, but not quantified)
b- value not confirmed by GCMS
Samples R09 and R012 are water and soil blanks, respectively

MCA 0156831
MCO 7683616
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TABLE 8-11: INORGANIC ANALYSIS OF GROUND WATER AND SOIL SAMPLES IN THE VICINITY OF CREEK SECTOR B (COLLECTED BY USEPA 3-3-82)

	SAMPLE LOCATIONS									
	GROUND WATER - in PPB						SOIL IN PPM			
PARAMETERS	S01	S02	S03	S04	S05	S06	S07	S010	S011	R012
Aluminum		400	390		940	1,200	750	600	430	
Antimony										
Arsenic	11			29			1.3	1.0		
Barium							80	80	80	
Beryllium										
Boron	10,500	11,000	8,000	1,800	140	110				
Cadmium	4.2	14	31	5.3		2.8	1.06	1.64	0.29	
Chromium	12						2.2			3.2
Cobalt	62	70	82	95						
Copper	65						16	24	13	
Iron	65,000	31,000	38,000	28,000	530	250	340	360	240	
Lead	570	97	74	9	11	10	(45)	(20)	(25)	
Manganese	1,600	1,100	1,500	5,100	460	80	120	630	134	
Mercury										
Mercury*	0.1	0.4	0.4	0.2	0.1					
Nickel							6.5	5.5	4	
Selenium										
Silver										
Thallium										
Tin									2	
Vanadium										
Zinc	107,000	109,000	40,000	1,900	260	350	96	77	130	

NOTE: Blanks indicate below detection limits
( ) - Results did not meet USEPA Quality Control criteria - Data unreliable
* Duplicate analysis performed by USEPA central regional laboratory
Samples R09 and R012 are water and soil blanks, respectively

MCA 0156832

MCO 7683617

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Quantified levels of bis-(2-ethylhexyl) phthalate were found in wells S01, S02, and S05. In addition, seven compounds from the pesticide fraction were detected in Wells S04, S05 (IEPA wells), and S06. Diethyl phthalate, butyl benzylphthalate, and methylene chloride were detected in the water blank, indicating that values of these parameters found in other samples should be disregarded. Methylene chloride was used to decontaminate sampling equipment, and concentrations of this parameter in all samples should not be considered indicative of aquifer conditions. Water quality standards for lead and cadmium were exceeded in one or more wells.

The soil samples showed trace levels of chlordane and dieldrin. It could not be determined if levels of pesticides found in the gardens soils were attributable to the use of well water or application of commercial pesticide products to the gardens. Phthalates, methylene chloride, chrysene, and chromium were detected in the soil blank (R012), and these compounds should be disregarded in other samples.

In September and October, 1980 IEPA conducted preliminary air monitoring in CS-8. The survey included use of detector tubes (Drager) for halogenated hydrocarbons, and collection of air samples in charcoal tubes with subsequent laboratory analysis. The detector tubes showed positive readings for hydrocarbons in the northern portion of CS-8, adjacent to the former Waggoner Building. Results were not quantified, and negative readings were observed in all other areas surveyed. Air samples were collected from two locations in CS-8 using charcoal tubes and sampling pumps. Two samples were collected from each location in order to monitor conditions for undisturbed and disturbed soil. Samples from the first location, 40 yards south of Queeny Avenue, showed no positive readings for volatile organic compounds (VOCs) for disturbed or undisturbed soil conditions. Xylene was detected for disturbed and undisturbed soil conditions at the second sampling location, which was 60 yards north of Judith Lane, adjacent to Site M. All samples were extracted and analyzed at IEPAs Springfield Laboratory.

A USEPA Field Investigation Team (FIT) contractor also performed an air monitoring survey in the creek bed in March, 1982. This survey involved the use of an organic vapor analyzer (OVA), an HNU photoionizer, and Drager detector tubes for phosgene gas. Results indicated that a small, but measurable, concentration of organic vapors were present in the breathing zone (5 feet above ground surface), with concentrations increasing closer to the creek bed. In the breathing zone, the OVA showed readings up to 0.5 ppm above background, and the HNU readings were as high as 9 ppm above background. The survey crew also observed a 3-inch effluent pipeline adjacent to the former Waggoner Building which was discharging a small stream of oily liquid. OVA and HNU readings were taken approximately 6 inches from the surface where this liquid had pooled. The OVA showed concentrations up to 350 ppm, and the HNU showed concentrations ranging from 400 to 900 ppm in this area. Phosgene gas was not detected in any area using the Drager tubes.

HRS scores have been calculated on two separate occasions for Dead Creek. The creek was first scored in July, 1982, by Ecology & Environment, Inc., with a final migration score of 18.48. The site was again scored in March, 1985 by IEPA in an attempt to increase the previous score. IEPAs assessment led to a final score of 29.23, however, this score has not been finalized by USEPA. Route scores for the 1982 assessment were as follows: ground water 4.24, surface water 7.55, and air 30.77. Corresponding route scores in the 1985 assessment were 5.65, 10.07, and 49.23. Observed releases were used for all route scores in both the 1982 and the 1985 scoring packages. The only difference in the assessments was in the value assigned for waste quantity in the three routes. The 1982 package listed waste quantity as unknown (assigned value - 0), while IEPA calculated an approximate volume of waste based on sample results and visual observations.

A significant amount of data has been developed showing a wide range of contaminants in and around CS-B. Review of existing file data indicates numerous possible sources of contamination in the area.

MCO 7683619

MCA 0156834

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Prior to blocking the culvert at Queeny Avenue, Cerro Copper and Monsanto Chemical reportedly discharged process wastes directly into the creek. According to past IEPA inspection reports the former Waggoner Company, an industrial waste hauling operation, discharged wash waters from truck cleaning activities directly to CS-B. After IEPA order Waggoner to cease this practice, an unlined surface impoundment was apparently used for disposal of wash water. In the 1940s and 1950s sites H and I were used for disposal of various industrial wastes. These sites were actually a single, large disposal area prior to the construction of Queeny Avenue in the late 1940s. In the 1950s, the Midwest Rubber Company, located west of State Route 50 and south of Queeny Avenue, had an effluent pipeline which ran from their plant location to the northern portion of CS-B. Midwest Rubber Co. reportedly discharged process wastes, including oils and cooling water, to the creek. Site G is a surface/subsurface disposal area with corroded drums and other wastes exposed on the surface. Surface drainage for at least a portion of this site is directed to CS-B.

Data Assessment and Recommendations

The scope of field investigation work for CS-B during the Dead Creek Project includes collecting three surface water samples from the Creek in Sector B. This sampling program should be sufficient to characterize the water currently in the creek. Soil gas and ambient air monitoring will also be done in and around CS-B.

Although a great deal of data is available for CS-B, most of the data is 4-6 years old. Because of the dynamic nature of the creek and disposal activities in the area, existing conditions may not be accurately characterized by historical sampling data. Feasibility study activities for CS-B could be accomplished using existing data and applying assumptions concerning chemical profiles (contaminant distribution). However, to properly accomplish the feasibility study activities, a current chemical depth profile of the creek bed should be developed. This would consist of collecting

sediment and subsurface soil samples from several locations in the creek bed and along the banks. The hydrology of the area has not been well-defined and should be addressed further. It has not been established whether the ground water discharges to Dead Creek or the creek acts as a recharge conduit for the Henry Formation aquifer. If discharge to the creek is occurring, the subsurface disposal areas (Sites H and I in particular) may be major contributors to the contamination of the creek.

Accordingly, existing IEPA monitoring wells on both sides of the creek should be redeveloped to allow for accurate water level measurements. This, in conjunction with detailed surveying of the creek bed and water levels in the creek, would allow adequate assessment of the hydrology in the area. This would be best accomplished using continuous-recording water level instrumentation, and should be continued over a period of time sufficient to address seasonal fluctuations. In addition, records of industries in the area should be thoroughly reviewed to establish a profile of possible releases from each source.

SITE M. HALL CONSTRUCTION PIT

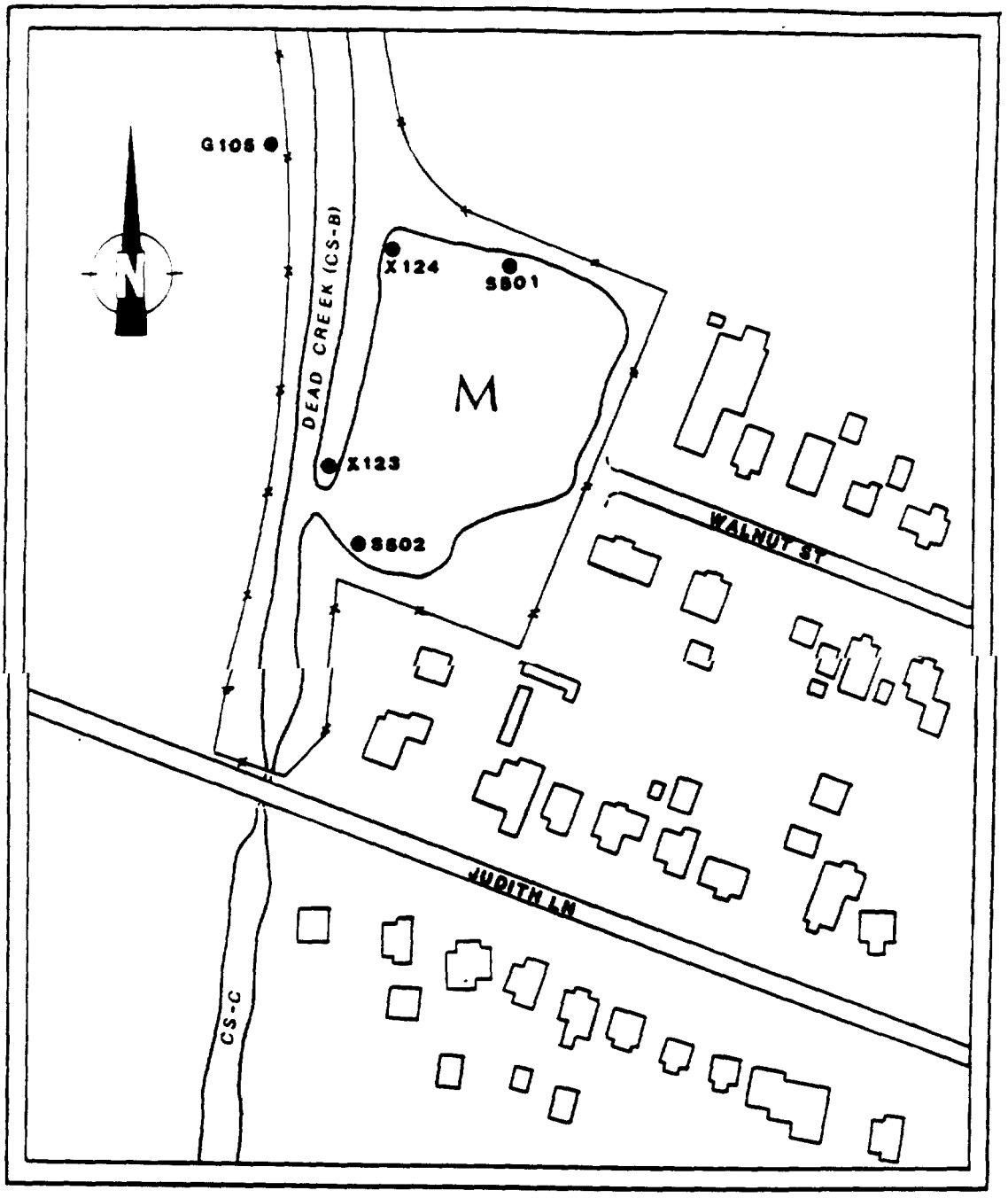
Site Description

Site M is a sand pit excavated by the H.H. Hall Construction Company in the mid to late 1940's. The pit is located immediately east of Dead Creek, and approximately 300 feet north of Judith Lane in Cahokia, Illinois (Figure M-1). The dimensions of the pit are approximately 275 by 350 feet. Presently, Site M is enclosed by a chain link fence, which also surrounds Creek Sector B. A small residential area is located just east of the pit on Walnut Street, which earlier served as an access road to Site M. The pit was excavated prior to any residential development on this street. Observations suggest that the pit is apparently isolated from Dead Creek by an embankment; however, this embankment may not be continuous. Aerial photographs indicate that a small break in the southern part of the embankment may allow flow between the creek and Site M. This possibility is supported by past IEPA inspections indicating discoloration in the pit similar to that observed in Dead Creek.

Site History and Previous Investigations

No information is available on file concerning waste disposal activities at Site M. It is possible that disposal did occur, since access to the pit remained unrestricted until a snow fence was erected in 1980. From review of historical aerial photographs, it is evident that minor changes in the dimensions of the pit have occurred. This could be an indication of filling around the perimeter of the pit. IEPA and the Cahokia Health Department have received numerous complaints about Site M and the creek from residents in the area. These complaints address, for the most part, seepage of odoriferous water into basements and problems associated with well water used to water gardens and lawns.

IEPA sampled several private wells in the area during the preliminary



LEGEND

G105 IEPA MONITORING WELL
X124 IEPA SEDIMENT SAMPLING LOCATION
S502 IEPA SURFACE WATER SAMPLING LOCATION

FIGURE M-1
DEAD CREEK SITE AREA M WITH SAMPLING LOCATIONS

MCA 136839

MCO 7683624

hydrogeological study conducted in 1980. In addition, one sample of basement seepage from a home on Walnut Street near Site M was collected. Analytical results of these samples are presented in Table B-9, located in the Creek Sector B portion of the report. The results show concentrations of copper, manganese, and phosphorus above the state's water quality standards in one or more wells as well as in the basement seepage sample.

In conjunction with the creek sampling done in 1980, IEPA collected sediment and water samples from Site M. Analytical data for these samples are presented in Table M-1. In general, the water samples showed no significant contamination, although water quality standards for copper, phosphorous, and zinc were exceeded. Trace levels of PCBs (0.9 to 4.4 ppb) were found in both samples. The sediment samples, however, did show fairly high levels of several contaminants, including cadmium, chromium, copper, lead, nickel, zinc, and PCBs. In general, the samples closer to the break in the embankment separating Site M from Dead Creek showed higher levels of contaminants than the other samples.

Because water levels in the pit were approximately two feet higher than those found in the closest monitoring wells, the IEPA study concluded that there is no hydrological connection between water in the pit and the ground water aquifer. This assessment may or may not be accurate.

Data Assessments and Recommendations

The IEPA study conducted in 1980 showed significant contamination at Site M and identified specific waste types present. Investigation of Site M for the Dead Creek Project includes collecting two surface water and three sediment samples. A soil gas survey and ambient air monitoring will also be conducted at Site M. This sampling program will not provide sufficient data to adequately evaluate remedial alternatives. Core samples should be collected from the bottom of the pit in order to determine the types of wastes present and the

TABLE M-1:

ANALYSIS OF SURFACE WATER AND SEDIMENT SAMPLES FROM SITE M
(COLLECTED BY IEPA 9-15-80)

	SAMPLE LOCATIONS			
	Water		Sediment	
PARAMETERS	S 501	S 502	X 123	X 124
Alkalinity	80	85		
Arsenic	0.006	0.01		
Barium	0.2	0.5	4,400	350
Berylium			3	1
BOD-5	4	33		
Boron	0.2	0.2	-	25
Cadmium	-	-	40	4
Calcium			12,500	4,500
COD	58	85		
Chloride	27	28		
Chromium	-	-	150	50
Copper	0.035	0.33	18,700	4,500
Cyanide	0.02	-		
Flouride	0.4	0.4		
Iron	0.8	1.8	49,000	13,500
Lead	-	0.01	1,400	130
Magnesium	6	6	3,400	3,500
Manganese	0.06	0.82	200	80
Mercury	-	-		
Nickel	0.02	0.05	1,600	590
Phenol	0.01	0.01		
Phosphorus	0.17	0.31		
Potassium	5.9	6.2	950	1,000
Silver	-	-	30	6
Sodium	24	25	650	100
Strontium			175	27
Vanadium			42	19
Zinc	0.1	0.7	17,700	2,600
PCBs	0.0009	0.0044	1,100	24
Dichlorobenzene				

NOTE: All results in ppm.
Blanks indicate parameter not analyzed.
- Indicates below detection limits.

MCA 0156841

MCO 7683626

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extent of vertical migration of contaminants that has occurred. In addition, several borings should be completed around the perimeter of the pit, including the embankment between the pit and the creek. It would also be necessary to verify that there is no hydrological connection between the water in the pit and the ground water aquifer. This would be best accomplished using continuous recording gauging stations at wells in the vicinity of the creek and at the pit. These activities would provide the information necessary to proceed with a viable remedial program.

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47

SPECIAL STUDY REPORT
(TYPE OF REPORT)

REPORT NO.: ES-80-SS-24

JOB/PROJECT NO.: 43-000-760.26-8623045
Transfer to 02-003-913.41-610

DATE: October 28, 1980

TITLE: MEASUREMENT OF SELECTED CHEMICALS IN SOIL FROM THE DEAD CREEK SITE - ILLINOIS EPA SPLIT SAMPLES

AUTHORS: Robert G. Kaley, II

CONTRIBUTORS: D. Guerry
O. Hicks
R. G. Hord

ABSTRACT: Three sediment samples and one well water sample were taken on October 2, 1980 by Monsanto and IEPA representatives. The Monsanto samples were transferred to our laboratory and analyzed for polychlorinated biphenyls, elemental phosphorus, chlorobenzenes, chlorophenols, phosphate esters, and metals (including arsenic and inorganic phosphorus). No elemental phosphorus was detected in any of the samples, which implies that phosphorus is not responsible for the "smoking earth" reported at the site. In addition, no organic chemicals were detected above the detection limits in the well water sample. However, varying amounts of the organic chemicals and metals were measured in the soil samples. One sample contained higher levels of polychlorinated biphenyls and other organic compounds, while the other two samples contained higher levels of metals. The results clearly indicate non-uniform contamination at the Dead Creek site.

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REPT. NO.: ES-80-SS-24 AUTHORS: R. G. Kaley, II
TITLE: MEASUREMENT OF SELECTED CHEMICALS IN SOIL FROM THE DEAD CREEK SITE - ILLINOIS EPA SPLIT SAMPLES
COPY NO.:

MEASUREMENT OF SELECTED CHEMICALS IN SOIL FROM THE DEAD CREEK SITE ILLINOIS EPA SPLIT SAMPLES

INTRODUCTION

Following media reports and subsequent Illinois EPA concern about hazardous chemicals at the Dead Creek site near Sauget, Illinois, personnel from Monsanto's W. G. Krummrich Plant and the Illinois EPA sampled several areas at the site and split the samples. The Monsanto samples were submittted to Environmental Sciences for characterization. Monsanto's concerns about the site arose from reports of high levels of polychlorinated biphenyls and phosphorus, as well as the reported presence of other chemicals, and the proximity of the site to the Krummrich Plant. These samples were taken to give both Monsanto and the Illinois EPA opportunity to confirm the reported levels found in earlier samplings by the Illinois EPA. In addition to polychlorinated biphenyls and phosphorus, several other "families" of chemicals were measured to try to identify or eliminate possible sources of the chemicals at the site.

SUMMARY

Three sediment samples and one well water sample were taken on October 2, 1980 by Monsanto and IEPA representatives. The Monsanto samples were transferred to our laboratory and analyzed for polychlorinated biphenyls, elemental phosphorus, chlorobenzenes, chlorophenols, phosphate esters, and metals (including arsenic and inorganic phosphorus). No elemental phosphorus was detected in any of the samples, which implies that phosphorus is not responsible for the "smoking earth" reported at the site. In addition, no organic chemicals were detected above the detection limits in the well water sample. However, varying amounts of the organic chemicals and metals were measured in the soil samples. One sample contained higher levels of polychlorinated biphenyls and other organic compounds, while the other two samples contained higher levels of metals. The results clearly indicate non-uniform contamination at the Dead Creek site.

DETAILS

Sampling

The three soil and one water samples were collected by Monsanto W. G. Krummrich plant personnel and IEPA personnel and split at the site. The Monsanto samples were transferred to the Environmental Analysis Group. In our laboratory, the sediment samples were handled according to Standard Operating Procedure (SOP) EAN-80-SOP-6, Homogenizing, Subdividing and Preserving Sediment Samples. Portions of the soil samples were transferred to Applied Sciences for the determination of metals and arsenic.

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Analytical Procedures

The three soil samples were analyzed for a variety of chemicals using established procedures or methods developed and validated for the chemicals of interest in soil. The following list tabulates the methods which were used.

Analyte	Method No.	Title
Polychlorinated Biphenyls	ES-80-M-28	Determination of Polychlorinated Biphenyls in Soil and Sediment
Chlorinated Benzenes	ES-80-M-29	Determination of Chlorinated Benzenes in Soil and Sediment
Chlorinated Phenols	ES-80-M-30	Determination of Chlorinated Phenols in Soil and Sediment
Elemental Phosphorus (P_4)	ES-80-M-24	Determination of Elemental Phosphorus (P_4) in Soil and Sediment
Phosphate Esters	ES-80-M-5	Determination of Group I Compounds in Sediments . . .
Metals	Ref. 1, 2	Inductively Coupled Plasma (ICP) . . . Method for Trace Element Analysis of Water and Wastes
Arsenic	Ref. 3	Methods for Chemical Analysis of Water and Wastes-Arsenic

All determinations were carried out in strict accordance with these methods, except that the polychlorinated biphenyls, chlorinated benzenes and phosphate esters were measured in extracts from acidified samples to facilitate determination of chlorinated phenols in the same extracts.

The water sample was extracted in accordance with SOP EAN-80-SOP-19, Extraction of Semivolatile Organic Compounds from Water. The levels of polychlorinated biphenyls and phosphorus were determined using the analytical conditions specified in the respective method for soils listed above.

Results

The analytical results for this study are tabulated in Tables I-VI. Each table contains the results for all of the samples for a specific group of compounds. All results for the soils are in ppm (parts per million or µg/g). The results for the water sample are in ppb (parts per billion, ng/g). In general, the stated detection limits are the lowest level at which a given measurement was validated. Levels which are apparently real, but which are below the validated detection limit are presented in parentheses.

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Quality Assurance

The quality assurance results (i.e., recovery and precision evaluations) for these samples have been compiled along with those of similar samples analyzed concurrently. These results are reported in Special Study ES-80-SS-27, Measurement of Selected Chemicals in Soil from the Dead Creek Site - Quality Assurance.

REFERENCES

1. Methods for Chemical Analysis of Waters and Wastes, EPA-600/4-79-020, page: Metals-6, Section 4.1.3.

2. Federal Register, Vol. 44, No. 233, December 3, 1979.

3. Methods for Chemical Analysis of Waters and Wastes, EPA-600/4-79-020, Method 206-Arsenic, pages: 206.2-1 to 206.5-2.

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TABLE I. PPM LEVELS OF PCBs AND ELEMENTAL PHOSPHORUS (P_4) IN DEAD CREEK SOIL AND WATER SAMPLES

ANALYTE \ ES LOG NO. / DATE SAMPLED / LOCATION	0100301 10/2/80 40 yds south of Queeny Ave. Center of Creek	0100303 10/2/80 268 paces south of 0100301	0100305 10/2/80 270 paces south of 0100303	(Water) 0100307 10/2/80 Well at Theresa's Greenhouse, 101 Walnut, Sauget, IL.	0041701 4/16/80 Soil Blank Mo. Bottoms St.Charles, MO.
PCB's (Cl_2 to Cl_6 Homologs)	13,000	240	45	ND < 1 ppb	ND < 1
P_4	ND < 1	ND < 1	ND < 1	ND < 1 ppb	ND < 1

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TABLE II. PPM LEVELS OF CHLOROBENZENES IN DEAD CREEK SOIL SAMPLES

ANALYTE \ ES LOG NO. / DATE SAMPLED / LOCATION	0100301 10/2/80 40 yds south of Queeny Ave. Center of Creek	0100303 10/2/80 268 paces south of 0100301	0100305 10/2/80 270 paces south of 0100303	0041701 4/16/80 Soil Blank Mo. Bottoms St. Charles, MO.
MONOCHLOROBENZENE	(0.9)	ND < 1	(0.3)	ND < 1
P-DICHLOROBENZENE	370	(0.3)	(0.4)	ND < 1
O-DICHLOROBENZENE	80	(0.6)	1.0	ND < 1
TRICHLOROBENZENES (3)	85	1.6	(0.7)	ND < 1
TETRACHLOROBENZENES (3)	6.1	2.4	(0.4)	ND < 1
PENTACHLOROBENZENE	ND < 1	ND < 1	ND < 1	ND < 1
HEXACHLOROBENZENE	ND < 1	1.2	ND < 1	ND < 1
NITROCHLOROBENZENES (O-, P-)	120	ND < 1	ND < 1	ND < 1

( ) Values in parentheses are below the validated detection limit. However, they represent levels detected with a S/N >2.5 and can be considered semi-quantitative.

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TABLE III. PPM LEVELS OF CHLOROPHENOLS IN DEAD CREEK SOIL SAMPLES

ANALYTE \ ES LOG NO. / DATE SAMPLED / LOCATION	0100301 10/2/80 40 yds south of Queeny Ave. Center of Creek	0100303 10/2/80 268 paces south of 0100301	0100305 10/2/80 270 paces south of 0100303	0041701 4/16/80 Soil Blank Mo. Bottoms St.Charles,MO.
O-CHLOROPHENOL	3.7	ND < 1	ND < 1	ND < 1
P-CHLOROPHENOL	6.6	ND < 1	(0.9)	ND < 1
2,4-DICHLOROPHENOL	1.2	ND < 1	ND < 1	ND < 1
PENTACHLOROPHENOL	130	ND < 1	1.8	ND < 1

( ) Values in parentheses are below the validated detection limit. However, they represent levels detected with a S/N >2.5 and can be considered semi-quantitative.

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TABLE IV. PPM LEVELS OF PHOSPHATE ESTERS IN DEAD CREEK SOIL SAMPLES

ANALYTE \ ES LOG NO. / DATE SAMPLED / LOCATION	0100301 10/2/80 40 yds south of Queeny Ave. Center of Creek	0100303 10/2/80 268 paces south of 0100301	0100305 10/2/80 270 paces south of 0100303	0041701 4/16/80 Soil Blank Mo. Bottoms St. Charles, MO.
DIBUTYLPHENYL PHOSPHATE	330	ND < 1	(0.8)	ND < 1
BUTYLDIPHENYL PHOSPHATE	ND < 1	ND < 1	(0.8)	ND < 1
TRIPHENYL PHOSPHATE	2600	ND < 1	ND < 1	ND < 1
2-ETHYLHEXYLDIPHENYL PHOSPHATE	ND < 1	ND < 1	2.2	ND < 1
ISODECYLDIPHENYL PHOSPHATE	ND < 1	ND < 1	ND < 1	ND < 1
T-BUTYLPHENYLDIPHENYL PHOSPHATE	28	ND < 1	ND < 1	ND < 1
DI-T-BUTYLPHENYLDIPHENYL PHOSPHATE	ND < 1	ND < 1	ND < 1	ND < 1
NONYLPHENYLDIPHENYL PHOSPHATE	ND < 1	ND < 1	ND < 1	ND < 1
CUMYLPHENYLDIPHENYL PHOSPHATE	3.7	ND < 1	ND < 1	ND < 1

( ) Values in parentheses are below the validated detection limit. However, they represent levels detected with a S/N >2.5 and can be considered semi-quantitative.

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MGK 1111027

TABLE V. PPM LEVELS OF METALS IN DEAD CREEK SOIL SAMPLES

ANALYTE \ ES LOG NO. / DATE SAMPLED / LOCATION	0100301 10/2/80 40 yds south of Queeny Ave. Center of Creek	0100303 10/2/80 268 paces south of 0100301	0100305 10/2/80 270 paces south of 0100303	0041701 4/16/80 Soil Blank Mo. Bottoms St.Charles,MO.
SILVER	ND <1	42	29	ND <1
ALUMINUM	1400	5100	5300	5600
BARIUM	770	1200	1300	130
BERYLLIUM	ND <1	ND <1	ND <1	ND <1
BORON	28	160	100	27
CALCIUM	8500	9200	6200	4600
CADMIUM	5.1	60	55	3.9
COBALT	15	180	120	33
CHROMIUM	25	110	240	19
COPPER	460	28,000	18,000	19
IRON	4700	53,000	30,000	9900
MAGNESIUM	460	2200	2000	2300
MANGANESE	29	170	110	510
MOLYBDENUM	6.1	92	68	11
SODIUM	400	540	410	320
NICKEL	110	2000	1700	39
LEAD	180	2000	1600	50
PHOSPHORUS	2500	13,000	9400	610
ANTIMONY	13	240	160	29
SILICON	73	150	89	110
TIN	18	260	220	18
STRONTIUM	35	230	110	17
TITANIUM	32	110	80	37
VANADIUM	34	140	130	130
ZINC	280	32,000	18,000	56
ARSENIC (By AA)	210	40	55	5

WGK 1111028

TABLE VI. SUMMARY OF PHOSPHORUS CONTENT (PPM) OF DEAD CREEK SOIL SAMPLES

ANALYTE \ ES LOG NO. / DATE SAMPLED / LOCATION	0100301 10/2/80 40 yds south of Queeny Ave. Center of Creek	0100303 10/2/80 268 paces south of 0100301	0100305 10/2/80 270 paces south of 0100305	0041701 4/16/80 Soil Blank Mo. Bottoms St.Charles,MO.
P - ELEMENTAL, By GC/MS	ND < 1	ND < 1	ND < 1	ND < 1
P-INORGANIC, By ICP	2500	13,000	9400	610
TOTAL PHOSPHATE ESTERS, By GC/MS	3000	ND < 10	4	ND < 10

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SPECIAL STUDY REPORT
(TYPE OF REPORT)

REPORT NO.: ES-80-SS-26

JOB/PROJECT NO.: 43-000-760.26-8623045
Transfer to 02-003-913.41-610

DATE: October 28, 1980

TITLE: MEASUREMENT OF SELECTED CHEMICALS IN SOIL FROM THE DEAD CREEK SITE - W. G. KRUMMRICH PLANT SAMPLINGS

AUTHORS: Robert G. Kaley, II

CONTRIBUTORS: D. Guerry, O. Hicks and R. G. Hord

ABSTRACT: Eight sediment samples were taken on August 29 (1), September 15 (2), and September 18 (5), 1980 by Monsanto W. G. Krummrich plant representatives. The samples were transferred to our laboratory for analysis. The samples were analyzed for polychlorinated biphenyls, elemental phosphorus, chlorobenzenes, chlorophenols, phosphate esters, and metals (including arsenic and inorganic phosphorus). No elemental phosphorus was detected in any of the samples, which implies that phosphorus is not responsible for the "smoking earth" reported at the site. Varying amounts of the organic chemicals and metals were measured in the soil samples. The results clearly indicate non-uniform contamination at the Dead Creek site.

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REPT. NO.: ES-80-SS-26 AUTHORS: R. G. Kaley, II
TITLE: MEASUREMENT OF SELECTED CHEMICALS IN SOIL FROM THE DEAD CREEK SITE - W. G. KRUMMRICH PLANT SAMPLINGS
COPY NO.:

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MEASUREMENT OF SELECTED CHEMICALS IN SOIL FROM THE DEAD CREEK SITE
W. G. KRUMMRICH PLANT SAMPLINGS

INTRODUCTION

Following media reports and subsequent Illinois EPA concern about the hazardous chemicals at the Dead Creek site near Sauget, Illinois, personnel from Monsanto's W. G. Krummrich Plant sampled several areas at the site. Samples were submitted to Environmental Sciences for characterization. Monsanto's concerns about the site arose from reports of high levels of polychlorinated biphenyls and phosphorus, as well as the reported presence of other chemicals, and the proximity of the site to the Krummrich Plant. These samples were taken to give Monsanto opportunity to confirm the reported levels found in earlier samplings by the Illinois EPA. In addition to polychlorinated biphenyls and phosphorus, several other "families" of chemicals were measured to try to identify or eliminate possible sources of the chemicals at the site.

SUMMARY

Eight sediment samples were taken on August 29 (1), September 15 (2), and September 18 (5), 1980 by Monsanto W. G. Krummrich plant representatives. The samples were transferred to our laboratory for analysis. The samples were analyzed for polychlorinated biphenyls, elemental phosphorus, chlorobenzenes, chlorophenols, phosphate esters, and metals (including arsenic and inorganic phosphorus). No elemental phosphorus was detected in any of the samples, which implies that phosphorus is not responsible for the "smoking earth" reported at the site. Varying amounts of the organic chemicals and metals were measured in the soil samples. The results clearly indicate non-uniform contamination at the Dead Creek site.

DETAILS

Sampling

The eight soil samples were collected by Monsanto W. G. Krummrich plant personnel. The Monsanto samples were transferred to the Environmental Analysis Group. In our laboratory, the sediment samples were handled according to Standard Operating Procedure (SOP) EAN-80-SOP-6, Homogenizing, Subdividing and Preserving Sediment Samples. Portions of the soil samples were transferred to Applied Sciences for the determination of metals and arsenic.

Analytical Procedures

The eight soil samples were analyzed for a variety of chemicals using established procedures or methods developed and validated for the chemicals of interest in soil. The following list tabulates the methods which were used.

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Analyte	Method No.	Title
Polychlorinated Biphenyls	ES-80-M-28	Determination of Polychlorinated Biphenyls in Soil and Sediment
Chlorinated Benzenes	ES-80-M-29	Determination of Chlorinated Benzenes in Soil and Sediment
Chlorinated Phenols	ES-80-M-30	Determination of Chlorinated Phenols in Soil and Sediment
Elemental Phosphorus (P_4)	ES-80-M-24	Determination of Elemental Phosphorus (P_4) in Soil and Sediment
Phosphate Esters	ES-80-M-5	Determination of Group I Compounds in Sediments. . .
Metals	Ref. 1, 2	Inductively Coupled Plasma (ICP). . . Method for Trace Element Analysis of Water and Wastes
Arsenic	Ref. 3	Methods for Chemical Analysis of Water and Wastes - Arsenic

All determinations were carried out in strict accordance with these methods, except that the polychlorinated biphenyls, chlorinated benzenes and phosphate esters were measured in extracts from acidified samples to facilitate determination of chlorinated phenols in the same extracts.

Results

The analytical results for this study are tabulated in Tables I-VI. Each table contains the results for all of the samples for a specific group of compounds. All results for the soils are in ppm (parts per million or μg/g). In general, the stated detection limits are the lowest level at which a given measurement was validated. Levels which are apparently real, but which are below the validated detection limit are presented in parentheses.

Quality Assurance

The quality assurance results (i.e., recovery and precision evaluations) for these samples have been compiled along with those of similar samples analyzed concurrently. These results are reported in Special Study ES-80-SS-27, Measurement of Selected Chemicals in Soil from the Dead Creek Site - Quality Assurance.

REFERENCES

1. Methods for Chemical Analysis of Waters and Wastes, EPA-600/4-79-020, page: Metals - 6, Section 4.1.3.

2. Federal Register, Vol. 44, No. 233, December 3, 1979.

3. Methods for Chemical Analysis of Waters and Wastes, EPA-600/4-79-020, Method 206 - Arsenic, pages: 206.2-1 to 206.5-2.

TABLE I. PPM LEVELS OF PCBs AND ELEMENTAL PHOSPHORUS (P_4) IN DEAD CREEK SOIL SAMPLES

ANALYTE \ ES LOG NO.	0091541	0091542	0091543	0091907	0091908	0091909	0091911	0041701	
DATE SAMPLED	8/29/80	9/15/80	9/15/80	9/18/80	9/18/80	9/18/80	9/18/80	4/16/80	
LOCATION	100' from Judith Ln.	North Start	300' from start	#9	#10	#11	#14	#15	Soil Blank Mo. Bottoms St.Charles,MO.
PCB's (Cl_2 to Cl_6 Homologs)	29	5000	190	4600	150	730	400	280	ND<1
P_4	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1

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TABLE II. PPM LEVELS OF CHLOROBENZENES IN DEAD CREEK SOIL SAMPLES

ANALYTE	ES LOG NO.	0091541	0091542	0091543	0091907	0091908	0091909	0091910	0091911	0041701
	DATE SAMPLED	8/29/80	9/15/80	9/15/80	9/18/80	9/18/80	9/18/80	9/18/80	9/18/80	4/16/80
	LOCATION	100' from Judith Ln.	North Start	300' from start	#9	#10	#11	#14	#15	Soil Blank Mo. Bottoms St.Charles,MO.
MONOCHLOROBENZENE		NA	NA	NA	(0.9)	2.0	(0.2)	ND<1	(0.1)	ND<1
P-DICHLOROBENZENE		NA	NA	NA	34	4.0	3.4	2.5	(0.7)	ND<1
O-DICHLOROBENZENE		NA	NA	NA	14	(0.5)	1.1	2.3	(0.2)	ND<1
TRICHLOROBENZENES (3)		NA	NA	NA	22	2.0	5.3	3.5	1.1	ND<1
TETRACHLOROBENZENES (3)		NA	NA	NA	4.0	(0.5)	2.1	(0.7)	(0.6)	ND<1
PENTACHLOROBENZENE		NA	NA	NA	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1
HEXACHLOROBENZENE		NA	NA	NA	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1
NITROCHLOROBENZENES (O-, P-)		NA	NA	NA	ND<5	ND<1	1.2	ND<1	ND<1	ND<1

NA = Not Analyzed

( ) Values in parentheses are below the validated detection limit. However, they represent levels detected with a S/N >2.5 and can be considered semi-quantitative.

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TABLE III. PPM LEVELS OF CHLOROPHENOLS IN DEAD CREEK SOIL SAMPLES

ANALYTE \ ES LOG NO. / DATE SAMPLED / LOCATION	0091541 8/29/80 100' from Judith Ln.	0091542 9/15/80 North Start	0091543 9/15/80 300' from start	0091907 9/18/80 #9	0091908 9/18/80 #10	0091909 9/18/80 #11	0091910 9/18/80 #14	0091911 9/18/80 #15	0041701 4/16/80 Soil Blank Mo. Bottoms St.Charles,MO.
O-CHLOROPHENOL	NA	NA	NA	17	ND<1	1.7	ND<1	ND<1	ND<1
P-CHLOROPHENOL	NA	NA	NA	20	ND<1	1.7	1.4	ND<1	ND<1
2,4-DICHLOROPHENOL	NA	NA	NA	4.6	ND<1	ND<1	ND<1	ND<1	ND<1
PENTACHLOROPHENOL	NA	NA	NA	32	ND<1	1.1	ND<1	ND<1	ND<1

NA = Not analyzed

( ) Values in parentheses are below the validated detection limit. However, they represent levels detected with a S/N >2.5 and can be considered semi-quantitative.

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TABLE IV. PPM LEVELS OF PHOSPHATE ESTERS IN DEAD CREEK SOIL SAMPLES

ANALYTE / ES LOG NO. / DATE SAMPLED / LOCATION	0091541 8/29/80 100' from Judith Ln.	0091542 9/15/80 North Start	0091543 9/15/80 300' from start	0091907 9/18/80 #9	0091908 9/18/80 #10	0091909 9/18/80 #11	0091910 9/18/80 #14	0091911 9/18/80 #15	0041701 4/16/80 Soil Blank Mo. Bottoms St.Charles,MO.
DIBUTYLPHENYL PHOSPHATE	ND<1	ND<100	ND<10	60	ND<1	ND<1	1.0	ND<1	ND<1
BUTYLDIPHENYL PHOSPHATE	NA	NA	NA	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1
TRIPHENYL PHOSPHATE	(0.3)	150	18	200	3.0	ND<1	ND<1	ND<1	ND<1
2-ETHYLHEXYLDIPHENYL PHOSPHATE	3.5	17	11	ND<1	ND<1	1.0	(0.5)	ND<1	ND<1
ISODECYLDIPHENYL PHOSPHATE	ND<1	ND<100	ND<10	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1
T-BUTYLPHENYLDIPHENYL PHOSPHATE	ND<1	ND<100	ND<10	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1
DI-T-BUTYLPHENYLPHENYL PHOSPHATE	NA	NA	NA	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1
NONYLPHENYLDIPHENYL PHOSPHATE	ND<2	ND<200	ND<20	ND<1	1.0	ND<1	ND<1	ND<1	ND<1
CUMYLPHENYLDIPHENYL PHOSPHATE	ND<1	ND<100	ND<10	2.6	2.4	2.4	2.2	2.6	ND<1

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NA = Not analyzed

( ) Values in parentheses are below the validated detection limit. However, they represent levels detected with a S/N >2.5 and can be considered semi-quantitative.

TABLE V. PPM LEVELS OF METALS IN DEAD CREEK SOIL SAMPLES

ANALYTE	ES LOG NO.	0091541	0091542	0091543	0091907	0091908	0091909	0091910	0091911	0041701
	DATE SAMPLED	8/29/80	9/15/80	9/15/80	9/18/80	9/18/80	9/18/80	9/18/80	9/18/80	4/16/80
	LOCATION	100' from Judith Ln.	North Start	300' from start	#9	#10	#11	#14	#15	Soil Blank Mo. Bottoms St.Charles,MO.
SILVER		17	ND<1	3.3	ND<1	20	20	19	4.2	ND<1
ALUMINUM		2300	720	720	2700	2400	3100	3600	3900	5600
BARIUM		210	2000	640	2400	230	940	1000	1100	120
BERYLLIUM		ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1
BORON		68	13	21	36	100	78	76	72	27
CALCIUM		2500	2700	2200	13,000	14,000	6200	9200	5600	4600
CADMIUM		60	5.9	17	5.1	40	42	45	53	3.9
COBALT		67	8.2	13	30	120	85	89	81	33
CHROMIUM		44	19	61	29	88	110	130	51	19
COPPER		25,000	2700	16,000	590	8900	13,000	12,000	14,000	19
IRON		24,000	2000	2600	8700	31,000	28,000	28,000	28,000	9900
MAGNESIUM		1000	400	310	1300	1700	1700	2400	2100	2300
MANGANESE		45	15	9.3	60	210	91	140	90	510
MOLYBDENUM		63	9.5	38	11	54	39	38	47	11
SODIUM		350	690	710	420	510	400	440	360	320
NICKEL		950	140	260	120	1100	900	1100	1400	39
LEAD		1000	390	1400	150	1200	1000	1100	1500	50
PHOSPHORUS		4400	770	2400	1900	7400	7000	6500	6700	610
ANTIMONY		130	23	54	22	160	93	88	120	29
SILICON		210	320	270	94	83	91	63	95	110
TIN		76	27	71	19	71	78	91	62	18
STRONTIUM		64	35	42	24	130	120	110	81	17
TITANIUM		49	60	94	36	56	50	47	51	37
VANADIUM		46	13	14	67	120	92	100	110	130
ZINC		20,000	1400	5900	380	19,000	11,000	10,000	18,000	56
ARSENIC (By AA)		NA	NA	NA	180	50	90	50	30	5

NA = Not analyzed

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TABLE VI. SUMMARY OF PHOSPHORUS CONTENT (PPM) OF DEAD CREEK SOIL SAMPLES

ANALYTE	ES LOG NO. DATE SAMPLED LOCATION	0091541 8/29/80 100' from Judith Ln.	0091542 9/15/80 North Start	0091543 9/15/80 300' from start	0091907 9/18/80 #9	0091908 9/18/80 #10	0091909 9/18/80 #11	0091910 9/18/80 #14	0091911 9/18/80 #15	0041701 4/16/80 Soil Blank Mo. Bottoms St.Charles,MO
P - ELEMENTAL, By GC/MS		ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1
P-INORGANIC, By ICP		4400	770	2400	1900	7400	7000	6500	6700	610
TOTAL PHOSPHATE ESTERS, By GC/MS		4	170	29	260	6.4	3.4	3.7	2.6	ND<10

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Monsanto

MIC ENVIRONMENTAL SCIENCES
(CO./DIV./DEPT./LOCATION)

SPECIAL STUDY REPORT
(TYPE OF REPORT)

REPORT NO.: ES-80-SS-27

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DATE: October 31, 1980

TITLE: MEASUREMENT OF SELECTED CHEMICALS IN SOIL FROM THE DEAD CREEK SITE - QUALITY ASSURANCE

AUTHORS: R. G. Kaley, II and O. Hicks

ABSTRACT: This report summarizes the quality assurance results obtained for various samples analyzed during the course of this project. The accuracy (recovery from spiked samples) and precision (relative standard deviation of replicate determinations) results are tabulated herein. Although it would be difficult to summarize the overall performance of the methods for all the analytes, in general, the methods performed at the recovery and precision levels established during method validation.

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REPT. NO.: ES-80-SS-27 AUTHORS: R. G. Kaley, II and O. Hicks
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MEASUREMENT OF SELECTED CHEMICALS IN SOIL FROM THE DEAD CREEK SITE - QUALITY ASSURANCE

INTRODUCTION

Following media reports and subsequent Illinois EPA concern about hazardous chemicals at the Dead Creek site near Sauget, Illinois, personnel from Monsanto's W. G. Krummrich Plant sampled several areas at the site. Samples were submitted to Environmental Sciences for analyses for polychlorinated biphenyls, elemental phosphorus, chlorinated benzenes, chlorinated phenols, phosphate esters, and metals. During the various determinations, replicates and spiked samples were analyzed to evaluate the performance of the method used for these particular samples.

SUMMARY

This report summarizes the quality assurance results obtained for various samples analyzed during the course of this project. The accuracy (recovery from spiked samples) and precision (relative standard deviation of replicate determinations) results are tabulated herein. Although it would be difficult to summarize the overall performance of the methods for all the analytes, in general, the methods performed at the recovery and precision levels established during method validation.

DETAILS

WGK 1111042

Analytical Methods

The soil samples were analyzed for the various chemicals using established procedures or methods developed and validated for the chemicals of interest in soil. The following list tabulates the methods which were used.

Analyte	Method No.	Title
Polychlorinated Biphenyls	ES-80-M-28	Determination of Polychlorinated Biphenyls in Soil and Sediment
Chlorinated Benzenes	ES-80-M-29	Determination of Chlorinated Benzenes in Soil and Sediment
Chlorinated Phenols	ES-80-M-30	Determination of Chlorinated Phenols in Soil and Sediment
Elemental Phosphorus (P_4)	ES-80-M-24	Determination of Elemental Phosphorus (P_4) in Soil and Sediment
Phosphate Esters	ES-80-M-5	Determination of Group I Compounds in Sediments . . .
Metals	Ref. 1, 2	Inductively Coupled Plasma (ICP) . . . Method for Trace Element Analysis of Water and Wastes
Arsenic	Ref. 3	Methods for Chemical Analysis of Water and Wastes - Arsenic

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WGK 1111042

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This report summarizes the quality assurance results obtained for various samples analyzed during the course of this project. The accuracy (recovery from spiked samples) and precision (relative standard deviation of replicate determinations) results are tabulated herein. Although it would be difficult to summarize the overall performance of the methods for all the analytes, in general, the methods performed at the recovery and precision levels established during method validation.

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WGK 1111042

Analytical Methods

The soil samples were analyzed for the various chemicals using established procedures or methods developed and validated for the chemicals of interest in soil. The following list tabulates the methods which were used.

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Polychlorinated Biphenyls	ES-80-M-28	Determination of Polychlorinated Biphenyls in Soil and Sediment
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Chlorinated Phenols	ES-80-M-30	Determination of Chlorinated Phenols in Soil and Sediment
Elemental Phosphorus (P_4)	ES-80-M-24	Determination of Elemental Phosphorus (P_4) in Soil and Sediment
Phosphate Esters	ES-80-M-5	Determination of Group I Compounds in Sediments . . .
Metals	Ref. 1, 2	Inductively Coupled Plasma (ICP) . . . Method for Trace Element Analysis of Water and Wastes
Arsenic	Ref. 3	Methods for Chemical Analysis of Water and Wastes - Arsenic

All determinations were carried out in strict accordance with these methods, except that the polychlorinated biphenyls, chlorinated benzenes and phosphate esters were measured in extracts from acidified samples to facilitate determination of chlorinated phenols in the same extracts.

Results

The results for the determinations of the compounds of interest have been reported in Special Studies ES-80-SS-24, 25, and 26, Measurement of Selected Chemicals in Soil from the Dead Creek Site . . . This Special Study is a compilation of the quality assurance results for all three Special Studies.

Quality Assurance

The recovery and precision results for the determinations are tabulated in Tables I-V. Each table contains the results for all quality assurance samples for a specific group of compounds. Recovery results are reported as percent recovery, calculated as

$$\% \text{ Recovery} = \frac{\text{Concentration (sample + spike)} - \text{average concentration (sample)}}{\text{Concentration (spike added)}} \times 100$$

Precision results are reported as percent relative standard deviation (RSD) for replicate determinations.

The tables present the recovery and precision results in concentration ranges (1-10 ppm to 10,000 - 100,000 ppm). The entries are averages of all values for all samples which had either recovery or precision evaluated in that range. All values are for actual samples except the metals recovery results, which are for spiked blank soil. In the recovery column, NE means Not Evaluated, i.e., no samples were spiked in that concentration range, and ND means Not Determinable, i.e., the spiking level was too low (usually <50%) compared to the level actually in the sample. In the precision columns, NE means Not Evaluated, i.e., no replicates were analyzed which contained the analyte in that concentration range.

More detailed compilations of the accuracy and precision results can be found in Reference 4.

REFERENCES

1. Methods for Chemical Analysis of Waters and Wastes, EPA-600/4-79-020, page: Metals - 6, Section 4.1.3.

2. Federal Register, Vol. 44, No. 233, December 3, 1979.

3. Methods for Chemical Analysis of Water and Wastes, EPA-600/4-79-020, Method 206 - Arsenic, pages: 206.2-1 to 206.5-2.

4. RGK NBP 1914831

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RECOVERY AND PRECISION

TABLE I. PCBs AND ELEMENTAL PHOSPHORUS (P_4) IN DEAD CREEK SOIL SAMPLES

ANALYTE / LEVEL	1-10 ppm		10-100 ppm		100-1,000 ppm		1,000-10,000 ppm		10,000-100,000 ppm	
	% Rec	% RSD	% Rec	%RSD	% Rec	%RSD	% Rec	%RSD	%Rec	% RSD
PCB's (Cl_2 to Cl_6 Homologs)	ND	NE	70%	17%	120%	18%	77%	58%	NE	0%
P_4	56%	NE	NE	NE	NE	NE	NE	NE	NE	NE

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RECOVERY AND PRECISION

TABLE II. CHLOROBENZENES IN DEAD CREEK SOIL SAMPLES

ANALYTE \ LEVEL	1-10 ppm % Rec	1-10 ppm % RSD	10-100 ppm % Rec	10-100 ppm % RSD	100-1,000 ppm % Rec	100-1,000 ppm % RSD
MONOCHLOROBENZENE	105%	NE	110%	NE	100%	NE
P-DICHLOROBENZENE	120%	21%	125%	64%	120%	NE
O-DICHLOROBENZENE	125%	16%	120%	NE	120%	8%
TRICHLOROBENZENES (3)	96%	14%	110%	13%	120%	NE
TETRACHLOROBENZENES (3)	110%	9%	120%	NE	130%	NE
PENTACHLOROBENZENE	140%	12%	120%	NE	140%	NE
HEXACHLOROBENZENE	135%	13%	90%	NE	110%	NE
NITROCHLOROBENZENES (O-,P-)	125%	37%	120%	NE	120%	26%

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RECOVERY AND PRECISION

TABLE III. CHLOROPHENOLS IN DEAD CREEK SOIL SAMPLES

ANALYTE \ LEVEL	1-10 ppm % Rec	1-10 ppm % RSD	10-100 ppm % Rec	10-100 ppm % RSD	100-1,000 ppm % Rec	100-1,000 ppm % RSD
O-CHLOROPHENOL	19%	34%	64%	NE	58%	NE
P-CHLOROPHENOL	36%	26%	16%	NE	30%	NE
2,4-DICHLOROPHENOL	66%	47%	59%	NE	50%	NE
PENTACHLOROPHENOL	140%	46%	40%	NE	36%	20%

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RECOVERY AND PRECISION

TABLE IV. PHOSPHATE ESTERS IN DEAD CREEK SOIL SAMPLES

ANALYTE \ LEVEL	1-10 ppm		10-100 ppm		100-1,000 ppm		1,000-10,000	
	% Rec	% RSD	% Rec	% RSD	% Rec	% RSD	% Rec	% RSD
DIBUTYLPHENYL PHOSPHATE	75%	NE	130%	NE	120%	12%	NE	NE
BUTYLDIPHENYL PHOSPHATE	120%	42%	115%	NE	NE	NE	NE	NE
TRIPHENYL PHOSPHATE	120%	89%	120%	NE	115%	NE	NE	6%
2-ETHYLHEXYLDIPHENYL PHOSPHATE	90%	47%	110%	NE	115%	NE	NE	NE
ISODECYLDIPHENYL PHOSPHATE	NE	NE	NE	NE	NE	NE	NE	NE
T-BUTYLPHENYLDIPHENYL PHOSPHATE	70%	NE	92%	100%	100%	NE	NE	NE
DI-T-BUTYLPHENYLPHENYL PHOSPHATE	88%	NE	96%	NE	NE	NE	NE	NE
NONYLPHENYLDIPHENYL PHOSPHATE	84%	8%	76%	NE	96%	NE	NE	NE
CUMYLPHENYLDIPHENYL PHOSPHATE	62%	21%	76%	NE	88%	NE	NE	NE

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WGK 1111047

RECOVERY AND PRECISION

TABLE V. METALS IN DEAD CREEK SOIL SAMPLES

ANALYTE \ LEVEL	1-10 ppm		1-100 ppm		100-1,000 ppm		1000-10,000 ppm		10,000-100,000 ppm	
	% Rec	% RSD	% Rec	% RSD	% Rec	% RSD	% Rec	% RSD	% Rec	% RSD
SILVER	NE	NE	NE	46%	NE	NE	NE	NE	NE	NE
ALUMINUM	ND	NE	ND	NE	ND	NE	NE	6.5%	NE	NE
BARIUM	ND	NE	ND	NE	89%	37%	NE	0%	NE	NE
BERYLLIUM	98%	NE	98%	NE	94%	NE	NE	NE	NE	NE
BORON	0%	NE	65%	19%	81%	3%	NE	NE	NE	NE
CALCIUM	ND	NE	ND	NE	ND	NE	NE	8.3%	NE	7.5%
CADMIUM	89%	5.2%	97%	21%	96%	NE	NE	NE	NE	NE
COBALT	51%	NE	115%	6.5%	97%	5.1%	NE	NE	NE	NE
CHROMIUM	27%	NE	109%	20%	91%	6.4%	NE	NE	NE	NE
COPPER	0%	NE	143%	66%	90%	NE	NE	NE	NE	11%
IRON	ND	NE	ND	NE	ND	NE	NE	NE	NE	8.1%
MAGNESIUM	ND	NE	ND	NE	ND	NE	NE	7.8%	NE	NE
MANGANESE	ND	NE	ND	13%	ND	10%	NE	NE	NE	NE
MOLYBDENUM	53%	NE	83%	11%	83%	NE	NE	NE	NE	NE
SODIUM	ND	NE	ND	NE	ND	11%	NE	NE	NE	NE
NICKEL	0%	NE	108%	14%	91%	13%	NE	4.5%	NE	NE
LEAD	0%	NE	165%	21%	93%	NE	NE	6.5%	NE	NE
PHOSPHORUS	ND	NE	ND	NE	ND	10%	NE	17%	NE	7.9%
ANTIMONY	0%	NE	27%	2.9%	27%	13%	NE	NE	NE	NE
SILICON	ND	NE	ND	NE	0%	49%	NE	NE	NE	NE
TIN	88%	NE	85%	5.6%	96%	5.4%	NE	NE	NE	NE
STRONTIUM	81%	NE	105%	3.3%	94%	6.5%	NE	NE	NE	NE
TITANIUM	ND	NE	99%	30%	30%	1.3%	NE	NE	NE	NE
VANADIUM	ND	NE	ND	13%	120%	11%	NE	NE	NE	NE
ZINC	ND	NE	139%	34%	87%	NE	NE	8.9%	NE	16%
ARSENIC (By AA)	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE

MGK 1111048

Submitted by:

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Prepared by:

Robert G. Kaley, II
Research Group Leader

Approved by:

James P. Mieure
Manager, Environmental Sciences

WGK 1111049

Post-it® brand fax transmittal memo ... pages

To Tom Benz	From Jim Buckley
Co. Cwm	Co. Cwm-Emelle
Dept. Enrac	Phone # 205-652-9721
Fax # 314-487-8733	Fax # 205-652-8102

TO: Tom Benz

FROM: Jim Buckley - Emelle Technical Mgr

DATE: June 5, 1990

RE: Monsanto Proposal
Dead Creek - Sector B

47

Based on a review of the background data and analytical data submitted, I offer the following observations:

1. PCB contamination is evident throughout the creek bed as found in 3 separate sampling events.

2. Heavy metal concentrations in many cases exceed EP Tox or TC "calculated" thresholds.

3. Other halogenated organic compounds present in soil besides PCB's include:

Dichlorobenzenes	(X125, P1, SD1)			
Dichlorophenols	(X125, SD1)			
Trichlorobenze	(X125, P1, SD1, SD2)			
Methylene Chloride				(S07, S010, R012)
Pentachlorophenol		(SD1, SD3)		
Tetrachlorbenzenes		(SD1)		
2, Chlorophenol		(SD1)		
Hexachlorobenzene			(SD2)	
2,3,7,8 Tetrachloro-dibenzo-p-dioxin				

4. For purposes of classification, no knowledge of process is imparted or implied, therefore a specific source (K waste) or non-specific source waste (F waste) is not determinable and no discussion of spills of listed wastes (U, P) is read in the assessment.

   More knowledge of the processes entering the creek should be explored before determining that the soils, when excavated, would be non-listed.

MCO 0706800

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5. As indicated earlier, the high metal concentration would lead one to think the soils would be possibly classed as RCRA Hazardous - EP Toxic (See 40 CFR 261.24 for possible As, Ba, Cd, Cr, Pb, Hg and Ag).

   This is based on the calculation of total concentration divided by a factor of 20. This approach has been accepted by IEPA in determining applicability of characteristic listing (D004-D017).

   However, based on ground water analysis it does not appear the metals are in a leachable form. This is evident based on the relatively low concentrations found in water.

6. Some of the sample locations indicate high concentration of PCB's (HOC's) and heavy metals which could potentially classify the soil as a California List Waste requiring incineration. The combination of hazardous waste (characteristic for metals) and HOC's > 1000 ppm would qualify as an incinerable - specifically PCB incineration (See 40 CFR 268.32 d.1 and 40 CFR 268.42 a.2).

Recommendations

1. Further classification via analysis and further background information is required for me to determine suitability for landfill disposal.

   a. Run toxicity characteristic "TC" metals and run"TC" organics also. (The organics portion will be applicable 9/25/90 and if organic exceeds threshold value, then waste may be hazardous by characteristic.) See attachment.

   b. Further investigate background of Dead Creek in order to classify under National Contingency Plan criteria.

2. The sampling for dioxins must be evaluated as to applicability to Corporate acceptance criteria of 1 ppb, 2, 3, 7, 8 TCDD. The fact that TCDD is present above detection limits raises my concerns. I must be assured, through sampling and analysis, that Corporate policies are not compromised.

3. If soils are considered non-regulated then they may be disposed of at Emelle as PCB waste. A comprehensive sampling and analysis plan should be developed in order to adequately classify waste soils upon removal.

MCO 0706801

4. If determined to be EP toxic for metals and total HOC's do not exceed or equal 1000 ppm, Emelle may offer stabilization then landfill or the stabilization of metals may take place in-situ or via on-site process prior to shipment.

5. As you can see the LDR, BDAT, Drop Dead Dates questions all hinge on waste classification issues. Segregation may definitely be a possibility similar to a job happening in the eastern region where some material is suitable for landfill and other materials must go to incineration from the same job.

6. Pending restrictions are (1) TC rule for characteristic determination effective 9/25/90. (2) August 8, 1990 variance expiration for characteristic metal wastes treatment standards. (3) Out-of-state disposal tax effective 7/15/90. (4) Possible classification as a smelting waste (Cerro Copper) i.e. K064.

only an opinion

~~7. Overall assessment of Dead Creek in perspective appears to be an on-site remediation project involving on-site technologies such as XTRAX or PYROX.~~

I appreciate the opportunity to review the project and look forward to assisting you and Monsanto in any way I can.

/llb

Attachment

MCO 0706802

Table IV.3--Toxicity Characteristic Constituents and Regulatory Levels

EPA HW Number[1]	Constituent	CAS Number[2]	Regulatory Level (mg/L)
D004	Arsenic	7440-38-2	5.0
D005	Barium	7440-39-3	100.0
D018	Benzene	71-43-2	0.5
D006	Cadmium	7440-43-9	1.0
D019	Carbon tetrachloride	56-23-5	0.5
D020	Chlordane	57-74-9	0.03
D021	Chlorobenzene	108-90-7	100.0
D022	Chloroform	67-66-3	6.0
D007	Chromium	7440-47-3	5.0
D023	o-Cresol	95-48-7	200.0[4]
D024	m-Cresol	108-39-4	200.0[4]
D025	p-Cresol	106-44-5	200.0[4]
D026	Cresol		200.0[4]
D016	2,4-D	94-75-7	10.0
D027	1,4-Dichlorobenzene	106-46-7	7.5
D028	1,2-Dichloroethane	107-06-2	0.5
D029	1,1-Dichloroethylene	75-35-4	0.7
D030	2,4-Dinitrotoluene	121-14-2	0.13[3]
D012	Endrin	72-20-8	0.02
D031	Heptachlor (and its hydroxide)	76-44-8	0.008
D032	Hexachlorobenzene	118-74-1	0.13[3]
D033	Hexachloro-1,3-butadiene	87-68-3	0.5
D034	Hexachloroethane	67-72-1	3.0
D008	Lead	7439-92-1	5.0
D013	Lindane	58-89-9	0.4
D009	Mercury	7439-97-6	0.2
D014	Methoxychlor	72-43-5	10.0
D035	Methyl ethyl ketone	78-93-3	200.0
D036	Nitrobenzene	98-95-3	2.0
D037	Pentachlorophenol	87-86-5	100.0
D038	Pyridine	110-86-1	5.0[3]
D010	Selenium	7782-49-2	1.0
D011	Silver	7440-22-4	5.0
D039	Tetrachloroethylene	127-18-4	0.7
D015	Toxaphene	8001-35-2	0.5
D040	Trichloroethylene	79-01-6	0.5
D041	2,4,5-Trichlorophenol	95-95-4	400.0

MCO 0706803

Table IV.3--Toxicity Characteristic Constituents and Regulatory Levels (continued)

EPA HW Number[1]	Constituent	CAS Number[2]	Regulatory Level (mg/L)
D042	2,4,6-Trichlorophenol	88-06-2	2.0
D017	2,4,5-TP (Silvex)	93-72-1	1.0
D043	Vinyl chloride	75-01-4	0.2

[1] Hazardous waste number.
[2] Chemical abstracts service number.
[3] Quantitation limit is greater than the calculated regulatory level. The quantitation limit therefore becomes the regulatory level.
[4] If o,m-,and p-Cresol concentrations cannot be differentiated, the total cresol (D026) concentration is used. The regulatory level for total cresol is 200 mg/l.

MCO 0706804

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SPECIAL STUDY REPORT
(TYPE OF REPORT)

47

REPORT NO.: ES-80-SS-24

JOB/PROJECT NO.: 43-000-760.26-8623045
Transfer to 02-003-913.41-610

DATE: October 28, 1980

TITLE: MEASUREMENT OF SELECTED CHEMICALS IN SOIL FROM THE DEAD CREEK SITE - ILLINOIS EPA SPLIT SAMPLES

AUTHORS: Robert G. Kaley, II

CONTRIBUTORS: D. Guerry
O. Hicks
R. G. Hord

ABSTRACT: Three sediment samples and one well water sample were taken on October 2, 1980 by Monsanto and IEPA representatives. The Monsanto samples were transferred to our laboratory and analyzed for polychlorinated biphenyls, elemental phosphorus, chlorobenzenes, chlorophenols, phosphate esters, and metals (including arsenic and inorganic phosphorus). No elemental phosphorus was detected in any of the samples, which implies that phosphorus is not responsible for the "smoking earth" reported at the site. In addition, no organic chemicals were detected above the detection limits in the well water sample. However, varying amounts of the organic chemicals and metals were measured in the soil samples. One sample contained higher levels of polychlorinated biphenyls and other organic compounds, while the other two samples contained higher levels of metals. The results clearly indicate non-uniform contamination at the Dead Creek site.

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WGK 1111083

REPT. NO.: ES-80-SS-24 AUTHORS: R. G. Kaley, II
TITLE: MEASUREMENT OF SELECTED CHEMICALS IN SOIL FROM THE DEAD CREEK SITE - ILLINOIS EPA SPLIT SAMPLES
COPY NO.:

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MEASUREMENT OF SELECTED CHEMICALS IN SOIL FROM THE DEAD CREEK SITE ILLINOIS EPA SPLIT SAMPLES

INTRODUCTION

Following media reports and subsequent Illinois EPA concern about hazardous chemicals at the Dead Creek site near Sauget, Illinois, personnel from Monsanto's W. G. Krummrich Plant and the Illinois EPA sampled several areas at the site and split the samples. The Monsanto samples were submittted to Environmental Sciences for characterization. Monsanto's concerns about the site arose from reports of high levels of polychlorinated biphenyls and phosphorus, as well as the reported presence of other chemicals, and the proximity of the site to the Krummrich Plant. These samples were taken to give both Monsanto and the Illinois EPA opportunity to confirm the reported levels found in earlier samplings by the Illinois EPA. In addition to polychlorinated biphenyls and phosphorus, several other "families" of chemicals were measured to try to identify or eliminate possible sources of the chemicals at the site.

SUMMARY

Three sediment samples and one well water sample were taken on October 2, 1980 by Monsanto and IEPA representatives. The Monsanto samples were transferred to our laboratory and analyzed for polychlorinated biphenyls, elemental phosphorus, chlorobenzenes, chlorophenols, phosphate esters, and metals (including arsenic and inorganic phosphorus). No elemental phosphorus was detected in any of the samples, which implies that phosphorus is not responsible for the "smoking earth" reported at the site. In addition, no organic chemicals were detected above the detection limits in the well water sample. However, varying amounts of the organic chemicals and metals were measured in the soil samples. One sample contained higher levels of polychlorinated biphenyls and other organic compounds, while the other two samples contained higher levels of metals. The results clearly indicate non-uniform contamination at the Dead Creek site.

DETAILS

Sampling

The three soil and one water samples were collected by Monsanto W. G. Krummrich plant personnel and IEPA personnel and split at the site. The Monsanto samples were transferred to the Environmental Analysis Group. In our laboratory, the sediment samples were handled according to Standard Operating Procedure (SOP) EAN-80-SOP-6, Homogenizing, Subdividing and Preserving Sediment Samples. Portions of the soil samples were transferred to Applied Sciences for the determination of metals and arsenic.

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Analytical Procedures

The three soil samples were analyzed for a variety of chemicals using established procedures or methods developed and validated for the chemicals of interest in soil. The following list tabulates the methods which were used.

Analyte	Method No.	Title
Polychlorinated Biphenyls	ES-80-M-28	Determination of Polychlorinated Biphenyls in Soil and Sediment
Chlorinated Benzenes	ES-80-M-29	Determination of Chlorinated Benzenes in Soil and Sediment
Chlorinated Phenols	ES-80-M-30	Determination of Chlorinated Phenols in Soil and Sediment
Elemental Phosphorus (P_4)	ES-80-M-24	Determination of Elemental Phosphorus (P_4) in Soil and Sediment
Phosphate Esters	ES-80-M-5	Determination of Group I Compounds in Sediments . . .
Metals	Ref. 1, 2	Inductively Coupled Plasma (ICP) . . . Method for Trace Element Analysis of Water and Wastes
Arsenic	Ref. 3	Methods for Chemical Analysis of Water and Wastes-Arsenic

All determinations were carried out in strict accordance with these methods, except that the polychlorinated biphenyls, chlorinated benzenes and phosphate esters were measured in extracts from acidified samples to facilitate determination of chlorinated phenols in the same extracts.

The water sample was extracted in accordance with SOP EAN-80-SOP-19, Extraction of Semivolatile Organic Compounds from Water. The levels of polychlorinated biphenyls and phosphorus were determined using the analytical conditions specified in the respective method for soils listed above.

Results

The analytical results for this study are tabulated in Tables I-VI. Each table contains the results for all of the samples for a specific group of compounds. All results for the soils are in ppm (parts per million or µg/g). The results for the water sample are in ppb (parts per billion, ng/g). In general, the stated detection limits are the lowest level at which a given measurement was validated. Levels which are apparently real, but which are below the validated detection limit are presented in parentheses.

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Quality Assurance

The quality assurance results (i.e., recovery and precision evaluations) for these samples have been compiled along with those of similar samples analyzed concurrently. These results are reported in Special Study ES-80-SS-27, Measurement of Selected Chemicals in Soil from the Dead Creek Site - Quality Assurance.

REFERENCES

1. Methods for Chemical Analysis of Waters and Wastes, EPA-600/4-79-020, page: Metals-6, Section 4.1.3.

2. Federal Register, Vol. 44, No. 233, December 3, 1979.

3. Methods for Chemical Analysis of Waters and Wastes, EPA-600/4-79-020, Method 206-Arsenic, pages: 206.2-1 to 206.5-2.

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TABLE I. PPM LEVELS OF PCBs AND ELEMENTAL PHOSPHORUS (P_4) IN DEAD CREEK SOIL AND WATER SAMPLES

ANALYTE \ ES LOG NO. / DATE SAMPLED / LOCATION	0100301 10/2/80 40 yds south of Queeny Ave. Center of Creek	0100303 10/2/80 268 paces south of 0100301	0100305 10/2/80 270 paces south of 0100303	(Water) 0100307 10/2/80 Well at Theresa's Greenhouse, 101 Walnut, Sauget, IL.	0041701 4/16/80 Soil Blank Mo. Bottoms St.Charles, MO.
PCB's (Cl_2 to Cl_6 Homologs)	13,000	240	45	ND < 1 ppb	ND < 1
IEPA (public release)	10,000	350	73		
IEPA (first release at press conference)	17,000	120	59		
P_4	ND < 1	ND < 1	ND < 1	ND < 1 ppb	ND < 1
IEPA (public release)	~~120,000~~	~~32,000~~	~~2000~~		
	5000	160,000	93,000		
	10,000	350	73	<1 ppb	
	2000	8900	4700	<1 ppb	

Total Phos
Chlorine

WGK 1111087

TABLE II. PPM LEVELS OF CHLOROBENZENES IN DEAD CREEK SOIL SAMPLES

ANALYTE \ ES LOG NO. / DATE SAMPLED / LOCATION	0100301 10/2/80 40 yds south of Queeny Ave. Center of Creek	0100303 10/2/80 268 paces south of 0100301	0100305 10/2/80 270 paces south of 0100303	0041701 4/16/80 Soil Blank Mo. Bottoms St. Charles, MO.
MONOCHLOROBENZENE	(0.9)	ND < 1	(0.3)	ND < 1
P-DICHLOROBENZENE	370	(0.3)	(0.4)	ND < 1
O-DICHLOROBENZENE	80	(0.6)	1.0	ND < 1
TRICHLOROBENZENES (3)	85	1.6	(0.7)	ND < 1
TETRACHLOROBENZENES (3)	6.1	2.4	(0.4)	ND < 1
PENTACHLOROBENZENE	ND < 1	ND < 1	ND < 1	ND < 1
HEXACHLOROBENZENE	ND < 1	1.2	ND < 1	ND < 1
NITROCHLOROBENZENES (O-, P-)	120	ND < 1	ND < 1	ND < 1

( ) Values in parentheses are below the validated detection limit. However, they represent levels detected with a S/N >2.5 and can be considered semi-quantitative.

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TABLE III. PPM LEVELS OF CHLOROPHENOLS IN DEAD CREEK SOIL SAMPLES

ANALYTE \ ES LOG NO. / DATE SAMPLED / LOCATION	0100301 10/2/80 40 yds south of Queeny Ave. Center of Creek	0100303 10/2/80 268 paces south of 0100301	0100305 10/2/80 270 paces south of 0100303	0041701 4/16/80 Soil Blank Mo. Bottoms St.Charles,MO.
O-CHLOROPHENOL	3.7	ND < 1	ND < 1	ND < 1
P-CHLOROPHENOL	6.6	ND < 1	(0.9)	ND < 1
2,4-DICHLOROPHENOL	1.2	ND < 1	ND < 1	ND < 1
PENTACHLOROPHENOL	130	ND < 1	1.8	ND < 1

( ) Values in parentheses are below the validated detection limit. However, they represent levels detected with a S/N >2.5 and can be considered semi-quantitative.

WGK 1111089

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TABLE IV. PPM LEVELS OF PHOSPHATE ESTERS IN DEAD CREEK SOIL SAMPLES

ANALYTE \ ES LOG NO. / DATE SAMPLED / LOCATION	0100301 10/2/80 40 yds south of Queeny Ave. Center of Creek	0100303 10/2/80 268 paces south of 0100301	0100305 10/2/80 270 paces south of 0100303	0041701 4/16/80 Soil Blank Mo. Bottoms St. Charles, MO.
DIBUTYLPHENYL PHOSPHATE	330	ND < 1	(0.8)	ND < 1
BUTYLDIPHENYL PHOSPHATE	ND < 1	ND < 1	(0.8)	ND < 1
TRIPHENYL PHOSPHATE	2600	ND < 1	ND < 1	ND < 1
2-ETHYLHEXYLDIPHENYL PHOSPHATE	ND < 1	ND < 1	2.2	ND < 1
ISODECYLDIPHENYL PHOSPHATE	ND < 1	ND < 1	ND < 1	ND < 1
T-BUTYLPHENYLDIPHENYL PHOSPHATE	28	ND < 1	ND < 1	ND < 1
DI-T-BUTYLPHENYLDIPHENYL PHOSPHATE	ND < 1	ND < 1	ND < 1	ND < 1
NONYLPHENYLDIPHENYL PHOSPHATE	ND < 1	ND < 1	ND < 1	ND < 1
CUMYLPHENYLDIPHENYL PHOSPHATE	3.7	ND < 1	ND < 1	ND < 1

( ) Values in parentheses are below the validated detection limit. However, they represent levels detected with a S/N >2.5 and can be considered semi-quantitative.

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TABLE V. PPM LEVELS OF METALS IN DEAD CREEK SOIL SAMPLES

ANALYTE \ ES LOG NO. / DATE SAMPLED / LOCATION	0100301 10/2/80 40 yds south of Queeny Ave. Center of Creek	0100303 10/2/80 268 paces south of 0100301	0100305 10/2/80 270 paces south of 0100303	0041701 4/16/80 Soil Blank Mo. Bottoms St.Charles,MO.
SILVER	ND <1	42	29	ND <1
ALUMINUM	1400	5100	5300	5600
BARIUM	770	1200	1300	130
BERYLLIUM	ND <1	ND <1	ND <1	ND <1
BORON	28	160	100	27
CALCIUM	8500	9200	6200	4600
CADMIUM	5.1	60	55	3.9
COBALT	15	180	120	33
CHROMIUM	25	110	240	19
COPPER	460	28,000	18,000	19
IRON	4700	53,000	30,000	9900
MAGNESIUM	460	2200	2000	2300
MANGANESE	29	170	110	510
MOLYBDENUM	6.1	92	68	11
SODIUM	400	540	410	320
NICKEL	110	2000	1700	39
LEAD	180	2000	1600	50
PHOSPHORUS	2500	13,000	9400	610
ANTIMONY	13	240	160	29
SILICON	73	150	89	110
TIN	18	260	220	18
STRONTIUM	35	230	110	17
TITANIUM	32	110	80	37
VANADIUM	34	140	130	130
ZINC	280	32,000	18,000	56

MGK 1111091

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TABLE VI. SUMMARY OF PHOSPHORUS CONTENT (PPM) OF DEAD CREEK SOIL SAMPLES

ANALYTE \ ES LOG NO. / DATE SAMPLED / LOCATION	0100301 10/2/80 40 yds south of Queeny Ave. Center of Creek	0100303 10/2/80 268 paces south of 0100301	0100305 10/2/80 270 paces south of 0100305	0041701 4/16/80 Soil Blank Mo. Bottoms St. Charles, MO.
P - ELEMENTAL, By GC/MS	ND < 1	ND < 1	ND < 1	ND < 1
P-INORGANIC, By ICP	2500	13,000	9400	610
TOTAL PHOSPHATE ESTERS, By GC/MS	3000	ND < 10	4	ND < 10
Phosphorus (released)	15,000	160,000	93,000	
Phosphorus (just testing) by EPA	2,000	120,000	32,100	

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TITLE: MEASUREMENT OF SELECTED CHEMICALS IN SOIL FROM THE DEAD CREEK SITE - CERRO COPPER COMPANY

AUTHORS: Robert G. Kaley, II

CONTRIBUTORS: D. Guerry, O. Hicks and R. G. Hord

ABSTRACT: Four sediment samples were taken on September 22, 1980 by Monsanto representatives. The samples were transferred to our laboratory and analyzed for polychlorinated biphenyls, elemental phosphorus, chlorobenzenes, chlorophenols, phosphate esters, and metals (including arsenic and inorganic phosphorus). Varying amounts of the organic chemicals and metals were measured in the soil samples. Some metals, e.g., copper, iron, lead and zinc were present at levels well above those in the Missouri Bottoms soil used as a control.

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REPT. NO.: ES-80-SS-25 AUTHORS: Robert G. Kaley, II
TITLE: MEASUREMENT OF SELECTED CHEMICALS IN SOIL FROM THE DEAD CREEK SITE - CERRO COPPER COMPANY
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MEASUREMENT OF SELECTED CHEMICALS IN SOIL FROM THE DEAD CREEK SITE-CERRO COPPER COMPANY

INTRODUCTION

Following media reports and subsequent Illinois EPA concern about hazardous chemicals at the Dead Creek site near Sauget, Illinois, personnel from Monsanto's W. G. Krummrich Plant sampled several areas on the property of Cerro Copper Company, north of the site. The samples were submitted to Environmental Sciences for characterization. Monsanto's concerns about the site arose from reports of high levels of polychlorinated biphenyls and phosphorus, as well as the reported presence of other chemicals, and the proximity of the site to the Krummrich Plant. In addition to polychlorinated biphenyls and phosphorus, several other "families" of chemicals were measured to try to identify or eliminate possible sources of the chemicals at the site. These samples were taken to determine if the source of metals in the site could be related to Cerro Copper Company operations.

SUMMARY

Four sediment samples were taken on September 22, 1980 by Monsanto representatives. The samples were transferred to our laboratory and analyzed for polychlorinated biphenyls, elemental phosphorus, chlorobenzenes, chlorophenols, phosphate esters, and metals (including arsenic and inorganic phosphorus). Varying amounts of the organic chemicals and metals were measured in the soil samples. Some metals, e.g., copper, lead and zinc were present at levels well above those in the Missouri Bottoms soil used as a control.

DETAILS

Sampling

The four soil samples were collected by Monsanto W. G. Krummrich plant personnel. The samples were transferred to the Environmental Analysis Group. In our laboratory, the sediment samples were handled according to Standard Operating Procedure (SOP) EAN-80-SOP-6, Homogenizing, Subdividing and Preserving Sediment Samples. Portions of the soil samples were transferred to Applied Sciences for the determination of metals and arsenic.

Analytical Procedures

The four soil samples were analyzed for a variety of chemicals using established procedures or methods developed and validated for the chemicals of interest in soil. The following list tabulates the methods which were used.

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Analyte	Method No.	Title
Polychlorinated Biphenyls	ES-80-M-28	Determination of Polychlorinated Biphenyls in Soil and Sediment
Chlorinated Benzenes	ES-80-M-29	Determination of Chlorinated Benzenes in Soil and Sediment
Chlorinated Phenols	ES-80-M-30	Determination of Chlorinated Phenols in Soil and Sediment
Elemental Phosphorus	ES-80-M-24	Determination of Elemental Phosphorus (P_4) in Soil and Sediment
Phosphate Esters	ES-80-M-5	Determination of Group I Compounds in Sediments
Metals	Ref. 1, 2	Inductively Coupled Plasma (ICP) ... Method for Trace Element Analysis of Water and Wastes
Arsenic	Ref. 3	Methods for Chemical Analysis of Water and Wastes - Arsenic

All determinations were carried out in strict accordance with these methods, except that the polychlorinated biphenyls, chlorinated benzenes and phosphate esters were measured in extracts from acidified samples to facilitate determination of chlorinated phenols in the same extracts.

Results

The analytical results for this study are tabulated in Tables I-VI. Each table contains the results for all of the samples for a specific group of compounds. All results for the soils are in ppm (parts per million or µg/g). In general, the stated detection limits are the lowest level at which a given measurement was validated. Levels which are apparently real, but which are below the validated detection limit are presented in parentheses.

Quality Assurance

The quality assurance results (i.e., recovery and precision evaluations) for these samples have been compiled along with those of similar samples analyzed concurrently. These results are reported in Special Study ES-80-SS-27, Measurement of Selected Chemicals in Soil from the Dead Creek Site - Quality Assurance.

REFERENCES

1. Methods for Chemical Analysis of Waters and Wastes, EPA-600/4-79-020, page: Metals - 6, Section 4.1.3.

2. Federal Resigter, Vol. 44, No. 233, December 3, 1979.

3. Methods for Chemical Analysis of Waters and Wastes, EPA-600/4-79-020, Method 206 - Arsenic, pages: 206.2-1 to 206.5-2.

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TABLE I. PPM LEVELS OF PCBs AND ELEMENTAL PHOSPHORUS (P_4) IN DEAD CREEK SOIL SAMPLES

ANALYTE \ ES LOG NO. / DATE SAMPLED / LOCATION	0092412 9/22/80 1N - Cerro Copper Co.	0092413 9/22/80 2N - Cerro Copper Co.	0092414 9/22/80 3S - Cerro Copper Co.	0092415 9/22/80 4S - Cerro Copper Co.	0041701 4/16/80 Soil Blank Mo.Bottoms St.Charles,MO.
PCB's (Cl_2 to Cl_6 Homologs)	530	4.1	410	150	ND<1
P_4	ND<1	ND<1	ND<1	ND<1	ND<1

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TABLE II. PPM LEVELS OF CHLOROBENZENES IN DEAD CREEK SOIL SAMPLES

ANALYTE \ ES LOG NO. / DATE SAMPLED / LOCATION	0092412 9/22/80 1N - Cerro Copper Co.	0092413 9/22/80 2N - Cerro Copper Co.	0092414 9/22/80 3S - Cerro Copper Co.	0092415 9/22/80 4S - Cerro Copper Co.	0041701 4/16/80 Soil Blank Mo. Bottoms St.Charles,MO.
MONOCHLOROBENZENE	4.0	ND<1	1.6	(0.1)	ND<1
P-DICHLOROBENZENE	160	(0.3)	23	1.7	ND<1
O-DICHLOROBENZENE	210	(0.2)	11	(0.4)	ND<1
TRICHLOROBENZENES (3)	14	2.5	47	29	ND<1
TETRACHLOROBENZENES (3)	10	4.9	25	6.7	ND<1
PENTACHLOROBENZENE	2.4	1.1	10	1.0	ND<1
HEXACHLOROBENZENE	3.5	ND<1	ND<3	(0.3)	ND<1
NITROCHLOROBENZENES (O-, P-)	ND<1	ND<1	ND<50	ND<1	ND<1

( ) Values in parentheses are below the validated detection limit. However, they represent levels detected with a S/N >2.5 and can be considered semi-quantitative.

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TABLE III. PPM LEVELS OF CHLOROPHENOLS IN DEAD CREEK SOIL SAMPLES

ANALYTE	ES LOG NO. DATE SAMPLED LOCATION	0092412 9/22/80 1N - Cerro Copper Co.	0092413 9/22/80 2N - Cerro Copper Co.	0092414 9/22/80 3S - Cerro Copper Co.	0092415 9/22/80 4S - Cerro Copper Co.	0041701 4/16/80 Soil Blank Mo. Bottoms St.Charles,MO.
O-CHLOROPHENOL		1.0	ND<1	ND<1	ND<2	ND<1
P-CHLOROPHENOL		ND<1	ND<1	2.4	1.8	ND<1
2,4-DICHLOROPHENOL		2.1	ND<1	ND<1	ND<2	ND<1
PENTACHLOROPHENOL		7.6	ND<1	ND<5	5.0	ND<1

( ) Values in parentheses are below the validated detection limit. However, they represent levels detected with a S/N >2.5 and can be considered semi-quantitative.

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TABLE IV. PPM LEVELS OF PHOSPHATE ESTERS IN DEAD CREEK SOIL SAMPLES

ANALYTE \ ES LOG NO. / DATE SAMPLED / LOCATION	0092412 9/22/80 1N - Cerro Copper Co.	0092413 9/22/80 2N - Cerro Copper Co.	0092414 9/22/80 3S - Cerro Copper Co.	0092415 9/22/80 4S - Cerro Copper Co.	0041701 4/16/80 Soil Blank Mo. Bottoms St.Charles,MO.
DIBUTYLPHENYL PHOSPHATE	1.9	ND<1	ND<1	ND<1	ND<1
BUTYLDIPHENYL PHOSPHATE	3.2	ND<1	3.4	1.6	ND<1
TRIPHENYL PHOSPHATE	40	ND<1	ND<1	1.7	ND<1
2-ETHYLHEXYLDIPHENYL PHOSPHATE	10	ND<1	1100	8.1	ND<1
ISODECYLDIPHENYL PHOSPHATE	ND<1	ND<1	ND<1	ND<1	ND<1
T-BUTYLPHENYLDIPHENYL PHOSPHATE	550	1.1	ND<1	ND<1	ND<1
DI-T-BUTYLPHENYLPHENYL PHOSPHATE	280	1.3	1.0	ND<1	ND<1
NONYLPHENYLDIPHENYL PHOSPHATE	980	12	4.3	3.1	ND<1
CUMYLPHENYLDIPHENYL PHOSPHATE	440	3.8	5.6	4.7	ND<1

( ) Values in parentheses are below the validated detection limit. However, they represent levels detected with a S/N >2.5 and can be considered semi-quantitative.

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TABLE V. PPM LEVELS OF METALS IN DEAD CREEK SOIL SAMPLES

ANALYTE	ES LOG NO. / DATE SAMPLED / LOCATION	0092412 / 9/22/80 / 1N - Cerro Copper Co.	0092413 / 9/22/80 / 2N - Cerro Copper Co.	0092414 / 9/22/80 / 3S - Cerro Copper Co.	0092415 / 9/22/80 / 4S - Cerro Copper Co.	0041701 / 4/16/80 / Soil Blank Mo. Bottoms St.Charles, MO.
SILVER		8.0	17	44	46	ND<1
ALUMINUM		1900	1800	4600	2600	5600
BARIUM		1500	210	1700	1900	120
BERYLLIUM		1.8	11	ND<1	ND<1	ND<1
BORON		92	460	180	100	27
CALCIUM		9600	1600	28,000	6500	4600
CADMIUM		34	180	56	37	3.9
COBALT		99	530	300	120	33
CHROMIUM		128	180	580	360	19
COPPER		15,000	17,000	29,000	21,000	19
IRON		35,000	24,000	70,000	48,000	9900
MAGNESIUM		1300	340	3600	1500	2300
MANGANESE		100	71	280	120	510
MOLYBDENUM		38	96	74	43	11
SODIUM		320	293	430	330	320
NICKEL		310	2000	2400	890	39
LEAD		1600	4600	2200	2000	60
PHOSPHORUS		6600	5900	12,000	6500	610
ANTIMONY		60	190	130	78	29
SILICON		110	220	110	72	110
TIN		270	990	350	260	18
STRONTIUM		56	15	100	57	17
TITANIUM		59	19	36	41	37
VANADIUM		59	49	140	76	130
ZINC		2100	6400	8800	5300	56
ARSENIC (By AA)		80	80	200	140	5

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TABLE VI. SUMMARY OF PHOSPHORUS CONTENT (PPM) OF DEAD CREEK SOIL SAMPLES

ANALYTE \ ES LOG NO. / DATE SAMPLED / LOCATION	0092412 9/22/80 1N - Cerro Copper Co.	0092413 9/22/80 2N - Cerro Copper Co.	0092414 9/22/80 3S - Cerro Copper Co.	0092415 9/22/80 4S - Cerro Copper Co.	0041701 4/16/80 Soil Blank Mo. Bottoms St.Charles,MO.
P - ELEMENTAL, By GC/MS	ND<1	ND<1	ND<1	ND<1	ND<1
P-INORGANIC, By ICP	6600	5900	12,000	6500	610
TOTAL PHOSPHATE ESTERS By GC/MS	2300	18	1100	19	ND<10

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SPECIAL STUDY REPORT
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REPORT NO.: ES-80-SS-26

JOB/PROJECT NO.: 43-000-760.26-8623045
Transfer to 02-003-913.41-610

DATE: October 28, 1980

TITLE: MEASUREMENT OF SELECTED CHEMICALS IN SOIL FROM THE DEAD CREEK SITE - W. G. KRUMMRICH PLANT SAMPLINGS

AUTHORS: Robert G. Kaley, II

CONTRIBUTORS: D. Guerry, O. Hicks and R. G. Hord

ABSTRACT: Eight sediment samples were taken on August 29 (1), September 15 (2), and September 18 (5), 1980 by Monsanto W. G. Krummrich plant representatives. The samples were transferred to our laboratory for analysis. The samples were analyzed for polychlorinated biphenyls, elemental phosphorus, chlorobenzenes, chlorophenols, phosphate esters, and metals (including arsenic and inorganic phosphorus). No elemental phosphorus was detected in any of the samples, which implies that phosphorus is not responsible for the "smoking earth" reported at the site. Varying amounts of the organic chemicals and metals were measured in the soil samples. The results clearly indicate non-uniform contamination at the Dead Creek site.

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REPT. NO.: ES-80-SS-26 AUTHORS: R. G. Kaley, II
TITLE: MEASUREMENT OF SELECTED CHEMICALS IN SOIL FROM THE DEAD CREEK SITE - W. G. KRUMMRICH PLANT SAMPLINGS
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MEASUREMENT OF SELECTED CHEMICALS IN SOIL FROM THE DEAD CREEK SITE
W. G. KRUMMRICH PLANT SAMPLINGS

INTRODUCTION

Following media reports and subsequent Illinois EPA concern about the hazardous chemicals at the Dead Creek site near Sauget, Illinois, personnel from Monsanto's W. G. Krummrich Plant sampled several areas at the site. Samples were submitted to Environmental Sciences for characterization. Monsanto's concerns about the site arose from reports of high levels of polychlorinated biphenyls and phosphorus, as well as the reported presence of other chemicals, and the proximity of the site to the Krummrich Plant. These samples were taken to give Monsanto opportunity to confirm the reported levels found in earlier samplings by the Illinois EPA. In addition to polychlorinated biphenyls and phosphorus, several other "families" of chemicals were measured to try to identify or eliminate possible sources of the chemicals at the site.

SUMMARY

Eight sediment samples were taken on August 29 (1), September 15 (2), and September 18 (5), 1980 by Monsanto W. G. Krummrich plant representatives. The samples were transferred to our laboratory for analysis. The samples were analyzed for polychlorinated biphenyls, elemental phosphorus, chlorobenzenes, chlorophenols, phosphate esters, and metals (including arsenic and inorganic phosphorus). No elemental phosphorus was detected in any of the samples, which implies that phosphorus is not responsible for the "smoking earth" reported at the site. Varying amounts of the organic chemicals and metals were measured in the soil samples. The results clearly indicate non-uniform contamination at the Dead Creek site.

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Analytical Procedures

The eight soil samples were analyzed for a variety of chemicals using established procedures or methods developed and validated for the chemicals of interest in soil. The following list tabulates the methods which were used.

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Analyte	Method No.	Title
Polychlorinated Biphenyls	ES-80-M-28	Determination of Polychlorinated Biphenyls in Soil and Sediment
Chlorinated Benzenes	ES-80-M-29	Determination of Chlorinated Benzenes in Soil and Sediment
Chlorinated Phenols	ES-80-M-30	Determination of Chlorinated Phenols in Soil and Sediment
Elemental Phosphorus (P_4)	ES-80-M-24	Determination of Elemental Phosphorus (P_4) in Soil and Sediment
Phosphate Esters	ES-80-M-5	Determination of Group I Compounds in Sediments. . .
Metals	Ref. 1, 2	Inductively Coupled Plasma (ICP). . . Method for Trace Element Analysis of Water and Wastes
Arsenic	Ref. 3	Methods for Chemical Analysis of Water and Wastes - Arsenic

All determinations were carried out in strict accordance with these methods, except that the polychlorinated biphenyls, chlorinated benzenes and phosphate esters were measured in extracts from acidified samples to facilitate determination of chlorinated phenols in the same extracts.

Results

The analytical results for this study are tabulated in Tables I-VI. Each table contains the results for all of the samples for a specific group of compounds. All results for the soils are in ppm (parts per million or $\mu g/g$). In general, the stated detection limits are the lowest level at which a given measurement was validated. Levels which are apparently real, but which are below the validated detection limit are presented in parentheses.

Quality Assurance

The quality assurance results (i.e., recovery and precision evaluations) for these samples have been compiled along with those of similar samples analyzed concurrently. These results are reported in Special Study ES-80-SS-27, Measurement of Selected Chemicals in Soil from the Dead Creek Site - Quality Assurance.

REFERENCES

1. Methods for Chemical Analysis of Waters and Wastes, EPA-600/4-79-020, page: Metals - 6, Section 4.1.3.

2. Federal Register, Vol. 44, No. 233, December 3, 1979.

3. Methods for Chemical Analysis of Waters and Wastes, EPA-600/4-79-020, Method 206 - Arsenic, pages: 206.2-1 to 206.5-2.

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TABLE I. PPM LEVELS OF PCBs AND ELEMENTAL PHOSPHORUS (P_4) IN DEAD CREEK SOIL SAMPLES

ANALYTE \ ES LOG NO. / DATE SAMPLED / LOCATION	0091541 8/29/80 100' from Judith Ln.	0091542 9/15/80 North Start	0091543 9/15/80 300' from start	0091907 9/18/80 #9 50's of Dickson	0091908 9/18/80 #10 50' N of Judy	0091909 9/18/80 #11 — Middle Between Judith & Queen	0091911 9/18/80 #14 Lake	0041701 4/16/80 #15 50' South of Judith	Soil Blank Mo. Bottoms St.Charles,MO.
PCB's (Cl_2 to Cl_6 Homologs)	29	5000	190	4600	150	730.	400	280	ND<1
P_4	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1

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TABLE II. PPM LEVELS OF CHLOROBENZENES IN DEAD CREEK SOIL SAMPLES

ANALYTE	ES LOG NO.	0091541	0091542	0091543	0091907	0091908	0091909	0091910	0091911	0041701
	DATE SAMPLED	8/29/80	9/15/80	9/15/80	9/18/80	9/18/80	9/18/80	9/18/80	9/18/80	4/16/80
	LOCATION	100' from Judith Ln.	North Start	300' from start	#9	#10	#11	#14	#15	Soil Blank Mo. Bottoms St.Charles,MO.
MONOCHLOROBENZENE		NA	NA	NA	(0.9)	2.0	(0.2)	ND<1	(0.1)	ND<1
P-DICHLOROBENZENE		NA	NA	NA	34	4.0	3.4	2.5	(0.7)	ND<1
O-DICHLOROBENZENE		NA	NA	NA	14	(0.5)	1.1	2.3	(0.2)	ND<1
TRICHLOROBENZENES (3)		NA	NA	NA	22	2.0	5.3	3.5	1.1	ND<1
TETRACHLOROBENZENES (3)		NA	NA	NA	4.0	(0.5)	2.1	(0.7)	(0.6)	ND<1
PENTACHLOROBENZENE		NA	NA	NA	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1
HEXACHLOROBENZENE		NA	NA	NA	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1
NITROCHLOROBENZENES (O-, P-)		NA	NA	NA	ND<5	ND<1	1.2	ND<1	ND<1	ND<1

NA = Not Analyzed

( ) Values in parentheses are below the validated detection limit. However, they represent levels detected with a S/N >2.5 and can be considered semi-quantitative.

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TABLE III. PPM LEVELS OF CHLOROPHENOLS IN DEAD CREEK SOIL SAMPLES

ANALYTE	ES LOG NO. / DATE SAMPLED / LOCATION	0091541 8/29/80 100' from Judith Ln.	0091542 9/15/80 North Start	0091543 9/15/80 300' from start	0091907 9/18/80 #9	0091908 9/18/80 #10	0091909 9/18/80 #11	0091910 9/18/80 #14	0091911 9/18/80 #15	0041701 4/16/80 Soil Blank Mo. Bottoms St.Charles,MO.
O-CHLOROPHENOL		NA	NA	NA	17	ND<1	1.7	ND<1	ND<1	ND<1
P-CHLOROPHENOL		NA	NA	NA	20	ND<1	1.7	1.4	ND<1	ND<1
2,4-DICHLOROPHENOL		NA	NA	NA	4.6	ND<1	ND<1	ND<1	ND<1	ND<1
PENTACHLOROPHENOL		NA	NA	NA	32	ND<1	1.1	ND<1	ND<1	ND<1

NA = Not analyzed

( ) Values in parentheses are below the validated detection limit. However, they represent levels detected with a S/N >2.5 and can be considered semi-quantitative.

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TABLE IV. PPM LEVELS OF PHOSPHATE ESTERS IN DEAD CREEK SOIL SAMPLES

ANALYTE	ES LOG NO. / DATE SAMPLED / LOCATION	0091541 8/29/80 100' from Judith Ln.	0091542 9/15/80 North Start	0091543 9/15/80 300' from start	0091907 9/18/80 #9	0091908 9/18/80 #10	0091909 9/18/80 #11	0091910 9/18/80 #14	0091911 9/18/80 #15	0041701 4/16/80 Soil Blank Mo. Bottoms St.Charles,MO.
DIBUTYLPHENYL PHOSPHATE		ND<1	ND<100	ND<10	60	ND<1	ND<1	1.0	ND<1	ND<1
BUTYLDIPHENYL PHOSPHATE		NA	NA	NA	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1
TRIPHENYL PHOSPHATE	WGK 1111153	(0.3)	150	18	200	3.0	ND<1	ND<1	ND<1	ND<1
2-ETHYLHEXYLDIPHENYL PHOSPHATE		3.5	17	11	ND<1	ND<1	1.0	(0.5)	ND<1	ND<1
ISODECYLDIPHENYL PHOSPHATE		ND<1	ND<100	ND<10	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1
T-BUTYLPHENYLDIPHENYL PHOSPHATE		ND<1	ND<100	ND<10	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1
DI-T-BUTYLPHENYLPHENYL PHOSPHATE		NA	NA	NA	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1
NONYLPHENYLDIPHENYL PHOSPHATE		ND<2	ND<200	ND<20	ND<1	1.0	ND<1	ND<1	ND<1	ND<1
CUMYLPHENYLDIPHENYL PHOSPHATE		ND<1	ND<100	ND<10	2.6	2.4	2.4	2.2	2.6	ND<1

NA = Not analyzed

( ) Values in parentheses are below the validated detection limit. However, they represent levels detected with a S/N >2.5 and can be considered semi-quantitative.

TABLE V. PPM LEVELS OF METALS IN DEAD CREEK SOIL SAMPLES

ES LOG NO. / DATE SAMPLED / LOCATION / ANALYTE	0091541 8/29/80 100' from Judith Ln.	0091542 9/15/80 North Start	0091543 9/15/80 300' from start	0091907 9/18/80 #9	0091908 9/18/80 #10	0091909 9/18/80 #11	0091910 9/18/80 #14	0091911 9/18/80 #15	0041701 4/16/80 Soil Blank Mo. Bottoms St.Charles,MO.
SILVER	17	ND<1	3.3	ND<1	20	20	19	4.2	ND<1
ALUMINUM	2300	720	720	2700	2400	3100	3600	3900	5600
BARIUM	210	2000	640	2400	230	940	1000	1100	120
BERYLLIUM	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1
BORON	68	13	21	36	100	78	76	72	27
CALCIUM	2500	2700	2200	13,000	14,000	6200	9200	5600	4600
CADMIUM	60	5.9	17	5.1	40	42	45	53	3.9
COBALT	67	8.2	13	30	120	85	89	81	33
CHROMIUM	44	19	61	29	88	110	130	51	19
COPPER	25,000	2700	16,000	590	8900	13,000	12,000	14,000	19
IRON	24,000	2000	2600	8700	31,000	28,000	28,000	28,000	9900
MAGNESIUM	1000	400	310	1300	1700	1700	2400	2100	2300
MANGANESE	45	15	9.3	60	210	91	140	90	510
MOLYBDENUM	63	9.5	38	11	54	39	38	47	11
SODIUM	350	690	710	420	510	400	440	360	320
NICKEL	950	140	260	120	1100	900	1100	1400	39
LEAD	1000	390	1400	150	1200	1000	1100	1500	50
PHOSPHORUS	4400	770	2400	1900	7400	7000	6500	6700	610
ANTIMONY	130	23	54	22	160	93	88	120	29
SILICON	210	320	270	94	83	91	63	95	110
TIN	76	27	71	19	71	78	91	62	18
STRONTIUM	64	35	42	24	130	120	110	81	17
TITANIUM	49	60	94	36	56	50	47	51	37
VANADIUM	46	13	14	67	120	92	100	110	130
ZINC	20,000	1400	5900	380	19,000	11,000	10,000	18,000	56
ARSENIC (By AA)	NA	NA	NA	180	50	90	50	30	5

NA = Not analyzed

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TABLE VI. SUMMARY OF PHOSPHORUS CONTENT (PPM) OF DEAD CREEK SOIL SAMPLES

ANALYTE / ES LOG NO. / DATE SAMPLED / LOCATION	0091541 8/29/80 100' from Judith Ln.	0091542 9/15/80 North Start	0091543 9/15/80 300' from start	0091907 9/18/80 #9	0091908 9/18/80 #10	0091909 9/18/80 #11	0091910 9/18/80 #14	0091911 9/18/80 #15	0041701 4/16/80 Soil Blank Mo. Bottoms St.Charles,MO
P - ELEMENTAL, By GC/MS	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1
P-INORGANIC, By ICP	4400	770	2400	1900	7400	7000	6500	6700	610
TOTAL PHOSPHATE ESTERS, By GC/MS	4	170	29	260	6.4	3.4	3.7	2.6	ND<10

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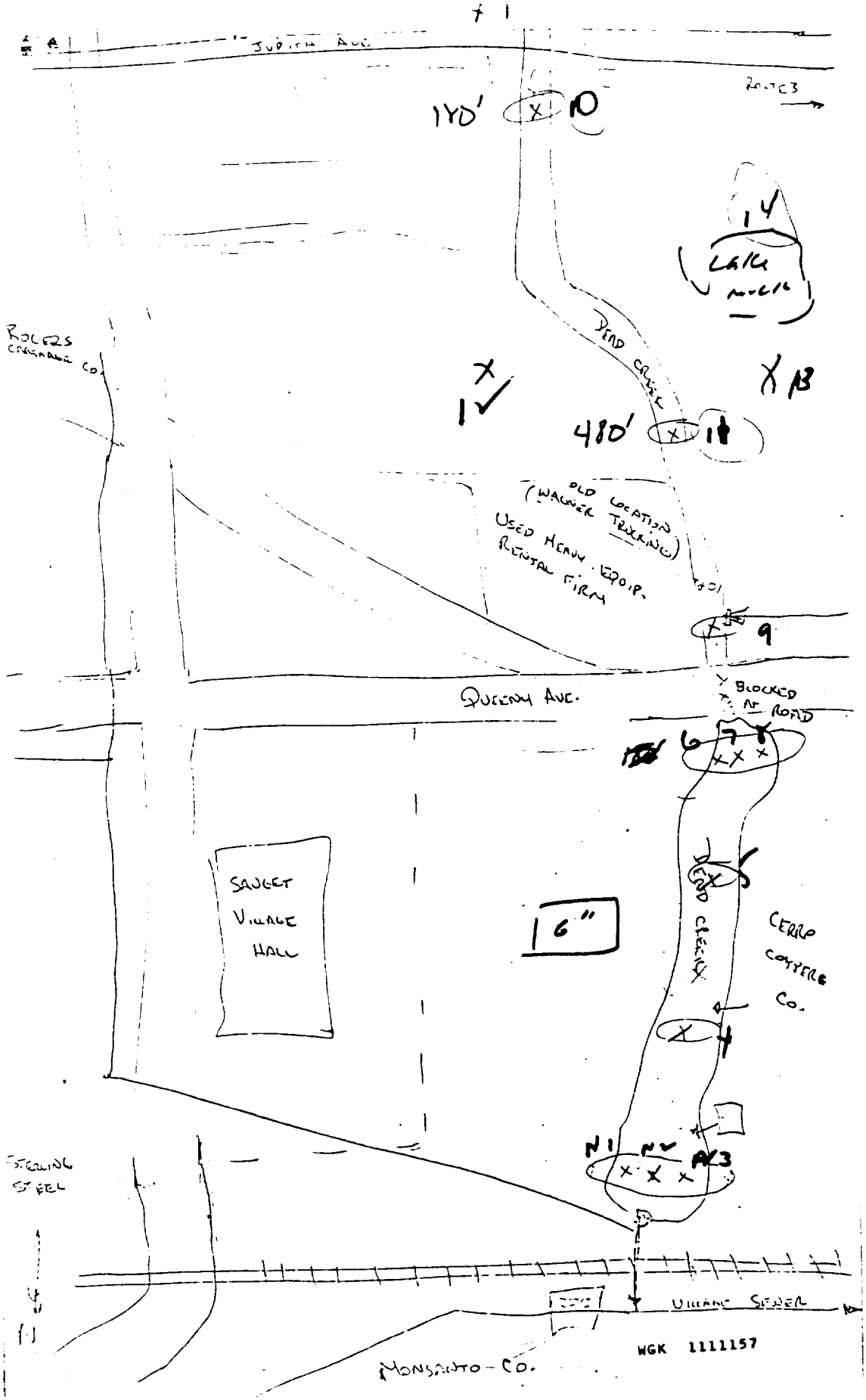

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MIC ENVIRONMENTAL SCIENCES
(CO./DIV./DEPT./LOCATION)

SPECIAL STUDY REPORT
(TYPE OF REPORT)

REPORT NO.: ES-80-SS-27

JOB/PROJECT NO.: 43-000-760.26-8623045
Transfer to 02-003-913.41-610

DATE: October 31, 1980

TITLE: MEASUREMENT OF SELECTED CHEMICALS IN SOIL FROM THE DEAD CREEK SITE - QUALITY ASSURANCE

AUTHORS: R. G. Kaley, II and O. Hicks

ABSTRACT: This report summarizes the quality assurance results obtained for various samples analyzed during the course of this project. The accuracy (recovery from spiked samples) and precision (relative standard deviation of replicate determinations) results are tabulated herein. Although it would be difficult to summarize the overall performance of the methods for all the analytes, in general, the methods performed at the recovery and precision levels established during method validation.

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REPT. NO.: ES-80-SS-27 AUTHORS: R. G. Kaley, II and O. Hicks
TITLE: MEASUREMENT OF SELECTED CHEMICALS IN SOIL FROM THE DEAD CREEK SITE - QUALITY ASSURANCE
COPY NO.:

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MEASUREMENT OF SELECTED CHEMICALS IN SOIL FROM THE DEAD CREEK SITE - QUALITY ASSURANCE

INTRODUCTION

Following media reports and subsequent Illinois EPA concern about hazardous chemicals at the Dead Creek site near Sauget, Illinois, personnel from Monsanto's W. G. Krummrich Plant sampled several areas at the site. Samples were submitted to Environmental Sciences for analyses for polychlorinated biphenyls, elemental phosphorus, chlorinated benzenes, chlorinated phenols, phosphate esters, and metals. During the various determinations, replicates and spiked samples were analyzed to evaluate the performance of the method used for these particular samples.

SUMMARY

This report summarizes the quality assurance results obtained for various samples analyzed during the course of this project. The accuracy (recovery from spiked samples) and precision (relative standard deviation of replicate determinations) results are tabulated herein. Although it would be difficult to summarize the overall performance of the methods for all the analytes, in general, the methods performed at the recovery and precision levels established during method validation.

DETAILS

Analytical Methods

The soil samples were analyzed for the various chemicals using established procedures or methods developed and validated for the chemicals of interest in soil. The following list tabulates the methods which were used.

Analyte	Method No.	Title
Polychlorinated Biphenyls	ES-80-M-28	Determination of Polychlorinated Biphenyls in Soil and Sediment
Chlorinated Benzenes	ES-80-M-29	Determination of Chlorinated Benzenes in Soil and Sediment
Chlorinated Phenols	ES-80-M-30	Determination of Chlorinated Phenols in Soil and Sediment
Elemental Phosphorus (P_4)	ES-80-M-24	Determination of Elemental Phosphorus (P_4) in Soil and Sediment
Phosphate Esters	ES-80-M-5	Determination of Group I Compounds in Sediments . . .
Metals	Ref. 1, 2	Inductively Coupled Plasma (ICP) . . . Method for Trace Element Analysis of Water and Wastes
Arsenic	Ref. 3	Methods for Chemical Analysis of Water and Wastes - Arsenic

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All determinations were carried out in strict accordance with these methods, except that the polychlorinated biphenyls, chlorinated benzenes and phosphate esters were measured in extracts from acidified samples to facilitate determination of chlorinated phenols in the same extracts.

Results

The results for the determinations of the compounds of interest have been reported in Special Studies ES-80-SS-24, 25, and 26, Measurement of Selected Chemicals in Soil from the Dead Creek Site . . . This Special Study is a compilation of the quality assurance results for all three Special Studies.

Quality Assurance

The recovery and precision results for the determinations are tabulated in Tables I-V. Each table contains the results for all quality assurance samples for a specific group of compounds. Recovery results are reported as percent recovery, calculated as

$$\% \text{ Recovery} = \frac{\text{Concentration (sample + spike)} - \text{average concentration (sample)}}{\text{Concentration (spike added)}} \times 100$$

Precision results are reported as percent relative standard deviation (RSD) for replicate determinations.

The tables present the recovery and precision results in concentration ranges (1-10 ppm to 10,000 - 100,000 ppm). The entries are averages of all values for all samples which had either recovery or precision evaluated in that range. All values are for actual samples except the metals recovery results, which are for spiked blank soil. In the recovery columns, NE means Not Evaluated, i.e., no samples were spiked in that concentration range, and ND means Not Determinable, i.e., the spiking level was too low (usually < 50%) compared to the level actually in the sample. In the precision columns, NE means Not Evaluated, i.e., no replicates were analyzed which contained the analyte in that concentration range.

More detailed compilations of the accuracy and precision results can be found in Reference 4.

REFERENCES

1. Methods for Chemical Analysis of Waters and Wastes, EPA-600/4-79-020, page: Metals - 6, Section 4.1.3.

2. Federal Register, Vol. 44, No. 233, December 3, 1979.

3. Methods for Chemical Analysis of Water and Wastes, EPA-600/4-79-020, Method 206 - Arsenic, pages: 206.2-1 to 206.5-2.

4. RGK NBP 1914831

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RECOVERY AND PRECISION

TABLE I. PCBs AND ELEMENTAL PHOSPHORUS (P_4) IN DEAD CREEK SOIL SAMPLES

ANALYTE	LEVEL	1-10 ppm		10-100 ppm		100-1,000 ppm		1,000-10,000 ppm		10,000-100,000 ppm	
		% Rec	% RSD	% Rec	%RSD	% Rec	%RSD	% Rec	%RSD	%Rec	% RSD
PCB's (Cl_2 to Cl_6 Homologs)		ND	NE	70%	17%	120%	18%	77%	58%	NE	0%
P_4		56%	NE	NE	NE	NE	NE	NE	NE	NE	NE

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RECOVERY AND PRECISION

TABLE II. CHLOROBENZENES IN DEAD CREEK SOIL SAMPLES

ANALYTE \ LEVEL	1-10 ppm % Rec	1-10 ppm % RSD	10-100 ppm % Rec	10-100 ppm % RSD	100-1,000 ppm % Rec	100-1,000 ppm % RSD
MONOCHLOROBENZENE	105%	NE	110%	NE	100%	NE
P-DICHLOROBENZENE	120%	21%	125%	64%	120%	NE
O-DICHLOROBENZENE	125%	16%	120%	NE	120%	8%
TRICHLOROBENZENES (3)	96%	14%	110%	13%	120%	NE
TETRACHLOROBENZENES (3)	110%	9%	120%	NE	130%	NE
PENTACHLOROBENZENE	140%	12%	120%	NE	140%	NE
HEXACHLOROBENZENE	135%	13%	90%	NE	110%	NE
NITROCHLOROBENZENES (O-,P-)	125%	37%	120%	NE	120%	26%

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RECOVERY AND PRECISION

TABLE III. CHLOROPHENOLS IN DEAD CREEK SOIL SAMPLES

ANALYTE \ LEVEL	1-10 ppm % Rec	1-10 ppm % RSD	10-100 ppm % Rec	10-100 ppm % RSD	100-1,000 ppm % Rec	100-1,000 ppm % RSD
O-CHLOROPHENOL	19%	34%	64%	NE	58%	NE
P-CHLOROPHENOL	36%	26%	16%	NE	30%	NE
2,4-DICHLOROPHENOL	66%	47%	59%	NE	50%	NE
PENTACHLOROPHENOL	140%	46%	40%	NE	36%	20%

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RECOVERY AND PRECISION

TABLE IV. PHOSPHATE ESTERS IN DEAD CREEK SOIL SAMPLES

ANALYTE \ LEVEL	1-10 ppm % Rec	1-10 ppm % RSD	10-100 ppm % Rec	10-100 ppm % RSD	100-1,000 ppm % Rec	100-1,000 ppm % RSD	1,000-10,000 % Rec	1,000-10,000 % RSD
DIBUTYLPHENYL PHOSPHATE	75%	NE	130%	NE	120%	12%	NE	NE
BUTYLDIPHENYL PHOSPHATE	120%	42%	115%	NE	NE	NE	NE	NE
TRIPHENYL PHOSPHATE	120%	89%	120%	NE	115%	NE	NE	6%
2-ETHYLHEXYLDIPHENYL PHOSPHATE	90%	47%	110%	NE	115%	NE	NE	NE
ISODECYLDIPHENYL PHOSPHATE	NE	NE	NE	NE	NE	NE	NE	NE
T-BUTYLPHENYLDIPHENYL PHOSPHATE	70%	NE	92%	100%	100%	NE	NE	NE
DI-T-BUTYLPHENYLPHENYL PHOSPHATE	88%	NE	96%	NE	NE	NE	NE	NE
NONYLPHENYLDIPHENYL PHOSPHATE	84%	8%	76%	NE	96%	NE	NE	NE
CUMYLPHENYLDIPHENYL PHOSPHATE	62%	21%	76%	NE	88%	NE	NE	NE

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RECOVERY AND PRECISION

TABLE V. METALS IN DEAD CREEK SOIL SAMPLES

ANALYTE \ LEVEL	1-10 ppm		1-100 ppm		100-1,000 ppm		1000-10,000 ppm		10,000-100,000 ppm	
	% Rec	% RSD	% Rec	% RSD	% Rec	% RSD	% Rec	% RSD	% Rec	% RSD
SILVER	NE	NE	NE	46%	NE	NE	NE	NE	NE	NE
ALUMINUM	ND	NE	ND	NE	ND	NE	NE	6.5%	NE	NE
BARIUM	ND	NE	ND	NE	89%	37%	NE	0%	NE	NE
BERYLLIUM	98%	NE	98%	NE	94%	NE	NE	NE	NE	NE
BORON	0%	NE	65%	19%	81%	3%	NE	NE	NE	NE
CALCIUM	ND	NE	ND	NE	ND	NE	NE	8.3%	NE	7.5%
CADMIUM	89%	5.2%	97%	21%	96%	NE	NE	NE	NE	NE
COBALT	51%	NE	115%	6.5%	97%	5.1%	NE	NE	NE	NE
CHROMIUM	27%	NE	109%	20%	91%	6.4%	NE	NE	NE	NE
COPPER	0%	NE	143%	66%	90%	NE	NE	NE	NE	11%
IRON	ND	NE	ND	NE	ND	NE	NE	NE	NE	8.1%
MAGNESIUM	ND	NE	ND	NE	ND	NE	NE	7.8%	NE	NE
MANGANESE	ND	NE	ND	13%	ND	10%	NE	NE	NE	NE
MOLYBDENUM	53%	NE	83%	11%	83%	NE	NE	NE	NE	NE
SODIUM	ND	NE	ND	NE	ND	11%	NE	NE	NE	NE
NICKEL	0%	NE	108%	14%	91%	13%	NE	4.5%	NE	NE
LEAD	0%	NE	165%	21%	93%	NE	NE	6.5%	NE	NE
PHOSPHORUS	ND	NE	ND	NE	ND	10%	NE	17%	NE	7.9%
ANTIMONY	0%	NE	27%	2.9%	27%	13%	NE	NE	NE	NE
SILICON	ND	NE	ND	NE	0%	49%	NE	NE	NE	NE
TIN	88%	NE	85%	5.6%	96%	5.4%	NE	NE	NE	NE
STRONTIUM	81%	NE	105%	3.3%	94%	6.5%	NE	NE	NE	NE
TITANIUM	ND	NE	99%	30%	30%	1.3%	NE	NE	NE	NE
VANADIUM	ND	NE	ND	13%	120%	11%	NE	NE	NE	NE
ZINC	ND	NE	139%	34%	87%	NE	NE	8.9%	NE	16%
ARSENIC (By AA)	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE

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METHOD REPORT
(TYPE OF REPORT)

REPORT NO.: ES-80-M-5

JOB/PROJECT NO.: 43-000-760.26-8630045

DATE: July 18, 1980

TITLE: DETERMINATION OF GROUP I COMPOUNDS IN SEDIMENTS FOR MIC NATIONAL AQUATIC MONITORING PROGRAM

AUTHORS: O. Hicks, J. A. Dixon, R. G. Kaley

ABSTRACT: The selected chemicals in the sediment are extracted by cyclohexane and the extracts are concentrated. The compounds are determined by gas chromatography/mass spectrometry (GC/MS) using the selected-ion-monitoring (SIM) mode. Identification of individual compounds is based on retention time and selected ion intensity ratio match with authentic standards. Concentration levels are calculated using an external standard method.

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AUTHORS: O. Hicks, J. A. Dixon, R. G. Kaley
TITLE: Determination of Group I Compounds in Sediments for MIC-National Aquatic Monitoring Program
REPT. NO.: ES-80-M-5
COPY NO.:

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DETERMINATION OF GROUP I COMPOUNDS IN SEDIMENTS FOR MIC NATIONAL AQUATIC MONITORING PROGRAM

1. SCOPE

1.1 This method was developed for the analysis of sediments for selected MIC chemicals. The method is applicable to samples containing as little as 0.02 µg/g of sediment. High levels of these chemicals, such as might occur near industrial sites, can be determined by decreasing sample size or concentration factor.

2. SUMMARY

2.1 The selected chemicals in the sediment are extracted by cyclohexane and the extracts are concentrated. The compounds are determined by gas chromatography/mass spectrometry (GC/MS) using the selected-ion-monitoring (SIM) mode. Identification of individual compounds is based on retention time and selected ion intensity ratio match with authentic standards. Concentration levels are calculated using an external standard method.

3. SIGNIFICANCE

3.1 Phthalate, phosphate and adipate esters are an important group of industrial fluids. They are widely used as general plasticizers, flame retardant plasticizers and fire resistant hydraulic fluids. The potential exists for these materials to enter the environment through leakage or disposal. Since such materials may be detrimental to environmental quality, there is a need to measure them in environmental samples. The products/compounds to be included in this study are:

Chemical Name	Abbreviation	Trade Name
dibutylphenyl phosphate	DBPP	Skydrol®
butyldiphenyl phosphate	BDPP	components
tributyl phosphate	TBP	
triphenyl phosphate	TPP	
2-ethylhexyldiphenyl phosphate	S-141	Santicizer® 141
t-butylphenyldiphenyl phosphate	t-buPDPP	Santicizer® 154
di-t-butylphenylphenyl phosphate	di-t-buPPP	
isodecyldiphenyl phosphate	S-148	Santicizer® 148
cumylphenyldiphenyl phosphate	CPDPP	Pydraul®
nonylphenyldiphenyl phosphate	NPDPP	components
isopropylphenyldiphenyl phosphate	K-100	Kronitex® 100
tricresyl phosphate	TCP	
benzylated m-xylene	S-150	Santosol® 150
di-n-hexyl adipate	S-367	Santicizer® 367
di-2-ethylhexyl adipate	DOA	
di-C_{7-9} alkyl adipate	S-97A	Santicizer® 97A
dibutyl phthalate	DBP	

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Chemical Name	Abbreviation	Trade Name
di-2-ethylhexyl phthalate	DEHP	
di-C_{7-9-11} alkyl phthalate	S-711	Santicizer® 711
butylbenzyl phthalate	S-160	Santicizer® 160
C_{7-9-11} benzyl phthalate	S-261	Santicizer® 261
texanolbenzyl phthalate	S-278	Santicizer® 278

4 APPARATUS

4.1 Kuderna-Danish evaporative concentrator (K&D), Kontes Glass Company. Cat. No. K-569000 (4 ml), Cat. No. K-569250 (1 ml).

4.2 Polytron® Sonic homogenizer - Brinkmann Instruments

4.3 A GC/MS equipped with an autosampler and computer/data system capable of operating the system in the SIM mode. An HP-5985 GC/MS/data system equipped with an HP-7671A autosampler was used for this study.

4.3.1 The chromatographic conditions described below are recommended and were used to obtain recovery data. The columns used were 1) a 1 meter by 2 mm i.d. glass column packed with 100-120 mesh Gas Chrom Q coated with 3% OV-101 and 2) a 1 meter by 2 mm i.d. glass column packed with 3% Silar 10-C. Column one is used for all phosphate ester esters and Santosol 150. The column temperature is programmed from 150°C to 300°C @ 16°C per minute: the temperature is held at 300°C for seven minutes. Column two is used for the phthalate and adipate esters. The column is programmed from 150°C to 250°C at 16°C per minute: the temperature is held at 250°C for seven minutes. The injection port and GC/MS interface temperatures are 250°C and 275°C respectively. Helium carrier gas flow is 24 ml per minute.

The HP-5985 GC/MS/data system has a BATCH program for use with the autosampler to operate in the SIM mode. BATCH program will sequentially run a designated GC program, store the data and print a hard copy for as many as 35 samples. Each GC run can be separated into 1 to 5 time windows and four selected masses (m/z) can be monitored during each time window.

4.4 Sediment Sample Bags - one quart or half gallon polyethylene bags (doubled). A representative bag was filled with 100 ml cyclohexane overnight and the cyclohexane concentrate (25/1) showed no significant interference with the procedure (Section 8).

4.5 Autosampler Supplies

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4.5.1 Wheaton "400" brand borosilicate glass autosampler vials - 1 ml capacity - 12 x 32 mm - Fisher Cat. No. 6-406AA.

4.5.2 Teflon® lined aluminum seals - Fisher Cat. No. 6-406-13 .

4.5.3 Crimping tool to seal - Fisher Cat. No. 6-406-60.

4.5.4 Micro-vials - for autosampler - 0.3 ml capacity - Supelco, Inc., Cat. No. 3-3208.

4.6 Refrigerated Superspeed Centrifuge - Sorvall® RC-5B or equivalent equipped with a Sorvall® 53-34 head.

4.7 Centrifuge tubes - Polypropylene - 46 ml capacity, 28.6 x 103.5 mm - Fisher Cat. No. 5-430-20.

4.7.1 Caps for centrifuge tubes - Fisher Cat. No. 5-566-20H.

5. REAGENTS AND MATERIALS

5.1 Cyclohexane - Burdick & Jackson - "Distilled in Glass" or equivalent.

5.2 o-xylene - Burdick & Jackson - "Distilled in Glass" or equivalent.

5.3 Methyl alcohol - Burdick & Jackson - "Distilled in Glass" or equivalent.

5.4 Isooctane - Burdick & Jackson - "Distilled in Glass" or equivalent.

5.5 Standard stock solution - For each compound to be determined, prepare a standard stock solution by weighing 0.100 g of the compound into a 100 ml volumetric flask and diluting to volume with o-xylene.

5.6 Working standard - Prepare a working standard by pipetting 1 or 2 ml of each appropriate stock solution into a 100 ml volumetric flask and diluting to volume with isooctane. This solution contains 10 or 20 µg/ml of each compound. Further 2:10 dilutions can be made as appropriate.

A second working solution is prepared in the same manner but diluted to 100 ml with methyl alcohol or dimethylformamide. This 10 µg/ml solution is used for spiking experiments.

5.7 Organic free water - Distilled, deionized, or purified water which has been demonstrated to be free of interfering organic compounds by extraction and analysis.

6. SEDIMENT SAMPLING

6.1 The samples are collected according to ES-80-M-3, MIC National Aquatic Monitoring Program - Sample Collection Method.

6.2 The samples are mixed and subdivided according to EAN-80-SOP-006, Standard Operating Procedure for Homogenizing, Subdividing and Preserving Sediment Samples.

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[redacted]

MISSING DOCUMENTS

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8. PROCEDURE

8.1 Extraction and Concentration of Sediment Samples

8.1.1 Remove samples from (freezer) storage and allow to equilibrate to room temperature.

8.1.2 Weigh a representative 10 g portion into a clean polyethylene test tube. Add 10 ml purified water and 10 ml of cyclohexane.

8.1.3 Place under the Polytron® probe and rotate slightly to mix. Turn speed to setting 4-5 and mix for ∿30 seconds.

8.1.4 Allow probe to drain and wash lightly with 1-2 ml of organic free water.

8.1.5 Cap test tube and place in refrigerated centrifuge (∿10°C). Spin at 15,000 rpm for 10 minutes.

8.1.6 Remove from centrifuge and remove upper cyclohexane layer into a 10 ml graduated cylinder using a glass eyedropper. Record the volume.

8.1.7 Transfer the cyclohexane in portions into a micro K&D (1 or 4 ml volume) apparatus containing a boiling chip and evaporate to ∿1 ml in a water bath.

8.1.8 Remove from bath and cool to room temperature.

8.1.9 When cool, remove the column and cap the receiver and place in the freezer, if analysis is not to be done immediately.

8.1.10 Weigh a second 10 g portion onto a watch glass, allow to dry in an oven at 105 ± 2°C overnight. Reweigh.

8.1.11 Allow to dry an additional 4 hours and reweigh; repeat until weight is constant.

8.2 Chromatography of Concentrated Extracts

8.2.1 If extracts have been frozen for storage, allow to equilibrate to room temperature. Adjust the volume to 1.0 ml and mix well.

8.2.2 Using a 500 µl syringe, place 300 µl of the concentrated extract into a micro vial (Section 4.6), cover with an aluminum seal and crimp to seal. Replace cap on remaining extract and return to freezer.

8.2.3 Standards (Section 7.3.1) are placed in 1 ml autosampler vials (Section 4.4) and sealed as in 8.2.2. A fine tip felt marker can be used to number the vials on the aluminum cap. Labels cannot be used as the vials will not then fit in the autosampler.

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8.2.4 Place the standards and samples (up to 35 total) in the autosampler.

8.2.5 AUTOTUNE the GC/MS/data system.

8.2.6 Set GC conditions for analysis. These should be determined by each laboratory. The conditions used in this laboratory are as follows:

8.2.6.1 for phosphate esters

1 meter, 2 mm i.d. glass, 3% OV-101 on 100-120 mesh Gas Chrom Q
Injection port temperature - 250°C
GC/MS interface lines - 275°C
Column temperature - 150°C to 300°C @ 16°C/min; hold at limit for 7 minutes..
Helium carrier gas flow - 24 ml/minute.

8.2.6.2 for TCP, Kronitex 100 and Santosol 150

Same conditions as 8.2.6.1

8.2.6.3 for phthalate and adipate esters

1 meter, 2 mm i.d. glass, 3% Silar 10-C on 100-120 mesh Gas Chrom Q
Injection port temperature - 250°C
GC/MS interface lines - 275°C
Column temperature - 150°C to 250°C @ 16°C/min; hold at limit for 7 minutes.
Helium carrier gas flow - 24 ml/minute.

8.2.7 Call BATCH program on data system and set conditions as follows:

8.2.7.1 for phosphate esters

4 SIM GROUPS - 0.8 minute delay.

Group 1 - 0.81 to 4.50 minutes monitors masses 94, 99, 286 and 306 with 200 millisecond dwell time/mass - monitors DBPP, BDPP and TBP.

Group 2 - 4.51 to 5.80 minutes monitor masses 326, 325, 251 and 170 with 200 millisecond dwell time/mass - monitors TPP and S-141.

Group 3 - 5.81 to 7.5 minutes monitor masses 382, 367, 251 and 170 with 200 millisecond dwell time/mass - monitors t-butyl PDPP and S-148

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Group 4 - 7.5 to 10.5 minutes monitor masses 381, 367, 423 and 429 with 200 millisecond dwell time/ mass - monitors NPDPP, CPDPP and di-t-butyl PPP.

8.2.7.2 for TCP, Kronitex 100 and Santosol 150

2 SIM groups - 0.8 minute delay

Group 1 - 0.81 to 4.5 minutes monitor masses 118, 181, 196 and 129 with 200 millisecond dwell times/ mass monitors S-150.

Group 2 - 4.5 to 10.5 minutes monitor masses 118, 117, 179 and 195 with 200 millisecond dwell times/ mass monitors Kronitex 100 and TCP.

8.2.7.3 for phthalate and adipate esters

1 SIM group - 1.4 minute delay

Group 1 - 1.4.-10.4 minutes monitor masses 149, 91, 167 and 129 with 200 millisecond dwell times/ mass monitors S-367-A, DOA, S-97-A, DEHP, S-711, DBP, S-160, S-261, and S-278.

8.2.8 Run BATCH program for phosphate esters using conditions listed in Sections 8.2.6.1 and 8.2.7.1. Calculate mean response factor, standard deviation, percent relative standard deviation and correlation coefficient for each compound to be determined.

8.2.9 Repeat step 8.2.1 adjusting the volume to 0.7 ml, if necessary. Repeat 8.2.2 through 8.2.8 using conditions listed in 8.2.6.2 and 8.2.7.2.

8.2.10 Repeat step 8.2.1 adjusting the volume to 0.4 ml, if necessary. Repeat 8.2.2 through 8.2.8 using conditions listed in 8.2.6.3 and 8.2.7.3.

9. CALCULATION OF RESULTS

9.1 Calculate the concentration of each compound injected from the response factor using the equation:

$$C_i = (RF_i)(A_i)$$

where

C_i = concentration of compound injected (ppm)
RF_i = response factor for compound (ppm/area unit)
A_i = peak area for compound (area unit)

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9.2 Calculate the compound concentration P , in micrograms per gram (ppm) using the following equation:

$$P = \frac{(C\ )(V_F)(V\ )}{(Ms)(V_X)}$$

where C = concentration of compound injected (ppm) (from 9.1).

V_F = volume of final concentrated extract (8.2.1) (usually 1.0 ml)

V = volume of cyclohexane extractant added (10 ml)

Ms = mass of sediment weighed (10g)

V_X = volume of cyclohexane transferred to K&D apparatus for concentration.

9.3 Calculate the compound concentration P , in ppm using the following equation:

$$P = \frac{(P\ )(W_W)}{W_D}$$

where P = value from 9.2 above

W_W = wet sediment weight (Section 8.1.10)

W_D = dry sediment weight (Section 8.1.11)

10. REPORT

10.1 Report results in micrograms per gram (ppm) without correction for any recovery data. The percent recoveries of known compounds added to samples or to reagent water as well as the step in the procedure where they were added must also be reported. Results for blanks must also be reported. Use the attached form for all data.

11. ACCURACY AND PRECISION

11.1 The expected accuracy of this method was determined by spiking known amounts of compounds of interest into Missouri River sediment. The data in Table II represent the percent recoveries determined by the procedure. Five replicates were analyzed at each level to determine precision (RSD).

12. SAFETY PRECAUTIONS

12.1 These samples may contain pathogens and should be handled as little as possible and then only by persons who have a current innoculation against typhoid.

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MIC-NAMP ANALYSIS REPORT FORM

Date _____ Analyte _____ Type of Sample (check one)

Analyst(s) _____ NBP # _____

☐ Water
☐ Sediment

Study No.	Log No.	Amount Found (ppb)	Comments

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Reviewed by: _____

Date: _____

Comments: _____

TABLE I

Compound	GC Retention time(s) in min	Selected Masses to measure	Selected Masses to confirm	GC Column	GC Run #
DBPP	2.3	94	286	1	1
BDPP	3.6	94	306	1	1
TBP	1.3	99	-	1	1
TPP	4.8	326	325	1	1
S-141	5.1	251	170	1	1
t-bu-PDPP	6.4	367	382	1	1
di-t-buPPP	7.8	423	-	1	1
S-148	6.1	251	170	1	1
CPDPP	8.9	429	-	1	1
NPDPP	8.2	367	381	1	1
Kronitex 100	5.8-7.4	118	117	1	2
TCP	6.2-7.4	179	195	1	2
Santosol 150	1.5	181	196	1	2
S-367	2.5	129	-	2	3
DOA	2.9	129	-	2	3
S-97A	3.2-4.4	129	-	2	3
DBP	3.1	149	-	2	3
DEHP	4.2	149	167	2	3
S-711	4.4-5.8	149	167	2	3
S-160	5.9	91	149	2	3
S-261	6.0-7.4	91	149	2	3
S-278	8.7	91	149	2	3

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TABLE II

MIC - MONITORING STUDY - % RECOVERY FROM SEDIMENT - 1980

	DBPP	BDPP	TBP	TPP	S-141	t-bu-PDPP	S-148	di-t-buPPP	CPDPP	NPDPP	S-150 (181)	K-100 (110)	TCP (179)	S-367	DOA	S-97A	DBP	DCHP (149)	S-711	S-160 (91)	S-261 (149)	S-278 (91)
Level 1 (ppb)	60	20	40	100	60	30	50	10	40	70	50	90	50	50	50	50	50	50	100	50	50	50
Mean	106	-	128	118	102	100	85	106	-	90	135	138	-	73	-	122	-	-	129	-	117	101
σ	13.5	-	14.6	9.4	11.5	29.4	16.7	22.5	-	14.8	26.4	63.6	-	21.8	-	42.0	-	-	37.6	-	42.9	22.5
% RSD	12.8	-	11.4	7.9	11.3	29.4	19.5	21.3	-	16.5	19.6	46.0	-	29.8	-	34.4	-	-	29.0	-	36.6	22.2
Level 2 (ppb)	120	40	70	210	110	60	100	20	80	150	100	170	100	100	100	100	90	100	200	100	100	100
Mean	101	113	126	112	99	116	99	109	104	110	119	118	-	152	119.4	121	-	154	140	131	163	106
σ	2.0	6.2	5.2	13.7	2.9	10.3	6.4	4.1	21.1	2.7	4.7	8.4	-	35.0	22.1	7.7	-	24.4	30.4	12.1	24.1	23.6
% RSD	2.0	5.5	4.1	12.2	3.0	8.9	6.4	3.8	20.2	2.5	4.0	7.2	-	23.1	18.5	6.4	-	15.9	21.8	9.2	14.8	22.4
Level 3 (ppb)	585	120	355	1045	550	290	500	100	380	730	520	850	510	525	500	515	460	460	1000	500	500	500
Mean	93	111	138	105	97	101	100	101	95	93	106	101	101	100	102.2	104	119	148	114	96	119	93
σ	14.0	24.4	27.8	25.8	25.1	17.6	27.7	29.2	16.4	17.6	26.0	24.3	25.1	32.9	23.3	28.4	26.3	41.7	28.8	28.2	27.2	22.4
% RSD	15.0	22.0	20.1	24.6	26.0	17.5	27.6	29.0	17.4	19.0	24.5	24.2	24.8	32.9	22.8	27.2	22.2	28.1	23.6	29.5	22.8	24.2
Level 4 (ppb)	1170	380	710	2090	1110	580	1000	200	760	1460	1030	1700	1020	1050	110	1030	920	920	1990	1010	1000	1010
Mean	110	112	134	115	107	118	108	97	114	107	111	107	103	99	98	93	107	102	101	102	102	91
σ	4.8	5.4	3.7	7.1	5.7	4.7	5.6	3.6	5.3	5.2	4.6	6.4	6.2	9.8	8.6	11.4	7.6	6.9	6.4	7.1	9.2	6.4
% RSD	4.4	4.9	2.8	6.2	5.4	4.0	5.2	3.7	4.7	4.9	4.1	6.0	6.0	9.9	8.8	12.3	7.0	6.8	6.3	6.9	8.9	7.1
Total Range	60-1170	40-380	40-710	100-2090	60-1100	30-580	50-1000	10-200	80-760	70-1500	50-1000	90-1700	500 1000	100-1000	100-1000	50-1000	450-1000	100-1000	100-2000	100-1000	50-1000	50-1000
Mean	102.6	112.2	131.6	107.8	101.0	109.0	99.4	102.4	105.0	100.7	117.8	116.0	102.0	106.1	106.5	110.0	113.0	134.7	121.0	116.3	125.4	97.7
σ	10.6	12.6	14.8	28.3	13.7	17.9	17.3	16.3	16.5	13.5	20.5	34.9	17.3	38.4	20.2	27.2	19.2	35.6	29.7	18.9	34.9	19.4
% RSD	10.3	11.3	11.2	26.2	13.6	16.4	17.4	16.0	15.7	13.4	17.4	30.1	16.9	36.2	19.0	24.7	17.0	26.4	24.5	16.3	27.8	19.9

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MIC ENVIRONMENTAL SCIENCES
(CO./DIV./DEPT./LOCATION)

METHOD REPORT
(TYPE OF REPORT)

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JOB/PROJECT NO.: 43-000-760.26-8623045
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DATE: October 15, 1980

TITLE: DETERMINATION OF ELEMENTAL PHOSPHORUS (P_4) IN SOIL AND SEDIMENT

AUTHORS: R. G. Kaley, II and O. Hicks

ABSTRACT: P_4 is extracted from the soil/sediment sample with benzene using the procedure described in Standard Operating Procedure (SOP) EAN-80-SOP-20, Extraction of Semivolatile Organic Chemicals from Soil/Sediment. The P_4 in the extract is measured by Selected Ion Monitoring (SIM) gas chromatography/mass spectrometry (GC/MS) The P_4 is quantitated using external standards. The average recovery of P_4 from soils containing 0.5 to 10 ppm P_4 was 85%. The precision of determinations averaged 18% relative standard deviation (RSD).

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REPT. NO.: ES-80-M-24 AUTHORS: R. G. Kaley, II and O. Hicks
TITLE: DETERMINATION OF ELEMENTAL PHOSPHORUS (P_4) in SOIL AND SEDIMENT
COPY NO.:

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R-1088(A)

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DETERMINATION OF ELEMENTAL PHOSPHORUS (P_4) IN SOIL AND SEDIMENT

1. SCOPE

1.1 This method is for the determination of elemental phosphorus (P_4) in soil and sediment samples.

1.2 The method is applicable to samples containing 0.5 µg/g to 10 µg/g (ppm) of P_4 in the sample. Higher levels can be determined by diluting the sample extract. However, proper validation at higher levels must be done.

1.3 The method has been validated using a Missouri Bottoms soil sample. Proper quality assurance must be carried out to verify the performance of the method for other soils and sediments.

2. SUMMARY

2.1 P_4 is extracted from the soil/sediment sample with benzene using the procedure described in Standard Operating Procedure (SOP) EAN-80-SOP-20, Extraction of Semivolatile Organic Chemicals from Soil/Sediment.

2.2 The P_4 in the extract is measured by Selected Ion Monitoring (SIM) gas chromatography/mass spectrometry (GC/MS).

2.3 The P_4 is quantitated using external standards.

2.4 The average recovery of P_4 from soils containing 0.5 to 10 ppm P_4 was 85%. The precision of the determinations averaged 18% relative standard deviation (RSD).

3 SIGNIFICANCE

3.1 Elemental phosphorus is a high volume industrial chemical used in the manufacture of phosphoric acid and inorganic phosphates.

3.2 The potential exists for P_4 to be present in industrial wastes.

3.3 This method provides a technique to measure P_4 in samples from sites potentially contaminated by disposal of such wastes.

3.4 The method further provides a selective method for determining P_4 in the presence of other P-containing compounds.

4. INTERFERENCES

4.1 Although the SIM GC/MS is a very sensitive and selective detector for the determination of the P_4, the potential exists for mass spectral interferences at one or more of the ions used for the determination.

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4.2 Use of ion intensity ratio comparisons for the molecular weight ion and a confirming ion can help identify such interferences.

4.3 All sampling equipment (if used), solvents, and laboratory glassware must be demonstrated to be free of interferents by the analysis of field and laboratory blanks.

5. SAFETY PRECAUTIONS

5.1 Benzene is a suspected human carcinogen. Extreme care must be taken when preparing standards or extracting samples. Use of a personal exposure monitoring system may be required.

5.2 Sediment or soil samples may contain pathogens. They should be handled as little as possible and then only by persons who have a current innoculation against typhoid.

5.3 All GC/MS vacuum pumps, especially the separator pump, must be equipped with a charcoal scrubber or must discharge into a scrubbed ventilation system to prevent discharge of hazardous vapors into the laboratory atmosphere.

6. APPARATUS

6.1 Apparatus required for EAN-80-SOP-20

6.1.1 Ultrasonic homogenizer - Polytron® (Brinkmann Instruments) or equivalent.

6.1.2 Test tubes - polypropylene, 50 mL

6.1.3 Centrifuge - refrigerated, capable of 15,000 rpm

6.1.4 Receivers - graduated 10 mL Kuderna-Danish receivers.

6.2 GC/MS - equipped with data system for instrument control and data accumulation and retrieval; must be capable of SIM operation.

6.3 Glass column for gas chromatograph - 1 m x 2 mm i.d., packed with a suitable packing (See Sec. 7.1).

6.4 Microsyringe - 10 µL capacity.

6.5 Usual laboratory volumetric glassware.

7. REAGENTS AND MATERIALS

7.1 GC column packing - 3% OV-101 on 100/120 mesh Gas Chrom® Q has been found suitable and was used for validation studies.

7.2 Benzene - Fisher Scientific Company - Pesticide Grade or equivalent. Benzene must be demonstrated to be free of analyte.

7.3 Stock standard - Prepare a stock standard solution (~1000 µg/mL) by dissolving a clean portion of elemental phosphorus in benzene.

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7.4 Working standards - Prepare working standards in the concentration range of interest by successive dilution of the stock standard. At least three standards must be prepared with concentration ranges not to exceed one decade.

8. SAMPLING

8.1 Soil or sediment samples should be collected according to established procedures, using clean equipment.

8.2 Label each sample container with its corresponding sample number and history.

8.3 A number of sampling blanks equal to at least 10% of the total number of samples should be collected at the sampling site.

8.4 In the laboratory, samples should be handled in accordance with EAN-80-SOP-006, SOP for Homogenizing, Subdividing, and Preserving Sediment Samples.

8.5 At least 10% of the samples should be analyzed in triplicate to determine precision.

8.6 At least 10% of the samples should be spiked at appropriate levels (e.g., 2X, 10X or 100X the estimated level in the samples) to determine accuracy (recovery).

9. CALIBRATION AND STANDARDIZATION

9.1 Mass spectrometer calibration

9.1.1 The sensitivity and mass offset (if applicable) of the mass spectrometer should be checked on a daily basis using a suitable calibration material, e.g., perfluoro-t-butyl amine (PFTBA).

9.2 Reference Standards and Blanks

9.2.1 GC retention time for P_4 should be determined by injecting 1 µL of the stock standard into the GC/MS operating in the scanning mode. The retention data and mass spectrum are used to select SIM conditions (selected ions and mass group retention window) for the determinations.

9.2.2 Field blanks (Section 8.3) and laboratory blanks (Section 4.3) (at least one per day) should be analyzed according to the procedure (Section 10).

9.3 Calibration Curves or Response Factors

9.3.1 The linearity of response for SIM GC/MS must be determined for P_4. Inject equal volumes (i.e., 3 µL) of various

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concentrations of working standards and measure the area of the P_4 peak.

9.3.2 For initial calibration, at least 3 working standards and a solvent blank should be analyzed in triplicate.

9.3.3 For routine use, at least three working standards and a solvent blank should be analyzed in duplicate on a daily basis to determine linearity and response factor.

9.3.4 Linearity can be established by plotting a calibration curve (peak areas vs ng injected (or vs concentration if equal injection volumes are used)) or by calculating a response factor (RF) (ng injected or concentration ÷ peak area) and plotting RF vs ng injected or vs concentration. Only sample peak areas which fall in the linear response range should be used to calculate concentrations.

9.3.5 Computer programs which calculate RF, average RF and standard deviation (SD), and perform a least-squares analysis can also be used. In general, a ± 20% relative SD (RSD) and a least squares correlation coefficient (R) of >0.95 are acceptable indicators of linearity.

9.3.6 Table I contains the RF, RSD, and R for the calibration phase of method development.

TABLE I

Compound	RF $\left(\frac{\text{ppm}}{\text{area count}}\right)$	RSD (%)	R
P_4	1.95 E-4	15	.97

10. PROCEDURE

10.1 Extraction

10.1.1 Extract P_4 from the soil or sediment samples using the procedure described in EAN-80-SOP-20, Extraction of Semivolatile Organic Chemicals from Soil/Sediment.

10.1.2 Use benzene (CAUTION!) as the extracting solvent because of the low solubility of P_4 in alkyl solvents.

10.1.3 Extract the number of replicates and spiked samples necessary to comply with quality assurance requirements (see Sections 8.5 and 8.6).

10.1.4 Store extracts in a refrigerator if they are not analyzed immediately.

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10.2 SIM GC/MS Analysis

10.2.1 Operate the GC/MS according to Standard Operating Procedure or manufacturer's instructions.

10.2.2 The following conditions have been found suitable for the chromatography of P_4.

Column: 1 m x 2 mm i.d. glass column packed with 3% OV 101 on 100/120 mesh Gas Chrom Q.

Column Temperature: 55° isothermal

Carrier Gas: Helium, 30 mL/min

Injection Port Temperature: 250°C

Jet Separator Manifold Temperature: 300°C

10.2.3 The following conditions have been found suitable for the SIM GC/MS determinations using an HP 5982A GC/MS system with associated 5934A data system:

Ion Source Temperature: 150°C
Separator: Glass jet
Ionization: Electron impact-70 eV or equivalent
Electron Multiplier Gain: 8 or 9 HI
Selected ions: m/z 124,93,62
Selected Ion Dwell Times: 200 ms

10.2.4 If the samples have been frozen for storage, allow to equilibrate to room temperature.

10.2.5 Inject a suitable size aliquot of the sample into the GC/MS. (If the injection volume equals that of the calibration standards, calculations are simplified.)

10.2.6 Measure peak area for the peak at retention time of P . Check ion intensity ratios for molecular and confirming ions to be sure that interferences are not present.

10.2.7 A sample SIM chromatogram for P standard is shown in Figure I for reference purposes.

10.2.8 Compare sample peak areas to the appropriate calibration curve to determine if they fall within the established linear range. If the area is outside the linear range, dilute the sample with benzene, record the dilution factor, and repeat 10.2.5 through 10.2.8.

11. CALCULATION OF RESULTS

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11.1 If injection volumes are not all equal:

11.1.1 Calculate the mass of P_4 by comparing to a calibration curve prepared daily or by calculating from the response factor using the equation

$$Mi = (RFi)(Ai)$$

where:

Mi = mass of P_4 injected (ng)

RFi = response factor for P_4 (ng/area count)

Ai = peak area for P_4 (area counts)

11.1.2 Calculate the concentration of P_4 using the following equation:

$$Ci = \frac{(Mi)(V_F)(DF)}{(V_I)(W)}$$

where:

Ci = concentration of P_4 (µg/g = ppm)

Mi = mass of P_4 (from Section 11.1.1)

V_F = volume of extract (mL)

V_I = injection volume (µL)

W = sample weight (g)

DF = dilution factor (Section 10.2.8)

11.2 If injection volumes are equal (e.g., 3 µL).

11.2.1 Calculate the concentration of P_4 by comparing to a calibration curve prepared daily or by calculating from the response factor using the equation:

$$Ci = \frac{(RFi)(Ai)(V_F)(DF)}{W}$$

where:

Ci = concentration of P_4 (µg/g = ppm)

RFi = response factor for P_4 (ppm/area count)

Ai = peak area for P_4 (area counts)

V_F = volume of extract (mL)

DF = dilution factor (Section 10.2.8)

W = sample weight (g)

12. REPORT

12.1 Report the results in µg/g (or ppm) without correction for recovery.

12.2 Report recoveries and precision determined on spiked samples and replicates.

12.3 Report results for all sampling and laboratory blanks.

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13. PRECISION AND ACCURACY

13.1 The precision and accuracy of this method were determined in a soil matrix (Missouri Bottoms) at four levels (0.5, 1, 5, and 10 ppm) by analysis of five replicates at each spiking level plus blanks.

13.2 The precision and accuracy results are summarized below. The recoveries are averages of all replicates at each spiking level. The precision is reported as relative standard deviation.

Level (ppm)	% Recovery	% RSD
0.5	74	9.1
1.0	89	35
5.0	86	11
10	90	16

14. REFERENCES

14.1 The raw data for this method validation is found in Monsanto Research Notebook pages:

OH 1805236
RGK 1914809, 1914811

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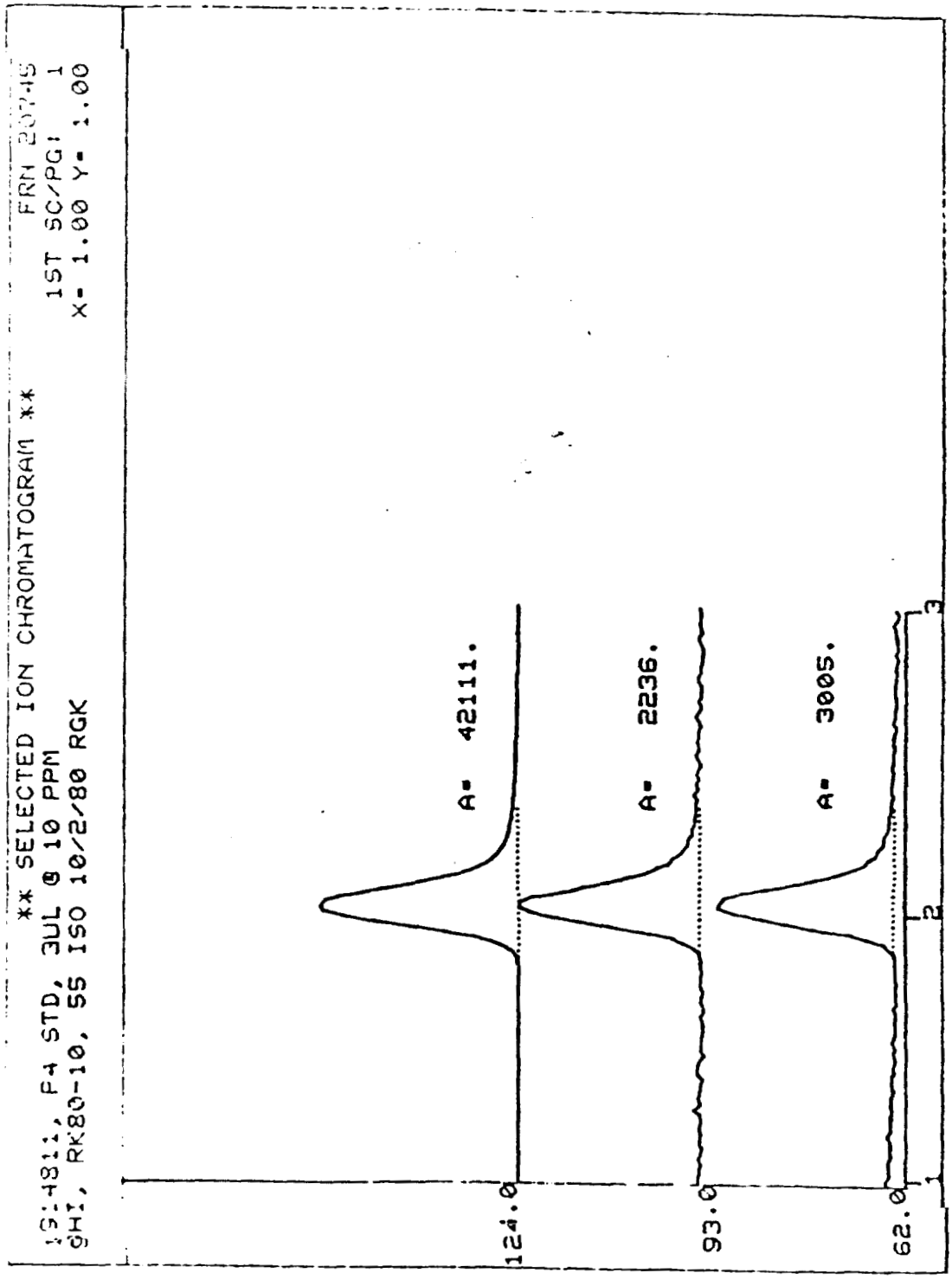
FIGURE I



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MIC ENVIRONMENTAL SCIENCES
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REPORT NO.: ES-80-M-28

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(02-003-913.41-610)

DATE: October 27, 1980

TITLE: DETERMINATION OF POLYCHLORINATED BIPHENYLS (PCBs) IN SOIL AND SEDIMENT

AUTHORS: R. G. Kaley, II and O. Hicks

ABSTRACT: The PCBs are extracted from the soil/sediment sample with an organic solvent using the procedure described in Standard Operating Procedure (SOP) EAN-80-SOP-20, Extraction of Semivolatile Organic Chemicals from Soil/Sediment. The PCBs in the extract are measured by Selected Ion Monitoring (SIM) gas chromatography/mass spectrometry (GC/MS). The PCBs are quantitated using external standards. The average recovery of PCBs from soils containing 2 to 200 ppm total PCBs was 76%. The precision of the determinations averaged 20% relative standard deviation (RSD), based on total PCBs.

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REPT. NO.: ES-80-M-28 AUTHORS: R. G. Kaley, II and O. Hicks
TITLE: DETERMINATION OF POLYCHLORINATED BIPHENYLS (PCBs) IN SOIL AND SEDIMENT

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4. INTERFERENCES

4.1 Although the SIM GC/MS is a very sensitive and selective detector for the determination of the PCBs, the potential exists for mass spectral interferences at one or more of the ions used for the determinations.

4.2 Use of ion intensity ratio comparisons for the molecular weight ion and a confirming ion can help identify such interferences.

4.3 All sampling equipment (if used), solvents, and laboratory glassware must be demonstrated to be free of interferents by the analysis of field and laboratory blanks.

5. SAFETY PRECAUTIONS

5.1 Benzene is a suspected human carcinogen. Extreme care must be taken when preparing standards or extracting samples. Use of a personal exposure monitoring system may be required. Avoid use of benzene if possible.

5.2 PCBs are suspected carcinogens. Extreme care must be taken when preparing standards from neat materials. Avoid all contact with standards and samples.

5.3 Sediment or soil samples may contain pathogens. They should be handled as little as possible and then only by persons who have a current innoculation against typhoid.

5.4 All GC/MS vacuum pumps, especially the separator pump, must be equipped with a charcoal scrubber or must discharge into a scrubbed ventilation system to prevent discharge of hazardous vapors into the laboratory atmosphere.

5.5 Dispose of materials containing PCBs in the manner prescribed for the laboratory. Do not pour down drains, etc.

6. APPARATUS

6.1 Apparatus required for EAN-80-SOP-20

6.1.1 Ultrasonic homogenizer - Polytron® (Brinkmann Instruments) or equivalent.

6.1.2 Test tubes - polypropylene, 50 mL.

6.1.3 Centrifuge - refrigerated, capable of 15,000 rpm.

6.1.4 Receivers - graduated 10 mL Kuderna-Danish receivers.

6.2 GC/MS - equipped with data system for instrument control and data accumulation and retrieval; must be capable of SIM operation.

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6.3 Glass column for gas chromatograph - 1 m x 2 mm i.d., packed with a suitable packing (See Section 7.1).

6.4 Microsyringe - 10 µL capacity.

6.5 Usual laboratory volumetric glassware.

7. REAGENTS AND MATERIALS

7.1 GC column packing - 3% OV-101 on 100/120 mesh Gas Chrom® Q has been found suitable and was used for validation studies.

7.2 Benzene - Fisher Scientific Company - Pesticide Grade or equivalent. Benzene must be demonstrated to be free of analyte.

7.3 Isooctane - Burdick and Jackson "Distilled in glass" or equivalent.

7.4 Stock standards - Prepare stock standard solutions (~1000 g/mL) of PCBs (e.g., Aroclor® 1242, Aroclor® 1254) by weighing 0.1g (to the nearest mg) into a 100 mL volumetric flask and diluting to volume with a suitable solvent (e.g., isooctane).

7.4.1 A stock standard containing equal concentrations of Aroclor® 1242 and Aroclor®1254 contains appropriate levels of Cl_2 through Cl_7 homologs for most applications.

7.5 Working standards - Prepare working standards in the concentration range of interest by successive dilution of the stock standards. At least three standards must be prepared with concentration ranges not to exceed one decade.

8. SAMPLING

8.1 Soil or sediment samples should be collected according to established procedures, using clean equipment.

8.2 Label each sample container with its corresponding sample number and history.

8.3 A number of sampling blanks equal to at least 10% of the total number of samples should be collected at the sampling site.

8.4 In the laboratory, samples should be handled in accordance with EAN-80-SOP-006, SOP for Homogenizing, Subdividing, and Preserving Sediment Samples.

8.5 At least 10% of the samples should be analyzed in triplicate to determine precision.

8.6 At least 10% of the samples should be spiked at appropriate levels (e.g., 2X, 10X or 100X the estimated level in the samples) to determine accuracy (recovery).

9. CALIBRATION AND STANDARDIZATION

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9.1 Mass spectrometer calibration

9.1.1 The sensitivity and mass offset (if applicable) of the mass spectrometer should be checked on a daily basis using a suitable calibration material, e.g., perfluoro-t-butyl amine (PFTBA).

9.1.2 Record the calibration results in the calibration log for the instrument.

9.2 Reference Standards and Blanks

9.2.1 GC retention times for each PCB homolog of interest should be determined by injecting 1 µL of the stock standard into the GC/MS operating in the scanning mode. The retention data and mass spectra are used to select SIM conditions (selected ions and mass group retention windows) for the determinations. Because of retention time overlap of PCB homologs, extracted ion current profiles (mass fragmentograms) are useful for determining retention windows.

9.2.2 Field blanks (Section 8.3) and laboratory blanks (Section 4.3) (at least one per day) should be analyzed according to the procedure (Section 10).

9.3 Calibration Curves or Response Factors

9.3.1 The linearity of response for SIM GC/MS must be determined for each PCB homolog. Inject equal volumes (e.g., 3 µL) of various concentrations of working standards and measure the area of each peak envelope for PCB homologs.

9.3.2 For initial calibration, at least 3 working standards and a solvent blank should be analyzed in triplicate.

9.3.3 For routine use, at least three working standards and a solvent blank should be analyzed in duplicate on a daily basis to determine linearity and response factors.

9.3.4 Linearity can be established by plotting a calibration curve (peak area vs ng injected (or vs concentration if equal injection volumes are used)) or by calculating a response factor (RF) (ng injected or concentration ÷ peak area) and plotting RF vs ng injected or vs concentration. Only sample peak areas which fall in the linear response range should be used to calculate concentrations.

9.3.5 Computer programs which calculate RFs, average RFs and standard deviation (SD), and perform a least-squares analysis can also be used. In general, a ± 20% relative SD (RSD) and a least squares correlation coefficient (R) of >0.95 are acceptable indicators of linearity.

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9.3.6 Table I contains the RF, RSD, and R for the calibration phase of method development.

TABLE I

Compound	RF ppm / area count	RSD(%)	R
Cl_2 PCB	1.10 E-4	22	.99
Cl_3 PCB	1.37 E-4	16	.995
Cl_4 PCB	1.32 E-4	13	.999
Cl_5 PCB	1.81 E-4	12	.997
Cl_6 PCB	3.31 E-4	11	.9995
Cl_7 PCB	2.10 E-3	4.7	.9998

10. PROCEDURE

10.1 Extraction

10.1.1 Extract PCBs from the soil or sediment samples using the procedure described in EAN-80-SOP-20, Extraction of Semivolatile Organic Chemicals from Soil/Sediment.

10.1.2 Extract the number of replicates and spiked samples necessary to comply with quality assurance requirements (see Sections 8.5 and 8.6).

10.1.3 Store extracts in a refrigerator if they are not analyzed immediately.

10.2 SIM GC/MS Analysis

10.2.1 Operate the GC/MS according to Standard Operating Procedure or manufacturer's instructions.

10.2.2 The following conditions have been found suitable for the chromatography of PCBs.

Column: 1 m x 2 mm i.d. glass column packed with 3% OV 101 on 100/120 mesh Gas Chrom Q.

Column Temperature: Program from 120°C to 280°C at 16°C/minute

Carrier Gas: Helium, 30 mL/min

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Injection Port Temperature: 250°C

Jet Separator Manifold Temperature: 300°C

10.2.3 The following conditions have been found suitable for the SIM GC/MS determinations using an HP 5982A GC/MS system with associated 5934A data system:

Ion Source Temperature: 150°C
Separator: Glass jet
Ionization: Electron impact - 70 eV or equivalent
Electron Multiplier Gain: 9 or 10 HI
Selected Ion Dwell Times: 200 ms

10.2.4 The selected ions, dwell times, and retention window groups are shown in Table II. Note that exact group starting times will be affected by anything that influences retention, such as column packing, column conditions, carrier flow, etc., so that the start times will have to be determined for any new set of conditions.

10.2.5 If the samples have been frozen for storage, allow to equilibrate to room temperature.

10.2.6 Inject a suitable size aliquot of the sample into the GC/MS. (If the injection volume equals that of the calibration standards, calculations are simplified.)

10.2.7 Measure peak areas for the peaks within retention windows for the PCB homologs. Check ion intensity ratios for molecular and confirming ions to be sure that interferences are not present.

10.2.8 Sample SIM chromatograms for a PCB standard are shown in Figure I A-C for reference purposes.

10.2.9 Compare sample peak areas to the appropriate calibration curve to determine if they fall within the established linear range. If the area is outside the linear range, dilute the sample with the appropriate solvent, record the dilution factor, and repeat 10.2.6 through 10.2.9 .

11. CALCULATION OF RESULTS

11.1 If injection volumes are not all equal:

11.1.1 Calculate the mass of each PCB homolog by comparing to a calibration curve prepared daily or by calculating from the response factor using the equation:

$$Mi = (RFi)(Ai)$$

where:

Mi = mass of homolog injected (ng)

RFi = Response factor for homolog (ng/area count)

Ai = peak area for homolog (area counts)

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11.1.2 Calculate the concentration of each homolog using the following equation:

$$Ci = \frac{(Mi)(V_F)(DF)}{(V_I)(W)}$$

where:

Ci = concentration of homolog (µg/g = ppm)
Mi = mass of homolog (from Section 11.1.1)
V_F = volume of extract (mL)
V_I = injection volume (µL)
W = sample weight (g)
DF = dilution factor (Section 10.2.9)

11.2 If injection volumes are equal (e.g., 5 µL)

11.2.1 Calculate the concentration of each homolog by comparing to a calibration curve prepared daily or by calculating from the response factor using the equation:

$$Ci = \frac{(RFi)(Ai)(V_F)(DF)}{W}$$

where:

Ci = concentration of homolog (µg/g = ppm)
RFi = response factor for homolog (ppm/area count)
Ai = peak area for homolog (area counts)
V_F = volume of extract (mL)
DF = dilution factor (Section 10.2.9)
W = sample weight (g)

11.3 Calculate total PCBs in sample by summing concentrations of each homolog calculated in 11.1 or 11.2.

12. REPORT

12.1 Report the results in µg/g (or ppm) without correction for recovery.

12.2 Report recoveries and precision determined on spiked samples and replicates.

12.3 Report results for all sampling and laboratory blanks.

13. PRECISION AND ACCURACY

13.1 The precision and accuracy of this method were determined in a soil matrix (Missouri Bottoms) at four levels (2.3, 11, 23, 230 ppm) by analysis of five replicates at each spiking level plus blanks.

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13.2 The precision and accuracy results are summarized in Table III. The recoveries are averages of all replicates at each spiking level. The precision is reported as relative standard deviation.

14. REFERENCES

14.1 The raw data for this method validation is found in Monsanto Research Notebook pages:

OH 1805237
RGK 1914812

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TABLE II

SELECTED IONS AND DWELL TIMES

GROUP 1

Start Time = .0

Mass	Dwell Time (ms)	
222.0	200	Cl_2 PCB
152.0	200	
256.0	200	Cl_3 PCB
186.0	200	

GROUP 2

Start Time = 3.6

Mass	Dwell Time (ms)	
290.0	200	Cl_4 PCB
220.0	200	
256.0	200	Cl_3 PCB
186.0	200	

GROUP 3

Start Time = 4.5

Mass	Dwell Time (ms)	
290.0	200	Cl_4 PCB
220.0	200	
324.0	200	Cl_5 PCB
254.0	200	

GROUP 4

Start Time = 5.5

Mass	Dwell Time (ms)	
358.0	200	Cl_6 PCB
288.0	200	
324.0	200	Cl_5 PCB
254.0	200	

GROUP 5

Start Time = 6.4

Mass	Dwell Time (ms)	
358.0	200	Cl_6 PCB
288.0	200	
324.0	200	Cl_7 PCB
254.0	200	

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FIGURE I A

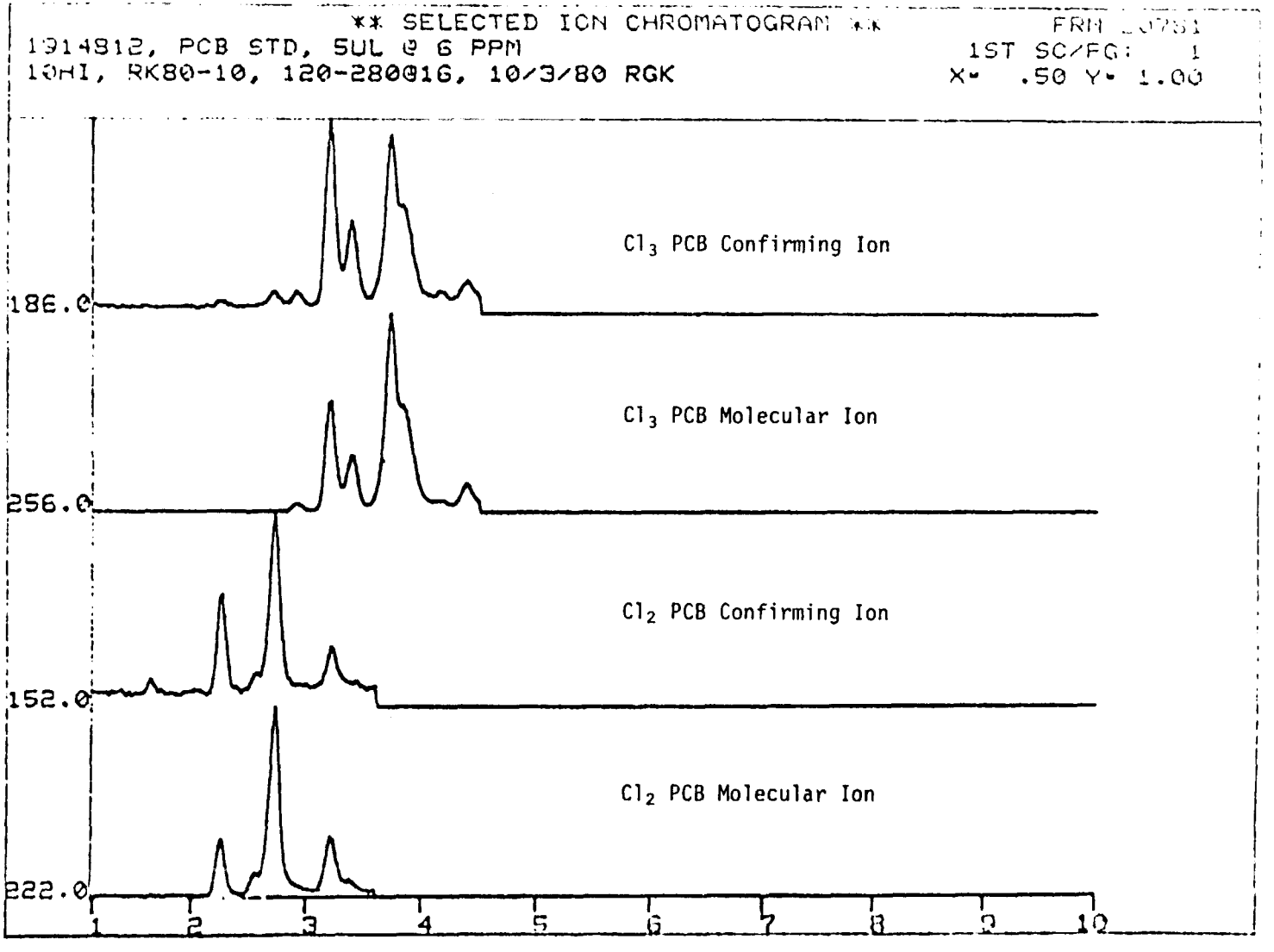

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FIGURE I B

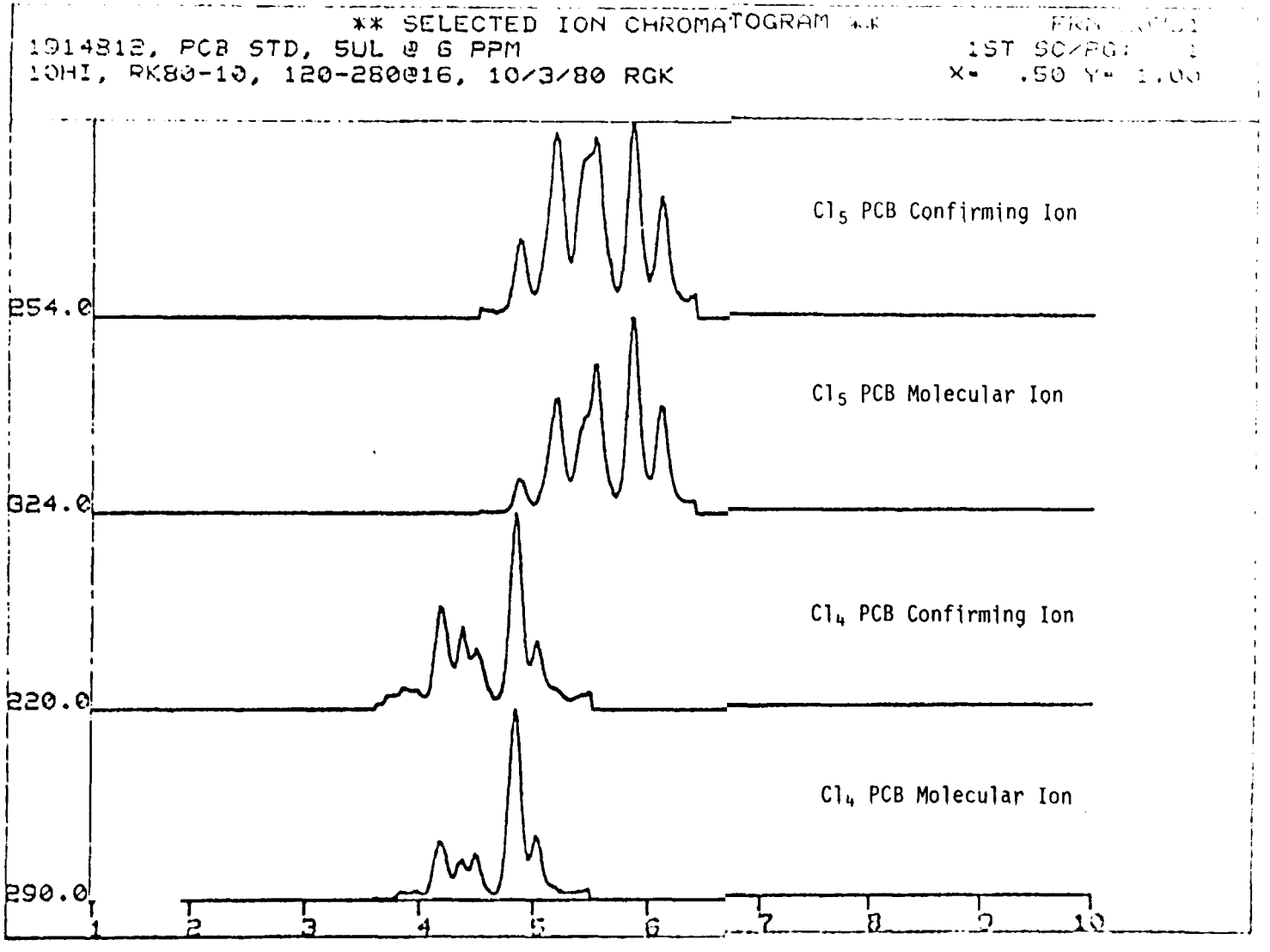

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FIGURE I C

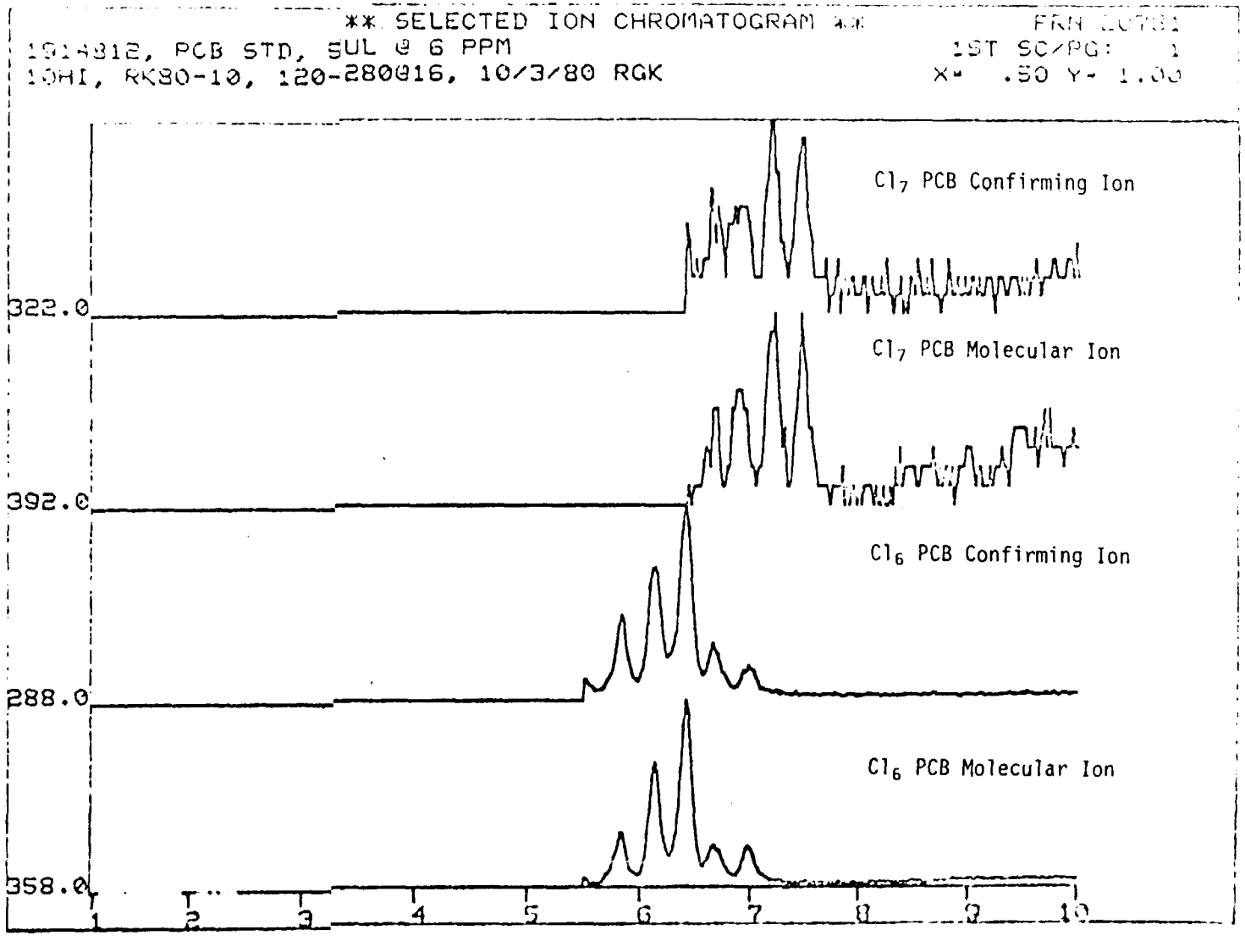
** SELECTED ION CHROMATOGRAM **
1914812, PCB STD, SUL @ 6 PPM
10HI, RK80-10, 120-280@16, 10/3/80 RGK
1ST SC/PG: 1
X- .50 Y- 1.00
Cl7 PCB Confirming Ion
Cl7 PCB Molecular Ion
Cl6 PCB Confirming Ion
Cl6 PCB Molecular Ion
322.0
392.0
288.0
358.0
1
2
3
4
5
6
7
8
9
10

TABLE III

RECOVERY AND PRECISION RESULTS

Cl_2 PCB

Spike ppm	Recovery %	RSD %
.20	81	44
1.0	72	23
2.0	79	13
20	82	13

Cl_5 PCB

Spike ppm	Recovery %	RSD %
.59	80	49
3.0	73	15
5.9	74	9.1
59	90	8.7

Cl_3 PCB

Spike ppm	Recovery %	RSD %
.63	84	38
3.2	67	20
6.3	71	8.6
63	78	12

Cl_6 PCB

Spike ppm	Recovery %	RSD %
.25	85	49
1.2	72	12
2.5	72	7.5
25	92	7.6

Cl_4 PCB

Spike ppm	Recovery %	RSD %
.53	84	45
2.7	71	17
5.3	70	8.4
53	83	7.8

Cl_7 PCB

Spike ppm	Recovery %	RSD %
.30	89	27
.61	69	10
6.1	94	13

TOTAL PCB

Spike ppm	Recovery %	RSD %
2.3	80	44
11	71	17
23	71	8.5
230	84	9.4

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METHOD REPORT
(TYPE OF REPORT)

REPORT NO.: ES-80-M-29

JOB/PROJECT NO.: 43-000-760.26-8623045
(02-003-913.41-610)

DATE: October 30, 1980

TITLE: DETERMINATION OF CHLORINATED BENZENES IN SOIL AND SEDIMENT

AUTHORS: R. G. Kaley, II and O. Hicks

ABSTRACT: The chlorobenzenes are extracted from the soil/sediment sample with an organic solvent using the procedure described in Standard Operating Procedure (SOP) EAN-80-SOP-20, Extraction of Semivolatile Organic Chemicals from Soil/Sediment. The chlorobenzenes in the extract are measured by selected ion monitoring (SIM) gas chromatography/mass spectrometry (GC/MS) and quantitated using external standards. The recovery and precision levels determined during method validation varied depending on compound and concentration.

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REPT. NO.: ES-80-M-29 AUTHORS: R. G. Kaley, II and O. Hicks
TITLE: DETERMINATION OF CHLORINATED BENZENES IN SOIL AND SEDIMENT
COPY NO.:

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DETERMINATION OF CHLORINATED BENZENES IN SOIL AND SEDIMENT

1. SCOPE

1.1 This method is for the determination of chlorinated benzenes in soil and sediment samples.

1.2 The method is applicable to samples containing 1 μg/g to 50 μg/g (ppm) of any individual chlorobenzene. Higher levels can be determined by diluting sample extracts or by analyzing smaller samples. However, proper validation at these higher levels should be carried out.

1.3 The method has been validated using a Missouri Bottoms soil sample. Proper quality assurance must be carried out to verify the performance of the method for other soils and sediments.

1.4 The method validation was done using benzene as the extraction solvent, because of a specific application of the method. In normal applications, isooctane is the recommended solvent. However, proper quality assurance must be carried out to verify the satisfactory performance of this solvent.

1.5 This method has been fully validated for mono-, di-, and trichlorobenzenes and nitrochlorobenzenes. However, with proper quality assurance, it is also applicable to tetra-, penta-, and hexachlorobenzenes.

2. SUMMARY

2.1 The chlorobenzenes are extracted from the soil/sediment sample with an organic solvent using the procedure described in Standard Operating Procedure (SOP) EAN-80-SOP-20, Extraction of Semivolatile Organic Chemicals from Soil/Sediment.

2.2 The chlorobenzenes in the extract are measured by selected ion monitoring (SIM) gas chromatography/mass spectrometry (GC/MS) and quantitated using external standards.

2.3 The recovery and precision levels determined during method validation varied depending on compound and concentration.

3. SIGNIFICANCE

3.1 Chlorobenzenes are widely used industrial chemicals and may also occur as contaminants of industrial processes. As such, the potential exists for the chemicals to be present in industrial wastes.

3.2 This method provides a technique to measure chlorobenzenes in samples from sites potentially contaminated by the disposal of such wastes.

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4. INTERFERENCES

4.1 Although the SIM GC/MS is a very sensitive and selective detector for the determination of the chlorobenzenes, the potential exists for mass spectral interferences at one or more of the ions used for the determinations.

4.2 Use of ion intensity ratio comparisons for the molecular weight ion and a confirming ion can help identify such interferences.

4.3 All sampling equipment (if used), solvents, and laboratory glassware must be demonstrated to be free of interferents by the analysis of field and laboratory blanks.

5. SAFETY PRECAUTIONS

5.1 Benzene is a suspected human carcinogen. Extreme care must be taken when preparing standards or extracting samples. Use of a personal exposure monitoring system may be required. Avoid use of benzene if possible.

5.2 HCB is a suspected carcinogen. Extreme care must be taken when preparing standards from neat materials. Avoid all contact with standards and samples.

5.3 Sediment or soil samples may contain pathogens. They should be handled as little as possible and then only by persons who have a current innoculation against typhoid.

5.4 All GC/MS vacuum pumps, especially the separator pump, must be equipped with a charcoal scrubber or must discharge into a scrubbed ventilation system to prevent discharge of hazardous vapors into the laboratory atmosphere.

6. APPARATUS

6.1 Apparatus required for EAN-80-SOP-20

6.1.1 Ultrasonic homogenizer - Polytron® (Brinkmann Instruments) or equivalent.

6.1.2 Test tubes - polypropylene, 50 mL

6.1.3 Centrifuge - refrigerated, capable of 15,000 rpm

6.1.4 Receivers - graduated 10 mL Kuderna-Danish receivers.

6.2 GC/MS - equipped with data system for instrument control and data accumulation and retrieval; must be capable of SIM operation and equipped for subambient gas chromatography.

6.3 Glass column for gas chromatograph - 1 m x 2 mm i.d., packed with a suitable packing (See Sec. 7.1).

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6.4 Microsyringe - 10 µL capacity.

6.5 Usual laboratory volumetric glassware.

7. REAGENTS AND MATERIALS

7.1 GC column packing - 3% OV-101 on 100/120 mesh Gas Chrom® Q has been found suitable and was used for validation studies.

7.2 Benzene - Fisher Scientific Company - Pesticide Grade or equivalent. Benzene must be demonstrated to be free of analyte.

7.3 Isooctane - Burdick & Jackson - "Distilled in glass" or equivalent.

7.4 Chlorobenzene samples - characterized neat materials.

7.5 Stock standards - Prepare a stock standard solution (~1000 µg/mL) of each chlorobenzene of interest by weighing 0.1g (to the nearest mg) of each material into a separate 100 mL volumetric flask and diluting to volume with the extraction solvent.

7.6 Working standards - Prepare mixed working standards in the concentration range of interest by combination and subsequent successive dilution of the stock standards. At least three working standards must be prepared, with concentration ranges not to exceed one decade.

8. SAMPLING

8.1 Soil or sediment samples should be collected according to established procedures, using clean equipment.

8.2 Label each sample container with its corresponding sample number and history.

8.3 A number of sampling blanks equal to at least 10% of the total number of samples should be collected at the sampling site.

8.4 In the laboratory, samples should be handled in accordance with EAN-80-SOP-006, SOP for Homogenizing, Subdividing, and Preserving Sediment Samples.

8.5 At least 10% of the samples should be analyzed in triplicate to determine precision.

8.6 At least 10% of the samples should be spiked at appropriate levels (e.g., 2X, 10X or 100X the estimated level in the samples) to determine accuracy (recovery).

9. CALIBRATION AND STANDARDIZATION

9.1 Mass spectometer calibration

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9.1.1 The sensitivity and mass offset (if applicable) of the mass spectrometer should be checked on a daily basis using a suitable calibration material, e.g., perfluoro-t-butyl amine ((PFTBA).

9.1.2 Record the calibration results in the calibration log for the instrument.

9.2 Reference Standards and Blanks

9.2.1 GC retention times for each chlorobenzene of interest should be determined by injecting 1 µL of each stock standard into the GC/MS operating in the scanning mode. The retention data and mass spectra are used to select SIM conditions (selected ions and mass group retention windows) for the determinations.

9.2.2 Field blanks (Section 8.5) and laboratory blanks (Section 4.3) (at least one per day) should be analyzed according to the procedure (Section 10).

9.3 Calibration Curves or Response Factors

9.3.1 The linearity of response for SIM GC/MS must be determined for each analyte. Inject equal volumes (e.g., 3 µL) of various concentrations of working standards and measure the area of each peak corresponding to an analyte of interest.

9.3.2 For initial calibration, at least 3 working standards and a solvent blank should be analyzed in triplicate.

9.3.3 For routine use, at least three working standards and a solvent blank should be analyzed in duplicate on a daily basis to determine linearity and response factors.

9.3.4 For each analyte, linearity can be established by plotting a calibration curve (peak area vs ng injected (or vs concentration if equal injection volumes are used)) or by calculating a response factor (RF) (ng injected or concentration ÷ peak area) and plotting RF vs ng injected or vs concentration. Only sample peak areas which fall in the linear response range should be used to calculate concentrations.

9.3.5 Computer programs which calculate RFs, average RFs and standard deviation (SD), and perform a least-squares analysis can also be used. In general, a ± 20% relative SD (RSD) and a least squares correlation coefficient (R) of >0.95 are acceptable indicators of linearity.

9.3.6 Table I contains the RF, RSD, and R for the calibration phase of method development.

TABLE I

Compound	RF (ppm/area count)	RSD (%)	R
Cl_1 benzene	1.85 E-4	14	.993
p-Cl_2 benzene	3.22 E-4	17	.99
o-Cl_2 benzene	2.64 E-4	23	.991
1,3,5-Cl_3 benzene	2.64 E-4	12	.992
o-Nitrochlorobenzene	9.43 E-4	10	.99
Cl_6 benzene	2.78 E-4	15	.994

10. PROCEDURE

10.1 Extraction

10.1.1 Extract the chlorobenzenes from the soil or sediment samples using the procedure described in EAN-80-SOP-20, Extraction of Semivolatile Organic Chemicals from Soil/Sediment.

10.1.2 Extract the number of replicates and spiked samples necessary to comply with quality assurance requirements (see Section 8.5 and 8.6).

10.1.3 Store extracts in a refrigerator if they are not analyzed immediately.

10.2 SIM GC/MS Analysis

10.2.1 Operate the GC/MS according to Standard Operating Procedure or manufacturer's instructions.

10.2.2 The following conditions have been found suitable for the chromatography of chlorobenzenes.

Column: 1 m x 2 mm i.d. glass column packed with 3% OV 101 on 100/120 mesh Gas Chrom Q.

Column Temperature: Program from 10°C to 200°C @ 16°C/min

Carrier Gas: Helium, 30 mL/min

Injection Port Temperature: 250°C

Jet Separator Manifold Temperature: 300°C

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10.2.3 The following conditions have been found suitable for the SIM GC/MS determinations using an HP 5982A GC/MS system with associated 5934A data system:

Ion Source Temperature: 150°C
Separator: Glass jet
Ionization: Electron impact - 70 eV or equivalent
Electron Multiplier Gain: 9 or 10 HI
Selected Ion Dwell Times: 200 ms

10.2.4 The selected ions, dwell times, and retention window groups are shown in Table II. Note that exact group starting times will be affected by anything that influences retention, such as column packing, column conditions, carrier flow, etc., so that the start times will have to be determined for any new set of conditions.

10.2.4 If the samples have been frozen for storage, allow to equilibrate to room temperature.

10.2.6 Inject a suitable size aliquot of the sample into the GC/MS. (If the injection volume equals that of the calibration standards, calculations are simplified.)

10.2.7 Measure peak areas for the peaks at the retention times or within retention windows for the compounds of interest. Check ion intensity ratios for molecular and confirming ions to be sure that interferences are not present.

10.2.8 Sample SIM chromatograms for a mixed chlorobenzene standard are shown in Figure I A-D. (Figure I B includes ions for phosphorus, which just happened to be a co-analyte for these samples.)

11. CALCULATION OF RESULTS

11.1 If injection volumes are not all equal:

11.1.1 Calculate the mass of each analyte by comparing to a calibration curve prepared daily or by calculating from the response factor using the equation:

$$Mi = (RFi)(Ai)$$

where:

Mi = mass of analyte injected (ng)

RFi = response factor for analyte (ng/area count)

Ai = peak area for analyte (area counts)

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11.1.2 Calculate the concentration of each analyte using the following equation:

$$Ci = \frac{(Mi)(V_F)(DF)}{(V_I)(W)}$$

where:

Ci = concentration of analyte (µg/g = ppm)

Mi = mass of analyte (from Section 11.1.1)

V_F = volume of extract (mL)

V_I = injection volume (µL)

W = sample weight (g)

DF = dilution factor (Section 10.2.9)

11.2 If injection volumes are equal (e.g., 3 µL):

11.2.1 Calculate the concentration of each analyte by comparing to a calibration curve prepared daily or by calculating from the response factor using the equation:

$$Ci = \frac{(RFi)(Ai)(V_F)(DF)}{W}$$

where:

Ci = concentration of analyte (µg/g = ppm)

RFi = response factor for analyte (ppm/area count)

Ai = peak area for analyte (area counts)

V_F = volume of extract (mL)

DF = dilution factor (Section 10.2.9)

W = sample weight (g)

12. REPORT

12.1 Report the results in µg/g (or ppm) without correction for recovery.

12.2 Report recoveries and precision determined on spiked samples and replicates.

12.3 Report results for all sampling and laboratory blanks.

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13. PRECISION AND ACCURACY

13.1 The precision and accuracy of this method were determined in a soil matrix (Missouri Bottoms) at four levels by analysis of five replicates at each spiking level plus blanks.

13.2 The precision and accuracy results are summarized in Table III. The recoveries are averages of all replicates at each spiking level. The precision is reported as relative standard deviation.

14. REFERENCES

14.1 The raw data for this method validation is found in Monsanto Research Notebook pages:

OH 1805238-9
RGK 1914813-5, 1914823

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TABLE II

SELECTED IONS AND DWELL TIMES

GROUP I

Start Time = .0

Mass	Dwell Time (ms)	
112.0	200	Cl_1 Benzene
114.0	200	

GROUP II

Start Time = 3.0

Mass	Dwell Time (ms)	
93.0	200	(Phosphorus) Cl_2 Benzene
111.0	200	
124.0	200	
146.0	200	

GROUP III

Start Time = 4.3

Mass	Dwell Time (ms)	
111.0	200	NCBs Cl_3 Benzene
145.0	200	
157.0	200	
180.0	200	

GROUP IV

Start Time = 6.2

Mass	Dwell Time (ms)	
111.0	200	NCBs
157.0	200	
179.0	200	Cl_4 Benzene
214.0	200	

GROUP V

Start Time = 7.7

Mass	Dwell Time (ms)	
248.0	200	Cl_5 Benzene
250.0	200	
282.0	200	Cl_6 Benzene
284.0	200	

NOTE: Groups I and II can be combined if phosphorus is excluded.

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TABLE III

RECOVERY AND PRECISION RESULTS

Cl_1 Benzene			p-Cl_2 Benzene			o-Cl_2 Benzene			1,3,5-Cl_3 Benzene			o,p-Nitrochlorobenzene		
Level (ppm)	Recovery (%)	RSD (%)	Level (ppm)	Recovery (%)	RSD (%)	Level (ppm)	Recovery (%)	RSD (%)	Level (ppm)	Recovery (%)	RSD (%)	Level (ppm)	Recovery** (%)	RSD (%)
1	91	13	1	120	10	1	130	5	1	120	12	2.0	140	10
5	38	87	5	80	28	5	81	23	5	100	13	10	140	10
10	13	11	10	58	9	10	57	7	10	82	10	20	130	4
50	56	25	50	93	10	50	90	10	50	100	13	100	120	12
5	98	11	5	150	7	5	130	2						
10	69	13	10	110	9	10	100	10						
50	104	17	50	120	10	50	120	9						

** High recoveries may be a result of quantitating both o- and p-NCB with an o-NCB standard

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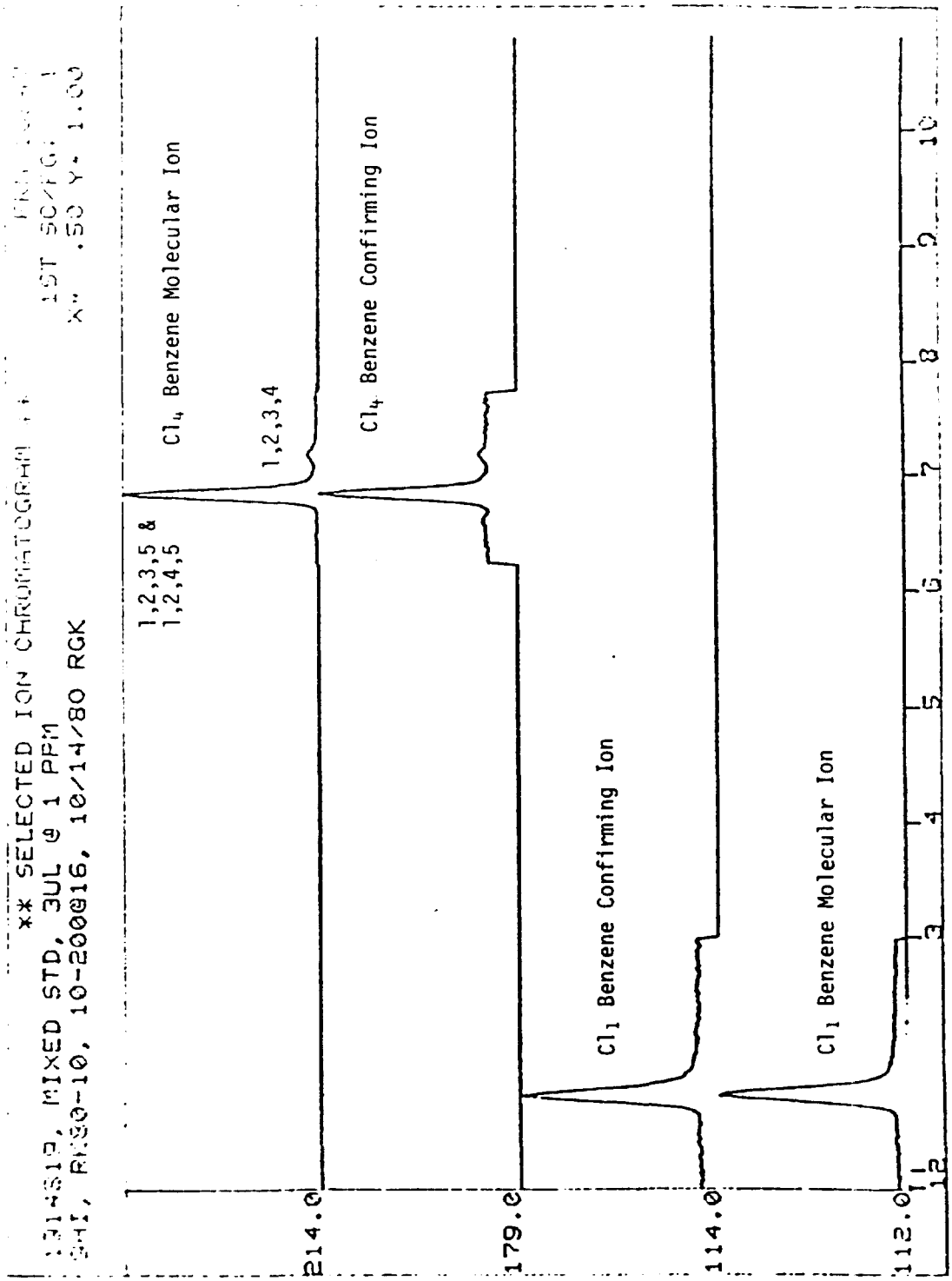
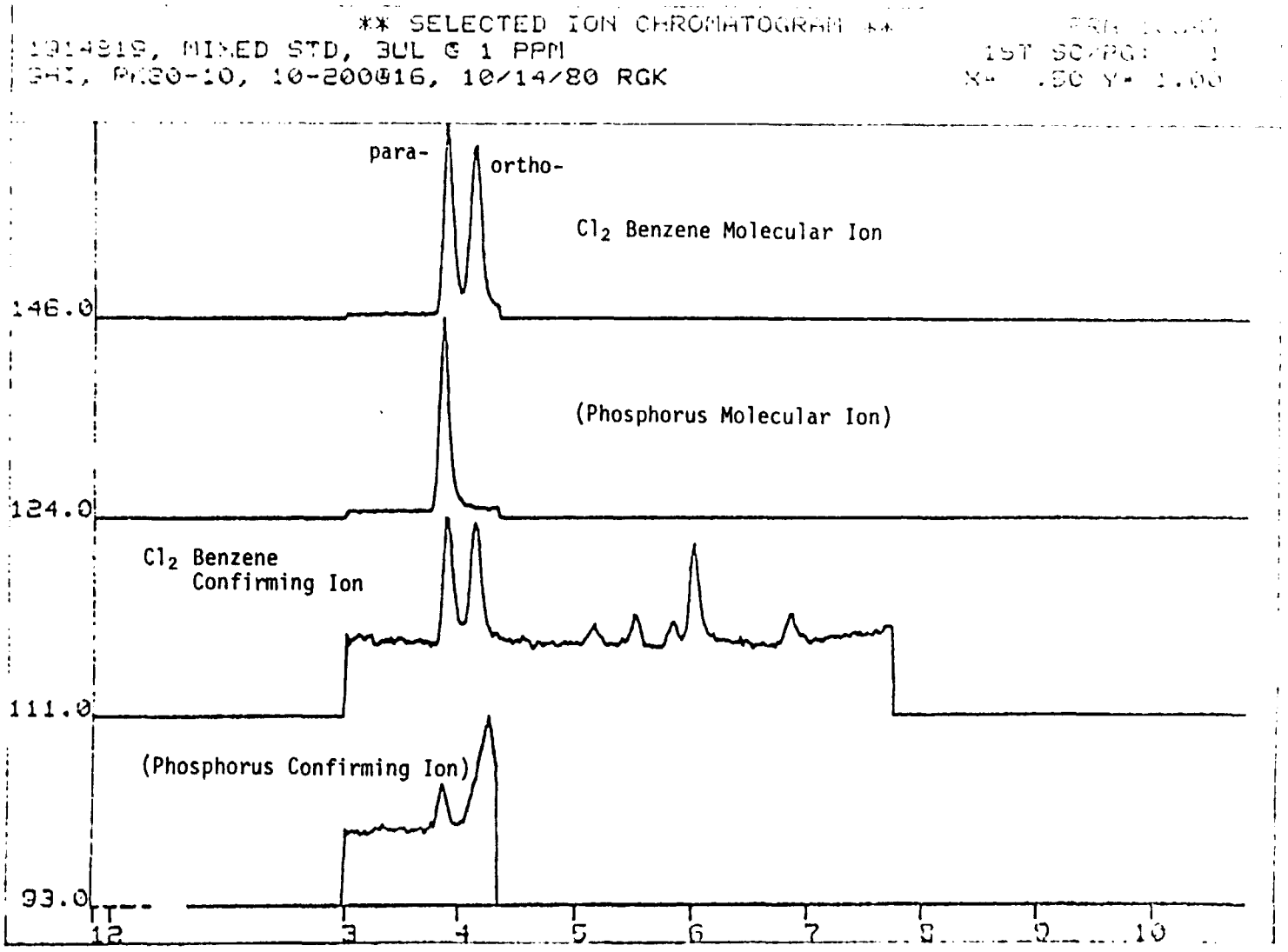
FIGURE I A



WGK 1111216

FIGURE I B



WGK 1111217

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FIGURE I C

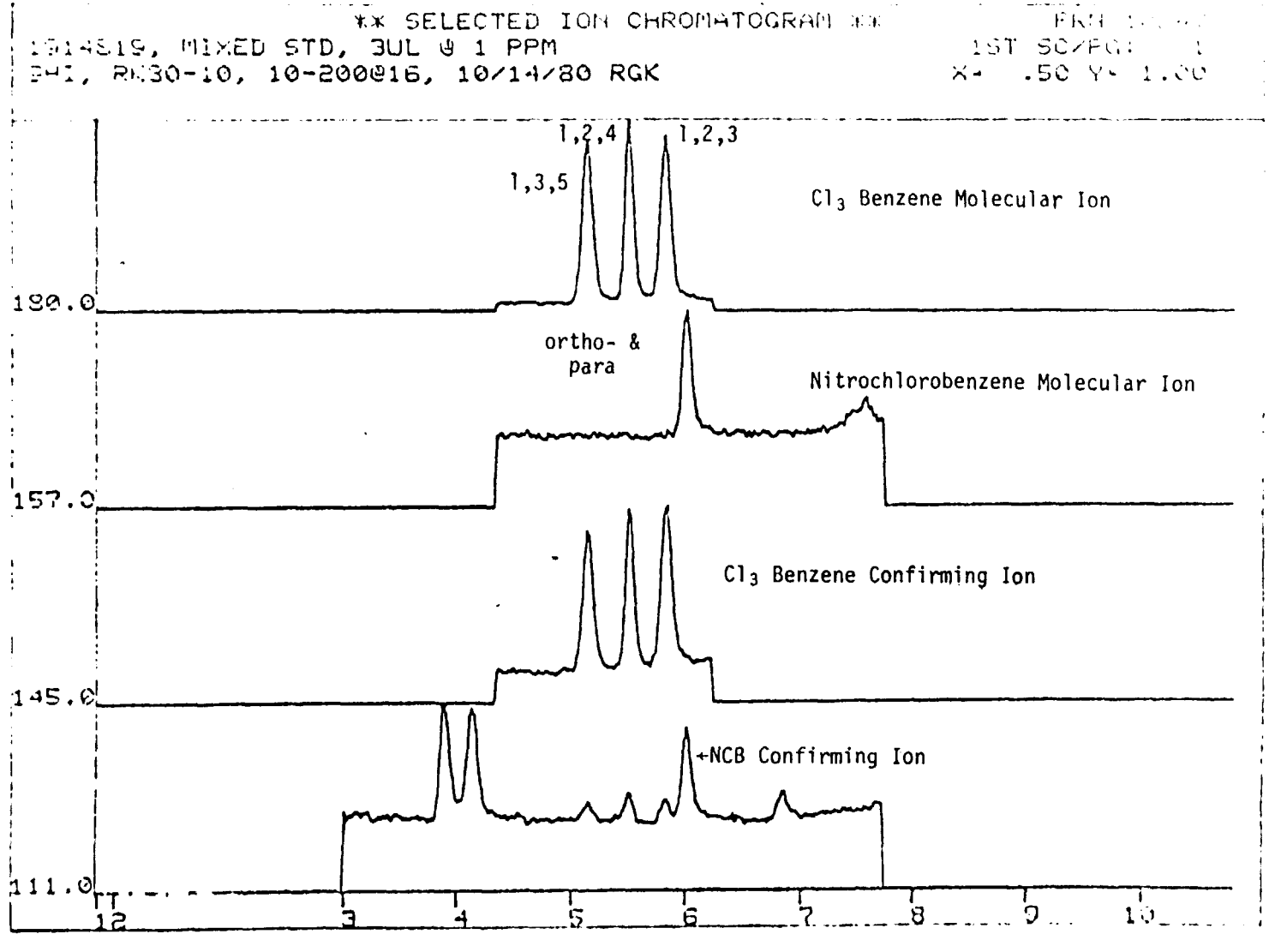

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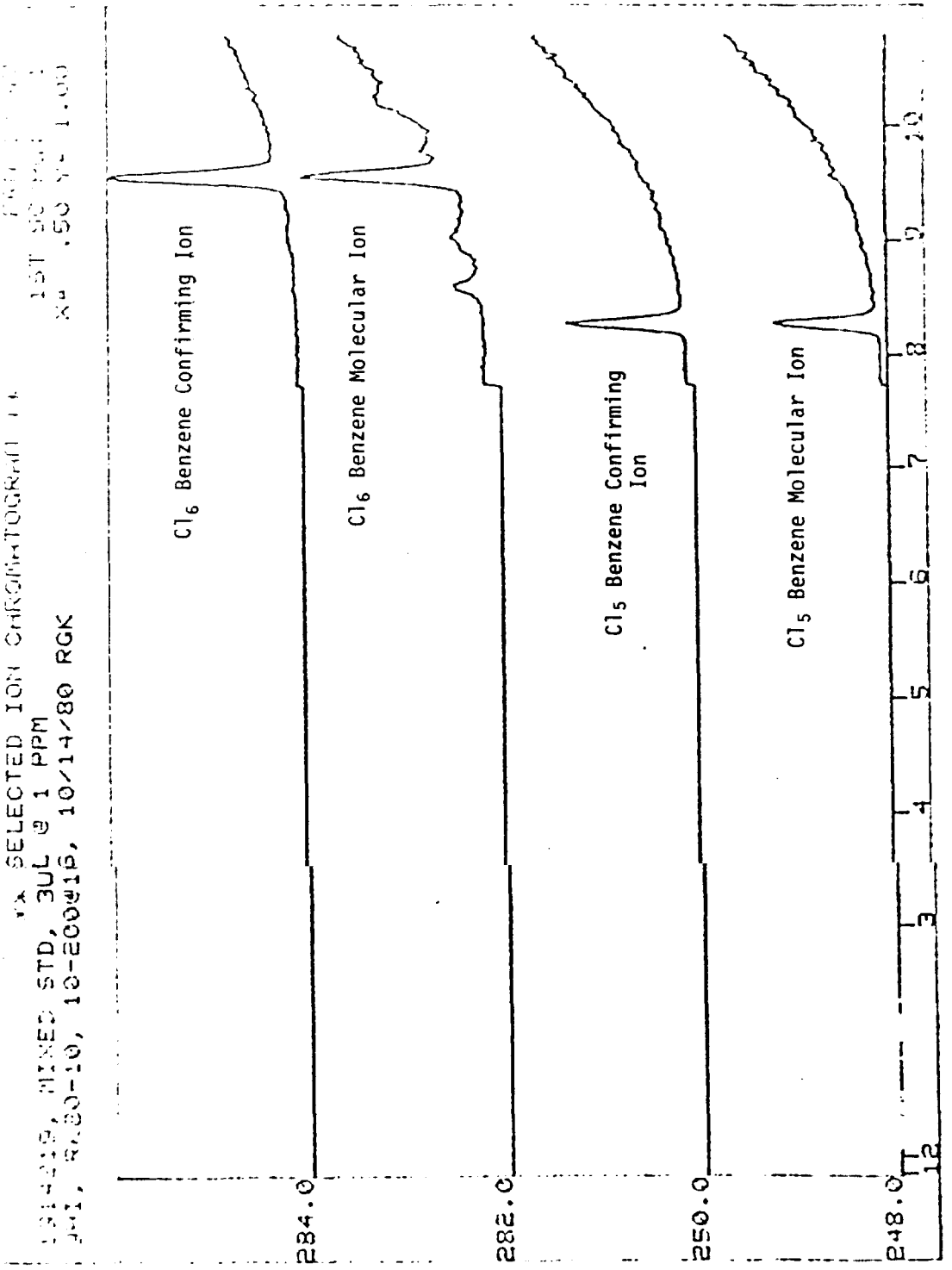
FIGURE I D



WGK 1111219

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WGK 1111220

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(CO./DIV./DEPT./LOCATION)

METHOD REPORT
(TYPE OF REPORT)

REPORT NO.: ES-80-M-30

JOB/PROJECT NO.: 43-000-760.26-8623045
(02-003-913.41-610)

DATE: October 30, 1980

TITLE: DETERMINATION OF CHLORINATED PHENOLS IN SOIL AND SEDIMENT

AUTHORS: O. Hicks, R. G. Kaley, II

ABSTRACT: The chlorinated phenols are extracted from the soil/sediment sample with an organic solvent using the procedure described in Standard Operating Procedure (SOP) EAN-80-SOP-20, Extraction of Semivolatile Organic Chemicals from Soil/Sediment. The chlorinated phenols in the extract are measured by selected ion monitoring (SIM) gas chromatography/mass spectrometry (GC/MS) and quantitated using external standards. The recovery and precision levels determined during method validation varied depending on compound and concentration.

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WGK 1111221

REPT. NO.: ES-80-M-30 AUTHORS: O. Hicks, R. G. Kaley, II
TITLE: DETERMINATION OF CHLORINATED PHENOLS IN SOIL AND SEDIMENT
COPY NO.:

R-1083(B)
R-1088(A)

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DETERMINATION OF CHLORINATED PHENOLS IN SOIL AND SEDIMENT

1. SCOPE

1.1 This method is for the determination of chlorinated phenols in soil and sediment samples.

1.2 The method is applicable to samples containing 1 µg/g to 50 µg/g (ppm) of individual chlorinated phenols. Higher levels can be determined by diluting sample extracts or by analyzing smaller samples. However, proper validation at these higher levels should be carried out.

1.3 The method has been validated using a Missouri Bottoms soil sample. Proper quality assurance must be carried out to verify the performance of the method for other soils and sediments.

1.4 The method validation was done using benzene as the extraction solvent, because of a specific application of the method. In normal applications, isooctane is the recommended solvent. However, proper quality assurance must be carried out to verify the satisfactory performance of this solvent.

1.5 This method has been fully validated for ortho, para, 2,4 di and penta chlorophenols.

2. SUMMARY

2.1 The chlorinated phenols are extracted from the soil/sediment sample with an organic solvent using the procedure described in Standard Operating Procedure (SOP) EAN-80-SOP-20, Extraction of Semivolatile Organic Chemicals from Soil/Sediment.

2.2 The chlorinated phenols in the extract are measured by selected ion monitoring (SIM) gas chromatography/mass spectrometry (GC/MS) and quantitated using external standards.

2.3 The recovery and precision levels determined during method validation varied depending on compound and concentration.

3. SIGNIFICANCE

3.1 Chlorinated phenols are widely used industrial chemicals and the potential exists for the chemicals to be present in industrial wastes.

3.2 This method provides a technique to measure chlorinated phenols in samples from sites potentially contaminated by the disposal of such wastes.

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4. INTERFERENCES

4.1 Although the SIM GC/MS is a very sensitive and selective detector for the determination of the chlorinated phenols, the potential exists for mass spectral interferences at one or more of the ions used for the determinations.

4.2 Use of ion intensity ratio comparisons for the molecular weight ion and a confirming ion can help identify such interferences.

4.3 All sampling equipment (if used), solvents, and laboratory glassware must be demonstrated to be free of interferents by the analysis of field and laboratory blanks.

5. SAFETY PRECAUTIONS

5.1 Benzene is a suspected human carcinogen. Extreme care must be taken when preparing standards or extracting samples. Use of a personal exposure monitoring system may be required. Avoid use of benzene if possible.

5.2 Some chlorophenols and trace contaminants are suspected carcinogens. Extreme care must be taken when preparing standards from neat materials. Avoid all contact with standards and samples.

5.3 Sediment or soil samples may contain pathogens. They should be handled as little as possible and then only by persons who have a current innoculation against typhoid.

5.4 All GC/MS vacuum pumps, especially the separator pump, must be equipped with a charcoal scrubber or must discharge into a scrubbed ventilation system to prevent discharge of hazardous vapors into the laboratory atmosphere.

6. APPARATUS

6.1 Apparatus required for EAN-80-SOP-20

6.1.1 Ultrasonic homogenizer - Polytron® (Brinkmann Instruments) or equivalent.

6.1.2 Test tubes - polypropylene, 50 mL

6.1.3 Centrifuge - refrigerated, capable of 15,000 rpm

6.1.4 Receivers - graduated 10 mL Kuderna-Danish receivers.

6.2 GC/MS - equipped with data system for instrument control and data accumulation and retrieval; must be capable of SIM operation.

6.3 Glass column for gas chromatograph - 1 m x 2 mm i.d., packed with a suitable packing (See Section 7.1).

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6.4 Microsyringe - 10 µL capacity.

6.5 Usual laboratory volumetric glassware.

7. REAGENTS AND MATERIALS

7.1 GC column packing - 1% SP-1240DA on 100/120 mesh Supelcoport has been found suitable and was used for validation studies.

7.2 Benzene - Fisher Scientific Company - Pesticide Grade or equivalent. Benzene must be demonstrated to be free of analyte.

7.3 Isooctane - Burdick & Jackson - "Distilled in Glass" or equivalent.

7.4 Chlorophenol samples - characterized neat materials.

7.5 Stock standards - Prepare a stock standard solution (~1000 µg/mL) of each chlorophenol of interest by weighing 0.1g (to the nearest mg) of each material into a separate 100 mL volumetric flask and diluting to volume with the extraction solvent.

7.5 Working standards - Prepare mixed working standards in the concentration range of interest by combination and subsequent successive dilution of the stock standards. At least three working standards must be prepared with concentration ranges not to exceed one decade.

8. SAMPLING

8.1 Soil or sediment samples should be collected according to established procedures, using clean equipment.

8.2 Label each sample container with its corresponding sample number and history.

8.3 A number of sampling blanks equal to at least 10% of the total number of samples should be collected at the sampling site.

8.4 In the laboratory, samples should be handled in accordance with EAN-80-SOP-006, SOP for Homogenizing, Subdividing, and Preserving Sediment Samples.

8.5 At least 10% of the samples should be analyzed in triplicate to determine precision.

8.6 At least 10% of the samples should be spiked at appropriate levels (e.g., 2X, 10X or 100X the estimated level in the samples) to determine accuracy (recovery).

9. CALIBRATION AND STANDARDIZATION

9.1 Mass spectrometer calibration.

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9.1.1 The sensitivity and mass offset (if applicable) of the mass spectrometer should be checked on a daily basis using a suitable calibration material, e.g., perfluoro-t-butyl amine (PFTBA).

9.1.2 Record the calibration results in the calibration log for the instrument.

9.2 Reference Standards and Blanks

9.2.1 GC retention times for each chlorinated phenol of interest should be determined by injecting 1 µL of each stock standard into the GC/MS operating in the scanning mode. The retention data and mass spectra are used to select SIM conditions (selected ions and mass group retention windows) for the determinations.

9.2.2 Field blanks (Section 8.3) and laboratory blanks (Section 4.3) (at least one per day) should be analyzed according to the procedure (Section 10).

9.3 Calibration Curves or Response Factors

9.3.1 The linearity of response for SIM GC/MS must be determined for each analyte. Inject equal volumes (e.g., 3 µL) of various concentrations of working standards and measure the area of each peak corresponding to an analyte of interest.

9.3.2 For initial calibration, at least 3 working standards and a solvent blank should be analyzed in triplicate.

9.3.3 For routine use, at least three working standards and a solvent blank should be analyzed in duplicate on a daily basis to determine linearity and response factors.

9.3.4 For each analyte, linearity can be established by plotting a calibration curve (peak area vs ng injected (or vs concentration if equal injection volumes are used)) or by calculating a response factor (RF) (ng injected or concentration ÷ peak area) and plotting RF vs ng injected or vs concentration. Only sample peak areas which fall in the linear response range should be used to calculate concentrations.

9.3.5 Computer programs which calculate RFs, average RFs and standard deviation (SD), and perform a least-squares analysis can also be used. In general, a ± 20% relative SD (RSD) and a least squares correlation coefficient (R) of >0.95 are acceptable indicators of linearity.

9.3.6 Table I contains the RF, RSD and R for the calibration phase of method development.

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TABLE I

Compound	RF (ppm/area count)	RSD %	R
o-chlorophenol	2.61 E-4	12	0.988
p-chlorophenol	2.57 E-4	13	0.988
2,4-dichlorophenol	7.96 E-4	7	0.996
pentachlorophenol	1.224 E-3	19	0.988

10. PROCEDURE

10.1 Extraction

10.1.1 Extract the chlorinated phenols from the soil or sediment samples using the procedure described in EAN-80-SOP-20, Extraction of Semivolatile Organic Chemicals from Soil/Sediment.

10.1.1.1 In Section 3.1.2 of above SOP, substitute 10 mL of 0.1N HCl for 10 mL purified water to insure extraction of acidic chlorinated phenols.

10.1.2 Extract the number of replicates and spiked samples necessary to comply with quality assurance requirements (see Sections 8.5 and 8.6).

10.1.3 Store extracts in a refrigerator if they are not analyzed immediately.

10.2 SIM GC/MS Analysis

10.2.1 Operate the GC/MS according to Standard Operating Procedure or manufacturer's instructions.

10.2.2 The following conditions have been found suitable for the chromatography of chlorinated phenols.

Column: 1 m X 2 mm i.d. glass column packed with 1% SP-1240DA on 100/120 mesh Supelcoport.

Column Temperature: Hold at 80°C-2'- program to 180°C @ 16°C/minute and hold for 4'.

Carrier Gas: Helium, 24 mL/min.

Injection Port Temperature: 200°C

Jet Separator Manifold Temperature: 275°C

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10.2.3 The following conditions have been found suitable for the SIM GC/MS determinations using an HP 5985 GC/MS system with associated 5934A data system and HP-7671A autosampler.

Ion Source Temperature: 250°C
Separator: Glass jet
Ionization: Electron impact-70 eV or equivalent
Electron Multiplier Voltage: 2200 eV
Selected Ion Dwell Times: 200 ms

10.2.4 The selected ions, dwell times, and retention window groups are shown in Table II. Note that exact group starting times will be affected by anything that influences retention, such as column packing, column conditions, carrier flow, etc., so that the start times will have to be determined for any new set of conditions.

10.2.5 If the samples have been frozen for storage, allow to equilibrate to room temperature.

10.2.6 Load samples and calibration standards into autosampler and set to inject suitable size aliquots into the GC/MS. (If the injection volume equals that of the calibration standards, calculations are simplified.)

10.2.7 Measure peak areas for the peaks at the retention times or within retention windows for the compounds of interest. Check ion intensity ratios for molecular and confirming ions to be sure that interferences are not present.

10.2.8 Sample SIM chromatograms for a mixed chlorinated phenols standard are shown in Figure IA and IB for reference purposes.

10.2.9 Compare sample peak areas to the appropriate calibration curve to determine if they fall within the established linear range. If the area is outside the linear range, dilute the sample with the appropriate solvent, record the dilution factor, and repeat 10.2.6 through 10.2.9.

11. CALCULATION OF RESULTS

11.1 If injection volumes are not all equal:

11.1.1 Calculate the mass of each analyte by comparing to a calibration curve prepared daily or by calculating from the response factor using the equation

$$Mi = (RFi)(Ai)$$

where:

Mi = mass of analyte injected (ng)
RFi = response factor for analyte (ng/area count)
Ai = peak area for analyte (area counts)

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11.1.2 Calculate the concentration of each analyte using the following equation

$$Ci = \frac{(Mi)(V_F)(DF)}{(V_I)(W)}$$

where:

Ci = concentration of analyte (µg/g = ppm)
Mi = mass of analyte (from Section 11.1.1)
V_F = volume of extract (mL)
V_I = injection volume (µL)
W = sample weight (g)
DF = dilution factor (Section 10.2.9)

11.2 If injection volumes are equal (e.g., 5 µL or fixed autosampler volume)

11.2.1 Calculate the concentration of each analyte by comparing to a calibration curve prepared daily or by calculating from the response factor using the equation:

$$Ci = \frac{(RFi)(Ai)(V_F)(DF)}{W}$$

where:

Ci = concentration of analyte (µg/g = ppm)
RFi = response factor for analyte (ppm/area count)
Ai = peak area for analyte (area counts)
V_F = volume of extract (mL)
DF = dilution factor (Section 10.2.9)
W = sample weight (g)

12. REPORT

12.1 Report the results in µg/g (or ppm) without correction for recovery.

12.2 Report recoveries and precision determined on spiked samples and replicates.

12.3 Report results for all sampling and laboratory blanks.

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13. PRECISION AND ACCURACY

13.1 The precision and accuracy of this method were determined in a soil matrix (Missouri Bottoms) at four levels (1, 5, 10 and 50 ppm) by analysis of five replicates at each spiking level plus blanks.

13.2 The precision and accuracy results are summarized in Table III. The recoveries are averages of all replicates at each spiking level. The precision is reported as relative standard deviation.

14. REFERENCES

14.1 The raw data for this method validation is found in Monsanto Research Notebook pages:

OH 1805238-9 and 1805242

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TABLE II

SELECTED IONS AND DWELL TIMES

GROUP 1

Start Time = 0

Mass	Dwell Time (ms)	
128	200	o-chlorophenol
64	200	
162	200	2,4 dichlorophenol
164	200	

GROUP 2

Start Time = 4.51 min

Mass	Dwell Time (ms)	
128	200	p-chlorophenol
65	200	
264	200	pentachlorophenol
268	200	

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FIGURE I A

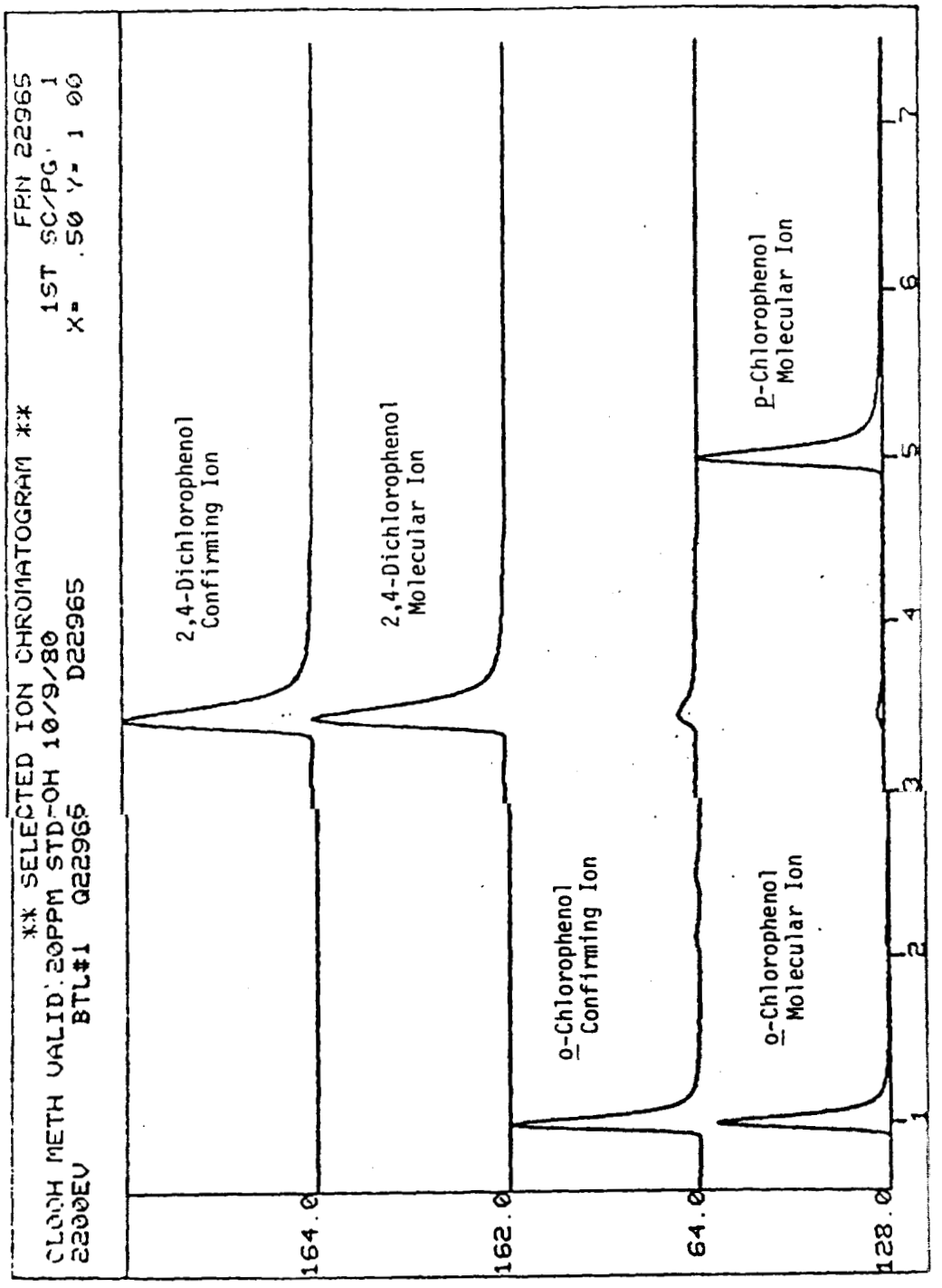

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FIGURE I B

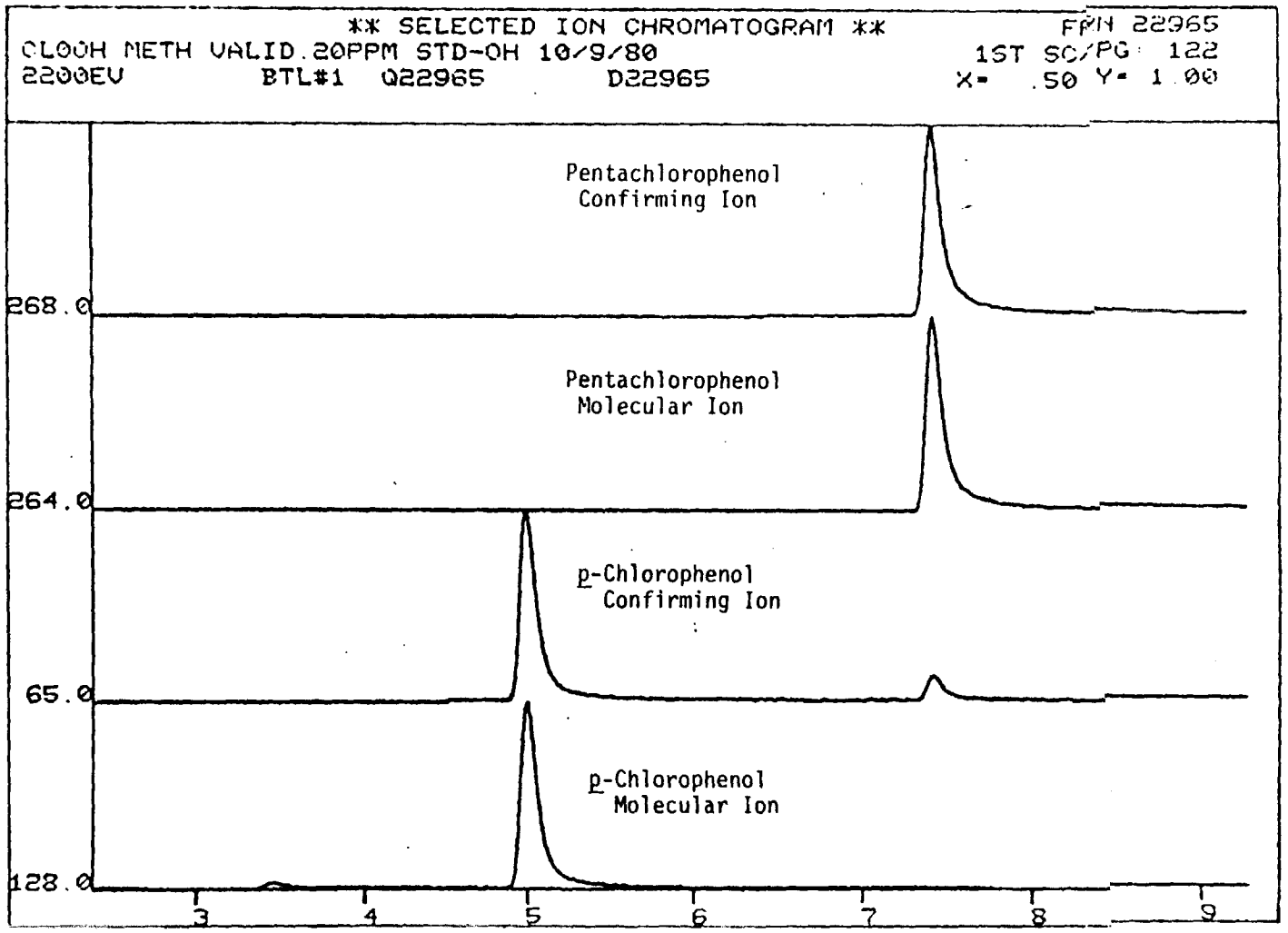

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TABLE III

RECOVERY AND PRECISION RESULTS

Level (ppm)	o-Chlorophenol		p-Chlorophenol		2,4-Dichlorophenol		Pentachlorophenol	
	% Rec	% RSD	% Rec	% RSD	% Rec	% RSD	% Rec	% RSD
1	82	11	72	10	93	9	88	4
5	62	7	59	10	71	11	88	15
10	49	5	47	8	54	5	74	12
50	67	9	62	8	72	8	62	2

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" Dead Creek E.I.

MIC ENVIRONMENTAL SCIENCES
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SPECIAL STUDY REPORT
(TYPE OF REPORT)

47

REPORT NO.: ES-81-SS-17

JOB/PROJECT NO.: 43-000-760.26-8723045
transfer to 02-003-913.41-610

DATE: February 27, 1981

TITLE: MEASUREMENT OF POLYCHLORINATED BIPHENYLS IN SOIL CORES FROM W. G. KRUMMRICH PLANT

AUTHORS: R. G. Kaley, O. Hicks, and P. R. Michael

ABSTRACT: Seven soil cores were sectioned by depth and analyzed for PCBs. Concentrations ranged from none detected, <1 ppm, to 200 ppm with no clear pattern of leaching or migration. Because these concentrations are significantly lower than most of the soil samples from the Dead Creek site, the W. G. Krummrich plant does not appear to be the major source of contamination.

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WGK 1110902

REPT. NO.: ES-81-SS-17 AUTHORS: R. G. Kaley, O. Hicks, and P. R. Michael
TITLE: MEASUREMENT OF POLYCHLORINATED BIPHENYLS IN SOIL CORES FROM W. G. KRUMMRICH PLANT
COPY NO.:

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R-1088(A)
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MEASUREMENT OF POLYCHLORINATED BIPHENYLS IN SOIL CORES FROM W. G. KRUMMRICH PLANT

INTRODUCTION

Earlier analyses of surface soil samples from the Dead Creek site near Sauget, Illinois found high levels (29-13000 ppm) of polychlorinated biphenyls (PCBs) (1,2). As a follow up to determine if the W. G. Krummrich plant was a source of the contamination, soil cores were taken on plant property from a location believed to be part of the old Dead Creek bed. The bed on plant property had been landfilled, which required the cores to be taken 12-19 feet below the present surface level. This special study reports the results of our analysis of the soil cores for PCBs.

SUMMARY

Seven soil cores were sectioned by depth and analyzed for PCBs. Concentrations ranged from none detected, <1 ppm, to 200 ppm with no clear pattern of leaching or migration. Because these concentrations are significantly lower than most of the soil samples from the Dead Creek site, the W. G. Krummrich plant does not appear to be the major source of contamination.

DETAILS

Sampling

Core samples were taken by Shannon & Wilson, Inc., Geotechnical Consultants. Seven cores in stainless steel tubes and an additional sample in a glass jar were received by the Environmental Analysis Group on 1/21/81. Our sample log numbers, description, and condition of the tubes as received are listed in Table I. Samples 1012101 and 1012102 were taken from locations that "could not possibly be contaminated" and served as sampling and analysis blanks.

All of the tubes had large gaps that did not contain any soil. Two additional samples in glass jars were received on 1/26/81. Sample 1012601 was reported to be the middle section of core 1012105 and sample 1012602 was reported to be the bottom section of core 1012103.

All of the cores were divided into three 6-8" sections and labeled TOP, MIDDLE, and BOTTOM. (Tops of the stainless steel tubes had holes drilled in the sides.) The samples were air dried and processed according to standard operating procedure (3).

ANALYSIS

All of the soils were analyzed for PCBs by GC/MS using a validated analytical method (4).

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RESULTS

The results for this study are contained in Table II. The concentrations were calculated in ppm (µg/g) on a dry weight basis. The "none detected" level (<1 ppm) is the lowest level at which the analytical method was validated. Numbers in parentheses are below the lowest validated level but do represent positive detection of PCBs.

Only about half of the soil samples contained measurable levels of PCBs. Because of the poor condition of the cores (gaps and empty sections) it is difficult to draw conclusions about PCBs leaching through the soil. However, there does not seem to be any systematic increase or decrease of concentration as a function of depth.

In comparing these results to earlier samples from the Dead Creek site, seven of the eleven Dead Creek soils had higher levels of PCBs (ranging from 1.2 to 65 times higher) than the most contaminated soil from the Krummrich plant. Therefore, it appears that the Krummrich plant is not a source of PCB contamination for the Dead Creek site.

QUALITY ASSURANCE

Two of the soil samples, 1012103 TOP and 1012106 MID, were analyzed in triplicate. Precision was 61% and 74% respectively, calculated as relative standard deviation. The poor precision is due to the very low levels of PCBs found in those two soil samples.

Accuracy (recovery) was evaluated by spiking the soil samples with known amounts of Aroclor® 1242 and 1254. Results of the spiking experiments are shown in Table III.

No PCBs were detected in any of the subsamples from either of the two blank samples, 1012101 and 1012102.

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Table I. Description of Soil samples from W. G. Krummrich Plant

Environmental Analysis Log No.	Sample Description*	Condition of Tube as Received
1012101	Boring #4 #1 12-13.5'	top 10.5" empty
1012102	Boring #4 #2 15-17'	top 7.5" empty
1012103	Boring B-1 #1 12-14'	top 4" empty, bottom 15.5" empty
1012104	Boring B-1 #2 15-17'	top 5" empty, bottom 15.5" empty
1012105	Boring B-2A #1 12-14.5'	tube completely empty except for 2" plug at top and 2" plug at bottom
1012106	Boring B-2B #2 15-17'	top 8" empty
1012107	Glass jar B-3 #1A 15-16.5'	-
1012108	Boring B-3 #2 17-19'	top 7.5 empty
1012601	Glass jar B2B-1 12-14'	-
1012602	Glass jar B1-1 12-14'	-

*All borings 3" o.d. and 30" long except for sample 1012105 which was 36" long.

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WGK 1110905

Table 11. Concentrations in ppm of PCBs in Soils from W. G. Krummrich Plant.

Sample Number		PCBs (Cl_2 to Cl_7 Homologs)
1012101	TOP	ND
	MIDDLE	ND
	BOTTOM	ND
1012102	TOP	ND
	MIDDLE	ND
	BOTTOM	ND
1012103	TOP	(0.9)
	MIDDLE	9.6
1012602	BOTTOM	(0.7)
1012104	TOP	(0.8)
	MIDDLE	ND
	BOTTOM	no sample
1012105	TOP	ND
1012601	MIDDLE	1.4
1012105	BOTTOM	(0.6)
1012106	TOP	(0.7)
	MIDDLE	12
	BOTTOM	ND
1012107	-	130
1012108	TOP	200
	MIDDLE	1[illegible]
	BOTTOM	(0.6)

ND - None detected, lowest validated level = 1 ppm.

( ) Numbers in parentheses represent positive detection of PCBs, however, precision and recovery values have not been established for the method at these levels.

WGK 1110906

Table III. Recovery of PCBs from Soils

Soil Sample		Spiking Level (ppm) of Aroclor® 1242 and 1254	% Recovery
10121103	TOP	2	61
10121106	MID	10	56
10121106	TOP	100	66

WGK 1110907

REFERENCES

1. R. G. Kaley, Special Study ES-80-SS-24, Measurement of Selected Chemicals in Soil from the Dead Creek Site - Illinois EPA Split Samples.

2. R. G. Kaley, Special Study ES-80-SS-26, Measurement of Selected Chemicals in Soil from the Dead Creek Site - W. G. Krummrich Plant Samplings.

3. O. Hicks, Standard Operating Procedure EAN-80-SOP-006, Homogenizing, Subdividing and Preserving Sediment Samples.

4. R. G. Kaley and O. Hicks, Method ES-80-M-28, Determination of Polychlorinated Biphenyls (PCBs) in Soil and Sediment.

OH NBP 1805266-68

RGK NBP 1914859

WGK 1110908

Submitted by:

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WGK 1110909

Monsanto

FROM NAME & LOCATION M.E. Webb, WGK

47

DATE September 8, 1980

SUBJECT SOIL SAMPLE ANALYSIS

REFERENCE

TO Paul Heisler, Safety Dept.

cc: W. Smull
H. Horner
J. Gloeckner
R. Sinise
T. Berner
K. Schutzenhofer
File

This report summarizes our analytical investigation of the soil sample that was taken from an area of "Dead Creek" near Judith Lane in Cahokia on 8/29/80. The sample was taken in an area where there were reported incidents of sustained smoking and burning of the soil.

I. General Appearance

The sample is moist, dark brown soil with a "musty" type odor but no distinctive chemical odor. The moisture content, determined as loss on drying at 110 C, is 19.5%.

II. Burning Characteristics

A portion of the dry sample was placed in a crucible and slowly heated with a gas burner. The sample started to smoke as it was being heated but no spontaneous ignition occurred. On applying an open flame to the sample, ignition occurred and a self-sustaining combustion continued for several seconds.

After burning subsided the sample was heated with the full heat of the burner for several minutes. Total weight loss on ignition was 33.6%.

III. Phosphorus Analysis

The question arose as to the possibility of elemental phosphorus being the initiator of combustion in the area where the sample was taken. If this were the case, significant amounts of P_2O_5 should be present in the sample.

To test for phosphate, a portion of the original sample was extracted by boiling in water for 1/2 hour. The aqueous extract was tested for phosphate by ion chromatography. None was detected. The lower limit of detection was 10 ppm PO_4 on an original sample basis.

A sulfuric acid-persulfate digestion procedure for total phosphorus (all form of phosphorus) was performed. Total phosphorus was found to be 0.04% (as P). This low level is probably attributable to normal soil background.

WGK 1111080

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IV. Solvent Extraction and Analysis

A portion of the original sample was extracted with methylene chloride using a SOXHLET extraction apparatus.

A gas chromatographic analysis of the extract was made on a Varian 3700 using a 6 ft. column of 5% Dexil 410 and flame ionization detection. The chromatogram showed an "envelope" of unresolved peaks eluting at high temperature typical of high boiling, high molecular weight, oil.

On evaporation of the methylene chloride from an aliquot of the extract, a dark brown, viscous oil comprising 9.2% by weight of the sample, was recovered.

An infrared analysis of the oil phase gave a spectrum that is typical of long chain aliphatic hydrocarbon. While the oil cannot be identified specifically, it is possible a waste lubricating or crank case oil, etc.

V. Ignition Residue Analysis

The residue remaining after ignition is a fine, brown powder. A semi-quantitative emission spectrographic analysis for metals was run on the residue.

The elements detected and approximate concentrations are as follows:

>1%	0.1 to 1%	<0.1%
Si, Fe, Cu	Al, Ca, Mg, Ni Sn, Pb, Ti, Zn	Mn, Cr

Because the copper concentration was felt to be unusually high, a quantitative analysis was made for copper by atomic absorption spectroscopy. The copper concentration was found to be 3.9%

Conclusions

The high concentration of oil found in the sample readily explains the combustible nature of the soil.

There were no indications of any organic chemicals or phosphorus in the sample that might associate it with a WGK origin.

The high level of copper found in the sample could be a clue to the source of the oil.

WGK Notebook Ref. p. 1770639, 1770837

M. E. Webb

M.E. Webb
AR&D

WGK 1111081

sl

ANALYSIS OF SOIL SAMPLES TAKEN ON 9/8/80 FROM DITCH LOCATED IN ST. CLAIR CO., CENTREVILLE TWP., R10W, T2N, BETWEEN SAUGET AND CAHOKIA. THE DITCH IS ABOUT 0.5 MILE LONG AND 20-30 FT. WIDE, AND IS ROUGHLY PARALLEL TO AND ABOUT 1400 FT. EAST OF ILL. HWY. 3, EXTENDING FROM QUEENY AVE. SOUTH TO JUDITH LANE. THE MISSISSIPPI R. IS ABOUT 1.5 MILES WEST OF THE DITCH.

	40 YDS. N. OF JUDITH LN.	50 YDS. S. OF QUEENY AVE
PCB'S	120 PPM	5200 PPM
PHOSPHORUS	120,000 PPM	NOT ANALYZED FOR METALS
COPPER	32,000 PPM	
ZINC	25,000 PPM	
IRON	70,000 PPM	
CALCIUM	11,000 PPM	
ALUMINUM	6,000 PPM	
BARIUM	4800 PPM	
NICKEL	3500 PPM	
MAGNESIUM	2900 PPM	
LEAD	2400 PPM	
SODIUM	1700 PPM	
POTASSIUM	1200 PPM	
CHROMIUM	360 PPM	
STRONTIUM	180 PPM	
MANGANESE	150 PPM	
CADMIUM	70 PPM	
VANADIUM	60 PPM	
SILVER	40 PPM	
COBALT	30 PPM	
BERYLLIUM	<1 PPM	

WGK 1111082

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PROTECTED MATERIAL: MONSANTO
INSURANCE COVERAGE LITIGATION

IN THE CIRCUIT COURT
TWENTIETH JUDICIAL CIRCUIT OF ILLINOIS
ST. CLAIR COUNTY

FILED
JUN 16 1986
CIRCUIT CLERK

PEOPLE OF THE STATE OF ILLINOIS,)
Plaintiff,)
vs.) CAUSE NO. 81-CH-19
PAUL SAUGET, individually, and SAUGET & COMPANY, a Delaware corporation,)
Defendants.)

REPORT OF PROCEEDINGS

Before the HONORABLE JONATHAN ISBELL, Judge

(July 24, 1985)

MONSANTO INSURANCE COMPANY LITIGATION:
MAY 25, 1990 ORDER PROTECTED MATERIAL
TREAT AS PROTECTED UNDER ATTORNEY-CLIENT
PRIVILEGE AND WORK-PRODUCT DOCTRINE.

APPEARANCES:

MR. MARK A. LaROSE, Assistant Attorney General,
On Behalf of the People of the State of Illinois; and

MR. BRUCE CARLSON, Staff Attorney,
On Behalf of the Illinois Environmental Protection Agency; and

MR. HAROLD G. BAKER, JR., Attorney at Law,
On Behalf of Paul Sauget, individually, and Sauget & Company, a Delaware corporation.

LINDA S. HOYLMAN, C.S.R.
Official Court Reporter

HED 0000425

PROTECTED MATERIAL: MONSANTO
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I N D E X

	INTRODUCED (Page)	ADMITTED (Page)	NOT ADMITTED (Page)
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MR. BAKER: You did swear him in, didn't you (to the Clerk)?

CLERK: Uh huh.

Q (Mr. Baker) Your name is Paul Sauget?

A Yes.

Q And you live in the Village of Sauget?

A Yes.

Q St. Clair County, Illinois?

A Yes.

Q You used to operate a landfill in St. Clair County?

A Yes.

Q Down along the river?

A Yes.

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Q I show you what the-- what I think we marked as Exhibit A on March the 20th, 1984, and I ask you if the area within the black lines truly depicts what may have been or was your landfill?

A Yeah, that's the vicinity, the area, or whatever.

Q Okay, this is obviously the Mississippi River up to the top of it?

A Yes.

Q Okay.

Mr. Sauget, in March of 1984, did you enter into an

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1 Q (Mr. Baker) Now, before I give this to you-- I'm
2 not trying to play a dirty trick on you.
3 Mr. Sauget, you are personally aware, are you not,
4 of the vicinity in which this landfill appears?
5 A I am.
6 Q And you've lived within what, four miles of that
7 area all of your life?
8 A Approximately, yes.
9 Q What lies-- Well, strike that.
10 Which way is north, Paul?
11 A Towards you.
12 Q Towards me?
13 A Right.
14 Q All right. So, north is where it says "fly-ash
15 pond"? That would be north compared to the rest of it, is
16 that right?
17 A That's right.
18 Q Okay. What is this white strip? What does it
19 represent that runs all the way north and south across the
20 picture?
21 A That's the seawall.
22 Q Or the levee?
23 A The levee and the seawall, the concrete wall on
24 the levee.

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1 Q As a matter of fact, that's a road of-- gravel
2 road that's on top of that seawall?
3 A It's on the east side of the levee, of the
4 seawall, of the white line.
5 Q What is this structure down here at the southwest
6 end of the picture?
7 A That's Cargill's, I guess,--
8 Q It's the old elevator?
9 A Wait a minute,--
10 Q It's the old elevator, is it not?
11 A Yeah, I think it is.
12 Q And that's the--
13 A Is that the railroad? Yeah, that's Cargill's.
14 It's St. Louis Grain or something now.
15 Q That's abandoned, isn't it?
16 A Yes.
17 Q And this area down about the east center of the
18 picture--
19 A That's Phillips.
20 Q Phillips Pipeline?
21 A Pipeline Company.
22 Q It's a tank farm?
23 A Right.
24 Q All right.

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1 Route 3, Illinois Route 3, is not shown on the
2 picture, but it's--
3 A Lower.
4 Q --down further to the east-- Down further to the
5 east, that doesn't sound right. But on the picture, it
6 would be down further to the east?
7 A That's right.
8 Q And it runs generally parallel with the levee?
9 A With the levee. In that location, yeah.
10 Q Mr. Sauget, are there any homes between the levee
11 and Route 3, either here by the Phillips' tank farm or over
12 here further north?
13 A No. No.
14 Q Are there any homes on the riverside of the
15 levee, south of the old landfill?
16 A How far south are you talking? If you go down
17 past--
18 Q Well, to the next section road, for example?
19 A No, no, nothing until you get past the canal.
20 Q And how far would that be?
21 A A couple of miles.
22 Q And are there any homes up to the north of the
23 old landfill on the riverside of the levee?
24 A No.

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1 Q Okay.

2 Somebody now uses and occupies a substantial portion

3 of this, do they not?

4 A They do.

5 Q And do you know of your own personal knowledge

6 who it is?

7 A Yes, I do.

8 Q Who?

9 A Pillsbury Company.

10 Q And my understanding is that they've leased the

11 area north of the old-- north of the Alton-Southern from

12 the owners of that ground?

13 A Not quite. They lease south of their present

14 location. They lease south to another property line in

15 there.

16 Q Can you show us on the map where Pillsbury is?

17 And maybe I ought not try to lead you.

18 A That-- I thought that was right there, I guess.

19 (At this time, the witness got up from the

20 witness stand and approached map.)

21 A Looks like the State could come up with a better

22 map than that.

23 THE COURT: Sir,-- Mr. Saugat, I have to remind

24 you, the Court Reporter is taking down everything you say.

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1 And even though, sometimes--

2 THE WITNESS: I can't see it from--

3 THE COURT: Wait, hold on. Even though sometimes

4 you're kind of really not talking for the record, you have

5 to realize it's all on the record. So, try to keep your

6 voice up, and don't mumble or talk under your breath.

7 THE WITNESS: I'm sorry

8 THE COURT: That's okay.

9 A That's-- That's Pillsbury. But this is a pretty

10 old map, isn't it? This is an old map.

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11 Q Well, can--

12 A This is Pillsbury, and this is something else.

13 Q Where you're pointing to, is where the--

14 THE COURT: Where it says "fly-ash pond."

15 Q (Mr. Baker) West and opposite about the third--

16 What do you call those? Peers out into the river?

17 A They have an unloading conveyor here, and they

18 got a grain loading conveyor here. That's not shown on

19 there.

20 Q How far south does Pillsbury use?

21 A Well, I don't know, they-- Pretty hard to tell

22 from this map. But they go, I would say, five hundred

23 feet.

24 Q Wasn't-- Pillsbury, in fact, has built a

1 railroad spur that comes off the Alton & Southern--
2 A Right.
3 Q --and in like this, is that not right?
4 A Two tracks.
5 MR. LaROSE: Excuse me, Your Honor. Excuse me,
6 Your Honor, I would ask that the witness be allowed to
7 testify and that counsel not lead the witness.
8 THE COURT: Leading, sustained.
9 MR. BAKER: All right.
10 Q (Mr. Baker) Has Pillsbury built a railroad?
11 A They built two tracks in from this Alton-Southern
12 line there into their terminal so-- where they load grain
13 onto the river. They have two tracks in there.
14 In fact, one of the--
15 MR. LaROSE: Excuse me, Your Honor, there is no
16 pending question.
17 THE COURT: Sustained.
18 Wait for a question.
19 THE WITNESS: Can I finish my answer?
20 THE COURT: The question was has Pillsbury built
21 railroad tracks. And if you haven't-- If you finished
22 your answer to that question, then wait till the next
23 question. If you haven't finished your answer, then you
24 may proceed. But make sure it's to the question he asked.

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1 A We're talking about railroad tracks?
2 Q Yes.
3 A I was trying to identify where they built them.
4 In fact, they got another railroad tracks that comes around
5 and goes over there.
6 THE COURT: Thanks.
7 A Storage track.
8 Q Now, let me go back to March of '84, Mr. Sauget,
9 and I hand you what has been marked for identification as
10 Joint Exhibit 1 and ask if you've seen that document
11 before.
12 (At this time, Joint Exhibit
13 No. 1, having been so marked
14 for identification, was
15 introduced into evidence.)

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16 A Yeah, I guess I have.
17 Q Did you sign that document?
18 A Yeah, I guess I have.
19 Q In that document you agreed to do certain things
20 in respect to your own landfill, did you not?
21 A I did.
22 Q Did you do them?
23 A No. Partially, but not of any consequences.
24 Q What have you done since that stipulation was

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1 Q 1984?

2 A No.

3 Q Have you made any-- You say you haven't done

4 anything since the spring of 1985 to put any more cover on?

5 A Not to put any on. I went down there to level

6 out what I had. That's when I got hung up in the mud, so I

7 quit.

8 I don't guess I can say anything, Judge, without--

9 THE COURT: I would appreciate your waiting for a

10 question. Right.

11 THE WITNESS: Then after that, do I get my

12 chance?

13 THE COURT: This is your chance, but your

14 attorney will take care of you, don't worry. Be patient.

15 You can whisper in his ear.

16 Q (Mr. Baker) Mr. Sauget, have you allowed dumping

17 on any part of the site since the flood in 1973?

18 A No, sir.

19 Q Are you allowing dumping on the site now?

20 A No.

21 Q There is,-- I think we have to admit there is

22 some dumping, is there not?

23 A There are.

24 Q And is that being done under your auspices?

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1 A (no response)
2 Q Are you doing it?
3 A No.
4 Q Are you allowing it to be done?
5 A No.
6 Q Do you have any interest in the real estate?
7 A No.
8 Q Do you know who owns the part south of the Alton-
9 Southern Parcel C or Track C?
10 A Yeah, I think I do. I think the same owners
11 still have it.
12 Q Who is that?
13 A Cahokia Trust Properties.
14 Q Have they, to your knowledge, done anything--
15 A Wait a minute.
16 Q Pardon?
17 A Let me think. I think they still own it.
18 THE COURT: What is Track C?
19 MR. BAKER: That's the part south of the
20 railroad there (indicating on map).
21 Q (Mr. Baker) And who owns the-- up north of the
22 railraod, "B" and "A" and further up, if you know?
23 A The first parcel north of the railroad is owned
24 by Monsanto. And there is another parcel owned by Phillips

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1 66. And then another parcel was owned by Portland Cement.
2 And I think a guy by the name of Spirtas-- He's a wrecking
3 contractor in St. Louis. --I heard or he told me that he
4 had purchased that from Portland, which I don't know for
5 sure. And then Eagle Marine owns from there north.
6 Q And Eagle Marine owns what is leased by
7 Pillsbury?
8 A What is leased by Pillsbury.
9 Q To your knowledge, are any of the owners allowing
10 people to dump down there?
11 A Not that I know of. I mean, Spirtas, he dumped
12 down there.
13 Q But Spirtas doesn't own anything that was in the
14 landfill, does he? Or does he?
15 A He did, yes.
16 MR. BAKER: I'm going to lead him, if I may,
17 because I think it will speed it up.
18 Q (Mr. Baker) When you're talking about Monsanto,
19 Pillsbury, and Phillips, there are three pie-shape
20 pieces,--
21 A Right.
22 Q --aren't there, that come from here to the river?
23 A That's right.
24 Q Monsanto, Phillips with the peer, and then you

MONSANTO INSURANCE COMPANY LITIGATION:
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1 say Spirtas-- I know it to be Patgood. --is here?
2 A Yeah, that's the Alton-Southern.
3 Q Here is the A.M.S.
4 A Okay. Monsanto owns the first strip.
5 Q Like that (indicating)?
6 A That (indicating).
7 Q And then Phillips?
8 A That's Phillips right there. And then Portland
9 Cement, which is now Spirtas.
10 Q Okay.
11 A And then Eagle Marine.
12 Q All right.
13 Do you have any estimation, Mr. Sauget,-- You say--
14 You've told us what it would cost. Do you have any
15 estimation of the time it would take you if you started
16 today and worked diligently with one dump truck and one
17 tractor, how long it would take you to completely fill the
18 areas that you agreed to fill, cover the areas you agreed
19 to fill?
20 A With one dump truck, ten years.
21 Q So, we could work down from there by the number
22 of trucks?
23 A Well, it's just a guess, but--
24 MR. BAKER: I have no other questions.

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1 You say "B"?

2 Q Paragraph 3.

3 A Oh, 3.

4 Q You agree that you were in continuing violation

5 of the Board Order, is that right?

6 A Not when they give me an Order to do something

7 that's impossible for me to do.

8 Q Sir, the question was in paragraph 3 of that

9 document, did you agree that you were in continuing

10 violation of the Board Order?

11 A Not when they give me an Order for something for

12 me to do that I can't do, and I don't think I'm in

13 violation.

14 THE COURT: Sir, the document speaks for itself.

15 Why don't you move beyond the document.

16 MR. LaROSE: Okay.

17 Q (Mr. LaRose) Mr. Sauget, at the time that you

18 entered into that agreement, those parcels that you've

19 identified on what we've marked as Plaintiff's Exhibit No.

20 2, they were owned by those companies at the time of this

21 agreement, weren't they?

22 (At this time, Plaintiff's

23 Exhibit No. 2, having been

24 so marked for identifica-

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1 tion, was introduced into
2 evidence.)
3 A I really don't know whether Spirtas bought that
4 then or not.
5 Q The other parcels were owned by Eagle Marine
6 and--
7 A Yeah.
8 Q --and by Monsanto, and by the oil company?
9 A Yeah.
10 Q And somebody owned that parcel named Spirtas?
11 A Yeah, I don't know when that trans- -- changed
12 hands.
13 Q And at that time, Pillsbury was operating under a
14 lease with Eagle Marine in 1984, weren't they?
15 A That's right.
16 Q So, you entered into this agreement even though
17 that property was owned by other people and even though
18 people were operating under a lease on that property, is
19 that correct?
20 A That's right.
21 Q Okay.
22 Now, you said that you spread some dirt in the spring
23 of '85?
24 A Well, it was-- It was in '84 that the dirt was

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1 fly-ash. That has been approved by the EPA. But I get
2 halfway in the ballgame, then they say no, you can't use
3 cinders anymore. And that's what got me in trouble.
4 Q As a matter of fact,-- As a matter of fact, the
5 area marked-- Boy, I hate these upside down maps. --"A"
6 is covered with cinders and fly-ash, is it not?
7 A Well, approximately. I mean, I can't really tell
8 from the map.
9 Q As a matter of fact, is part of "B" covered with
10 cinders and fly-ash?
11 A Yes.
12 Q And the cinders and fly-ash came from where, Mr.
13 Sauget?
14 A Came from Monsanto in the St. Louis plant and in
15 the Krummrich plant.
16 Q And that's still available?
17 A That's still available.
18 And also at that time, I had available to me a fly-
19 ash-- not a fly-ash. It's a slag mound north of Monsanto
20 Avenue that was available to me then that made excellent
21 cover. It got as hard as this top. But they wouldn't let
22 me use it.
23 Q As a matter of fact, the part that's covered here
24 in "A" with fly-ash is stage vegetation?

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1 A Oh, yeah. Well, part of that, Pillsburry has
2 coal on it, stacked and piled on it; and one time, they had
3 a pile of corn on it; and they stockpiled things out there
4 on that area.
5 Q And it's hard?
6 A Pardon?
7 Q It's hard?
8 A It's hard, yes.
9 Q All right.
10 THE COURT: Wait.
11 MR. LaROSE: Are you done?
12 MR. BAKER: Yeah.
13
14 (FURTHER) EXAMINATION
15 BY MR. LaROSE:
16 Q Mr. Sauget, you know anything about permeability?
17 A Well, a little, a little something.
18 Q Do you know what permeability means?
19 A Stable, tightness, stable built, lack of
20 penetration.
21 Q Would you know if permeability means the ability
22 of water to travel through a given substance in a given
23 amount of time?
24 A I know water travels.

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1 Patrick McCarthy.

2 THE COURT: Mr. McCarthy, step forward, please.

3 Come up here. I'll swear you in.

4 Raise your right hand.

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5

6 PATRICK M. McCARTHY

7 being called as a witness by Mr. LaRose, having been first

8 duly sworn by the Court, testified as follows:

9 DIRECT EXAMINATION

10 BY MR. LaROSE:

11 Q Mr. McCarthy, could you state your name for the

12 record, please?

13 A Patrick Michael McCarthy.

14 Q And your present occupation, Mr. McCarthy?

15 A Environmental Specialist with the Illinois EPA,

16 Division of Land and Pollution Control in the Collinsville

17 Regional Office.

18 Q How long have you held that title, Mr. McCarthy?

19 A Since 1972, January.

20 Q Okay. Have you had any special training as

21 Environmental Protection Specialist?

22 A Yes. I have had numerous seminars and training

23 from the U.S. EPA, private training with consultants,

24 safety training, sampling techniques, investigation

1 A Well, basically, as I stated earlier, determining
2 the area in question that was the fill area and walking in
3 a certain direction in every fifty, seventy-five yards, a
4 hundred yards, stopping, digging, and just recording what
5 was found.
6 Q Digging how far?
7 A Until I encountered refuse.
8 Q Okay. Do the pictures that appear on page 2
9 through 5 of what has been marked as Plaintiff's Group
10 Exhibit 3 fairly and accurately represent the areas in
11 which you took depth probings in Decembr of 1979?
12 A This is correct.
13 Q Okay. Mr. McCarthy, I'm going to hand you what
14 I've marked as Plaintiff's Group Exhibit 3A and ask if you
15 can identify that, please.
16 (At this time, Plaintiff's
17 Group Exhibit 3A, having
18 been so marked for identi-
19 fication, was introduced
20 into evidence.)
21 A Yes, this is the site sketch I prepared at the
22 time of the December '79 inspections. One-- Page 1 shows
23 what we referred to as Area "A" and "B," and page 2 is Area
24 "C."

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1 Q Okay, now, at the time that you took this in '79,
2 there were no designated areas, "A," "B," and "C"?
3 A That's correct, we considered "A" and "B" to be
4 the northern site, "C" to be the southern site.
5 Q Okay, what does page 1 depict, not which area,
6 but what specifically does it depict?
7 A Okay. it shows approximate locations and the
8 distance between those locations of the probings that I
9 took on the date and also on the legend shows the depth of
10 cover before encountering refuse.
11 Q Okay. how many depth probings did you take on
12 December the 6th of 1979 of what would be the-- Correct me
13 if I'm wrong. --the northern portion of the site?
14 A Seven.
15 Q Okay. And what were the results of those
16 probings?
17 A That no area was found that contained two foot of
18 final cover.
19 Q Okay, directing your attention to page 2 of
20 Plaintiff's Group Exhibit 3A. what specifically is depicted
21 on page 2?
22 A Again, the approximate location of the areas that
23 I did depth probings to determine the depth of final cover
24 and also the distances between those probing areas and also

1 McCarthy, if you can identify that?

2 (At this time, Plaintiff's

3 Group Exibit No. 4. having

4 been so marked for identifi-

5 cation, was introduced into

6 evidence.)

7 A Yes, this is a report that I prepared after the

8 July 26th and 27th inspections at the subject facility.

9 Q Okay, and how many pages are there to that

10 exhibit?

11 A Eight.

12 Q Okay. And it includes what material?

13 A Okay, page 1 is a cover memo, summary memo of the

14 inspection. Pages 2 and 3 reflect what was determined--

15 the locations of the probings on the northern site, and 4

16 and 5-- pages 4 and 5 show the location business and the

17 depth of cover on the southern portion-- southern side.

18 And pages 6, 7 and 8 are photographs showing again

19 techniques used at that time. a scade in this case,

20 determining-- digging down until encountering refuse.

21 Q Directing your attention to page 2 of that

22 document. what does page 2 specifically identify?

23 A The approximate locations of the depth probings

24 taken on July 29th, 1982.

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After having handed Counsel a copy, I'm going to hand you what I've marked as Plaintiff's Group Exhibit No. 5 and ask you if you can identify that document?

(At this time, Plaintiff's Exhibit No. 5, having been so marked for identification, was introduced into evidence.)

A Yes, this is an inspection report that I prepared after inspecting the facility which consists of the narrative on page 1, locations of probings of the southern site, Area "C," on page 2; and page 3 is locations of probings and photographs taken of Areas "A" and "B;" and then pages 4 through 10 are photographs taken by myself on March 28th, 1985--

Q Okay.

A --during the time of the inspection.

Q Did you take depth probings on March 28th, 1985?

A Yes.

Q Okay. How many did you take on the-- what would be Section "C" of the site?

A Section "C," there were ten.

Q Okay. Are-- Now, the location of those probings, do they appear anywhere in that exhibit?

1 water. It would not-- It would not meet the requirements
2 of final cover if two foot of suitable final cover were
3 there. Therefore, I did not probe it.
4 Q Okay. Did you take a photograh of that area that
5 was recently spread?
6 A Yes.
7 Q Okay. I'm going to hand you what has been
8 previously marked as Plaintiff's Group Exhibit No. 6, a
9 copy of which I'm handing Counsel, and ask you if you can
10 identify that document?
11 (At this time, Plaintiff's
12 Group Exhibit No. 6, having
13 been so marked for identifi-
14 cation, was introduced into
15 evidence.)
16 A Okay, this is a document which is a-- page 1 is
17 a cover memo which briefly discusses May 10th and May 20th,
18 those short visits and then also the June 10th, 1985
19 inspection that I conducted.
20 Q So that the report then of your-- the entire
21 report and photographs of your June 10th, 1985 inspection?
22 A Yes, along with some informaton on May 10th and
23 20th.
24 Q Does that packet of information contain the

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1 (At this time, Plaintiff's
2 Exhibit No. 7, having been
3 so marked for identifica-
4 tion, was introduced into
5 evidence.)
6 A Yes, this is the report that I pepared reflecting
7 the conditions I observed at the site on July 23rd, 1985.
8 Q And after-- Does that report fairly and
9 accurately represent the original report that you prepared
10 regarding your inspection of the site yesterday?
11 A Yes, it does.
12 Q Okay. In fact, that's a carbon copy?
13 A This is a carbon copy of the report, yes.
14 Q After inspecting the site yesterday and in
15 conjunction with the preparation of your report, did you
16 reach a conclusion as to whether any of the site had two
17 foot of suitable cover in accordance with the stipulation
18 and the agreement and the corresponding Court Orders of
19 1984?
20 A Yes, I did.
21 Q Okay, and what was that conclusion?
22 A I concluded that the facility was not in
23 compliance with the two-foot final cover requirement.
24 Q Okay.

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1 (At this time, Plaintiff's
2 Exhibit No. 2, having been
3 offered into evidence, was
4 admitted, there being no
5 objection by Mr. Baker.)
6 MR. LaROSE: I would move for admission of
7 Plaintiff's Group Exhibit 3, which is the December 12th,
8 1979 inspection report and corresponding photographs of Mr.
9 McCarthy?
10 THE COURT: Any objection?
11 MR. BAKER: Objection I made earlier.
12 THE COURT: Overruled. Admitted.
13 (At this time, Plaintiff's
14 Exhibit No. 3, having been
15 offered into evidence, was
16 admitted over the objection
17 of Mr. Baker.)
18 MR. LaROSE: Okay, I offer Plaintiff's Group
19 Exhibit No. 4, which is the inspection report of July 29th,
20 1982 and corresponding photographs and probing results of
21 Mr. McCarthy.
22 MR. BAKER: Objection I made earlier.
23 THE COURT: Overruled. Admitted.
24 (At this time, Plaintiff's

A Which area?

Q Well, you've testified to several areas, a lot of it along the dividing line, as I understood it, between "A" and "B."

A I would have to check the reports, but it's been there over a year.

Q You know whence it came?

A No, I do not.

Q As a matter of fact, some of it's been there since '82, hasn't it?

A That's possible.

Q Look at your Exhibit No. 4, if you would, please. And I direct you to the third paragraph and the last sentence therein. The northern portion of the northern site consists of Pillsbury Company coal, coke and grain operation plus their permitted demolition site?

A Yes.

Q Do they have a permit to dump demolition rubble?

A They did, yes.

Q They did?

A Yes. But not in Area "A," "B," or "C," north of that in the fly-ash pond.

Q Did they dump this?

A Excuse me?

1 Q Did they dump the demolotion rubble that's there?
2 A In Area "A," I don't know who dumped the
3 demolition material there.
4 Q Was it dumped after-- Well, strike that.
5 Isn't it a fact that, at least, since January 1, 1974,
6 Sauget has not used the site?
7 A I don't know that for a fact.
8 Q Do you know when he quit using it?
9 A (no response)
10 Q All right, strike that.
11 He has quit using it, hasn't he, as a landfill?
12 A To the best of my knowledge, yes.
13 Q All right. But you don't remember when?
14 A No, not exactly.
15 Q Pat, does it help the flood was in '73?
16 A I remember the flood very well.
17 Q Because you were down there during the flood?
18 A Yes, I was.
19 Q And he ceased using it either before, during or
20 shortly after the flood, didn't he?
21 A The flood was in the spring of '73, March and
22 April. There was--
23 Q Well, at one time-- He had an argument about
24 whether he continued to dump or not during the flood,

1 right?
2 A Yes.
3 Q Okay, but he quit after the flood, didn't he?
4 If he didn't quit during or before, he quit after the
5 flood?
6 A The best of my knowledge, he quit the majority of
7 his operation. I can't say one hundred percent.
8 Q Pat, did he put this construction rubble on any
9 part of the site that you know of or allow it to be put
10 there?
11 A Talking about that which I had testified to
12 earlier, I don't know if he put it there.
13 Q Would you-- You were here in the courtroom
14 earlier in the afternoon when he testified as to where the
15 site is and the surrounding areas, were you not?
16 A Yes.
17 Q Do you find any fault with his testimony as to
18 where it is?
19 A I was at a disadvantage, and then I was behind
20 the photograph at the time.
21 Q All right, let me run it through with you.
22 It is on the riverside of the levee?
23 A Correct.
24 Q It lies between a fly-ash pond on the north?

1 mile and east of and parallel to the levee?

2 A Yes.

3 Q And there aren't any houses except on the east

4 side of Route 3, are there?

5 A In that vicinity, that's correct.

6 Q All right.

7 Have you ever tested the fly-ash that has been used as

8 cover on this site?

9 A I have not, no.

10 Q Okay. Have you really ever done a complete grid

11 system inspection of this site?

12 A No. As my reports show, it was a--

13 Q A couple of them, at least, were just in a

14 straight line north and south?

15 A (indicated yes)

16 Q But you never went like-- What do they call it?

17 Graph paper or true grit?

18 A This is correct.

19 Q All right.

20 Have you done anything about the demolition rubble

21 that's on the site?

22 A No.

23 Q Has your agency done anything about it?

24 A No. Other than this proceeding.

1 Q All right, then in Plaintiff's Exhibit 7 you say,
2 "One load of construction and demolition material was
3 observed in the southern part of Area "B." A name was
4 obtained from several blank checks. A letter will be
5 written to that company."
6 A Yes.
7 Q Who is the prospective dumper?
8 A Within the load of construction and demolition
9 debris, I found business-style multiple checkstubs, and
10 there was a construction company from Cahokia with the name
11 on it.
12 Q Okay. Not Sauget and Company?
13 A No.
14 Q All right. So, your suspicion is that maybe, at
15 least, it emanated with something they have something to do
16 with?
17 A That's my suspicion, yes.
18 Q Whether they were the dumper or they were the--
19 What do you call it in the business?
20 A Generator.
21 Q Generator.
22 And you don't know whether some of the-- some of the
23 other construction rubble is some that Pillsbury brought in
24 and put where they were allowed to put it or not?

1 A I don't know for a--
2 Q Fact?
3 A Fact who brought it.
4 Q Have you made any inspection of the other
5 construction rubble to determine any type of identity like
6 you did on the stuff you found yesterday?
7 A I-- Yes, in the sense that I looked at it. I
8 didn't see any papers or anything that would indicate a
9 name.
10 Q If Sauget testified he didn't put it there, would
11 you have any reason to doubt that?
12 MR. LaROSE: I'm going to object to that. It
13 calls for speculation.
14 MR. BAKER: Well, that was his testimony.
15 THE COURT: Overruled.
16 You may answer the question.
17 A I can't refute it. I can't doubt it.
18 Q Pat, would you-- would it be fair to state that
19 yesterday and this morning substantially all of "A" and "B"
20 and "C" were covered by vegetation?
21 A "C" for sure.
22 Q Well, let's exclude the Pillsbury part of "A" and
23 "B."
24 A Okay. Yes, if you exclude that, the majority of

1 it would be covered by vegetation at this time.

2 Q And the cinders that are in place are pretty darn

3 well packed down, aren't they?

4 A Packed down?

5 Q Well, they support automobile traffic, heavy

6 truck traffic?

7 A There's several roads on the site, yes.

8 Q They're not concrete or a gravel, are they?

9 Aren't there cinders in place?

10 A Yes.

11 Q Okay. And aren't they reasonably well pervious?

12 THE COURT: Impervious?

13 Q (Mr. Baker) Wait a minute, impervious? Or have

14 you been there when there has been a recent rain?

15 A I can't-- They're a packed road. I can't--

16 Q Let me ask you the question this way: Pat, have

17 you ever seen one of those heavy trucks coming to and from

18 Pillsbury bogged down in one of the roads?

19 A No.

20 Q And have you been there long enough to give us an

21 estimate of maybe how many trucks Pillsbury has coming in

22 and going out during an hour?

23 A You're talking going out the north way?

24 Q Yeah.

1 A It would be purely speculative.
2 Q Would you say it's a rather-- it's more than
3 five an hour during the time they're working?
4 A At times I have been there, yes.
5 Q Much more than five?
6 A Yes, it's-- There is a lot of coal trucks going
7 out and grain trucks coming in.
8 Q Pat, could you tell us in your opinion how much
9 of it-- of "A" and "B" Pillsbury, in fact, is using?
10 A It varies.
11 Q Well, by season?
12 A I don't know if it's seasonal, but I know it
13 varies.
14 Q Well, they use it for coal, don't they?
15 A Yes.
16 Q And they use it for grain? Have you been there
17 when they've had grain piles?
18 A They did at one time, but I haven't seen any
19 grain there for quite sometime.
20 Q This morning or yesterday, how much would you say
21 they were using of "A" and "B"?
22 A I would say none of "B."
23 Q None of "B" this morning?
24 A That's correct. And I would say the northern

1 third maybe of "A."

2 Q The northern third? If "A" is twenty acres,

3 you're saying they're using the northern seven?

4 A Well, of course, they're also using what is

5 labeled there as the fly-ash pit because that's filled in.

6 Q Did you say you think this picture was taken in

7 '80?

8 A I know it was taken in '80.

9 Q Do you remember-- Was it an I.D.O.T. picture?

10 A Yes.

11 Q That's where you guys got it, wasn't it?

12 A Correct.

13 Q And you remember when Pillsbury came in?

14 A Not really.

15 Q Pat, is the line between "A" and "B" identifiable

16 on the ground? It's not-- Let me ask the question this

17 way: It is not a natural line? It's not a ditch or a

18 mountain or a hill or anything like that, is it?

19 A That's correct.

20 Q It's a line that we agreed upon way back when,

21 and it's supposed to run off the high tension tower, isn't

22 it?

23 A There's one in that general location, yes.

24 Q That is the best we can do on it.

1 MR. LaROSE: That's all I have.
2
3 THE COURT: Mr. Baker?
4 MR. BAKER: Nothing.
5 THE COURT: You may step down. Thank you.
6 (At this time, the witness was excused from the
7 witness stand.)
8
9 THE COURT: Call your next witness.
10 MR. LaROSE: Your Honor, before it gets out of
11 everybody's mind, I would like to reoffer Group Exibits--
12 THE COURT: Let's start with one at a time.
13 Okay?
14 MR. LaROSE: Okay. The-- Where are we, 5?
15 THE COURT: 5. Start with 5.
16 MR. LaROSE: Group Exhibit No. 5 which is Mr.
17 McCarthy's inspection report dated 3-28-85 along with
18 corresponding photographs and diagrams showing the depth
19 probe samples.
20 MR. BAKER: It's not a limited offer, though, is
21 it?
22 THE COURT: A limited offer? No, I think you're
23 saying the entire exhibit, correct?
24 MR. LaROSE: Correct.

1 MR. LaROSE: The People would call at this time
2 Mr. Delbert Haschemeyer.
3 THE COURT: Step forward, please.
4 Please raise your right hand to be sworn.
5
6 DELBERT HASCHEMEYER
7 being called as a witness by Mr. LaRose, and having been
8 first duly sworn, testified as follows:
9 THE COURT: Have a seat right there, please.
10 DIRECT EXAMINATION
11 BY MR. LaROSE:
12 Q Mr. Haschemeyer, could you state your full name
13 for the record, please?
14 A Delbert D. Haschemeyer.
15 Q Could you spell Haschemeyer for the Court
16 Reporter?
17 A H-A-S-C-H-E-M-E-Y-E-R.
18 Q Your present employment position, Mr.
19 Haschemeyer?
20 A Deputy Director with Illinois EPA.
21 Q Is that Deputy Director of the entire agency?
22 A That's correct.
23 Q Out of which office do you work?
24 A Director's Office.

that the People have; and subject to reservation of argument, the People would rest.

THE COURT: Okay, do you have any rebuttal, sir?

MR. BAKER: Just-- I have to make something eminently clear.

Would you retake the stand, please (to his client).

PAUL SAUGET

being recalled to the witness stand by his attorney in rebuttal, having been previously sworn, testified as follows:

(REBUTTAL) DIRECT EXAMINATION

BY MR. BAKER:

Q You're the same Paul Sauget who testified earlier?

A Yes, I am.

Q And I assume. Mr. Sauget, you realize you're still under oath?

A I do.

Q I guess that admonition ought to be made by the Court.

Mr. McCarthy talked about having observed construction rubble on the site in, as I understand it, two different places, one down near the-- at or near the line between

1 "A" and "B" and another up apparently further north.
2 You're familiar with the site as it exists today, are you
3 not?
4 A I am.
5 Q Did you put or cause any of that construction
6 rubble to be put on that site?
7 A No. sir, I did not.
8 MR. BAKER: No other questions.
9
10 MR. LaROSE: I have nothing further.
11 THE COURT: You may step down.
12 (Witness excused from the witness stand at this
13 time.)
14
15 THE COURT: Do you rest on rebuttal?
16 MR. BAKER: I rest.
17 THE COURT: Very well. Closing arguments. The
18 State? Well, closing arguments, Mr. Baker has the burden
19 of proof, it's your opportunity to proceed.
20 Okay, as you will,--
21 MR. BAKER: Wait a minute, may I reopen my
22 rebuttal?
23 THE COURT: Sure.
24 MR. BAKER: I remembered something.

35

MONSANTO INSURANCE COMPANY LITIGATION:
MAY 25, 1990 ORDER PROTECTED MATERIAL
TREAT AS PROTECTED UNDER ATTORNEY-CLIENT
PRIVILEGE AND WORK-PRODUCT DOCTRINE.

PROTECTED MATERIAL: MONSAN
INSURANCE COVERAGE LITIGAT

IN THE CIRCUIT COURT
TWENTIETH JUDICIAL CIRCUIT OF ILLINOIS
ST. CLAIR COUNTY

FILED
JUN 16 1986
6 copies
CIRCUIT CLERK

PEOPLE OF THE STATE OF ILLINOIS,)
Plaintiff,)
vs.)
PAUL SAUGET, individually, and)
SAUGET & COMPANY, a Delaware)
corporation,)
Defendants.)

CAUSE NO. 81-CH-19

REPORT OF PROCEEDINGS

Before the HONORABLE JONATHAN ISBELL, Judge

- E X H I B I T S -

(July 24, 1985)

APPEARANCES:

MR. MARK A. LaROSE, Assistant Attorney General,
On Behalf of the People of the State of Illinois;
and

MR. BRUCE CARLSON, Staff Attorney,
On Behalf of the Illinois Environmental
Protection Agency; and

MR. HAROLD G. BAKER, JR., Attorney at Law,
On Behalf of Paul Sauget, individually, and
Sauget & Company, a Delaware corporation.

LINDA S. HOYLMAN, C.S.R.
Official Court Reporter

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1 PLAINTIFF'S EXHIBIT NO. 2:

2

3

4 (NOTE: PLAINTIFF'S EXHIBIT NO. 2 HAS BEEN WITHDRAWN
5 FROM THE COURT FILE AND IS IN THE CARE AND CUSTODY OF MR.
6 PATRICK M. McCARTHY OF THE ILLINOIS ENVIRONMENTAL
7 PROTECTION AGENCY AT THE TIME OF THE PREPARATION OF THIS
8 REPORT OF PROCEEDINGS.)

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1 PLAINTIFF'S EXHIBIT NO. 3:

PROTECTED MATERIAL: MONSA
INSURANCE COVERAGE LITIGA

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MONSANTO INSURANCE COMPANY LITIGATION:
MAY 25, 1990 ORDER PROTECTED MATERIAL
TREAT AS PROTECTED UNDER ATTORNEY-CLIENT
PRIVILEGE AND WORK-PRODUCT DOCTRINE.

PROTECTED MATERIAL: MONSAN
INSURANCE COVERAGE LITIGAT

December 12, 1979

Division File

P. M. McCarthy

St. Clair County - LPC 163 121 01 - Sauget/Sauget
Note: Refer to attached sketches for details.

On December 6 and 11, 1979, I inspected the subject site to determine compliance with PCB Order # 77-84, dated August 24, 1978. The order directed the placement of final cover over 20% of the site during each six month period. Therefore, as of August 24, 1979, 40% should be final covered. (50% by November 24, 1979.) As of the date of this memo, it is estimated that less than 5% of the site has final cover, and a portion of that is merely stockpiled. This figure is based on the following:

a) diggings made these two dates
b) conversation with Paul Sauget on October 9, 1979 at which time he stated that the only final cover hauled in, is in the extreme southern portion of the northern site (stockpiled), and further that he has hauled only "a few loads in 1979"
c) personal knowledge of the site and its basically dormant state
d) two surface and underground fires on the southern site (9-76 and 10-79)

Since the close of the landfill, a coal unloading operation has begun by the Pillsbury Company. On December 11, 1979, Russell Selph, manager of the facility, stated that the recent filling operation on the northern site was done by him. He stated that the filling had ceased and would not resume without a permit. He also stated that the current fill face was approximately the old road on the south end of the fly ash pit, making it the 1966 line. I explained to him that the past landfill operator is under PCB Order to apply final cover and that any operations that alter the land would only complicate matters. He said that his company, Pillsbury, has leased 83 acres of this tract from Eagle Marine Industries, and has no plans to make any major changes.

The attached maps indicated the approximate location and depths of borings which determine the amount of cover, and other pertinant data. It should be noted that this summer and entire fall season, has been dry and would have been ideal for final covering operations.

PMM:jlr

cc: Enforcement Services - Stan Parsons (w/attachments)
Southern Region
FOS Manager

HED 0000506

7-24-85
Admitted

PLAINTIFF'S EXHIBIT 3 GROUP

KM

MONSANTO INSURANCE COMPANY LITIGATION:

MAY 25, 1990 ORDER PROTECTED MATERIAL.
TREAT AS PROTECTED UNDER ATTORNEY-CLIENT
PRIVILEGE AND WORK-PRODUCT DOCTRINE.

PROTECTED MATERIAL: MONSA
INSURANCE COVERAGE LITIGA

Date: December 11, 1979

Time: 4:30 A.M. P.M.

Photograph By:

PMcCarthy

Location: LPC- 163 121 01

St. Clair Co.

Sauget /Sauget

Comments: Photograph taken

toward the South

Date:

Time: A.M. P.M.

Photograph By:

Location: LPC-

Co.

/

Comments: Photograph taken

toward the

MONSANTO INSURANCE COMPANY LITIGATION

MAY 25, 1990 ORDER PROTECTED MATERIAL
TREAT AS PROTECTED UNDER ATTORNEY-CLIENT
PRIVILEGE AND WORK-PRODUCT DOCTRINE.

PROTECTED MATERIAL: MONSANTO
INSURANCE COVERAGE LITIGATION

Date: December 6, 1979

Time: 3:55 A.M. (P.M.)

Photograph By: PMMcCarthy

Location: LPC- 163 121 01

St. Clair Co.

Sauget / Sauget

Comments: Photograph taken

toward the North

Date: December 6, 1979

Time: 4:05 A.M. (P.M.)

Photograph By: PMMcCarthy

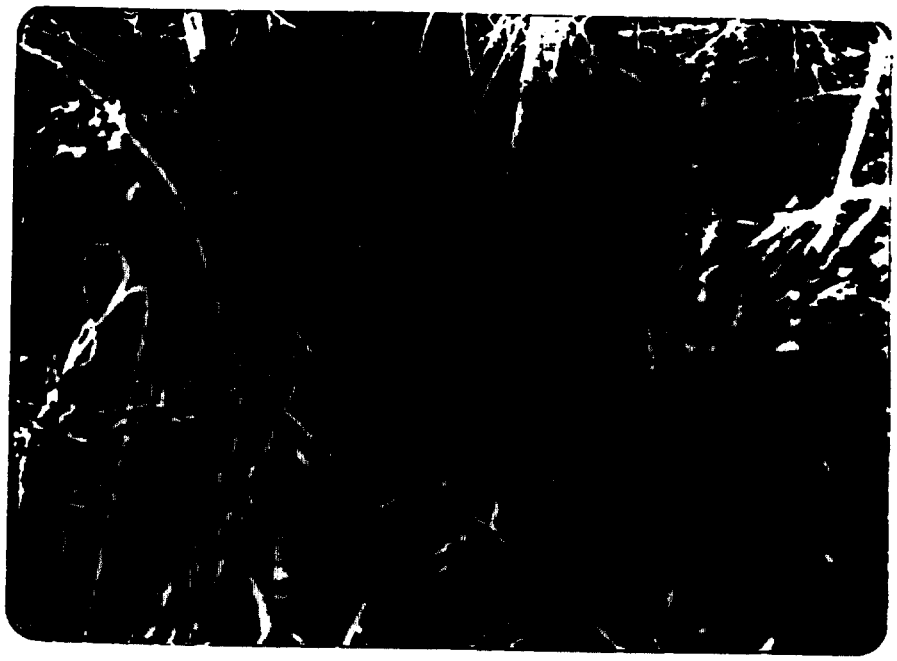
Location: LPC- 163 121 01

St. Clair Co.

Sauget /Sauget

Comments: Photograph taken

toward the North



MONSANTO INSURANCE COMPANY LITIGATION:

MAY 25, 1990 ORDER PROTECTED MATERIAL.
TREAT AS PROTECTED UNDER ATTORNEY-CLIENT
PRIVILEGE AND WORK-PRODUCT DOCTRINE.

PROTECTED MATERIAL: MONSANTO
INSURANCE COVERAGE LITIGATIO

Date: December 6, 1979

Time: 4:15 A.M. (P.M.)

Photograph By: PMMcCarthy

Location: LPC- 163 121 01

St. Clair Co.

Sauget / Sauget

Comments: Photograph taken

toward the North

Date: December 6, 1979

Time: 4:20 A.M. (P.M.)

Photograph By: PMMcCarthy

Location: LPC- 163 121 01

St. Clair Co.

Sauget / Sauget

Comments: Photograph taken

toward the East Southeast

MONSANTO INSURANCE COMPANY LITIGATION

MAY 25, 1990 ORDER PROTECTED MATERIAL.
TREAT AS PROTECTED UNDER ATTORNEY-CLIENT
PRIVILEGE AND WORK-PRODUCT DOCTRINE.

PROTECTED MATERIAL: MONSANTO
INSURANCE COVERAGE LITIGATIC

Date: December 6, 1979

Time: 4:30 A.M. (P.M.)

Photograph By: PMMcCarthy

Location: LPC- 163 121 01

St. Clair Co.

Sauget / Sauget

Comments: Photograph taken

toward the North Northeast

Date: December 6, 1979

Time: 4:40 A.M. (P.M.)

Photograph By: PMMcCarthy

Location: LPC- 163 121 01

St. Clair Co.

Sauget / Sauget

Comments: Photograph taken

toward the North

HED 0000510

EPA/CERRO COPPER/EIL/PCB ATTORNEY WORK PRODUCT / ATTORNEY CLIENT PRIVILEGE

1 PLAINTIFF'S EXHIBIT NO. 4:

PROTECTED MATERIAL: MONSANTO
INSURANCE COVERAGE LITIGATION

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HED 0000511

MONSANTO INSURANCE COMPANY LITIGATION:

MAY 25, 1990 ORDER PROTECTED MATERIAL.
TREAT AS PROTECTED UNDER ATTORNEY-CLIENT
PRIVILEGE AND WORK-PRODUCT DOCTRINE.

July 29, 1982

PROTECTED MATERIAL: MONSANT
INSURANCE COVERAGE LITIGATI

Division File

P. M. McCarthy

LPC 16312101 - St. Clair County - Sauget/Sauget

On July 26 and 27, 1982, Jay Evans and this writer conducted a final cover check at the subject site. The site is divided by the Alton and Southern Railroad tracks, and will be referred to as the Northern site, (north of the A & S) and the Southern Site, (south of the A & S).

On the Northern Site we dug fifteen test holes randomly. Eight of the holes contained no soil before encountering refuse. In most cases, cinders were covering the refuse, except one, in which demolition was covering the refuse. The six, which contained soil as cover, averaged 8.8 inches.

The southern portion of the Northern Site is grown up in weeds and appears dormant. The stockpiled cover material in the extreme south-western portion of the site remains. It is covered with weeds. The northern portion of the Northern Site consists of the Pillsbury Company coal, coke, and grain operation, plus their permitted demolition site.

The Southern Site has been effectively restricted and no additional random dumping has occurred. No covering has occurred, either. Diggings in December of 1979 showed an average of 5.6" of cover. On July 27, 1982 Jay Evans and this writer tested twenty locations for a total cover of 113", which averages 5.65".

On July 29, 1982, this writer returned to both sites to photograph them. Several photographs were taken on the previous two days, however, camera failure occurred.

PMH:jlr

cc: Southern Region
Phil Van Ness - Enforcement
Vince Moreth

7/24/85

HED 0000512

EPA/CERRO COPPER/EIL/PCB ATTORNEY WORK PRODUCT / ATTORNEY CLIENT PRIVILEGE

ILLINOIS ENVIRONMENTAL PROTECTION AGENCY

MONSANTO INSURANCE COMPANY LITIGATION: MAY 25, 1990 ORDER PROTECTED MATERIAL. TREAT AS PROTECTED UNDER ATTORNEY-CLIENT PRIVILEGE AND WORK PRODUCT DOCTRINE

MEMORANDUM

TO: Division File

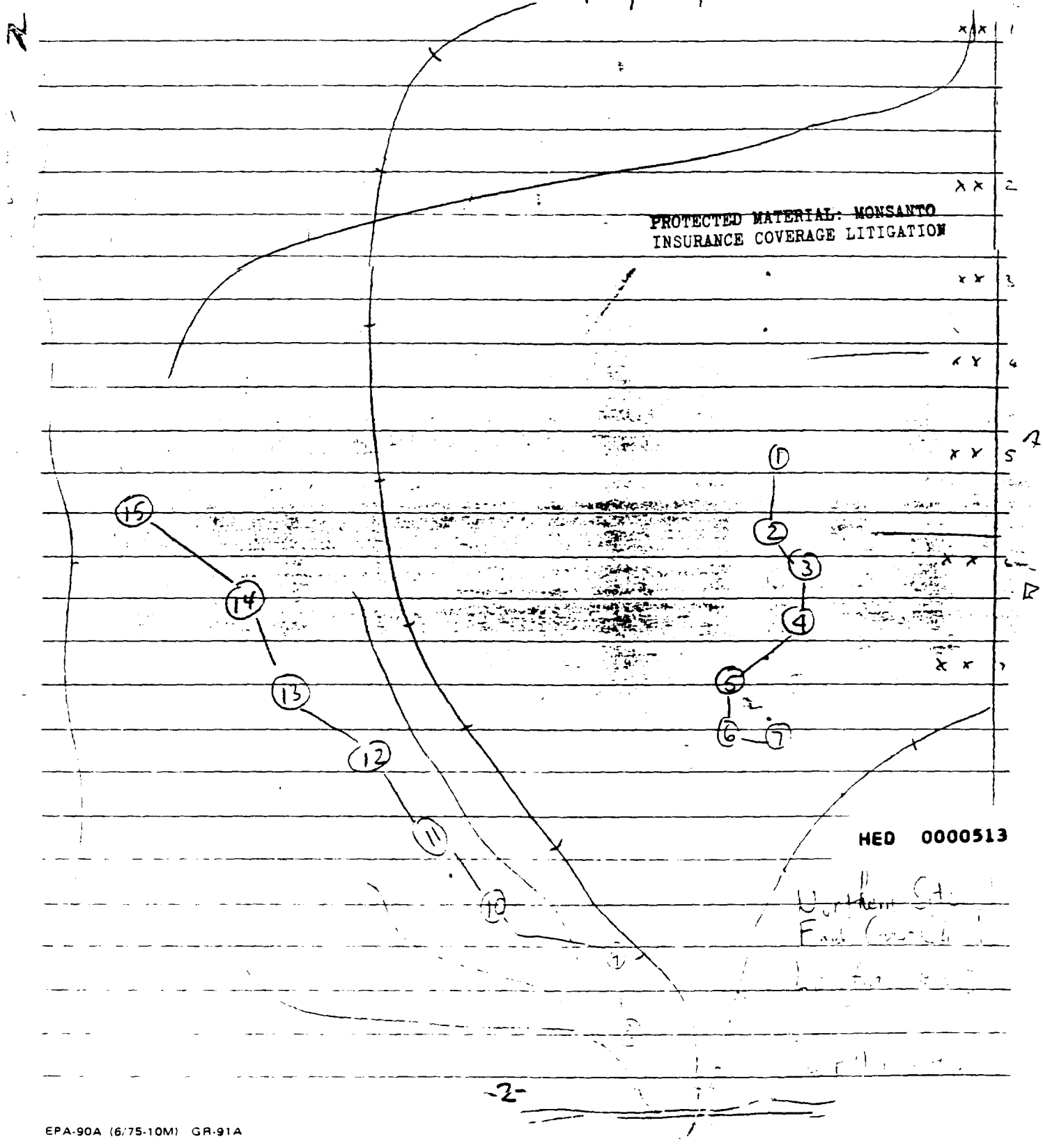
DATE: 7/29/82

FROM: P.M. McCarthy, Southern Region

☒ Information only

☐ Response requested

SUBJECT: St. Clair Co. L.P.C. 1631210101 Sauget / Sauget



HED 0000513

-2-

EPA-90A (6/75-10M) GR-91A

ILLINOIS ENVIRONMENTAL PROTECTION AGENCY

MEMORANDUM

MONSANTO INSURANCE COMPANY LITIGATION:

MAY 25, 1990 ORDER PROTECTED MATERIAL. TREAT AS PROTECTED UNDER ATTORNEY CLIENT PRIVILEGE AND WORK-PRODUCT DOCTRINE.

TO: Division File

DATE: 7/29/92

FROM: PMMcCarthy - Southern Region

☑ Information only

SUBJECT: St. Clair Co LPC 1631210 1

☐ Response requested

1) 7" of cinders before encountering refuse - due west of transmission lines #5
2) 14" of cinders to trash - 30 yds south of #1
3) 4" of demolition to trash (glass, metal, asbestos) - 40 yds Southwest of #2
4) 27" of cinders to trash (on a cinder pile) - 25 yds southwest of #4
5) 3" of cinders to trash - 16 yds southwest of #4
6) 4" of cinders to trash - 30 yds " of #5
7) 6" of cinders to trash (rags + plastic) - 35 yds SE of #6
8) 4" of cinders to trash - ≈ 40 yds north of southern entrance
9) 8" to trash (soil type & cover)
10) 9" to trash - 40 yds North of #9
11) 9.5" of soil to trash - 50 yds North of #10
12) 7" of soil to trash - 50 yds North of #11
13) 21" of cinders to trash - 50 yds North of #12
14) 8" of sandy soil to trash - 60 yds NNE of #13
15) 11" of soil + cinders to trash - 50 yds N of #14

PROTECTED MATERIAL: MONSANTO INSURANCE COVERAGE LITIGATION

- survey conducted on 7/26/92 by J Evans + PMMcCarthy
- all distances approximated
- depth measured w/ yardstick

7/29/92 Northern Site

HED 0000514

EPA-90A (6/75-10M) GR-91A

EPA/CERRO COPPER/EIL/PCB ATTORNEY WORK PRODUCT / ATTORNEY CLIENT PRIVILEGE

ILLINOIS ENVIRONMENTAL PROTECTION AGENCY

MEMORANDUM

TO: Division File

DATE: 7/29/92

FROM: P.M. McCarthy

☒ Information only

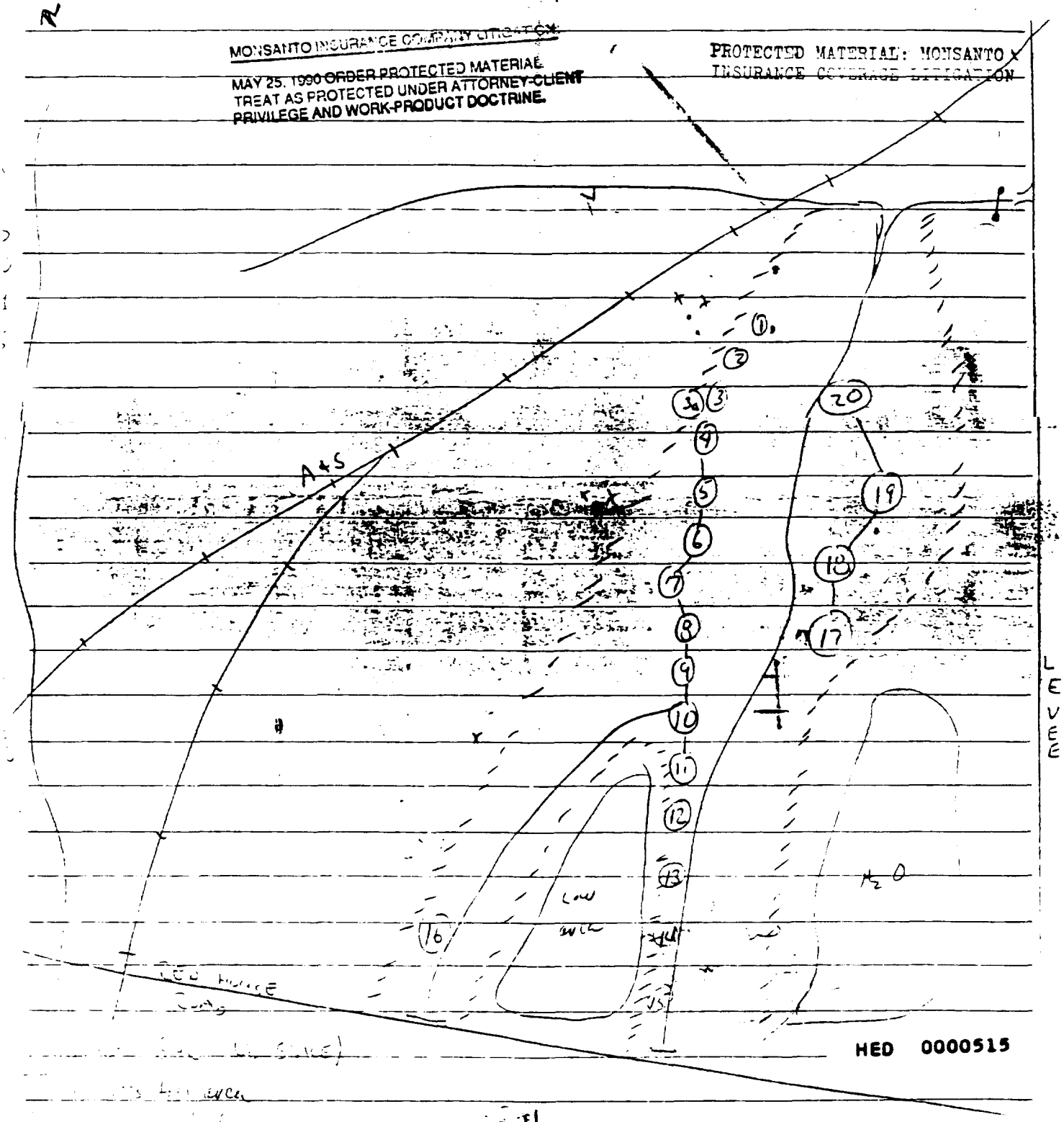
SUBJECT: St. Clair Co. LPC 16312101 Sauget/Sauget

☐ Response requested

MONSANTO INSURANCE COMPANY LITIGATION

MAY 25, 1990 ORDER PROTECTED MATERIAL
TREAT AS PROTECTED UNDER ATTORNEY-CLIENT
PRIVILEGE AND WORK-PRODUCT DOCTRINE.

PROTECTED MATERIAL: MONSANTO
INSURANCE COVERAGE LITIGATION



HED 0000515

-4-

EPA-90A (6/75-10M) GR-91A

EPA/CERRO COPPER/EIL/PCB ATTORNEY WORK PRODUCT / ATTORNEY CLIENT PRIVILEGE

ILLINOIS EPA

ILLINOIS ENVIRONMENTAL PROTECTION AGENCY

MEMORANDUM

MONSANTO INSURANCE COMPANY LITIGATION:

MAY 25, 1990 ORDER PROTECTED MATERIAL.
TREAT AS PROTECTED UNDER ATTORNEY-CLIENT PRIVILEGE AND WORK-PRODUCT DOCTRINE.

TO: Division File

DATE: 7/29/82

FROM: P.M. McCarthy

☒ Information only

☐ Response requested

SUBJECT: St. Clair Co. LPC-1631210 Sauget/Sauget

1) 10" of sandy soil to trash - 35 yds SW of transmission lines
2) 4" of sandy soil to trash - 25 yds SW of #1
3) 5" of sandy soil to trash - 25 yds SW of #2
3a) 3" of " " " " - 1 yd West of #3
4) 8" of " " " " - 25 yds SW " #3a
5) 3' of sandy soil to trash - 35 yds SW " #4
6) 6" " " " " - 35 yds SW of #5
7) 6" of sandy soil to trash - 50 yds SW of #6
8) 4" of " " " - 40 yds SW " #7
9) 6" of sandy soil to trash - 45 yds SW of #8
10) 7" " " " (even w/ northern bank of Ho) - 45 yds SW of #9
11) 6" " " " - 75 yds SW of #10
12) 4" of sandy soil to trash - 60 yds SW of #11
13) 9" " " " - 50 yds SW of #12
14) 4" of sandy soil to trash - 75 yds SW of #13
15) 9" " " " - 120 yds SW of #14 - ≈55 yds North of South gate
16) 4" of sandy soil to trash - ≈100 yds N of Red Horse Road
17) 4" " " " " " - 30 yds W of on site road - South of second set of transmission lines
18) exposed trash - no digging (≈10 yds x 10 yds) - 35 yds NE of #17
19) 5" of sandy soil to trash - 40 yds SE of #18
20) 5" " " " " - 50 yds N of #19

Southern site

PROTECTED MATERIAL: MONSANTO INSURANCE COVERAGE LITIGATION

HED 0000516

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EPA-90A (6/75-10M) GR-91A

MONSANTO INSURANCE COMPANY LITIGATION:

MAY 25, 1990 ORDER PROTECTED MATERIAL.
TREAT AS PROTECTED UNDER ATTORNEY-CLIENT
PRIVILEGE AND WORK-PRODUCT DOCTRINE.

Date: July 28, 1982

Time: 9:10 A.M. P.M.

Photograph By:

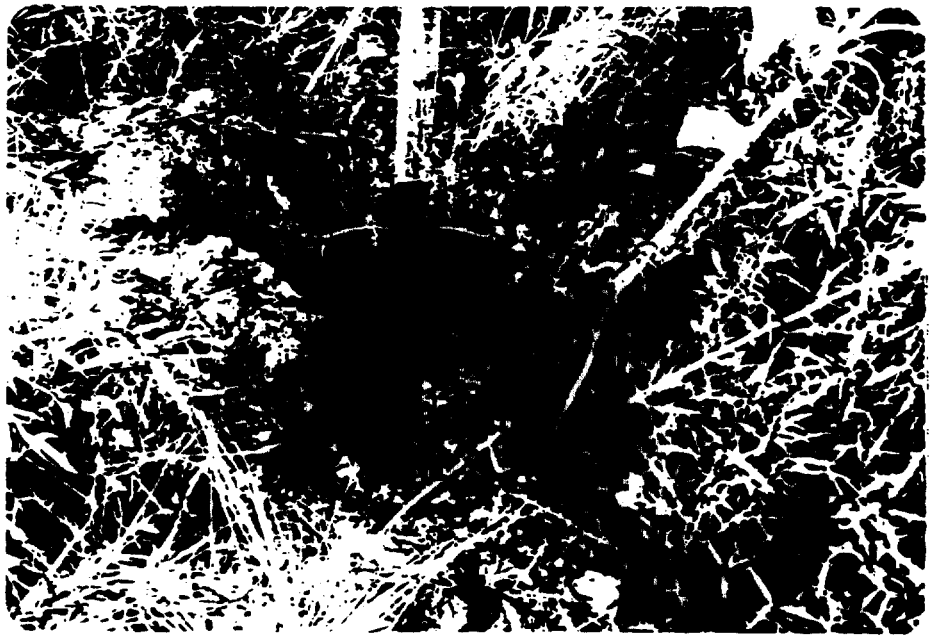
Location: LPC- 16312101

St. Clair Co.

Sauget / Sauget

Comments: Photograph taken

toward the North



Date:

Time: A.M. P.M.

Photograph By:

Location: LPC-

Co.

/

Comments: Photograph taken

toward the

PROTECTED MATERIAL: MONSANTO
INSURANCE COVERAGE LITIGATION

HED 0000517

L/NPC 24 6/78

EPA/CERRO COPPER/EIL/PCB ATTORNEY WORK PRODUCT / ATTORNEY CLIENT PRIVILEGE

MONSANTO INSURANCE COVERAGE LITIGATION
MAY 25, 1990 ORDER PROTECTED MATERIAL
TREAT AS PROTECTED UNDER ATTORNEY-CLIENT
PRIVILEGE AND WORK-PRODUCT DOCTRINE.

PROTECTED MATERIAL: MONSANTO
INSURANCE COVERAGE LITIGATION

Date: July 28, 1982

Time: 9:15 A.M. P.M.

Photograph By:

Location: LPC- 16312101

St. Clair Co.

Sauget / Sauget

Comments: Photograph taken

toward the North

Date: July 28, 1982

Time: 9:15 A.M. P.M.

Photograph By:

Location: LPC- 16312101

St. Clair Co.

Sauget / Sauget

Comments: Photograph taken

toward the North

HED 0000518

L/NPC 24 6/78

EPA/CERRO COPPER/EIL/PCB ATTORNEY WORK PRODUCT / ATTORNEY CLIENT PRIVILEGE

MONSANTO INSURANCE COVERAGE LITIGATION

MAY 25, 1990 ORDER PROTECTED MATERIAL
TREAT AS PROTECTED UNDER ATTORNEY-CLIENT
PRIVILEGE AND WORK-PRODUCT DOCTRINE.

Date: July 28, 1982

Time: 9:30 A.M. P.M.

Photograph By:

Location: LPC- 16312101

St. Clair Co.

Sauget / Sauget

Comments: Photograph taken

toward the West Northwest

Date:

Time: A.M. P.M.

Photograph By:

Location: LPC-

Co.

/

Comments: Photograph taken

toward the

PROTECTED MATERIAL: MONSANTO
INSURANCE COVERAGE LITIGATION

HED 0000519

EPA/CERRO COPPER/EIL/PCB ATTORNEY WORK PRODUCT / ATTORNEY CLIENT PRIVILEGE

1 PLAINTIFF'S EXHIBIT NO. 3A:

MONSANTO INSURANCE COMPANY LITIGATION:

MAY 25, 1990 ORDER PROTECTED MATERIAL.
TREAT AS PROTECTED UNDER ATTORNEY-CLIENT
PRIVILEGE AND WORK-PRODUCT DOCTRINE.

PROTECTED MATERIAL: MONSANTO
INSURANCE COVERAGE LITIGATIO

DECEMBER 11, 1979 BY: P.M. MCCARTHY

Probing Information: (by shovel)

#1 - 4" cover
#2 - 4" cover
#3 - 6" "
#4 - 5" "
#5 - 9" "
#6 - 4" "
#7 - 7" "

One photo taken of digging #7

▨ = extent of fill area

XX = transmission towers

NOT TO SCALE

ST. CLAIR CO 16312101
SAUGET / SAUGET

HED 0000522

-2-

HMSQ01865

1 PLAINTIFF'S EXHIBIT NO. 5:

MONSANTO INSURANCE COMPANY LITIGATION:

MAY 25, 1990 ORDER PROTECTED MATERIAL. TREAT AS PROTECTED UNDER ATTORNEY-CLIENT PRIVILEGE AND WORK-PRODUCT DOCTRINE.

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17 PROTECTED MATERIAL: MONSANTO INSURANCE COVERAGE LITIGATION
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EPA/CERRO COPPER/EIL/PCB ATTORNEY WORK PRODUCT / ATTORNEY CLIENT PRIVILEGE

ENVIRONMENTAL PROTECTION AGENCY - STATE OF ILLINOIS
L P C F C 0 5 5 - C
(1) (8) (9)
OBSERVATION REPORT - SITE INVENTORY NO. 1631210001
(11) (18)

[redacted] CO. - L.P.C. Region # 5 Date 03/28/85
(20) (25)

SAUGET / SAUGET
(Location) (Responsible Party)

Letter Sent (Yes or No) Y
(26)

Samples Taken: Yes ( ) No (✓) Time: From 10:10 am
Ground Water( ) Surface( ) Other( ) To 02:00 pm
Photos Taken: Yes (✓) No ( ) Interviewed NO ONE

Weather 85° Sunny

Inspector P M M MDC
(27) (29)

Previous Inspection 1/27/84 Previous Correspondence 10/6/83 Site Open: Yes( ) No(X)

OPERATIONAL STATUS:		TYPE OF OPERATION:				AUTHORIZATION:	
Operating	( )	Landfill	(X)	Storage	( )	E.P.A. Permit	( )
Temporarily Closed	( )	Random Dump	( )	Salvage	( )	Variance	( )
Closed Not Covered	(X)	Other	( )	A.C.D.	( )	21(e)	( )
Closed and Covered	( )	Quantity Received Daily(1-6)	1			Board Order	( )
			(30)			Illegal (5)	(X) 5
							(31)

IMPROVED MONSANTO INSURANCE COMPANY LITIGATION:

SAME MAY 25, 1990 ORDER PROTECTED MATERIAL TREAT AS PROTECTED UNDER ATTORNEY-CLIENT PRIVILEGE AND WORK-PRODUCT DOCTRINE.

PROTECTED MATERIAL: MONSANTO INSURANCE COVERAGE LITIGATION

LPC 4 1/79 5,000

DETERIORATED

I S or D
(62)

GENERAL REMARKS: FACILITY WAS INSPECTED BY PMMCCARTHY AND M.D GRANT - NO SIGNIFICANT CHANGE WAS OBSERVED SINCE 1/27/84 - THE NORTH SITE AREAS "A" & "B" WERE INSPECTED AFTER NOTIFYING PILLSBURY CO. - PHOTOGRAPHS WERE TAKEN TO SHOW SIMILAR OR IDENTICAL CONDITIONS OF PAST INSPECTIONS - THE AREAS EAST OF THE PILLSBURY SPUR ON AREAS "A" & "B" WERE INSPECTED FIRST - THIS AREA CONTAINS EXPOSED DEMO, POORLY COVERED WASTE, AREAS OF EXPOSED WASTE - PHOTOS WILL DEMONSTRATE THESE CONDITIONS. THE AREA WEST OF THE RR SPUR STILL CONTAINS MUCH OF THE SAME STOCKPILED CONDITIONS AS SEEN ON 1/27/84 - THIS IS EVIDENCED BY PHOTOS - SIX HOLES WERE DUG IN THIS AREA

INTERVIEW: AND ARE DOCUMENTED AS FOLLOWS: (A) = 7" OF COVER (B1) 15" (B2) 10" [redacted] AVG DEPTH OF COVER = 7"

[redacted] (HOLES DUG w/ SPADE) - VERY LITTLE [redacted] AT THIS FACILITY - BY COMPARING PHOTOS TAKEN 7/82 [redacted] RANDOM DUMPING HAS OCCURRED - DEPTHS OF COVER [redacted] FOLLOWS: (F) = 5" OF COVER (G) 6" (H) = 2" (T) = 4" (J) = 3" (K) [redacted] (M) = 3" (N) = 9" (O) = 2" AVG DEPTH = 4.6"

DIAGRAM:

NUMBERS 1-13 ON THE TWO SKETCHES RELATE TO PHOTOS THAT

7/24/85 Admitted

HED 0000524

PLAINTIFF'S EXHIBIT GROUP

HMSQ0186

[illegible]

EPA/CERRO COPPER/EIL/PCB ATTORNEY WORK PRODUCT / ATTORNEY CLIENT PRIVILEGE

MONSANTO INSURANCE

MAY 25, 1996 ORDER PROTECTED MATERIAL
TREAT AS PROTECTED UNDER ATTORNEY-CLIENT
PRIVILEGE AND WORK-PRODUCT DOCTRINE.

[redacted] PROTECTION AGENCY

MEMORANDUM

TO: [redacted]

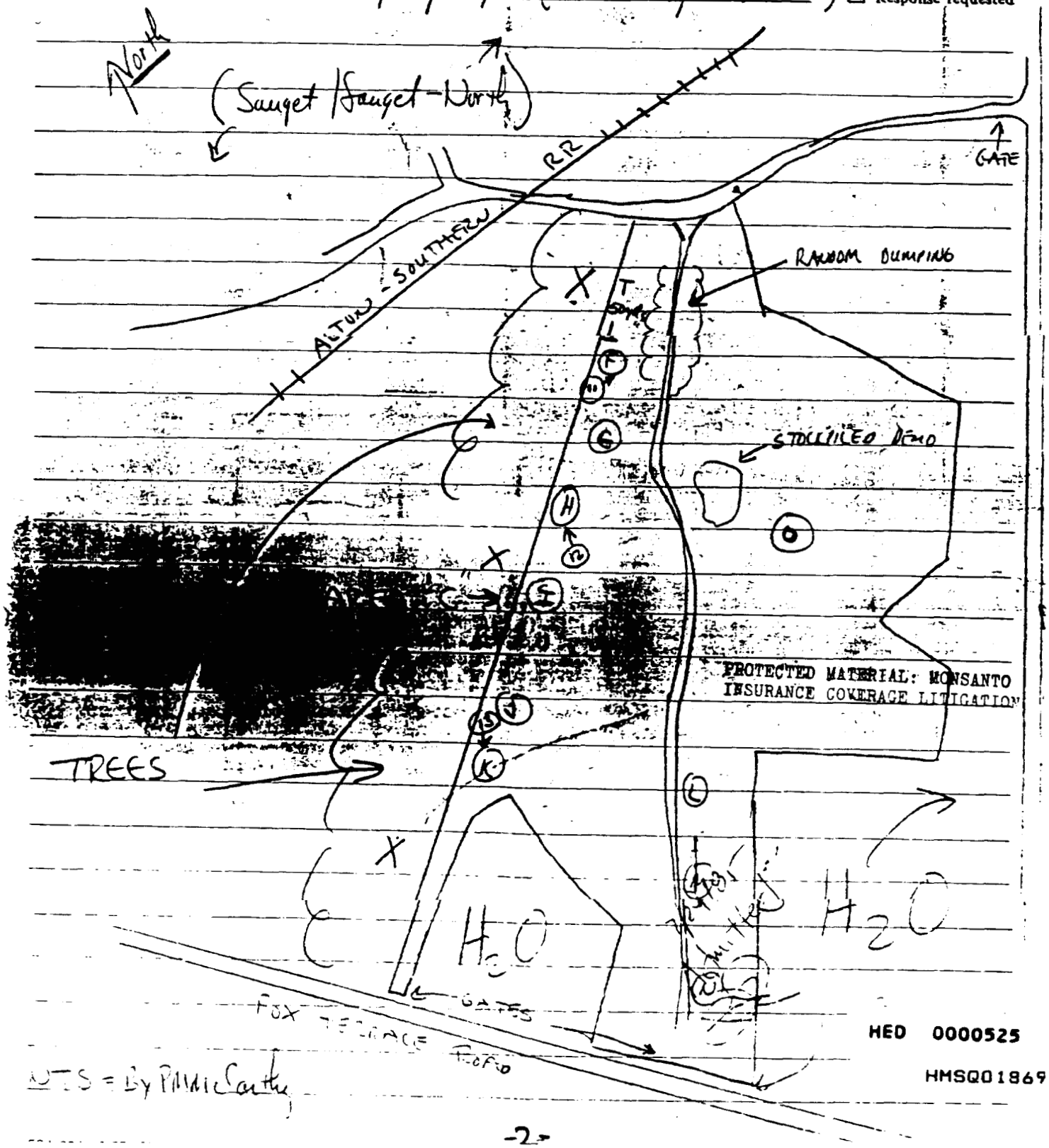
DATE: 3/28/85

FROM: [redacted] M McCarthy

☒ Information only

SUBJECT: St. Clair Co. - Sauget / Sauget (South of A/S RR Tracks)

☐ Response requested



[redacted]

PROTECTED MATERIAL: MONSANTO
INSURANCE COVERAGE LITIGATION

NTS = By PMMcCarthy

HED 0000525

HMSQ01869

EPA/CERRO COPPER/EIL/PCB ATTORNEY WORK PRODUCT / ATTORNEY CLIENT PRIVILEGE

MEMORANDUM

TO: [redacted]

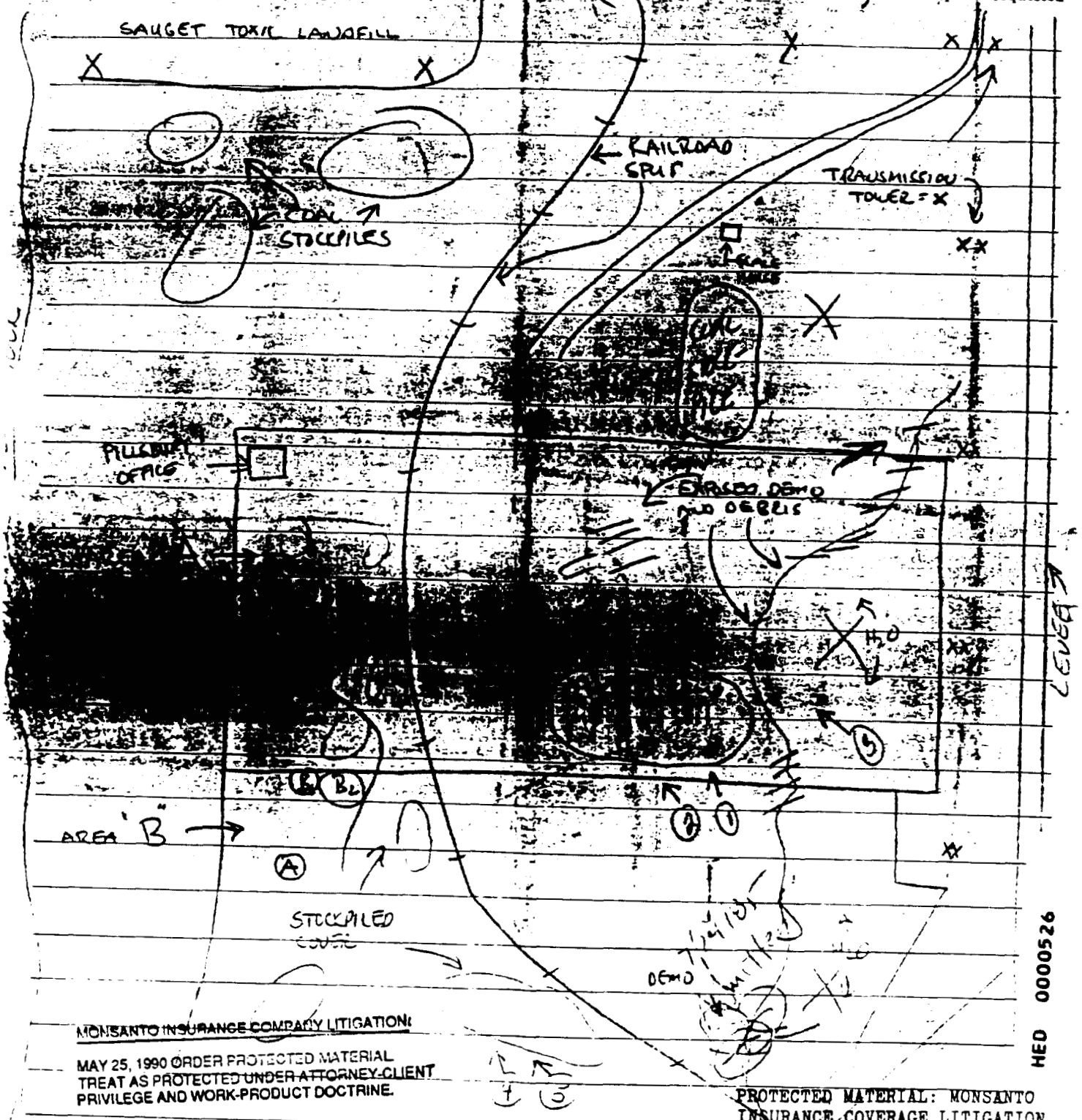
DATE: 3/28/85

FROM: [redacted]

☒ Information only

☐ Response requested

SUBJECT: St. Clair Co. - Sauget / Sauget (North of AHS Tracks)



MONSANTO INSURANCE COMPANY LITIGATION

MAY 25, 1990 ORDER PROTECTED MATERIAL
TREAT AS PROTECTED UNDER ATTORNEY-CLIENT PRIVILEGE AND WORK-PRODUCT DOCTRINE.

PROTECTED MATERIAL: MONSANTO INSURANCE COVERAGE LITIGATION

HED 0000526

HMSQ0187

EPA-90A (G 75-10M) GR-91A

-3-

Date: March 28, 1985

Time: 10:45 A.M. P.M.

Photograph By: P.R. McCarthy

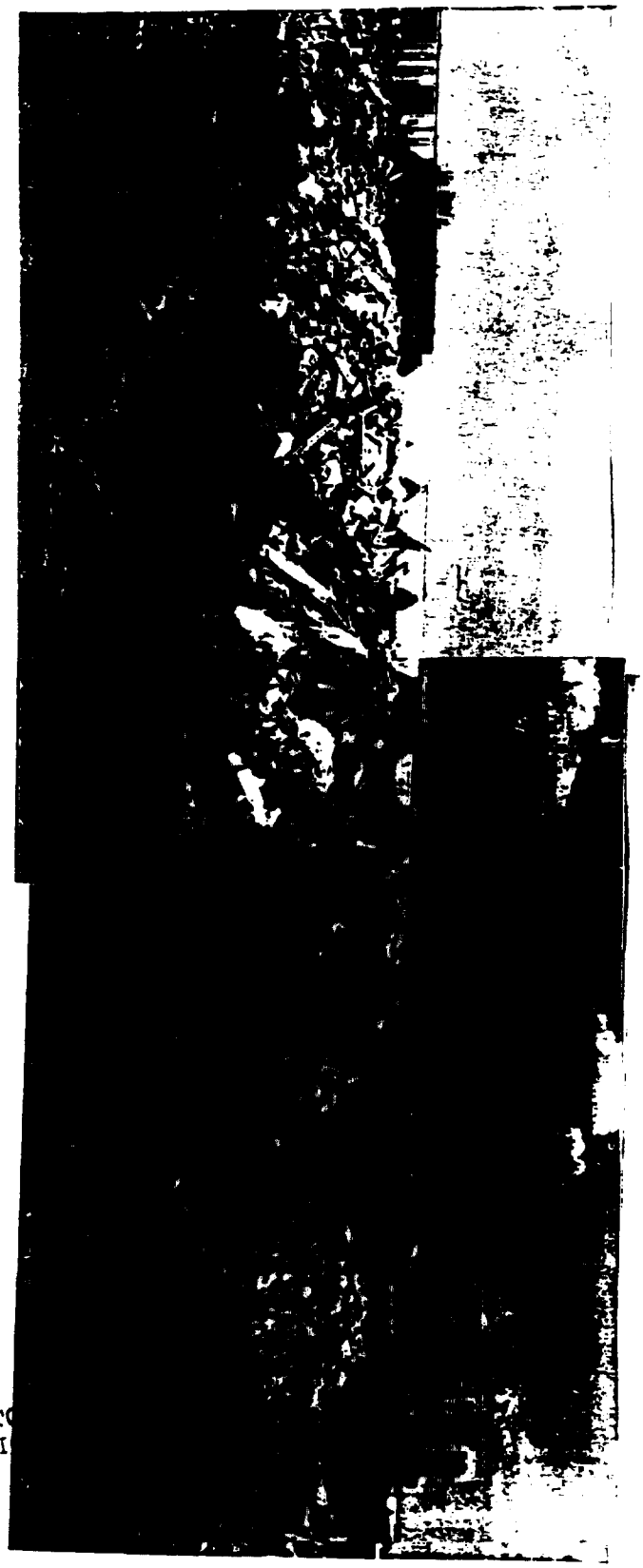
Location: LPC- 1631210001

St. Clair Co.

Sauget / Sauget

Comments: Photograph taken

toward the North Northwest



Date: March 28, 1985

Time: 10:45 A.M. P.M.

Photograph By: P.R. McCarthy

Location: LPC- 1631210001

St. Clair Co.

Sauget / Sauget

Comments: Photograph taken

toward the North

MONSANTO INSURANCE COMPANY LITIGATION:
MAY 25, 1990 ORDER PROTECTED MATERIAL
TREAT AS PROTECTED UNDER ATTORNEY-CLIENT
PRIVILEGE AND WORK-PRODUCT DOCTRINE.

PROTECTED MATERIAL: MONSANTO
INSURANCE COVERAGE LITIGATI

March 28, 1985

10:55 A.M. P.M.

aph By:

P.M. McCarthy

n: LPC- 1631210001

St. Clair Co.

Sauget / Sauget

s: Photograph taken

he Northwest

A.M. P.M.

h By:

LPC-

Co.

/

Photograph taken

PROTECTED MATERIAL: MONSANTO INSURANCE COVERAGE LITIGATION

MONSANTO INSURANCE COMPANY LITIGATION:

MAY 25, 1990 ORDER PROTECTED MATERIAL TREAT AS PROTECTED UNDER ATTORNEY-CLIENT PRIVILEGE AND WORK-PRODUCT DOCTRINE.

HED 0000528

Date: March 28, 1985

Time: 11:10 A.M. P.M.

Photograph By:

Location: LPC- 1631210001

St. Clair Co.

Sauget / Sauget

Comments: Photograph taken

toward the North

Date: March 28, 1985

Time: 11:10 A.M. P.M.

Photograph By:

Location: LPC- 1631210001

St. Clair Co.

Sauget / Sauget

Comments: Photograph taken

ward the Northeast

MONSANTO INSURANCE COMPANY LITIGATION:

MAY 25, 1990 ORDER PROTECTED MATERIAL
TREAT AS PROTECTED UNDER ATTORNEY-CLIENT
PRIVILEGE AND WORK-PRODUCT DOCTRINE.

PROTECTED MATERIAL: MO
INSURANCE COVERAGE LIT

HED 0000529

/NPC 24 6/78

EPA/CERRO COPPER/EIL/PCB ATTORNEY WORK PRODUCT / ATTORNEY CLIENT PRIVILEGE

ate: March 28, 1985

ime: 11:40 (A.M.) P.M.

notograph By:

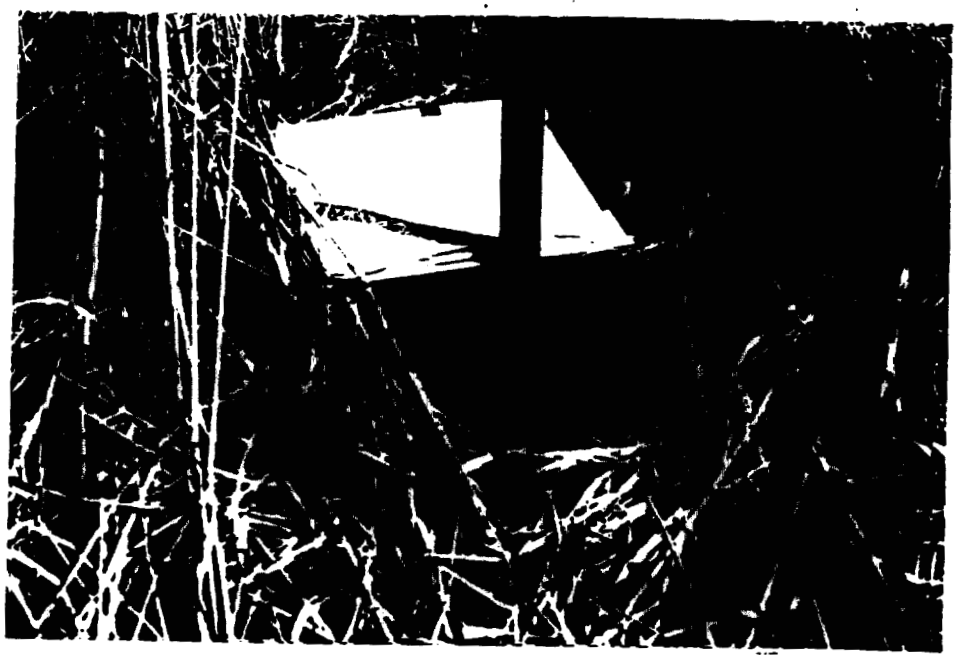
ocation: LPC- 1631210001

St. Clair Co.

Sauget / Sauget

mments: Photograph taken

ward the East



MONSANTO INSURANCE COMPANY LITIGATION:

MAY 25, 1990 ORDER PROTECTED MATERIAL
TREAT AS PROTECTED UNDER ATTORNEY-CLIENT
PRIVILEGE AND WORK-PRODUCT DOCTRINE.

e: March 28, 1985

e: 11:45 (A.M.) P.M.

tograph By:

ation: LPC- 1631210001

St. Clair Co.

Sauget / Sauget

ents: Photograph taken

rd the South

PROTECTED MATERIAL: MONSANTO
INSURANCE COVERAGE LITIGATION

HED 0000530

PC 24 6/78

EPA/CERRO COPPER/EIL/PCB ATTORNEY WORK PRODUCT / ATTORNEY CLIENT PRIVILEGE

Date: March 28, 1985

Time: 11:50 A.M. P.M.

Photograph By:

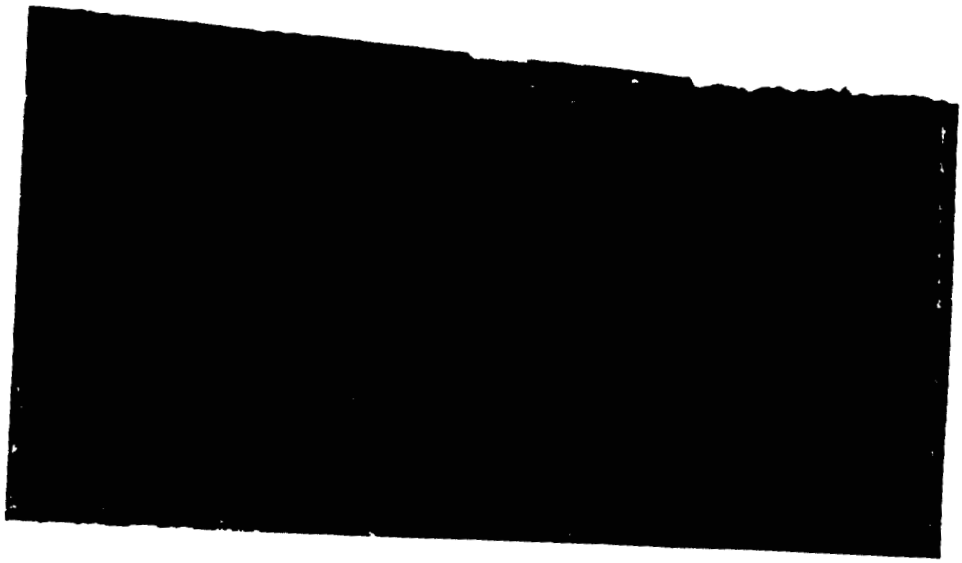
Location: LPC- 1631210001

St. Clair Co.

Sauget / Sauget

Comments: Photograph taken

ward the South



MONSANTO INSURANCE COMPANY LITIGATION:

MAY 25, 1990 ORDER PROTECTED MATERIAL
TREAT AS PROTECTED UNDER ATTORNEY-CLIENT
PRIVILEGE AND WORK-PRODUCT DOCTRINE.

e: March 28, 1985

e: 11:50 A.M. P.M.

tograph By:

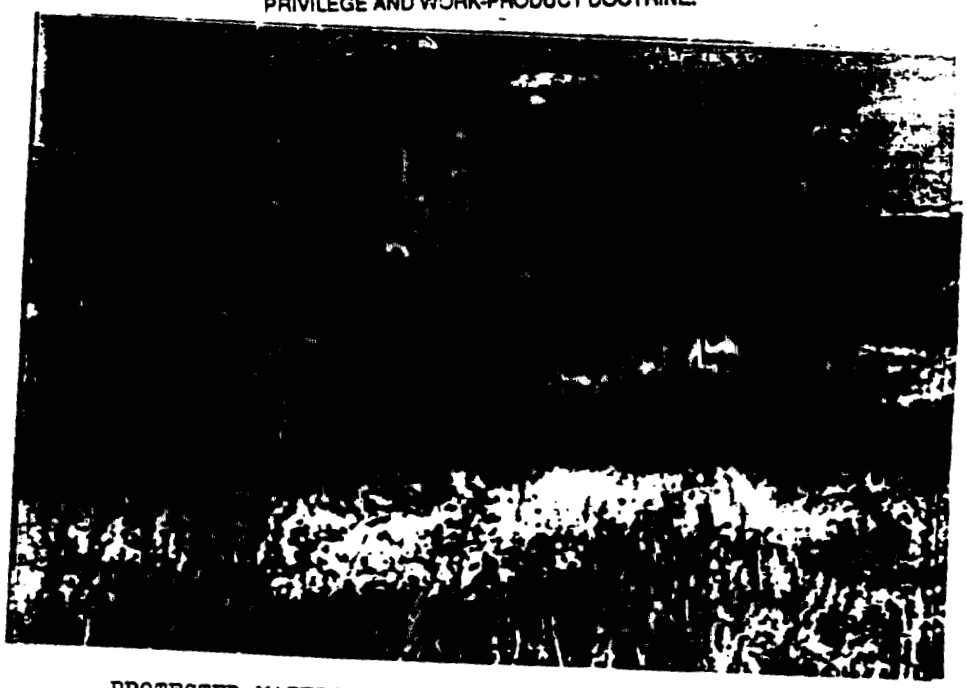
ation: LPC- 1631210001

St. Clair Co.

Sauget / Sauget

ents: Photograph taken

rd the North Northeast



PROTECTED MATERIAL: MONSANTO
INSURANCE COVERAGE LITIGATION

Date: March 28, 1985

Time: 1:05 A.M. P.M.

Photograph By: [illegible]

Location: LPC- 1631210001

St. Clair Co.

Sauget / Sauget

Comments: Photograph taken

Toward the Northeast

MONSANTO INSURANCE COMPANY LITIGATION:

MAY 25, 1990 ORDER PROTECTED MATERIAL.
TREAT AS PROTECTED UNDER ATTORNEY-CLIENT
PRIVILEGE AND WORK-PRODUCT DOCTRINE.

Date: March 28, 1985

Time: 1:15 A.M. P.M.

Photograph By: [illegible]

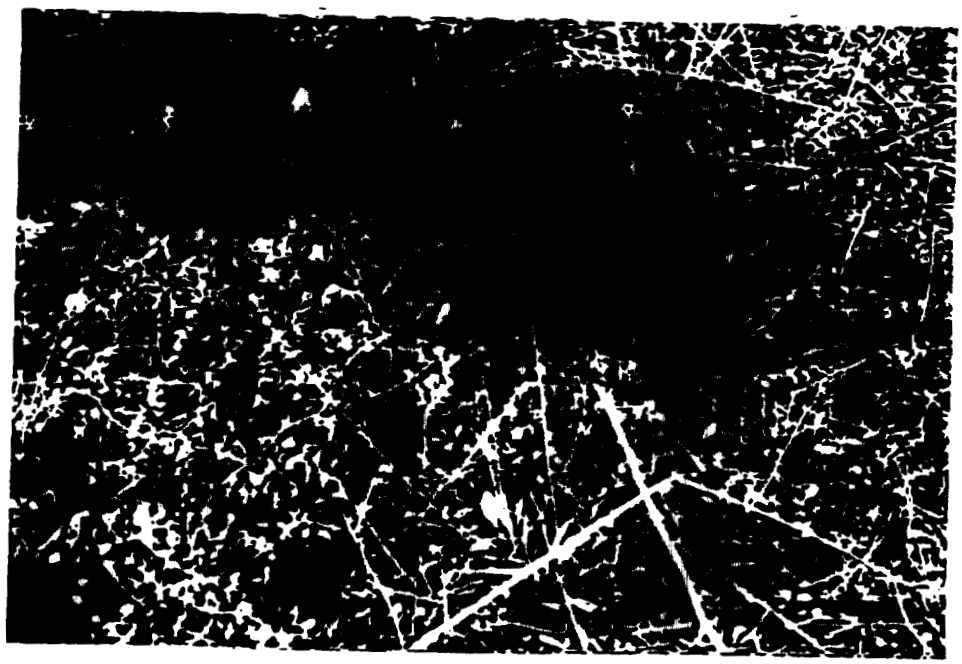
Location: LPC- 1631210001

St. Clair Co.

Sauget / Sauget

Comments: Photograph taken

Toward the North



PROTECTED MATERIAL: MONSANTO
INSURANCE COVERAGE LITIGATION

HED 0000532

EPA/CERRO COPPER/EIL/PCB ATTORNEY WORK PRODUCT / ATTORNEY CLIENT PRIVILEGE

Date: March 28, 1985

Time: 1:20 A.M. P.M.

Photograph By:

Location: LPC- 1631210001

St. Clair Co.

Sauget / Sauget

Comments: Photograph taken

toward the South Southwest

Date:

Time: A.M. P.M.

Photograph By:

Location: LPC-

Co.

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Comments: Photograph taken

toward the

MONSANTO INSURANCE COMPANY LITIGATION:

MAY 25, 1990 ORDER PROTECTED MATERIAL
TREAT AS PROTECTED UNDER ATTORNEY-CLIENT
PRIVILEGE AND WORK-PRODUCT DOCTRINE.

PROTECTED MATERIAL: MONSANTO
INSURANCE COVERAGE LITIGATION

HED 0000533

1 PLAINTIFF'S EXHIBIT NO. 7:

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MONSANTO INSURANCE COMPANY LITIGATION:

MAY 25, 1990 ORDER PROTECTED MATERIAL
TREAT AS PROTECTED UNDER ATTORNEY-CLIENT
PRIVILEGE AND WORK-PRODUCT DOCTRINE.

PROTECTED MATERIAL: MONSANTO
INSURANCE COVERAGE LITIGATION

HED 0000534

ENVIRONMENTAL PROTECTION AGENCY STATE OF ILLINOIS

L P C F C 0 5 5 C
(1) (8) (9)

OBSERVATION REPORT - SITE INVENTORY NO. 1 6 3 1 2 1 0 0 0 1
(11) (18)

St. Clair CO. - L.P.C. Region # S Date 0 7/2 3/8 5
(20) (25)

Sauget / Sauget Letter Sent (Yes or No) ____
(Location) (Responsible Party) (26)

Samples Taken: Yes ( ) No (X) Time: From 0 8 : 1 5 a m Weather 68° Sunny Dry
Ground Water( ) Surface( ) Other( ) To 1 0 : 0 0 a m
Photos Taken: Yes (5) No ( ) Interviewed No one Inspector P M M
(27) (29)

Previous Inspection 6/10/85 Previous Correspondence 4/3/85 Site Open: Yes( ) No(X)

OPERATIONAL STATUS:		TYPE OF OPERATION:				AUTHORIZATION:	
Operating	( )	Landfill	(X)	Storage	( )	E.P.A. Permit	( )
Temporarily Closed	( )	Random Dump	( )	Salvage	( )	Variance	( )
Closed Not Covered	(X)	Other ____	( )	A.C.D.	( )	21(e)	( )
Closed and Covered	( )	Quantity Received Daily(1-6)	1 (30)			Board Order	( )
						Illegal (5)	(X) 5 (31)

IMPROVED

SAME

DETERIORATED

LPC 4 1/79 5,000

I S or D C (62)

GENERAL REMARKS: Areas A, B and C were walked and inspected - The photos taken on 7/28/85 and 6/10/85 were compared to the conditions observed this date - No significant change was observed - No active operations with regards to covering were taking place - One load of construction and demolition material was observed in the southern part of Area "B" - A name was obtained from several blank checks - A letter will be written to that company. No observable recent random dumping has occurred in Area "C". The area observed on June 10, 1985 in the extreme southern portion of Area "B" and determined to be the responsibility of Patgood Inc. of St. Louis has been spread and leveled and the southern slope has been covered.

INTERVIEW: [redacted]

MONSANTO INSURANCE COMPANY LITIGATION

MAY 25, 1990 ORDER PROTECTED MATERIAL.
TREAT AS PROTECTED UNDER ATTORNEY-CLIENT PRIVILEGE AND WORK-PRODUCT DOCTRINE.

DIAGRAM:

HED 0000535

PROTECTED MATERIAL: MONSANTO INSURANCE COVERAGE LITIGATION

7/22/85

PLAINTIFF'S EXHIBIT 7

1 PLAINTIFF'S EXHIBIT NO. 6:

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MONSANTO INSURANCE COMPANY LITIGATION:

MAY 25, 1990 ORDER PROTECTED MATERIAL.
TREAT AS PROTECTED UNDER ATTORNEY-CLIENT
PRIVILEGE AND WORK-PRODUCT DOCTRINE.

PROTECTED MATERIAL: MONSANTO
INSURANCE COVERAGE LITIGATION

EPA/CERRO COPPER/EIL/PCB ATTORNEY WORK PRODUCT / ATTORNEY CLIENT PRIVILEGE

ILLINOIS ENVIRONMENTAL PROTECTION AGENCY — MEMORANDUM

DATE: June 10, 1985

TO: Division File

FROM: P. M. McCarthy

SUBJECT: St. Clair Co. Sauget/Sauget
1631210001

On the above date I conducted an inspection of this facility. On May 10, 1985 and May 20, 1985 I visited the site briefly to determine if any covering activity was occurring. On May 20, 1985 it was observed that one area of stockpiled cover had been spread. This is discussed later.

The "south site", (area C) is unchanged with regards to any covering operation. No noticeable random dumping, if any, has occurred since the last inspection. The subject site is covered with green vegetation.

The "north site", (areas A and B) was walked and photographs were taken. The photos that I took on the March 28, 1985 inspection were compared to the conditions that exist this date.

An area in the northern portion of area "A", west of the "Pillsbury Spur", has been spread, however it is uneven and some water was ponding. Also, the cover material contained broken pavement/or rocks, and its suitability is questionable.

Areas of stockpiled cover within "A" and "B" were also observed. Some piles appear to be free of anything unnatural, while others contain high percentages of demolition, (broken pavement, brick, asphalt and rebar).

Some recent stockpiling of soil, demolition material and mixtures thereof (15 to 20 loads) were observed in the area of the extreme southern portion of "Area B". It has been determined that this situation is the responsibility of Patgood, Inc, of St. Louis, MO and is being addressed separately.

MONSANTO INSURANCE COMPANY LITIGATION:
MAY 25, 1990 ORDER PROTECTED MATERIAL
TREAT AS PROTECTED UNDER ATTORNEY-CLIENT PRIVILEGE AND WORK-PRODUCT DOCTRINE.

PMM:cas

cc: DLPC - Southern Region
cc: Bruce Carlson

PROTECTED MATERIAL: MONSANTO INSURANCE COVERAGE LITIGATION

HED 0000537

7/24/85 Admitted

PLAINTIFF'S EXHIBIT

IL 532-0570
EPA-90 (Rev. 6/75-20M)

EPA/CERRO COPPER/EIL/PCB ATTORNEY WORK PRODUCT / ATTORNEY CLIENT PRIVILEGE

ILLINOIS ENVIRONMENTAL PROTECTION AGENCY

MEMORANDUM

TO: Division File Pg 2

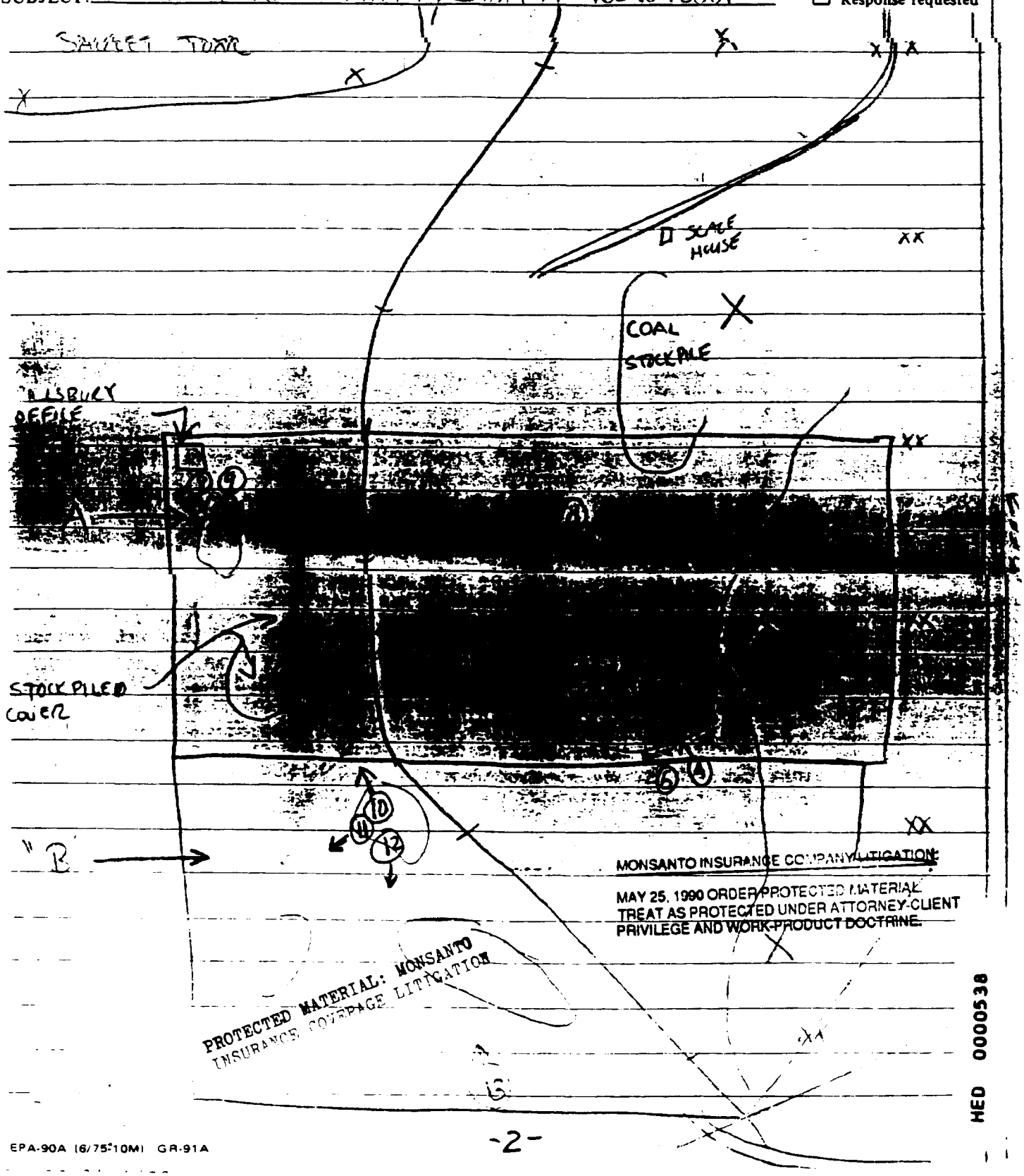
DATE: 6/10/85

FROM: P McCARTHY

☒ Information only

SUBJECT: ST CLAIR CO - SAUGET/SAUGET 1631210001

☐ Response requested



MONSANTO INSURANCE COMPANY LITIGATION

MAY 25, 1990 ORDER PROTECTED MATERIAL
TREAT AS PROTECTED UNDER ATTORNEY-CLIENT PRIVILEGE AND WORK-PRODUCT DOCTRINE.

PROTECTED MATERIAL: MONSANTO INSURANCE COVERAGE LITIGATION

HED 0000538

EPA-90A (6/75-10M) GR-91A

EPA/CERRO COPPER/EIL/PCB ATTORNEY WORK PRODUCT / ATTORNEY CLIENT PRIVILEGE

Date: May 10, 1985

Time: 8:00 A.M. P.M.

Photograph By: Patrick W. McCarthy

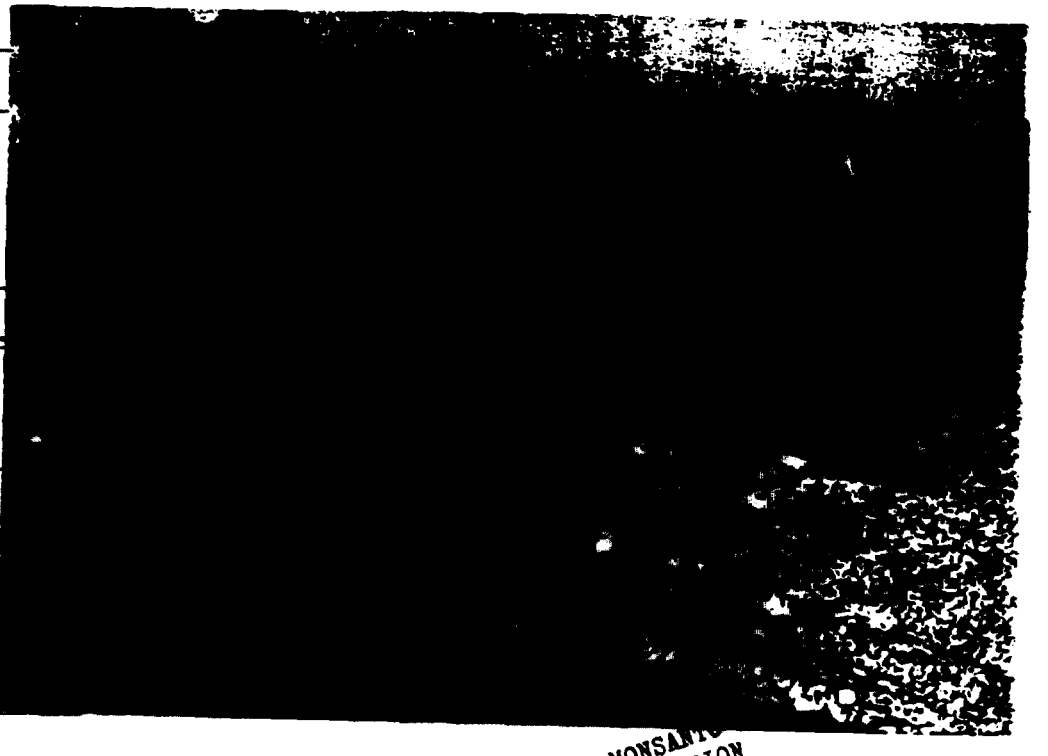
Location: LPC- 1631210001

St. Clair Co.

Sauget / Sauget

Comments: Photograph taken

toward the South Southwest



Date:

Time: A.M.

Photograph By:

Location: LPC-

Co.

/

Comments: Photograph taken

toward the

PROTECTED MATERIAL: MONSANTO
INSURANCE COVERAGE LITIGATION

MONSANTO INSURANCE COMPANY LITIGATION:

MAY 25, 1990 ORDER PROTECTED MATERIAL
TREAT AS PROTECTED UNDER ATTORNEY-CLIENT
PRIVILEGE AND WORK-PRODUCT DOCTRINE.

HED 0000539

EPA/CERRO COPPER/EIL/PCB ATTORNEY WORK PRODUCT / ATTORNEY CLIENT PRIVILEGE

Date: June 10, 1985

Time: 8:15 A.M. P.M.

Photograph By: Pam McCarthy

Location: LPC- 1631210001

St. Clair Co.

Sauget / Sauget

Comments: Photograph taken

toward the North Northwest

Date: June 10, 1985

Time: 8:15 A.M. P.M.

Photograph By: Pam McCarthy

Location: LPC- 1631210001

St. Clair Co.

Sauget / Sauget

Comments: Photograph taken

toward the North

PROTECTED MATERIAL: MONSANTO
INSURANCE COVERAGE LITIGATION

MONSANTO INSURANCE COMPANY LITIGATION:

MAY 25, 1990 ORDER PROTECTED MATERIAL
TREAT AS PROTECTED UNDER ATTORNEY-CLIENT
PRIVILEGE AND WORK-PRODUCT DOCTRINE.

HED 0000540

EPA/CERRO COPPER/EIL/PCB ATTORNEY WORK PRODUCT / ATTORNEY CLIENT PRIVILEGE

MONSANTO INSURANCE COMPANY LITIGATION:

MAY 25, 1990 ORDER PROTECTED MATERIAL
TREAT AS PROTECTED UNDER ATTORNEY-CLIENT
PRIVILEGE AND WORK-PRODUCT DOCTRINE.

Date: June 10, 1985

Time: 8:20 (A.M.) P.M.

Photograph By: D. McCarty

Location: LPC- 1631210001

St. Clair Co.

Sauget, Sauget

Comments: Photograph taken

toward the Southeast

Date: June 10, 1985

Time: 8:20 (A.M.) P.M.

Photograph By: D. McCarty

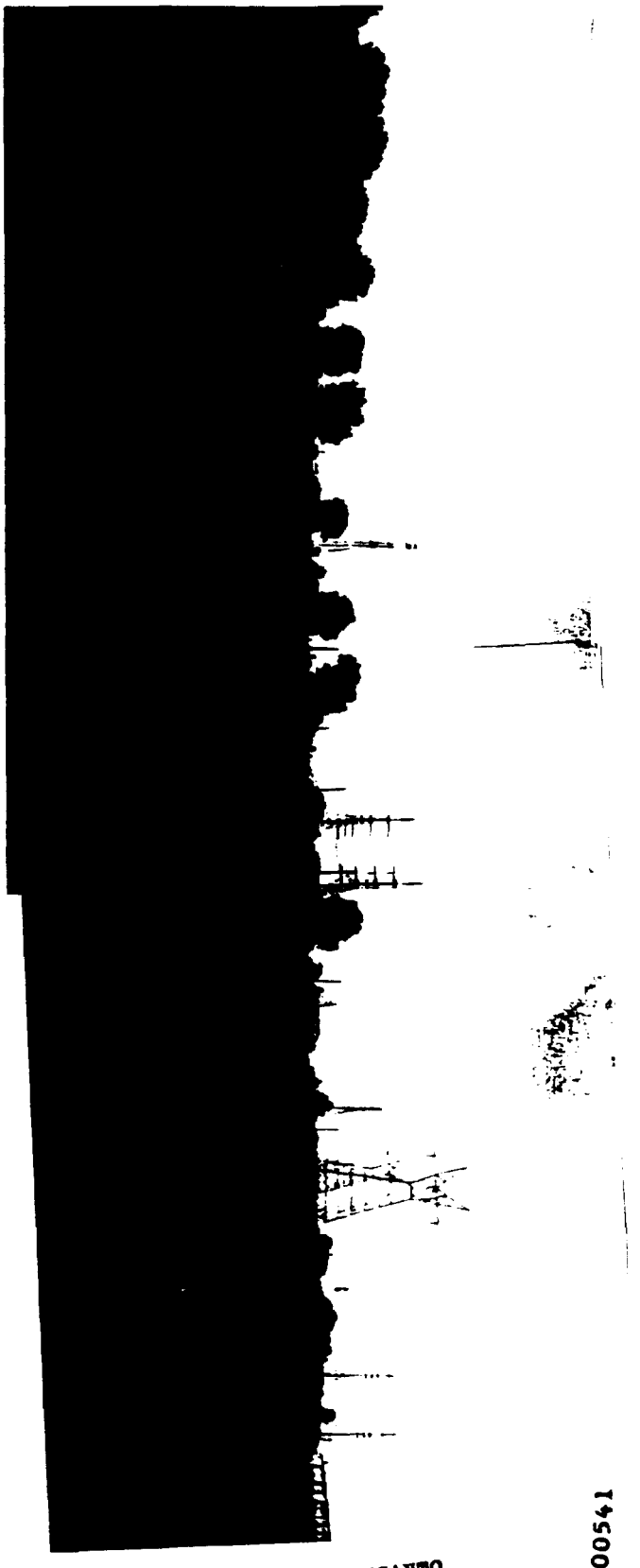
Location: LPC- 1631210001

St. Clair Co.

Sauget, Sauget

Comments: Photograph taken

toward the South Southeast



PROTECTED MATERIAL: MONSANTO
INSURANCE COVERAGE LITIGATION

EPA/CERRO COPPER/EIL/PCB ATTORNEY WORK PRODUCT / ATTORNEY CLIENT PRIVILEGE

MONSANTO INSURANCE COMPANY LITIGATION

MAY 25, 1990 ORDER PROTECTED MATERIAL
TREAT AS PROTECTED UNDER ATTORNEY-CLIENT
PRIVILEGE AND WORK-PRODUCT DOCTRINE.

Date: June 10, 1985

Time: 8:25 A.M. P.M.

Photograph By:

Location: LPC- 1631210001

St. Clair Co.

Sauget/ Sauget

Comments: Photograph taken

toward the South

Date: June 10, 1985

Time: 8:25 A.M. P.M.

Photograph By:

Location: LPC- 1631210001

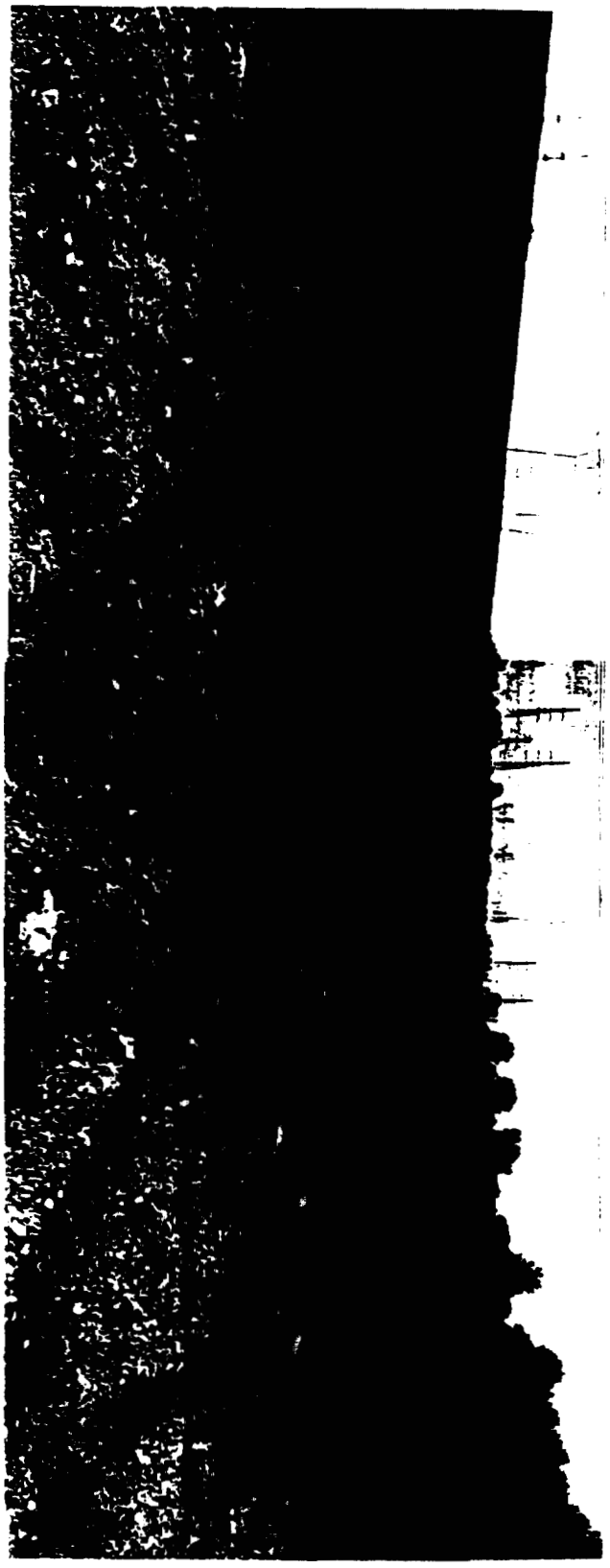
St. Clair Co.

Sauget / Sauget

Comments: Photograph taken

toward the South Southwest

PROTECTED MATERIAL: MONSANTO
INSURANCE COVERAGE LITIGATION



MONSANTO INSURANCE COMPANY LITIGATION:

MAY 25, 1990 ORDER PROTECTED MATERIAL
TREAT AS PROTECTED UNDER ATTORNEY-CLIENT
PRIVILEGE AND WORK-PRODUCT DOCTRINE.

ate: June 10, 1985

ime: 8:30 (A.M.) P.M.

hotograph By: [illegible]

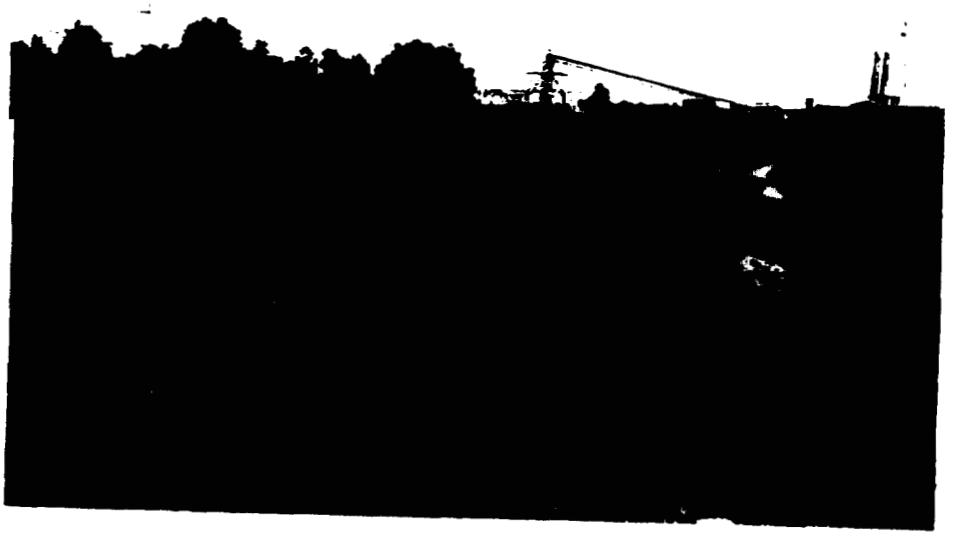
ocation: LPC- 1631210001

St. Clair Co.

Sauget / Sauget

omments: Photograph taken

ward the North



ate: June 10, 1985

ime: 8:30 (A.M.) P.M.

hotograph By: [illegible]

ocation: LPC- 1631210001

St. Clair Co.

Sauget / Sauget

mments: Photograph taken

ward the West

PROTECTED MATERIAL: MONSANTO
INSURANCE COVERAGE LITIGATION

HED 0000543

MONSANTO INSURANCE COMPANY LITIGATION:

MAY 25, 1990 ORDER PROTECTED MATERIAL.
TREAT AS PROTECTED UNDER ATTORNEY-CLIENT
PRIVILEGE AND WORK-PRODUCT DOCTRINE.

Date: June 10, 1985

Time: 8:30 A.M. P.M.

Photograph By:

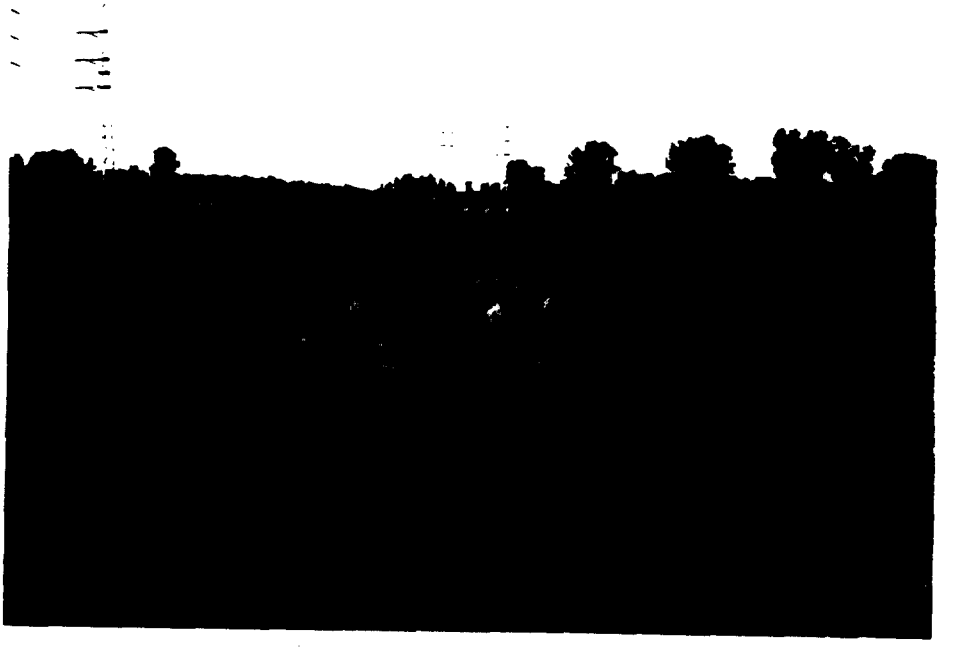
Location: LPC- 1631210001

St. Clair Co.

Sauget / Sauget

Comments: Photograph taken

toward the South Southwest



Date:

Time: A.M. P.M.

Photograph By:

Location: LPC-

Co.

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Comments: Photograph taken

the

PROTECTED MATERIAL: MONSANTO
INSURANCE COVERAGE LITIGATION

HED 0000544

Date: June 10, 1985

Time: 8:40 A.M. P.M.

Photograph By: J.M. McCarthy

Location: LPC- 1631210001

St. Clair Co.

Sauget / Sauget

Comments: Photograph taken

toward the North

MONSANTO INSURANCE COMPANY LITIGATION:

MAY 25, 1990 ORDER PROTECTED MATERIAL
TREAT AS PROTECTED UNDER ATTORNEY-CLIENT
PRIVILEGE AND WORK-PRODUCT DOCTRINE.

Date:

Time: A.M. P.M.

Photograph By:

Location: LPC-

Co.

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Comments: Photograph taken

toward the

PROTECTED MATERIAL: MONSANTO
INSURANCE COVERAGE LITIGATION

HED 0000545