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.

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 ug/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.

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

ES-80-SS-24
Page 4

MONS 022337

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.

MONS 022338

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.

MONS 022339

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.

MONS 022340

TABLE V. PPM LEVELS OF METALS IN LEAD 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

MONS 022341

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

ES-80-S5-24
Page 9

MONS 022342

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