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TECHNICAL MEMORANDUM

ENVIRONMENTAL RESOURCES MANAGEMENT GROUP

Soil Organic Carbon
Enviro-Chem Superfund Site
Zionsville, Indiana

January 25, 1996

Submitted on behalf of the EnviroChem Trustees by
Environmental Resources Management-North Central, Inc.
540 Lake Cook Road, Suite 300
Deerfield, Illinois 60015

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1.0 *INTRODUCTION*

This Technical Memorandum reports the results of the Soils Total Organic Carbon (TOC) Investigation conducted at the Environmental Conservation and Chemical Corporation (Enviro-Chem) site in Zionsville, Indiana.

The investigation was conducted to obtain site-specific fraction of organic carbon (f_{oc}) data to determine the site-specific distribution coefficients (K_d) to be used in correcting the Enviro-Chem "Acceptable Soil Concentrations" presented in Table 3-1 of the Consent Decree, Exhibit A.

2.0 *BACKGROUND*

The Enviro-Chem Acceptable Soil Concentrations were originally calculated in 1989 and are presented in Table 3-1 of Exhibit A of the Consent Decree (Exhibit A).[1] These values serve as the soil clean-up standards for the remedial action.[2] They are also used to calculate the "Soil Vapor Criterion"[3] and to demonstrate soil clean-up compliance[4].

2.1 *SITE-SPECIFIC ACCEPTABLE SOIL CONCENTRATIONS*

The Enviro-Chem Acceptable Soil Concentrations were based on ingestion of subsurface water at the site boundary, assuming a dilution of leachate to subsurface water of 1:196. The concentrations were calculated following the procedures described in Appendix B of Exhibit A of the Consent Decree. "The concentrations shown in Table B6 (in Appendix B) were used to determine the Acceptable Soil Concentrations specified in Table 3-1, using a risk of 10^{-6} and a soil organic carbon content of 0.12%, as presented in the RI."[5,6]

includes error in aquifer length Should be 1:108

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1 Consent Decree in Civil Action No. 83-1419C, United States of America. State of Indiana vs. Environmental Conservation and Chemical Corporation, et. al.

2 Exhibit A, page 21, lines 645 through 648 and 666 through 668.

3 Exhibit A, page 27, lines 859 through 862.

4 Exhibit A, page 28, lines 866 through 868.

5 Exhibit A, Appendix B, unnumbered page following Table B6.

6 During the Phase II Supplemental Investigation, nine compounds not included in Table 3-1 of Exhibit A were detected in a ground water sample. The United States Environmental Protection Agency (USEPA) proposed the addition of these nine compounds to Table 3-1 of Exhibit A, and calculated Acceptable Soil Concentrations using the procedure described in Appendix B of Exhibit A also using a soil organic carbon content of 0.12%. The corrected organic carbon value reported herein is also applicable to these compounds, if they are added to Exhibit A.

2.2 *TOTAL ORGANIC CARBON*

In Exhibit A, a value of 0.12% for the organic carbon fraction f_{oc} in the soil was used. In recent correspondence and discussion,[7,8,9,10,11,12] there has been some confusion as to the source of this value. In particular, it has not been clear whether the value was obtained from field samples taken during the Remedial Investigation (RI)[13] or was based on literature references.[14] A review of the RI, and of meeting notes and correspondence from 1989, indicates the following:

- The RI does not present site-specific organic carbon (f_{oc}) data.
- In preparation of RI Table 5-3, USEPA's contractor CH_2M-Hill, assumed that the f_{oc} value was approximately 0.12% to calculate physical - chemical properties of indicator organics (specifically Log K_{ow} and K_d values). Although this f_{oc} value was not presented in the RI, its use can be calculated from the values that were presented.
- At a meeting on February 24, 1989, CH_2M-Hill acknowledged that the f_{oc} value for the till used in the RI was determined from literature values. Although CH_2M-Hill said it would provide a literature reference for the value used, no reference was provided.
- At a meeting on April 5, 1989, in response to a potentially responsible parties (PRPs) comment that the values in Table 3-1 of Exhibit A were conservative (because the f_{oc} value used was conservative), CH_2M-Hill suggested using a value for f_{oc} that was an order of magnitude less than the value assumed in the RI, based on data from another site. In response, the PRPs offered to

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7 Letter to the Enviro-Chem Trustees from USEPA, December 6, 1995.

8 Letter to Roy Ball of Environmental Resources Management-North Central, Inc. from Michael McAteer of USEPA, October 12, 1995.

9 Letter to the Enviro-Chem Trustees from Thomas Krueger of USEPA, November 6, 1995.

10 Letter to Roy Ball of Environmental Resources Management-North Central, Inc. from Michael McAteer of USEPA, November 21, 1995.

11 Letter to Michael McAteer of USEPA from the Enviro-Chem Trustees, November 29, 1995.

12 Letter to the Enviro-Chem Trustees from Michael McAteer of USEPA, December 6, 1995.

13 CH_2M-Hill, Remedial Investigation, Enviro-Chem Superfund Site, 1982.

14 Exhibit A, Appendix B, Table B8.

show that the value assumed in the RI was conservative based on the literature and that therefore a more stringent (lower) value was not appropriate. At that meeting, an Indiana Department of Environmental Management representative indicated that it could accept the f_{oc} value implicitly used in the RI as the basis for the values in Table 3-1 of Exhibit A, if the PRPs could show that the value was conservative.

- In a letter dated April 11, 1989, Environmental Resources Management-North Central, Inc. (ERM-North Central) provided an initial range of literature values that showed that the f_{oc} value implicitly used in the RI was conservative.[15]

- None of the meeting notes reflect any consideration of the possibility that site-specific organic carbon value (f_{oc}) was an order of magnitude higher (not lower) than the value assumed in the RI.

At the USEPA's request in July 1995, the Trustees conducted a Central Support Zone Investigation (CSZI). The CSZI showed that in the soils of the Central Support Zone immediately adjacent to the site, the site-specific organic carbon f_{oc} was an order of magnitude higher than the value assumed in the RI. CH_2M-Hill questioned whether the f_{oc} value in the Central Support Zone was representative of the f_{oc} value of the site.[16]

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15 The Environmental Resources Management-North Central, Inc. letter makes reference to "...the organic carbon level used in Exhibit A (which was taken from the RI)...." It is clear from the discussions that prompted the letter that this refers to the soil organic carbon level that was used by CH_2M-Hill in computing Table 5-3, and does not imply that the value was based on field sampling performed at the Enviro-Chem site during the RI (which it was not).

16 Technical Memorandum from Frank Mahuta of CH_2M-Hill to Michael McAteer of USEPA, October 2, 1995.

3.0 *ORGANIC CARBON INVESTIGATION*

As a result of the CSZI f_{oc} data, on November 20 and 21, 1995, Dow Environmental, Inc. (DEI) conducted a field investigation to determine site-specific f_{oc}. Its investigation was performed in accordance with the procedures described in the Soils TOC Investigation Field Sampling Plan dated October 1995. A total of 79 soil samples were collected from 16 soil borings advanced within the remedial boundary. These samples were then sent to Ceimic Corporation (Ceimic) of Naragansett, Rhode Island, where TOC analysis was performed by using EPA Solid Waste Method 9060.

3.1 *SCOPE OF WORK*

Soil borings were drilled on a grid spaced 100 feet apart at the locations shown in Figure 1. The grid spacing is based on the Illinois Environmental Protection Agency's procedure for estimating the number of sample locations for verifying Resource Conservation Recovery Act clean closure.[17]

Borings were drilled at the grid locations by using hollow-stem augering techniques. Split-spoon samples were taken continuously from 0 to 10 feet by using a clean, decontaminated sampling spoon. Each sample collected was logged by the site geologist in accordance with the procedures outlined in the Unified Soil Classification System. A portion of each remaining sample was placed in a 4-ounce, clear, wide-mouth glass jar for submission to Ceimic. A field geologist, wearing a clean pair of latex gloves, used a decontaminated stainless steel trowel to transfer soil into the sample jars. Drilling terminated at a depth of 10 feet at each boring. On completion of data acquisition activities, all borings were grouted with a cement/bentonite slurry.

Sample shipping, handling, and custody procedures were performed in accordance with the USEPA Region V Guidance for Superfund Investigations.[18]

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[17] Illinois Environmental Protection Agency, Guidance for Preparing Closure Plans for Interim Status RCRA Hazardous Waste Facilities, November 1994.

[18] USEPA, Region V Content Requirements for Quality Assurance Project Plans, January 1986.

3.2 *SITE GEOLOGY*

Not known for sure

add The trustees bel

Several investigations have contributed to the understanding of Enviro-Chem site geology.[13,19,20] The shallow geology, from which the samples were collected, consists of unconsolidated glacial deposits which are composed predominantly of vertically heterogenous brown to gray clays and silts with occasional fine to coarse sand lenses. The sand lenses are laterally discontinuous. The clay and silt unit is laterally persistent, but the distribution of the individual silt and clay layers vary throughout the area of investigation.

3.3 *ANALYTICAL RESULTS*

The organic carbon results are summarized in Table 1. The reported f_{oc} values for each borehole were averaged (vertical averaging) so that the resulting value would be representative of the f_{oc} encountered by a contaminant migrating downward toward ground water within the "column" of the borehole. As part of an emergency response action in 1984, a clay cap, which was approximately 2 feet thick, was installed over the site.[21] Therefore, the f_{oc} values nearest the surface (0-2 feet) were excluded from the vertical averaging because they represent the organic carbon in the cap, rather than in the naturally occurring geologic unit. As shown in Figure 1, the vertically averaged data does not demonstrate any areal pattern or clustering.

median would be preferred

The calculation of the mean f_{oc} value and the lower 90% confidence interval followed the procedures outlined in USEPA "Test Methods for Evaluating Solid Waste Physical/Chemical Methods - Volume II" (SW-846) for statistical analysis of chemical concentrations in solid waste.[22] SW-846 states, on page NINE-10, "The validity of a confidence interval for the true mean concentration of a chemical contaminant of a solid waste is, as previously noted, based on the assumption that individual concentrations of the contaminant exhibit a *normal distribution*. If this is not the case, normality can be achieved by transforming the data and the statistical analysis can be performed on the transformed data."

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19 Dow Environmental, Inc., Central Support Zone Investigation Report, Enviro-Chem Superfund Site, September 1995.

20 Dow Environmental, Inc., Phase II Supplemental Investigation Report, Enviro-Chem Superfund Site, March 1993.

21 USEPA, Region V Waste Management Division, Emergency Response Section, On-Scene Coordinator's Report for Environmental Conservation and Chemical Corporation, June 14, 1985.

22 USEPA, SW-846 Test Methods for Evaluating Solid Waste Physical/Chemical Methods - Volume II, November 1986.

If a cumulative normal distribution is plotted with the ordinate in normal probability scale, it will lie on a straight line.[23] As shown in Figure 1 in the Attachment, the data set of vertically averaged f_{oc} appeared to follow a normal distribution based on visual inspection of a simple graphical test for normality. Therefore, in accordance with the procedures outlined in SW-846, the untransformed data were subject to statistical analysis.

The mean f_{oc} value was determined to be 11,453 mg/kg (1.15%), the standard deviation of the mean was 2,192 mg/kg, and the 90% lower confidence limit organic carbon value was determined to be 9,261 mg/kg (0.926%). The summary report of the statistical treatment, performed using Statgraphics software, is included in the Attachment.

[23] Sokal, R.R. and F.J. Rohlf, Biometry 1969, W.H. Freeman and Company.

4.0 *CORRECTED SITE-SPECIFIC ACCEPTABLE SOIL CONCENTRATIONS*

The corrected Acceptable Soil Concentrations presented in Table 2 were calculated in accordance with the procedures presented in Appendix C of the Enviro-Chem RI, with the following modifications:

- The Acceptable Subsurface Water Concentration for 1,1-dichloroethane was changed to 810 $\mu g/L$ as approved by the USEPA[24];

- The site-specific f_{oc} was changed to 0.00926 (see Section 3.3 for a discussion of the statistical treatment of site-specific TOC data);

- Drinking water Maximum Contaminant Levels (MCLs) have been promulgated for chlorobenzene, ethyl benzene, toluene, and total xylenes. The Acceptable Subsurface Water Concentrations were calculated based on MCL-proposed goals in 1989. The corrected Acceptable Soil Concentrations have been calculated with the current MCL values;

- The MCLs for barium and cadmium have been updated[25]; therefore, the Acceptable Soil Concentrations have been calculated using the new values;

- The risk-based corrected Acceptable Subsurface Water Concentrations were calculated in accordance with the USEPA's "Risk Assessment Guidance for Superfund: Volume I-Human Health Evaluation Manual (Part B, Development of Risk-Based Preliminary Remediation Goals)," December 1991; and

- The nine additional compounds proposed by the USEPA have been calculated and are included in the list of corrected Acceptable Soil Concentrations. These additional compounds have not as of yet been added to the Consent Decree.

Table 3 presents a comparison of the corrected Acceptable Soil Concentrations with the current Acceptable Soil Concentration values as presented in Table 3-1 of Exhibit A. Table 4 presents a comparison of the corrected Acceptable Soil Concentrations with the Maximum Concentrations in soil detected during the RI.

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24 Letter to Roy Ball of Environmental Resources Management-North Central, Inc. from Michael McAteer of USEPA, October 12, 1995.

25 National Primary Drinking Water Regulations, 40 Code of Federal Regulations 141.

Table 5 presents the soil vapor concentrations in equilibrium with the corrected Acceptable Soil Concentrations. These equilibrium soil vapor concentrations will be compared with analytical results of vapor samples taken during soil vapor extraction system restart spikes to determine compliance with the Soil Vapor Criterion.[26]

[26] Exhibit A, page 29, lines 904 through 910.

TABLEAU

TABLE 1
SOIL TOTAL ORGANIC CARBON RESULTS
ENVIRO-CHEM SUPERFUND SITE
ZIONSVILLE, INDIANA

Boring No.	Sample No.	Boring Location		Sampled Interval					Mean (2'-10') (mg/kg)
		Northing (feet)	Easting (feet)	A (0'-2') (mg/kg)	B (2'-4') (mg/kg)	C (4'-6') (mg/kg)	D (6'-8') (mg/kg)	E (8'-10') (mg/kg)	
B100	EC-B1217	922,270.990	725,902.440	4,360	3,760	5,900	4,060	15,300	7,255
B101	EC-B1218	922,170.998	725,903.712	4,860	3,670	5,990	14,100	6,210	7,493
B102	EC-B1219	922,071.006	725,904.983	7,260	16,800	16,500	15,100	7,920	14,080
B103	EC-B1220	921,971.014	725,906.255	6,230	6,620	44,100	40,400	12,200	25,830
B104	EC-B1224	922,260.718	725,802.448	9,460	2,510	2,810	11,800	13,100	7,555
B105	EC-B1223	922,169.726	725,803.720	5,640	18,000	17,000	24,900	12,500	18,100
B106	EC-B1222	922,060.735	725,804.991	5,420	8,840	14,000	11,300	9,500	10,910
B107	EC-B1221	921,969.743	725,806.263	5,740	7,430	11,700	9,060	9,240	9,358
B108	EC-B1216	922,268.447	726,702.456	3,000	4,730	9,040	16,500	18,000	12,068
B109	EC-B1215	922,168.455	725,703.728	6,190	2,610	3,480	3,300	3,120	3,128
B110	EC-B1214	922,068.463	725,704.999	3,280	2,850	2,700	4,130	7,080	4,190
B111	EC-B1213	921,968.471	725,706.271	4,890	[No recovery]	5,630	2,430	4,360	4,140
B112	EC-B1226	921,933.610	725,928.740	8,740	17,300	5,970	8,040	8,240	9,888
B113	EC-B1227	921,833.618	725,930.012	10,300	5,460	14,900	8,260	19,000	11,905
B114	EC-B1225	921,932.338	725,828.748	12,200	6,970	19,300	16,900	12,000	13,793
B115	EC-B1228	921,832.346	725,830.020	12,300	25,100	21,500	22,900	24,700	23,550

TABLE 2
CORRECTED SITE-SPECIFIC ACCEPTABLE CONCENTRATIONS (9)
ENVIRO-CHEM SUPERFUND SITE
ZIONSVILLE, INDIANA
(Page 1 of 4)

Parameter	Acceptable Subsurface Water Concentration (1,2) (ug/L)	Acceptable Stream Concentration (3,4) (ug/L)	Acceptable Soil Concentration (5,6) (mg/kg)
Volatile Organic Compounds			
Acetone	3,650 RB		3.81
Chlorobenzene	100 MCL		126
Chloroform	100 MCL	15.7	16.9
1,1-Dichloroethane	810 EPA		90.6
1,1-Dichloroethene	7 MCL	1.85	0.879
Ethyl benzene	700 MCL	3,280	1,790
Methylene chloride	5 MCL	15.7	0.161
Methyl ethyl ketone	170 LDWHA		0.561
Methyl isobutyl ketone	2,920 RB		109
Tetrachloroethene	1.64 RB	8.85	2.25
Toluene	1,000 MCL	3,400	889
1,1,1-Trichloroethane	200 MCL	5,280	53.7
1,1,2-Trichloroethane	1.49 RB	41.8	0.401
Trichloroethene	5 MCL	80.7	1.77
Total Xylenes	10,000 MCL		33,000
Semivolatile Organic Compounds			
bis(2-ethylhexyl)phthalate	6.08 RB	50,000	
Di-n-butyl phthalate	3,650 RB	154,000	
Diethyl phthalate	29,200 RB	52,100	
Isophorone	89.6 RB		
Naphthalene	1,460 RB	620	
Phenol	21,900 RB	570	1,150

TABLE 2
CORRECTED SITE-SPECIFIC ACCEPTABLE CONCENTRATIONS (9)
ENVIRO-CHEM SUPERFUND SITE
ZIONSVILLE, INDIANA
(Page 2 of 4)

Parameter	Acceptable Subsurface Water Concentration (1,2) (ug/L)	Acceptable Stream Concentration (3,4) (ug/L)	Acceptable Soil Concentration (5,6) (mg/kg)
Inorganics			
Antimony	15 RB		
Arsenic	50 MCL	0.0175	
Barium	2000 MCL		
Beryllium	183 RB		
Cadmium	5 MCL		
Chromium VI	50 MCL	11	
Lead	50 MCL	10	
Manganese	183 RB		
Nickel	150 LDWHA	100	
Silver	50 MCL		
Tin	21900 RB		
Vanadium	256 RB		
Zinc	10950 RB	47	
Cyanide	154 LDWHA	5.2	
Polychlorinated biphenyls	0.011 RB (7)	0.000079 (7,8)	
Proposed Additional Compounds			
Vinyl chloride	2 MCL	525	0.014
1,2-Dichloroethane	5 MCL	243	0.256
Dimethyl phthalate	365,000 RB	10,000	49,100
Chloroethane			
Trichlorofluoromethane	10,950 RB		6,730
1,2-Dichloroethene(total)	70 MCL	1.85	3.84
2,4-Dimethyl phenol	730 RB	2,120	348
1,2-Dichlorobenzene	600 MCL	763	2,610
Butyl benzyl phthalate	7,300 RB	3	798,000

TABLE 2
(Page 3 of 4)

CORRECTED SITE-SPECIFIC ACCEPTABLE CONCENTRATIONS(9)
ENVIRO-CHEM SUPERFUND SITE
ZIONSVILLE, INDIANA

NOTES:

(1) RB = Risk-based standard. U.S. EPA, Risk Assessment Guidance for Superfund: Volume I-Human Health Evaluation Manual (Part B, Development of Risk-based Preliminary Remediation Goals), December 1991.

EPA = Letter from Michael McAteer of United States Environmental Protection Agency to the Enviro-Chem Trustees, October 12, 1995.

MCL = Drinking water Maximum Contaminant Level. 40 CFR 141

LDWHA = Lifetime drinking water health advisory. U.S. EPA, Superfund Public Health Evaluation Manual, update of November 16, 1987.

(2) In the event that higher concentrations than those set forth for any parameter in this column are present in the upgradient subsurface water in the till and/or sand and gravel according to the procedure specified below, then those higher upgradient subsurface water concentrations and not the values set forth in this table shall constitute the Acceptable Subsurface Water Concentrations within the meaning of this Exhibit A and the Consent Decree. Those upgradient subsurface water concentrations are referred to in this Exhibit A as "Applicable Subsurface Water Background Concentrations." Twelve subsurface water samples will be taken from existing or new well locations, approved by EPA, over at least a 12-month period in areas upgradient of the site. The exact procedure, location of wells, and schedule for collecting and analyzing the samples will be approved by EPA, after consultation with the state, prior to its implementation. Subsurface samples for inorganics and PCB analysis will be filtered. For each parameter, the analytical results from the 12 samples will be analyzed using standard statistical procedures. The mean and standard deviation will be calculated, and all nondetects will be assigned a value equal to 1/2 the EPA-approved quantification limit. For purposes of this Document, "Applicable Subsurface Water Background Concentrations" is defined as two (2) standard deviations above the calculated mean of these 12 samples.

(3) Stream Criteria, from Table 1 of the Record of Decision for the site, September 25, 1987.

CORRECTED SITE-SPECIFIC ACCEPTABLE CONCENTRATIONS(9)
ENVIRO-CHEM SUPERFUND SITE
ZIONSVILLE, INDIANA

(4) In the event that higher concentrations than those set forth for any parameter in this column are present in the upstream surface water, then those higher upstream concentrations and not the values set forth in this table shall constitute the Acceptable Stream Concentrations within the meaning of this Exhibit A and the Consent Decree. Those higher upstream surface water concentrations are referred to in this Exhibit A as "Applicable Surface Water Background Concentrations." Twelve surface water samples will be taken from Unnamed Ditch upstream of the site over at least a 12-month period. The exact procedure, location of samples, and schedule for collecting and analyzing the samples will be approved by EPA, after consultation with the state, prior to its implementation. For each parameter, the analytical results from the 12 samples will be analyzed using standard statistical procedures. The mean and standard deviation will be calculated, and all nondetects will be assigned a value equal to 1/2 the EPA-approved quantification limit. For purposes of this document, "Applicable Surface Water Background Concentrations" is defined as two (2) standard deviations above the calculated mean of these 12 samples.

(5) Acceptable Soil Concentration is based on ingestion of subsurface water at the site boundary, assuming a dilution of leachate to subsurface water of 1:196 (Appendix B).

(6) The Acceptable Soil Concentrations, within the meaning of this Exhibit A and the Consent Decree, will be achieved when the arithmetic average of the 20 soil sample results for each parameter, assigning all nondetect results a value of 1/2 the detection limit, do not exceed the values set forth in this table by more than 25%.

(7) So long as the EPA-approved quantification limit for PCBs in water is above the acceptable subsurface water and stream concentrations for PCBs, compliance with the Acceptable Subsurface and Stream Concentrations for PCBs will be determined as follows: all subsurface and surface water sample results for PCBs must be below the EPA-approved quantification limit for PCBs (at the time compliance is determined).

(8) Modified from Superfund Public Health Evaluation Manual, October, 1986, EPA 4/540/1-86/060, OSWER Directive 9285.4-1.

(9) Revised Site-Specific Acceptable Soil Concentrations were calculated in accordance with the procedures in Appendix B of Exhibit A using updated Acceptable Subsurface Water Concentrations (shaded) and the f_{oc} value corresponding to the 90% lower confidence limit of the mean of the TOC values from the TOC Investigation.

TABLE 3
COMPARISON OF CURRENT AND CORRECTED ACCEPTABLE SOIL CONCENTRATIONS
ENVIRO-CHEM SUPERFUND SITE
ZIONSVILLE, INDIANA

Parameter	Current Acceptable Soil Concentration (1) (mg/kg)	Corrected Acceptable Soil Concentration (2,3,4,5) (mg/kg)
Volatile Organic Compounds		
Acetone	0.490	3.81
Chlorobenzene	10.1	126
Chloroform	2.30	16.9
1,1-Dichloroethane	0.0057	90.6
1,1-Dichloroethene	0.120	0.879
Ethyl benzene	234	1,790
Methylene chloride	0.020	0.161
Methyl ethyl ketone	0.075	0.561
Methyl isobutyl ketone	8.90	109
Tetrachloroethene	0.130	2.25
Toluene	238	889
1,1,1-Trichloroethane	7.20	53.7
1,1,2-Trichloroethane	0.022	0.401
Trichloroethene	0.240	1.77
Total Xylenes	195	33,000
Semivolatile Organic Compounds		
Phenol	9.8	1,150
Proposed Additional Compounds		
Vinyl chloride		0.014
1,2-Dichloroethane		0.256
Dimethyl phthalate		49,100
Chloroethane		
Trichlorofluoromethane		6,730
1,2-Dichloroethene(total)		3.84
2,4-Dimethyl phenol		348
1,2-Dichlorobenzene		2,610
Butyl benzyl phthalate		798,000

Notes:

(1) Exhibit A, Table 3-1.

(2) The acceptable subsurface water concentration used in the calculation for 1,1-dichloroethane was 810 ug/L as agreed to by the USEPA in their letter of October 12, 1995.

(3) The corrected acceptable subsurface water concentrations for chlorobenzene, ethyl benzene, toluene, and total xylenes were based on currently promulgated drinking water MCLs.

(4) The foc in the site soil is estimated to vary from 0.243% to 4.41% based on TOC analytical results. The foc values from each boring were averaged (vertical averaging). The mean and 90% lower confidence limit of these vertical averages was calculated and the 90% lower confidence limit of 0.926% was used in calculating the corrected acceptable soil concentrations. Calculations are summarized in the Attachment.

(5) Risk-based acceptable subsurface water concentrations were calculated in accordance with the USEPA's "Risk Assessment Guidance for Superfund: Volume I - Human Health Evaluation Manual (Part B, Development of Risk-Based Preliminary Remediation Goals)," December, 1991.

Key:

MCLs = Maximum Contaminant Levels.
foc = Fraction of organic carbon.
TOC=Total organic carbon.
USEPA = United States Environmental Protection Agency.

TABLE 4
COMPARSION OF CORRECTED ACCEPTABLE SOIL CONCENTRATIONS
AND MAXIMUM DETECTED SOIL CONCENTRATIONS
ENVIRO-CHEM SUPERFUND SITE
ZIONSVILLE, INDIANA

Parameter	Corrected Acceptable Soil Concentration (1) (mg/kg)	Maximum Detected Concentration (2) (mg/kg)
Volatile Organic Compounds		
Acetone	3.81	650
Chloroform	16.9	2.90
1,1-Dichloroethane	90.6	0.380
1,1-Dichloroethene	0.879	35.0
Ethyl benzene	1,790	1,500
Methylene chloride	0.161	310
Methyl ethyl ketone	0.561	2,800
Methyl isobutyl ketone	109	190
Tetrachloroethene	2.25	650
Toluene	889	2,000
1,1,1-Trichloroethane	53.7	1,100
1,1,2-Trichloroethane	0.401	0.556
Trichloroethene	1.77	4,800
Total Xylenes	33,000	6,800
Semivolatile Organic Compounds		
Phenol	1,150	570
Proposed Additional Compounds		
Vinyl chloride	0.014	0.007
1,2-Dichloroethane	0.256	ND
Dimethyl phthalate	49,100	1,300
Chloroethane		ND
Trichlorofluoromethane	6,730	ND
1,2-Dichloroethene(total)	3.84	120
2,4-Dimethyl phenol	348	ND
1,2-Dichlorobenzene	2,610	900
Butyl benzyl phthalate	798,000	47

Note:

(1) Corrected Acceptable Soil Concentrations are determined in accordance with footnotes 5 and 6 in Table 2.

(2) Reported in CH2M-Hill, "Environmental Conservation and Chemical Corporation Remedial Investigation," March, 1986.

Key:

ND = Not detected.

TABLE 5
SOIL VAPOR CONCENTRATIONS IN EQUILIBRIUM
WITH CORRECTED ACCEPTABLE SOIL CONCENTRATIONS (1)
ENVIRO-CHEM SUPERFUND SITE
ZIONSVILLE, INDIANA

Compound (2)	Soil Vapor Concentration (3)	
	(mg/L)	(ppmv)
Volatile Organics Compounds		
Acetone	4.77	1,910
Chloroform	18.1	3,540
1,1-Dichloroethane	61.8	51,900
1,1-Dichloroethene	0.110	3,590
Ethyl benzene	2.88	62,100
Methylene chloride	18.1	173
Methyl ethyl ketone	221	94.3
Methyl isobutyl ketone	15.0	1,950
Tetrachloroethene	284	280
Toluene	0.633	101,000
1,1,1-Trichloroethane	0.293	10,800
1,1,2-Trichloroethane	8.39	19.2
Trichloroethene	2.00	507
Total Xylenes	4,430	971,000
Semivolatile Organic Compounds		
Phenol	0.623	154
Proposed Additional Compounds		
Vinyl chloride	1.31	484
1,2-Dichloroethane	0.039	9
Dimethyl phthalate	4,720	1,680,000
Chloroethane	1,200,000,000	203,000,000,000
Trichlorofluoromethane	3.68	880
1,2-Dichloroethene(total)	1.22	146
2,4-Dimethyl phenol	0.039	7.35
1,2-Dichlorobenzene	9.28	1,466
Butyl benzyl phthalate	0.076	5.64

Notes:

(1) Corrected Acceptable Soil Concentrations are determined in accordance with footnotes 5 and 6 in Table 2.

(2) Compounds above correctd acceptable soil concentrations in Table 3 are to be removed by vapor extraction.

(3) Calculated according to methods in Appendix D of Exhibit A of the Consent Decree.

1/18/96 | DMP- | K:\CPFILES\ERM\ECC\91112\03\ACAD\TOC\FIG1A.DWG JAN 18, 1996 2:41 PM

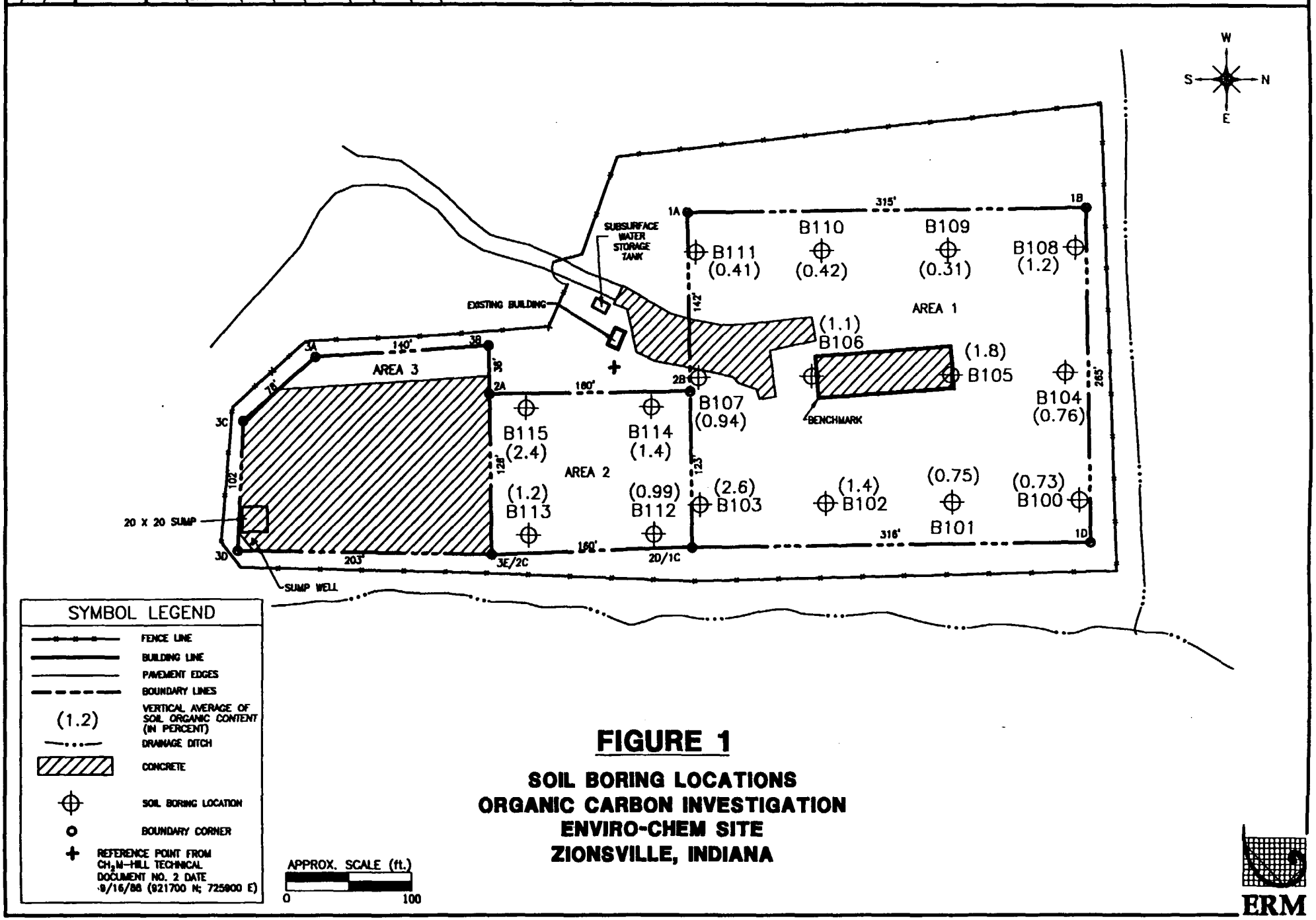


FIGURE 1

SOIL BORING LOCATIONS
ORGANIC CARBON INVESTIGATION
ENVIRO-CHEM SITE
ZIONSVILLE, INDIANA

APPENDIX A

ATTACHMENT A

STATGRAPHICS SUMMARY REPORT

ECC TOC DATA ANALYSIS
1/2/1996 11:16 PM

Procedure Summary

Data variable: int2_10

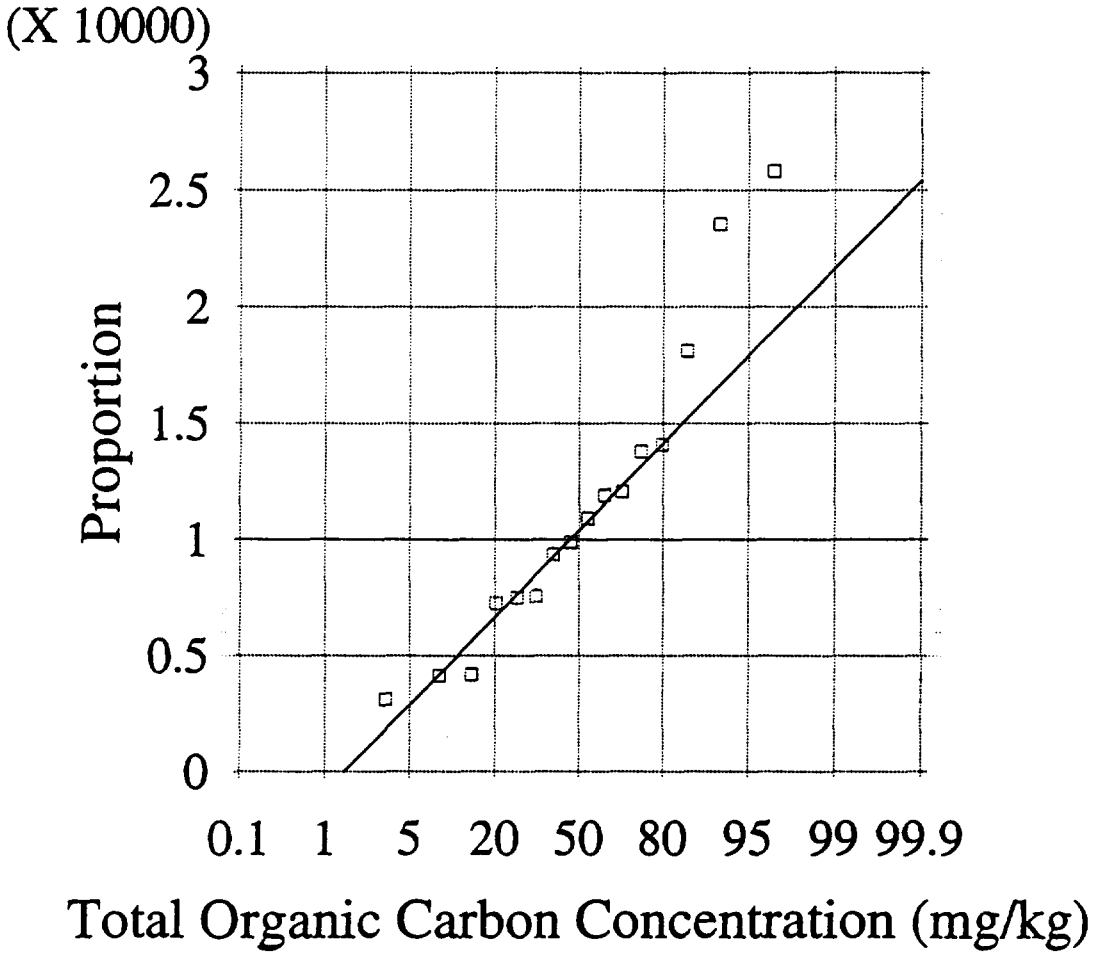
16 values ranging from 3128.0 to 25830.0

Summary Statistics for int2_10

Count = 16
Average = 11452.7
Variance = 4.27564E7
Standard deviation = 6538.84
Minimum = 3128.0
Maximum = 25830.0
Sum = 183243.0

Confidence Intervals for int2_10

80.0% confidence interval for mean: 11452.7 +/- 2191.51 [9261.18,13644.2]

80.0% confidence interval for standard deviation: [5361.97,8662.55]

Normal Probability Plot for 2 to 10' Interval