In Partial Fulfillment of Consent Order Requirements
CERCLA Docket No. 87-1

BASELINE RISK ASSESSMENT
SHERIDAN DISPOSAL SERVICES SITE
WALLER COUNTY, TEXAS

Volume II
Appendices

Prepared For:

The Sheridan Site Committee

W.O. #91-15

November 1, 1988

Prepared by:

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Errata

1. The Remedial Investigation/Feasibility Study (RI/FS) and Risk Assessment were written on behalf of the Sheridan Site Committee (a group of potentially responsible parties such as waste generators and transporters). The Environmental Protection Agency (EPA) has reviewed these documents and is in general agreement with their technical content. However, this general approval should not be construed to mean that the Agency agrees with every individual statement contained in the report.

2. The total waste volumes estimated in the Remedial Investigation (RI) differ significantly from those described in the Feasibility Study and Risk Assessment. One reason for this difference is that additional sampling of the pond was conducted after the RI was completed. This additional sampling indicated the sludge thickness was significantly less than originally described in the RI. Further, based on EPA's and the Sheridan Site Committee's best professional judgement and experience with similar sites, the extent of soil contamination beneath the lagoon (3 feet) assumed in the RI was extremely high. Some of the types of waste found at the site and the low permeability clay soils which underlie the lagoon would tend to minimize migration of contaminants into soils. Although the actual depth of contaminated soil beneath the lagoon could not be measured due to concerns about introducing contaminants to previously clean areas, EPA maintains that the total waste volume of 44,000 cubic yards described in the Feasibility Study and Risk Assessment represents the best available estimate of the amount of waste which will require remediation. During the remedial design or remedial action, the waste volume requiring remediation will be modified accordingly, if the waste is found at deeper levels than anticipated.

3. The soil mixing alternative was carried through to the detailed analysis of alternatives due to the preference of the Sheridan Site Committee. EPA believes that the soil mixing alternative should have been removed from consideration as a potential remedy during the preliminary screening of alternatives.

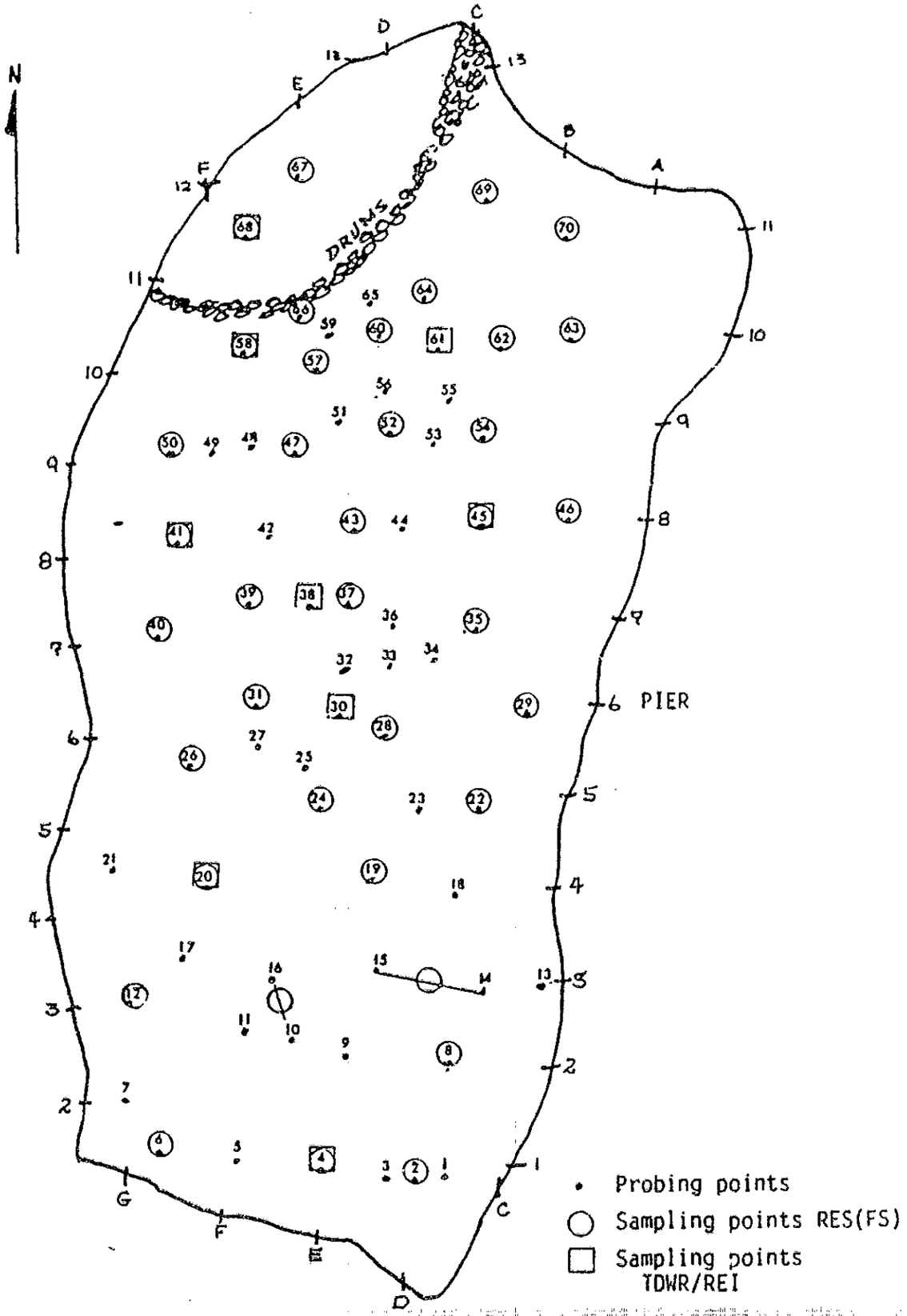
011460

APPENDIX A

Cross-Sections and Sludge Depth Data
from Rollins Letter Report to TDWR,
dated November 7, 1984

1011461

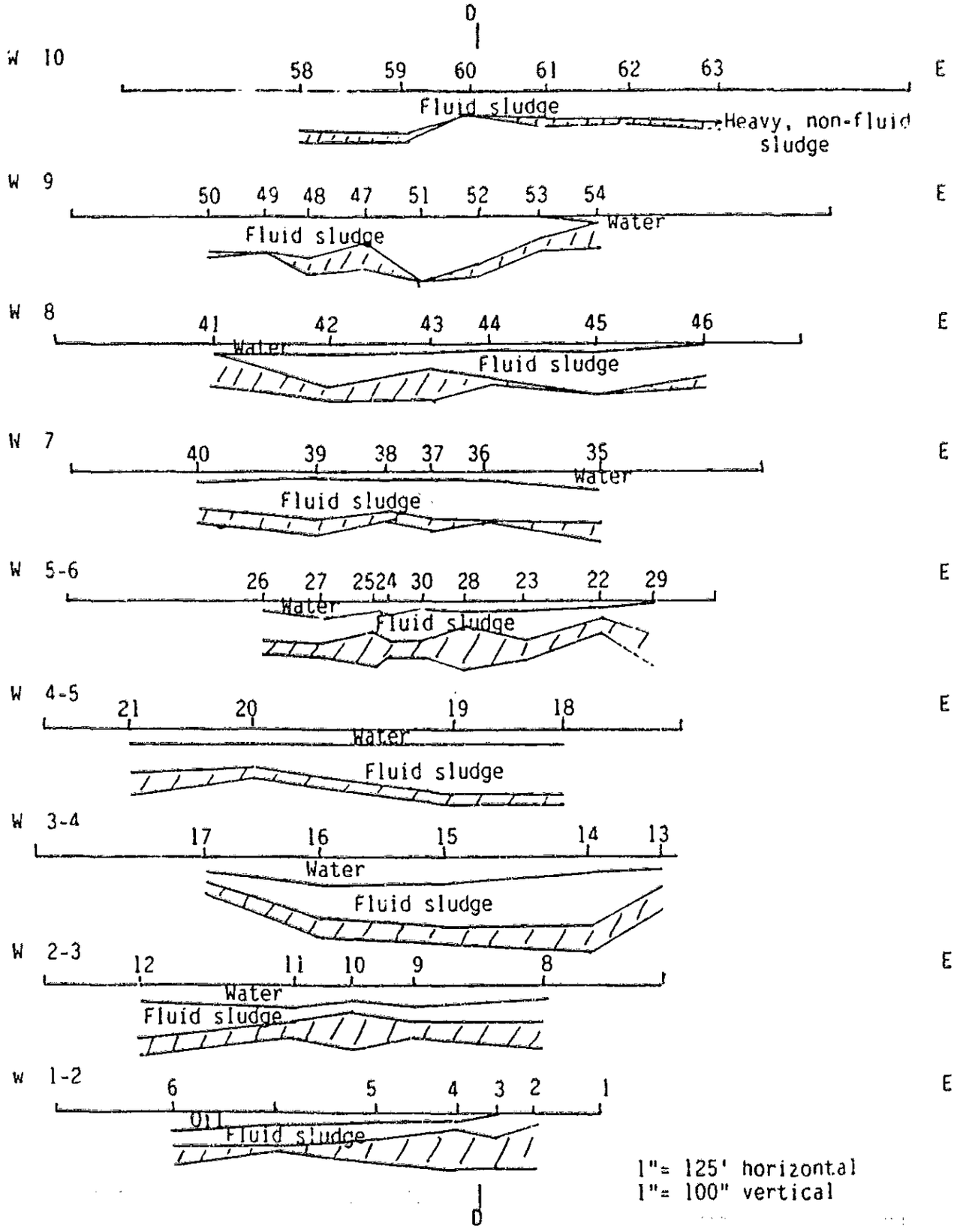
DRAWING 1



011462

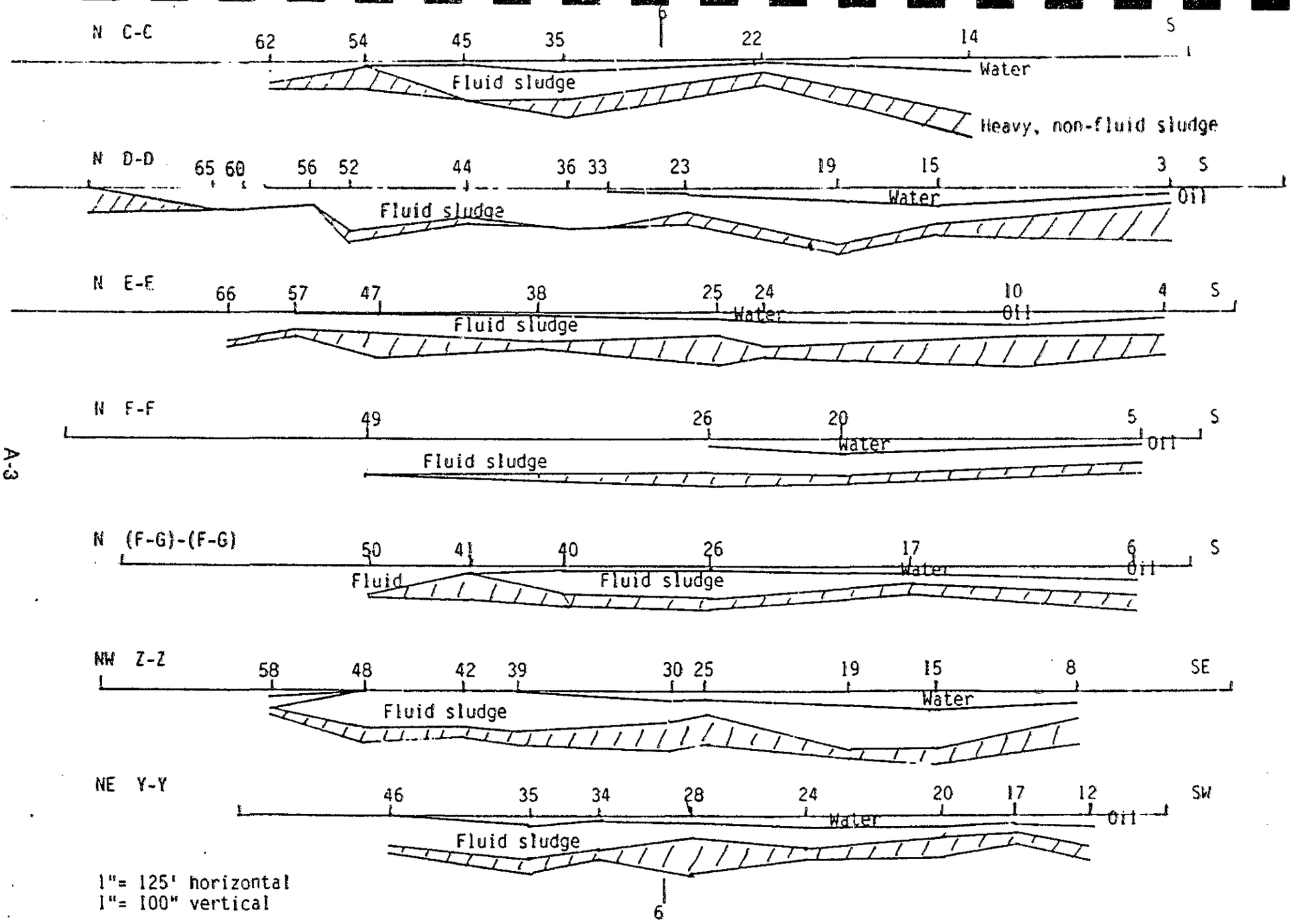
SHERIDAN LAGOON - PROBING AND SAMPLING LOCATIONS

RES(FS) - SEPTEMBER 18-19 AND SEPTEMBER 26-28, 1984



EAST-WEST ELEVATION CROSS SECTIONS - SHERIDAN LAGOON september 18-19,1984

011463



NORTH-SOUTH ELEVATION CROSS SECTIONS - SHERIDAN LAGOON September 18-19, 1984

011464

APPENDIX B

Quality Assurance and Quality Control Methodology for Chemical Analyses

011465

ETC ENVIRONMENTAL TESTING and CERTIFICATION

January 26, 1986

TABLE 2: METHOD PERFORMANCE DATA

Surrogate Recovery Soil- GC/MS Data (QR20)

Chain of Custody Data Required for ETC Data Management Summary Reports

K8171

ETC Sample No.	Company	Facility	Sample Point	Date	Time	Elapsed Hours

Compound	Amount Added ug	% Recovery	Control Limits *	
			Lower	Upper
VOLATILE FRACTION				
Toluene-D8	.250	78	50	160
Bromofluorobenzene	.250	89	50	160
1,2-Dichloroethane-D4	.250	82	50	160
ACID FRACTION				
Phenol-D5	100	72	20	140
2-Fluorophenol	100	84	20	140
2,4,6-Tribromophenol	100	99	10	140
BASE/NEUTRAL FRACTION				
Nitrobenzene-D5	50	153**	20	140
2-Fluorobiphenyl	50	64	20	140
Terphenyl-D14	50	31	20	150

* IFB EPA Control Limits.

** Recovery variable due to sample matrix interference.

- Three surrogate compounds are added to each sample in the batch for Base/Neutral analysis.
- Three surrogate compounds are added to each sample in the batch for Acid analysis.
- A blind quality control sample is introduced to the laboratory for analysis on a weekly basis.
- Each GC/MS is checked and retuned, if necessary, at the beginning of each day to ensure that its performance on decafluorotriphenylphosphine (DFTPP) meets the EPA criteria.
- A calibration curve for quantitation is prepared using a mixture of standards composed of either the Organic Acid or Base/Neutral Extractable Compounds at a minimum of 3 concentrations and using five internal standards for quantitation.

Analysis of Metals

All Samples

- New standards are prepared for each batch of samples.
- Normal calibration is performed using a blank sample and four standards that have been through the sample preparation procedure. A regression analysis is used to construct the calibration curve.
- All EP Toxicity samples and all samples determined by furnace atomic absorption are calculated by the "method of additions".
- For each sample analysis that requires the use of the "method of additions" technique, a three point calibration is performed using U.S. EPA "Methods for Chemical Analysis of Water and Wastes, 1979". Results are obtained using linear regression analysis. Any regression with a coefficient of correlation below 0.990 is considered suspect, necessitating review of calibration data or sample re-analysis.
- In constructing the normal calibration curves the lowest concentration levels we use are values greater than or equal to 5 times the Instrumental Detection Limit (IDL).
- All calibration standards are analyzed in duplicate, at a minimum.
- Independent reference standards are used to check the accuracy of calibration standards.
- A check standard is analyzed every ten samples to validate the normal calibration curve.
- One customer sample out of every ten is analyzed in triplicate.

Homogeneous Samples (except for Mercury analysis)

Samples are analyzed in batches of 30 or less. For batches in which the sample matrices are homogeneous, the QC program is a minimum of 25% and consists of analyzing:

- 3 sets of triplicate analyses;
- 2 Replicate spikes;
- 1 independent reference standard;
- 4 Calibration standards (processed using the sample preparation method);
- 4 Calibration standards (without sample preparation); and
- 1 Reagent Blank.

011467

Summary of Quality Assurance/Quality Control Procedures (QA/QC)

ETC bases its quality assurance protocols on the following government guidelines:

- "Handbook for Analytical Quality Control in Water and Wastewater Laboratories", EPA-600/4-79-019, March 1979;
- National Enforcement Investigation Center Policies, and Procedures manual; EPA-330/9/79/001-R, October 1979;
- the recommended guidelines for EPA Methods 624 and 625. (Federal Register, December 3, 1979; updated on October 26, 1984);
- "Manual of Analytical Methods for the Analysis of Pesticides in Humans and Environmental Samples," EPA 600/8-80-038, June 1980;
- "Determination of 2,3,7,8-TCDD in Soil and Sediment" EPA, Region VII, Kansas City, September 1983;
- Organic Analysis: Multi-media, Multi Concentration-IFB WA84-A267; and
- Dioxin Analysis:Soil/Sediment Matrix; Multi-Concentration; Selected Ion Monitoring with Jar Extration Procedure-IFB WA84-A002

However, we have modified our protocols to provide a higher level of QA/QC than the guidelines require. For example, we analyze a higher than required number of quality control samples and we pay especially careful attention to the certification of the "reference standard" compounds we use in analysis. Below are listed the key QA/QC elements for the methods we used.

Analysis of Volatile Organic Compounds by Gas Chromatography/Mass Spectrometry

- Each batch of 13 samples consists of 9 customer samples (at a maximun), one blank sample, one spiked blank, one spiked sample and one replicate sample. This amounts to a 30% quality control factor.
- Three surrogate compounds are added to each sample in the batch of 13.
- A blind quality control sample is introduced to the laboratory for analysis on a weekly basis.
- Each GC/MS is checked and retuned, if necessary, at the beginning of each day to ensure that its performance on bromofluorobenzene (BFB) meets the EPA criteria.
- A calibration curve for quantitation is prepared using a mixture of Volatile Organic Priority Pollutant "standards" at a minimum of 3 different concentrations and using a mixture of 3 internal standards at a constant concentration.
- The calibration curve is verified with a mixture of priority pollutant standards every day. If the response factors vary greater than 25%, the instrument must be recalibrated.

Analysis of Organic Compounds Extracted in Acid or Base/Neutral Solutions by Gas Chromatography/Mass Spectrometry

- Each batch of 20 samples consists of 16 customer samples (at a maximum), one blank sample, one spiked blank (for water matrices), one sample spiked with the priority pollutant standard mixture and a duplicate customer sample. This amounts to a 20% quality control factor.

Methodology
for
GC/MS Analysis of Priority Pollutant Compounds

The methods employed in the GC/MS analysis for priority pollutants are established EPA methods. Rigid compliance with the instrument parameters and performance criteria of the published methods was achieved. In some cases, the precise amounts of sample used and the sample handling procedures vary with the complexity of the sample matrix. Qualitative identification of the priority pollutants was performed using the relative retention times, the relative abundance of three characteristic ions and the abundance ratios. The entire mass spectrum was reviewed to confirm each identification. Quantitative analysis of detected compounds was performed by using a response factor generated by a major characteristic ion of the specific compound and an internal standard.

Compounds, in addition to those on the priority pollutant list, were identified through a computer-aided search of the NBS-EPA spectra library. After review the identifications are included in a separate tabulation and labelled "tentatively identified".

Volatile Priority Pollutant Compounds

For the analysis of Volatile priority pollutants in a soil matrix, a modified version of EPA Method 624 was used. The modification can be be summarized as follows: 1-3 gm of the solid sample are weighed into a 15 ml Hypo vial. The vial is sealed immediately with a teflon-backed silicone septum. A solution containing 3 internal standards is injected through the septum onto the sample. The vial is attached to the Purge and Trap sampler in series with a 5 ml organic-free water trap. The sample vial is heated at 80 degrees Centigrade for 20 minutes. An inert gas sweeps the volatile organic compounds through the water trap onto a sorbent column where they are trapped. When the purge cycle is complete, the sorbent column is heated and backflushed with helium to desorb the purgeable organic compounds onto a gas chromatographic column. The gas chromatograph is temperature programmed to separate the purgeable mixture. The separated purgeable components are then identified and quantitated using a computerized mass spectrometer.

Acid, Base/Neutral and Pesticide Priority Pollutant Compounds

For the analysis of the Acid, Base/Neutral and Pesticide priority pollutants in a soil matrix, a modification of EPA Method 625 was used. The method can be summarized as follows: A 30 gm semi-wet soil sample is soxhlet extracted with a 1:1 mixture of acetone and hexane. The acetone is thermally stripped. The remaining hexane extract is diluted to 200 ml with methylene chloride and twice extracted with an aqueous NaOH solution followed by an extraction with deionized water. The methylene chloride extract is dried and concentrated to a 1 ml final volume. This concentrate is injected into a GC/MS instrument configured for the analysis of Base/Neutral priority pollutant compounds. The remaining aqueous extracts are combined and the pH adjusted to a value less than 2. The aqueous phase is serially extracted with 3 aliquots of methylene chloride. The methylene chloride extracts are dried, concentrated to a 1 ml final volume. The concentrate is injected into a GC/MS instrument configured for the analysis of acid extractable priority pollutant compounds.

011469

ROCKY MOUNTAIN ANALYTICAL LABORATORY

Organic Analytical Methodology

Parameter	Units	Nominal Detection Limit[a]	Methodology	Reference[1]	Preservation Bottle No.	Maximum Holding Time[b]
Purgeables	ug/l	1	Purge & Trap GC/MS	624	11	14 days
Base/Neutrals	ug/l	10	Extraction/GC/MS	625	12	7 days/40 days
Acids	ug/l	10	Extraction/GC/MS	625	12	7 days/40 days
Organochlorine Pesticides/PCBs	ug/l	0.01	Extraction/GC/ECD	608	13	7 days/40 days
		10	Extraction/GC/MS	625	12	7 days/40 days
Phenoxy Herbicides	ug/l	0.01	Extraction/GC/ECD	(2)	14	7 days/40 days
Total Organic Halogen (TOX)	ug/l	5	Adsorption/Coulometric	450.1(3)	15	-
Trihalomethanes (THM)	ug/l	1	Extraction/GC/ECD	(4)	11	14 days
		1	Purge & Trap GC/MS	(4)	11	14 days
Dioxin	ug/l	0.005	Extraction/GC/MS/ECD	613	16	7 days/40 days
Purgeable Halocarbons	ug/l	0.01	Purge & Trap/GC/Hall	601	11	14 days
Purgeable Aromatics	ug/l	1	Purge & Trap/GC/PID	602	17	14 days
Acrolein & Acrylonitrile	ug/l	100	Purge & Trap/GC/FID	603	18	14 days
Phenols by GC	ug/l	10	Extraction/GC/FID	604	16	7 days/40 days
Benzidines	ug/l	0.1	Extraction/HPLC	605	19	7 dyas/40 days
Phthalate Esters	ug/l	10	Extraction/GC/FID	606	12	7 days/40 days
Nitrosamines	ug/l	1	Extraction/GC/NPD	607	20	7 days/40 days
Nitroaromatics/Isophorone	ug/l	1	Extraction/GC/FID & GC/ECD	609	12	7 days/40 days
Polynuclear Aromatics	ug/l	0.5	Extraction/HPLC	610	20	7 days/40 days
Haloethers	ug/l	1	Extraction/GC/Hall	611	17	7 days/40 days
Chlorinated Hydrocarbons	ug/l	0.02	Extraction/GC/ECD	612	12	7 days/40 days
Organophosphorus Pesticides	ug/l	0.1	Extraction/GC/NPD	622(5)	12	7 days/40 days
Triazine Pesticides	ug/l	0.1	Extraction/GC/NPD	(6)	12	7 days/40 days

References

(1) Federal Register, Vol. 44, No. 233, Monday, December 3, 1979.
(2) "Method for Chlorinated Phenoxy Acid Herbicides in Industrial Effluents", Federal Register, Vol. 38, No. 75, Part II.
(3) "Total Organic Halide", US EPA-EMSL, Cincinnati, November, 1980.
(4) Federal Register, Vol. 44, No. 231, Tuesday, November 29, 1979, Appendix, Part I.
(5) "Method 622-Organophosphorus Pesticides", Proposed EPA Method, 304 (h) Committee.
(6) Federal Register, Vol. 38, No. 75, 1973.

Notes

[a] Nominal values are the best achievable with the listed analytical method for a typical component. Interferences in specific samples may result in a higher detection limit.

[b] Applicable to NPDES Wastes as updated by Robert C. Booth, Director, EMSL-Cincinnati, September 22, 1981. Where two times are given, the first refers to the time to extraction, the second to the time of instrumental analysis.

Organic Analytical Methodology

Parameter	Units	Nominal Detection Limit[a]	Methodology	Reference[1]	Preservation Bottle No.	Maximum Holding Time[b]
Purgeables	ug/l	1	Purge & Trap GC/MS	624	11	14 days
Base/Neutrals	ug/l	10	Extraction/GC/MS	625	12	7 days/40 days
Acids	ug/l	10	Extraction/GC/MS	625	12	7 days/40 days
Organochlorine Pesticides/PCB's	ug/l	0.01	Extraction/GC/ECD	608	13	7 days/40 days
		10	Extraction/GC/MS	625	12	7 days/40 days
Phenoxy Herbicides	ug/l	0.01	Extraction/GC/ECD	(2)	14	7 days/40 days
Total Organic Halogen (TOX)	ug/l	5	Adsorption/Coulometric	450.1(3)	15	-
Trihalomethanes (THM)	ug/l	1	Extraction/GC/ECD	(4)	11	14 days
		1	Purge & Trap GC/MS	(4)	11	14 days
Dioxin	ug/l	0.005	Extraction/GC/MS/ECD	613	16	7 days/40 days
Purgeable Halocarbons	ug/l	0.01	Purge & Trap/GC/Hall	601	11	14 days
Purgeable Aromatics	ug/l	1	Purge & Trap/GC/PID	602	17	14 days
Acrolein & Acrylonitrile	ug/l	100	Purge & Trap/GC/FID	603	18	14 days
Phenols by GC	ug/l	10	Extraction/GC/FID	604	16	7 days/40 days
Benzidines	ug/l	0.1	Extraction/HPLC	605	19	7 dyas/40 days
Phthalate Esters	ug/l	10	Extraction/GC/FID	606	12	7 days/40 days
Nitrosamines	ug/l	1	Extraction/GC/NPD	607	20	7 days/40 days
Nitroaromatics/isophorone	ug/l	1	Extraction/GC/FID & GC/ECD	609	12	7 days/40 days
Polynuclear Aromatics	ug/l	0.5	Extraction/HPLC	610	20	7 days/40 days
Haloethers	ug/l	1	Extraction/GC/Hall	611	17	7 days/40 days
Chlorinated Hydrocarbons	ug/l	0.02	Extraction/GC/ECD	612	12	7 days/40 days
Organophosphorus Pesticides	ug/l	0.1	Extraction/GC/NPD	622(5)	12	7 days/40 days
Triazine Pesticides	ug/l	0.1	Extraction/GC/NPD	(6)	12	7 days/40 days

References

(1) Federal Register, Vol. 44, No. 233, Monday, December 3, 1979.
(2) "Method for Chlorinated Phenoxy Acid Herbicides in Industrial Effluents", Federal Register, Vol. 38, No. 75, Part II.
(3) "Total Organic Halide", US EPA-EMSL, Cincinnati, November, 1980.
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Notes

[a] Nominal values are the best achievable with the listed analytical method for a typical component. Interferences in specific samples may result in a higher detection limit.

[b] Applicable to NPDES Wastes as updated by Robert C. Booth, Director, EMSL-Cincinnati, September 22, 1981. Where two times are given, the first refers to the time to extraction, the second to the time of instrumental analysis.

Organic Analytical Methodology (continued)

Preservation Bottle No.	Parameter Group	Bottle	Preservation
11	Purgeables	40 ml glass with teflon lined silicone septum cap	4°C (thiosulfate if Cl_2 present)
17	Purgeables	40 ml glass with teflon lined silicone septum cap	4°C, HCl to pH less than 2 (thiosulfate if Cl_2 present)
18	Purgeables	40 ml glass with teflon lined silicone septum cap	4°C, adjust pH to 4 - 5 (thiosulfate if Cl_2 present)
16	Extractables	1 liter glass with teflon lined cap	4°C (thiosulfate if Cl_2 present)
19	Extractables	1 liter glass with teflon lined cap	4°C, adjust pH to 2 - 7 (thiosulfate if Cl_2 present)
12, 13, 14	Extractables	1 liter glass with teflon lined cap	4°C
20	Extractables	1 liter glass with teflon lined cap	4°C, store in dark (thiosulfate is Cl_2 present)
15	TOX	250 ml glass with teflon lined cap, single 1 liter glass with teflon lined cap, quad.	4°C, store in dark (thiosulfate if Cl_2 present)

Inorganic Analytical Methodology

Parameter	Units	Nominal Detection Limit[a]	Methodology	Reference	Preservation Bottle No.	Maximum Holding Time[b]
MAJOR IONS						
Sodium	mg/l	0.5	ICP Emission Spectroscopy	3	4	6 months
Potassium	mg/l	0.3	ICP Emission Spectroscopy	3	4	6 months
Calcium	mg/l	0.1	ICP Emission Spectroscopy	3	4	6 months
Magnesium	mg/l	0.1	ICP Emission Spectroscopy	3	4	6 months
Chloride	mg/l	3	Manual Titrimetric, Hg $(NO_3)_2$	1-325.3/2-407B	1	28 days
			Automated Colorimetric Ferricyanide	1-325.2	1	28 days
Fluoride	mg/l	0.1	Electrode	1-340.2/2-413B	1	28 days
Sulfate	mg/l	5	Manual Turbidimetric	1-375.4/2-426C	1	28 days
			Automated Colorimetric MTB	1-375.2	1	28 days
Total Alkalinity as $CaCO_3$ at pH 4.5	mg/l	5	Titrimetric	1-310.1/2-403	1	14 days
Carbonate Alkalinity as $CaCO_3$ at pH 8.3	mg/l	5	Titrimetric	1-310.1/2-403	1	14 days
Bicarbonate Alkalinity as $CaCO_3$ at pH 4.5	mg/l	5	Titrimetric	1-310.1/2-403	1	14 days
Hydroxide Alkalinity as $CaCO_3$	mg/l	5	Calculation	2-403	-	-
Nitrate+Nitrite as N	mg/l	0.1	Manual Cd Reduction - Colorimetric	1-353.3/2-418C	2	28 days
		0.1	Automated Cd Reduction - Colorimetric	1-353.2	2	28 days
Total Cations	meq/l	0.1	Calculation	2-104C	-	-
Total Anions	meq/l	0.1	Calculation	2-104C	-	-
Difference	%	0.1	Calculation	2-104C	-	-
RADIOCHEMISTRY						
Gross Alpha	pCi/l	0.1	Proportional Counter	2-703	5	6 months
Gross Beta	pCi/l	0.1	Proportional Counter	2-703	5	6 months
Radium 226	pCi/l	0.1	Separation - Counter	2-705	5	6 months
Radium 228	pCi/l	0.1	Separation - Counter	2-707	5	6 months
Uranium	mg/l	0.005	Fluorimetric	4-D2907-75	5	6 months

Inorganic Analytical Methodology (Continued)

Parameter	Units	Nominal Detection Limit[a]	Methodology	Reference	Preservation Bottle No.	Maximum Holding Time[b]
INORGANIC PARAMETERS (Continued)						
Total Phosphorus as P	mg/l	0.06	Digestion; ICP Emission Spectroscopy	1-4.1.4; 3	4	28 days
		0.01	Digestion - Colorimetric	1-365.2; 1-424C,F	2	28 days
Silica as SiO_2	mg/l	0.1	ICP Emission Spectroscopy	3	4	28 days
	mg/l	1	Colorimetric	1-370.1; 2-425C	1	28 days
Biological Oxygen Demand	mg/l	2	Dilution Bottle - D.O. Probe	1-405.1; 2-507	1	48 hours
Chemical Oxygen Demand	mg/l	5	Micro Colorimetric	1-410.4; 2-508A	2	28 days
Total Organic Carbon	mg/l	0.1	Oxidation-Infrared Absorption	1-415.1; 2-505	2	28 days
Ammonia as N	mg/l	0.1	Electrode	1-350.3; 2-417E	2	28 days
		0.1	Automated Colorimetric	1-350.1	2	28 days
Total Kjeldahl Nitrogen as N	mg/l	0.1	Digestion - Electrode	1-351.4; 2-420B	2	28 days
		0.1	Digestion - Colorimetric	1-351.2	2	28 days
Total Organic Nitrogen as N	mg/l	0.1	Calculation (TKN - NH_3)	-	-	-
Oil and Grease	mg/l	1	Freon Extraction-Gravimetric	1-413.1; 2-503A	3	28 days
Free Cyanide	mg/l	0.01	Chlorination-Distillation-Colorimetric	1-335.1; 2-412F,D	6	14 days
Total Cyanide	mg/l	0.01	Distillation - Colorimetric	1-335.2; 2-412B,D	6	14 days
Phenolics	mg/l	0.01	Distillation - Colorimetric	1-420.1; 2-510A,B	2	28 days
Fecal Coliform	Colonies/100 ml	1	Membrane Filter	2-909C	8	ASAP
Total Coliform	Colonies/100 ml	1	Membrane Filter	2-909A	8	ASAP
Bromide	mg/l	0.1	Colorimetric	2-405	1	28 days
Residual Chlorine	mg/l	0.05	Amperometric	1-330.2; 2-408C	1	ASAP
Hexavalent Chromium	mg/l	0.01	Colorimetric	1-218.4; 2-312B	1	24 hours
Color	units	5	Pt-Co Colorimetric	1-110.2; 2-204A	1	48 hours
Hardness as $CaCO_3$	mg/l	5	Calculation	2-314A	4	6 months
Nitrite as N	mg/l	0.01	Colorimetric	1-354.1; 2-419	1	48 hours
Sulfide	mg/l	0.05	Titrimetric - Electrode	1-376.1; 2-427B,D	7	7 days
Sulfite	mg/l	2	Titrimetric	1-377.1; 2-428	1	ASAP
MBAS (Surfactants)	mg/l	0.1	Colorimetric	1-425.1; 2-512A	1	48 hours
Turbidity	NTU	0.1	Turbidimeter	1-180.1; 2-214A	1	48 hours

Inorganic Analytical Methodology (Continued)

Parameter	Units	Nominal Detection Limit[a]	Methodology	Reference	Preservation Bottle No.	Maximum Holding Time[b]
TRACE METALS[c]						
Aluminum	mg/l	0.05	ICP Emission Spectroscopy	3	4	6 months
Antimony	mg/l	0.002	Furnace Atomic Absorption	1-204.2	4	6 months
Arsenic	mg/l	0.002	Furnace Atomic Absorption	1-206.2	4	6 months
Barium	mg/l	0.005	ICP Emission Spectroscopy	3	4	6 months
Beryllium	mg/l	0.001	ICP Emission Spectroscopy	3	4	6 months
Boron	mg/l	0.004	ICP Emission Spectroscopy	3	4	6 months
Cadmium	mg/l	0.002	ICP Emission Spectroscopy	3	4	6 months
Chromium	mg/l	0.005	ICP Emission Spectroscopy	3	4	6 months
Cobalt	mg/l	0.003	ICP Emission Spectroscopy	3	4	6 months
Copper	mg/l	0.002	ICP Emission Spectroscopy	3	4	6 months
Iron	mg/l	0.05	ICP Emission Spectroscopy	3	4	6 months
Lead	mg/l	0.025	ICP Emission Spectroscopy	3	4	6 months
		0.001	Furnace Atomic Absorption	1-239.2	4	6 months
Manganese	mg/l	0.005	ICP Emission Spectroscopy	3	4	6 months
Mercury	mg/l	0.0002	Cold Vapor Atomic Absorption	1-245.1	4	6 months
Molybdenum	mg/l	0.005	ICP Emission Spectroscopy	3	4	6 months
Nickel	mg/l	0.01	ICP Emission Spectroscopy	3	4	6 months
Selenium	mg/l	0.002	Furnace Atomic Absorption	1-270.2	4	6 months
Silver	mg/l	0.003	ICP Emission Spectroscopy	3	4	6 months
Strontium	mg/l	0.005	ICP Emission Spectroscopy	3	4	6 months
Thallium	mg/l	0.002	Furnace Atomic Absorption	1-279.2	4	6 months
Tin	mg/l	0.03	ICP Emission Spectroscopy	3	4	6 months
Titanium	mg/l	0.002	ICP Emission Spectroscopy	3	4	6 months
Vanadium	mg/l	0.002	ICP Emission Spectroscopy	3	4	6 months
Zinc	mg/l	0.004	ICP Emission Spectroscopy	3	4	6 months
INORGANIC PARAMETERS						
pH	units	0.01	Meter	1-150.1; 2-423	1	ASAP
Specific Conductance at 25°C	umhos/cm	1	Bridge	1-120.1; 2-205	1	28 days
Total Dissolved Solids	mg/l	10	Gravimetric, 180°C	1-160.1; 2-209B	1	7 days
Total Suspended Solids	mg/l	2	Gravimetric, 105°C	1-160.2	1	7 days
Total Solids	mg/l	10	Gravimetric, 105°C	1-160.3	1	7 days
Total Volatile Solids	mg/l	10	Gravimetric, 550°C	1-160.4	1	7 days
Ortho-Phosphate as P	mg/l	0.01	Single Reagent Colorimetric	1-365.2; 2-424F	1	48 hours

Inorganic Analytical Methodology (Continued)

References

(1) "Methods for Chemical Analysis of Water and Wastes", EPA-600/4-79-020, EMSL, Cincinnati, 1979.

(2) "Standard Methods for the Examination of Water and Wastewater", 15th Edition, APHA, 1980.

(3) 40 CFR 136.3, Table II.

(4) "Annual Book of ASTM Standards", Part 31, Water, 1980.

Notes

[a]Nominal values are the best achievable with the listed analytical method. Interferences in specific samples may result in a higher detection limit.

[b]Applicable to NPDES wastes as updated by Robert C. Booth, Director, EMSL-Cincinnati, September 22, 1981.

[c]Digestion procedure 1-4.1.4 used for elements determined by ICP Emission Spectroscopy when determining total metals. Digestion procedures for graphite furnace elements included with reference listed.

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Bottle No.	Parameters	Container	Preservative	Notes
1	Cl^-, F^-, $SO_4^=$, Tot. Alk., $CO_3^=$ Alk., HCO_3^- Alk., SiO_2, BOD, Br^-, res. Cl_2, Cr^{+6}, color, NO_2^-, $SO_3^=$, OH^- Alk., pH, spec. cond., TDS, TSS, TS, TVS, o-PO_4 MBAS, Turbidity.	500 mL poly	4^oC	Provide unfiltered sample for solids and turbidity.
2	Tot.P, COD, TOC, NH_3, TKN, TON, Phenolics NO_3 + NO_2.	1 liter glass	2 ml 50% H_2SO_4, 4^oC	
3	O & G	1 liter glass	4 ml 50% H_2SO_4, 4^oC	Do not filter, collect directly in bottle.
4	Na, K, Ca, Mg, A Sb, As, Ba, Be, B, Cd, Cr, Co, Cu, Fe, Pb, Mn, Hg, Mo, Ni, Se, Ag, Sr, Tl, Sn, Ti, V, Zn, ICP, Hardness	500 ml poly	5 ml 50% HNO_3	Provide separate samples for total and dissolved sample (filter before adding to bottle).
5	Alpha, Beta, Ra^{226}, Ra^{228}, U	1 liter poly (no Ra^{228}) ½ gallon poly (with Ra^{228})	10 ml 50% HNO_3 20 ml 50% HNO_3	
6	Free CN, Tot. CN	500 ml poly	2 ml 50% NaOH, 4^oC	
7	Sulfide	250 ml poly	1 ml 1 N Zn acetate, 1 ml 50% NaOH, 4^oC	
8	Fecal coli., total coli.	8 oz. sterile	4^oC	Collect directly in sterile bottle.
11	VOA, purgeable organics, THM	3-40 ml glass vial	4^oC	Completely fill bottle, leave no air bubbles.
12	B/NA	1 liter glass	4^oC	
13	Pest./PCB	1 liter glass	4^oC	
14	Herbicides	1 liter glass	4^oC	
15	TOX	1 liter glass	4^oC	

[a]40 CFR 136.3 Table II.
[b]Note: Certain other non-routine samples may require different perservation to remove interferences as specified in 40 CFR 136.3 Table II.

APPENDIX C

EPA Tables for Chemical/Physical Properties,
Fate/Persistence and Toxicology

(from Appendix A Exhibits, Superfund
Public Health Assessment Manual,
OSWR Directive 9285.4-1)

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APPENDIX A

SUMMARY TABLES FOR CHEMICAL-SPECIFIC DATA

Appendix A contains the following six summary data tables:

- Exhibit A-1: Physical, Chemical, and Fate Data
- Exhibit A-2: Half-Lives in Various Media
- Exhibit A-3: Toxicity Data for Potential Carcinogenic Effects -- Selection of Indicator Chemicals Only
- Exhibit A-4: Toxicity Data for Potential Carcinogenic Effects -- Risk Characterization
- Exhibit A-5: Toxicity Data for Noncarcinogenic Effects -- Selection of Indicator Chemicals Only
- Exhibit A-6: Toxicity Data for Noncarcinogenic Effects -- Risk Characterization

These tables summarize key quantitative parameters for more than 300 chemicals or chemical groups that were evaluated as part of the Superfund reportable quantity (RQ) adjustment process or the intra-agency reference dose (RfD) review process. These specific chemicals are included because of the amounts of readily available toxicity information. This list should not be interpreted as a complete list of chemicals of concern at Superfund sites. Other substances may be important at certain sites. However, this appendix covers many toxic chemicals commonly detected at Superfund sites.

Chemical-specific parameters listed in the tables are primarily those referred to in this manual, although a limited amount of other useful information (e.g., CAS number, molecular weight) is also provided. Values for physical, chemical, and fate parameters given in Exhibits A-1 and A-2 are provided for the convenience of the user and have not been fully peer reviewed within EPA. Conversely, values given in Exhibits A-4 and A-6 for acceptable intake level and/or carcinogenic potency have been reviewed within EPA and should generally be used in the public health evaluation process at Superfund sites. The sources of values and data transformation procedures, if any, are described in the following sections.

In addition to the six data summary tables described above, a list of chemicals for which EPA Health Effects Assessment documents are available is provided in Exhibit A-7.

A-1 Exhibit A-1: Physical, Chemical, and Fate Data

The physical, chemical, and fate data shown in Exhibit A-1 were either recorded directly from standard secondary references or were derived based on information contained in such references. A general hierarchy of sources was established, and values were taken from sources in order of the hierarchy. The hierarchy was ordered with documents developed specifically for the Superfund program at the top, followed by other relevant EPA data compilations, and then general reference texts at the bottom. In general, succeeding references were used only when a value could not be obtained from a reference higher in the hierarchy. Priority was given to more recent sources, and measured values were chosen over estimated values even if obtained from a source lower on the hierarchy. The hierarchy of sources used to select values for Exhibit A-1 is shown below and is lettered to correspond with the sources referenced in the exhibit. More complete reference information for each of these sources is in the reference list for Appendix A. A brief description of the derivation of values for each parameter in Exhibit A-1 follows the hierarchy listed below.

A) ECAO, EPA, Health Effects Assessments, 1985
B) Jaber *et al.*, 1984
C) Mabey *et al.*, 1982
D) Callahan *et al.*, 1979
E) ORD, EPA, 1981
F) Dawson *et al.*, 1980
G) Lyman *et al.*, 1982
H) OWRS, EPA, 1980
I) Weast *et al.*, 1979
J) Verschueren, 1983
K) Windholz *et al.*, 1976
L) Perry and Chilton, 1973
M) OSW, EPA, 1984b
N) OSW, EPA, 1984a

Water Solubility is the maximum concentration of a chemical that dissolves in pure water at a specific temperature and pH. It is a critical property affecting environmental fate and transport. Values for water solubility, in mg/l, were recorded in Exhibit A-1 directly using the hierarchy of sources and general decision rules outlined above. Values are given for a neutral pH and a temperature range of 20 to 30°C. Chemicals listed in the literature as being "infinitely soluble" were assigned a solubility value of 1,000,000 mg/l.

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Vapor Pressure is a relative measure of the volatility of a chemical in its pure state and is an important determinant of the rate of vaporization from waste sites. Values for this parameter, in units mm Hg, were recorded directly from the hierarchy of sources described above. Values are given for a temperature range of 20 to 30° C.

Henry's Law Constant is another parameter important in evaluating air exposure pathways. Values for Henry's Law Constant (H) were calculated using the following equation and the values previously recorded for solubility, vapor pressure, and molecular weight:

$$H(atm-m^3/mole) = \frac{vapor\ pressure(atm) \times MW(g/mole)}{water\ solubility\ (g/m^3)}$$

Organic Carbon Partition Coefficient (Koc) is a measure of the tendency for organics to be adsorbed by soil and sediment and is expressed as:

$$Koc = \frac{mg\ chemical\ adsorbed/kg\ organic\ carbon}{mg\ chemical\ dissolved/liter\ of\ solution}$$

The Koc is chemical specific and is largely independent of soil properties. Most Koc values in Exhibit A-1 were recorded directly from the above hierarchy of sources. However, some Koc values were estimated using methods specified in Lyman (1982). Estimated values are clearly designated as such.

Octanol-Water Partition Coefficient (Kow) is a measure of how a chemical is distributed at equilibrium between octanol and water. Although Kow is not directly referenced in the text of this manual, it is an important parameter and is used often in the assessment of environmental fate and transport for organic chemicals. Additionally, Kow is a key variable used in the estimation of other properties. For the convenience of the user, values for log Kow have been included in Exhibit A-1. These values were recorded directly from the hierarchy of sources referenced above.

Bioconcentrateion Factor as used in this manual is a measure of the tendency for a chemical contaminant in water to accumulate in fish tissue. The equilibrium concentration of a contaminant in fish can be estimated by multiplying the concentration of the chemical in surface water by the fish bioconcentration factor for that chemical. This parameter is therefore an important determinant for human intakes via the aquatic food ingestion route. Values for bioconcentration factors shown in Exhibit A-1 were recorded directly from the above hierarchy of sources.

A.2 Exhibit A-2 : Half-Lives Media

Chemical Half-Lives are used in thi measures of persistence, or how long remain, in various environmental me presents values for overall half-lives, result of all removal processes (e.g., p chemical transformation, and biologica acting together rather than a mechanism. All of the half-life values were recorded directly from two sources. Effects Assessments (ECAO, 1985 profiles for the RCRA Risk-Cost (OSW, 1984b). The same source letter was followed for Exhibit A-2 as for Exh

A.3 Exhibit A-3: Toxicity Potential Carcinogenic Selection of Indicator Chemical

For the risk assessment process manual, data presented in Exhibit A-3 ar the selection of indicator chemicals and risk characterization. These data wer information contained in the Reportab data base (OHEA, 1986). The procec convert source data to the values given are described briefly below.

The 10% Effective Dose (ED_{10}) repre which a 10 percent incremental carcino is observed. This parameter was ca oral and inhalation routes by taking the Potency Factor Estimate (PFE) given i base (this source defines PFE = 1/E ED_{10} = 1/PFE). The ED_{10} is in units

Toxicity Constants vary for different ex As such, Exhibit A-3 contains toxicity c specific to water (wTc) and soil (sTc) and a value for air (aTc) for the inhal of these constants for potential carcino on the ED_{10}, standard intake assum respective media, and a standard b specific equations and assumptions the various toxicity constants are p discussed in further detail in Appendix

A.4 Exhibit A-4: Toxicit Potential Carcinogenic Eff Characterization

Data presented in Exhibit A-4 are characterization, as opposed to the indicator chemicals. Values in this exhib in the following manner.

Carcinogenic Potency Factors are upper 95 percent confidence limits on the slope of the dose-response curve. These values were recorded directly from HEAs or CAG summary tables, with the actual source cited in the exhibit for each value and then fully referenced at the end of the exhibit. Potency factors are used to estimate potential carcinogenic risk. These factors, specific to different exposure routes, are given in Exhibit A-4 in units of $(mg/kg/day)^{-1}$.

Weight of Evidence ratings qualify the level of evidence that supports designating a chemical as a human carcinogen. Exhibit A-4 lists ratings based on EPA categories for potential carcinogens, which are fully itemized in Exhibit B-2. The ratings were recorded directly from the RQ data base. (Note: Weight-of-evidence ratings are also used in the procedure for selecting indicator chemicals.)

A.5 Exhibit A-5: Toxicity Data for Noncarcinogenic Effects--Selection of Indicator Chemicals Only

The data in Exhibit A-5 were generated based on information contained in the RQ data base for chronic effects (ECAO, 1984). Values for the parameters in Exhibit A-5, which are used in the selection of indicator chemicals but not in risk characterization, were derived in the following manner. In addition, chemicals marked in Exhibit A-5 with "@" also exhibit potential carcinogenic effects. The reader is referred to Exhibits A-3 and A-4 for information concerning these effects.

To determine the human Minimum Effective Dose (MED), the RQ data base was reviewed to identify the studies with the highest composite score (a score that combines MED and severity of effect) for oral and for inhalation exposure routes. These MEDs were recorded under the appropriate exposure route in Exhibit A-5. If composite score values were reported to be equal, the study that yielded the lowest MED was used. For metals, one MED value was derived from all studies for the various compounds of a given metal. Human MED values are expressed in Exhibit A-5 in terms of mg/day. If an MED was available for only one exposure route, it was recorded in Exhibit A-5 for the other exposure routes without modification unless the toxic effect was at the site of entry.

Severity of effect Ratings, or RVe's, were recorded from the RQ data base for the same study used to determine MED values. These rating constants are unitless integers ranging from 1 to 10, corresponding to various levels of severity of effects. The severity scale is presented in Exhibit B-1.

Toxicity Constants for noncarcinogenic effects, like those for carcinogens, are specific to water, soil, and air and are designated in Exhibit A-5 as wTn, sTn, and aTn, respectively. Again, these toxicity constants are used only in the indicator chemical selection step of the process. Values in Exhibit A-5 are based on standard intake assumptions as well as a chemical's RVe and MED values. Refer to Appendix B for the specific toxicity constant equations and for a discussion on their application.

A.6 Exhibit A-6: Toxicity Data for Noncarcinogenic Effects-- Risk Characterization

Exhibit A-6 gives values for parameters that are used in actual risk characterization. The methods used to derive these values are described below. Although the data in Exhibit A-6 are for noncarcinogenic effects, several of the chemicals listed in the exhibit (those marked with an "@") also exhibit potential carcinogenic effects. Exhibits A-3 and A-4 should be referred to for information concerning carcinogenic effects.

Subchronic acceptable intake (AIS) values are short-term acceptable intake levels and are recorded directly from the appropriate HEA. Likewise, values for chronic acceptable intake (AIC), which is the long-term acceptable intake level for noncarcinogenic effects, were recorded directly from the appropriate HEA or from compilations of Agency-verified reference dose (RfD) values. These verified reference doses were developed by an EPA work group chaired by the Office of Research and Development in 1985 and 1986. The actual source used for each value is cited in Exhibit A-6 and is referenced fully at the end of the exhibit. AIS and AIC are used to characterize risks of noncarcinogenic effects. Both AIS and AIC values are in units of mg/kg/day.

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REFERENCES FOR APPENDIX A

CAG, U.S. EPA, 1985. Relative Carcinogenic Potencies Among 54 Chemicals Evaluated by the Carcinogen Assessment Group As Suspect Human Carcinogens.

Callahan *et al.*, 1979. Water-Related Environmental Fate of 129 Priority Pollutants, Volumes I and II, Office of Water Planning and Standards, Office of Water and Waste Management, U.S. EPA, EPA Contract Nos. 68-01-3852 and 68-01-3867. [Source D*]

Dawson, *et al.*, 1980. Physical/Chemical Properties of Hazardous Waste Constituents. Prepared By Southeast Environmnetal Research Laboratory for U.S. EPA. [Source F*]

ECAO, U.S. EPA, 1985. Health Effects Assessment for [Specific Chemical]. [Note: 58 individual documents available for specific chemicals or chemical groups] [Source A*]

ECAO, U.S. EPA, 1984. Summary Data Tables for Chronic Noncarcinogenic Effects. [Note: Prepared during RQ adjustment process]

Jaber, *et al.*, 1984. Data Acquisition for Environmental Transport and Fate Screening. Office of Health and Environmental Assessment, U.S. EPA. Washington, DC, EPA 600/6-84-009 [Source B*]

Lyman, 1982. Adsorption Coefficient for Soils and Sediments. Chapter 4 in Lyman *et al.*, *Handbook of Chemical Property Estimation Methods*. McGraw-Hill, New York.

Lyman, *et al.*, 1982. *Handbook of Chemical Property Estimation Methods* McGraw-Hill, New York. [Source G*]

Mabey, *et al.*, 1982. Aquatic Fate Process Data for Organic Priority Pollutants. Prepared by SRI International, EPA Contract Nos. 68-01-3867 and 68-03-2981, prepared for Monitoring and Data Support Division, Office of Water Regulations and Standards, Washington, DC. [Source C*]

OHEA, U.S. EPA, 1986. Methodology for Evaluating Reportable Quantity Adjustments Pursuant to CERCLA Section 102, External Review Draft. OHEA-C-073.

ORD, U.S. EPA, 1981. Treatability Manual, Volume I, EPA 600/2-82-001a. [Source E*]

OSW, U.S. EPA, 1984a. Characterization of Constituents from Selected Waste Streams Listed in 40 CFR Section 261. Prepared by Environ Corporation. [Source N*]

OSW, U.S. EPA, 1984b. Exposure Risk-Cost Analysis Model. Pre Corporation. [Source M*]

OWRS. U.S. EPA, 1980. Ambi Criteria Documents for [Specific H*]

Perry and Chilton, 1973. *Che Handbook*, McGraw-Hill, 5th Ed. [S

Verschueren, 1983. *Handbook of E for Organic Chemicals*. Van Nost New York, 2nd ed. [Source J*]

Weast *et al.*, 1979. CRC *Handbook Physics*. [Source I*]

Windholz, et al., 1976. *The Merck I*

*Source letters correspond to Exhibits A-1 and A-2.

Date Prepared: October 1, 1986

EXHIBIT A-1

PHYSICAL, CHEMICAL, AND FATE DATA

Chemical Name	CAS #	Mole Weight (g/mole)	Water Solubility (mg/l)	S*	Vapor Pressure (mm Hg)	S*	Henry's Law Constant (atm-m3/mol)	S*	Koc (ml/g)	S*	Log Kow	S*	Fish BCF (l/kg)	S*
Acenaphthene	83-32-9	154	3.42E+00	C	1.55E-03	C	9.20E-05		4600	C	4.00	C	242	H
Acenaphthylene	208-96-8	152	3.93E+00	C	2.90E-02	C	1.48E-03		2500	C	3.70	C		
Acetone	67-64-1	58	1.00E+06	#	2.70E+02	J	2.06E-05		2.2	&	-0.24	J		
Acetonitrile	75-05-8	41	1.00E+06	#	7.40E+01	F	4.00E-06		2.2	&	-0.34	F		
2-Acetylaminofluorene	53-96-3	223	6.50E+00	B			NA		1600	&	3.28	B		
Acrylic Acid	79-10-7	72	1.00E+06	#	4.00E+00	F					0.13	F	0	F
Acrylonitrile	107-13-1	53	7.90E+04	C	1.00E+02	C	8.84E-05		0.85	C	0.25	C	48	C
Aflatoxin B1	1162-65-8	312					NA							
Aldicarb	116-06-3	190												
Aldrin	309-00-2	365	1.80E-01	C	6.00E-06	C	1.60E-05		96000	C	5.30	C	28	H
Allyl Alcohol	107-18-6	58	5.10E+05	B	2.46E+01	B	3.69E-06		3.2	&	-0.22	B		
Aluminum Phosphide	20859-73-8	58												
4-Aminobiphenyl	92-67-1	169	8.42E+02	B	6.00E-05	B	1.59E-08		107	&	2.78	B		
Amitrole	61-82-5	84	2.80E+05	B			NA		4.4	&	-2.08	B		
Ammonia	7664-41-7	17	5.30E+05	F	7.60E+03	F	3.21E-04		3.1	&	0.00	F	0	F
Anthracene	120-12-7	178	4.50E-02	A	1.95E-04	A	1.02E-03		14000	C	4.45	A		
Antimony and Compounds	7440-36-0	122			1.00E+00	N	NA						1	H
Arsenic and Compounds	7440-38-2	75			0.00E+00	E	NA						44	H
Asbestos	1332-21-4	NA	NA		NA		NA		NA		NA		0	D
Auramine	2465-27-2	267	2.10E+00	B			NA		2900	&	4.16	B		
Azaserine	115-02-6	173	1.36E+05	B			NA		6.6	&	-1.08	B		
Aziridine	151-56-4	43	2.66E+06	B	2.55E+02	B	5.43E-06		1.3	&	-1.01			
Barium and Compounds	7440-39-3	137					NA							
Benefin	1861-40-1	335												
Benzene	71-43-2	78	1.75E+03	A	9.52E+01	A	5.59E-03		83	C	2.12	A	5.2	H
Benzidine	92-87-5	184	4.00E+02	C	5.00E-04	C	3.03E-07		10.5	C	1.30	C	87.5	H
Benz(a)anthracene	56-55-3	228	5.70E-03	C	2.20E-08	C	1.16E-06		1380000	C	5.60	C		
Benz(c)acridine	225-51-4	229	1.40E+01	B			NA		1000	&	4.56	B		
Benzo(a)pyrene	50-32-8	252	1.20E-03	A	5.60E-09	A	1.55E-06		5500000	C	6.06	C		
Benzo(b)fluoranthene	205-99-2	252	1.40E-02	C	5.00E-07	C	1.19E-05		550000	C	6.06	A		
Benzo(ghi)perylene	191-24-2	276	7.00E-04	A	1.03E-10	A	5.34E-08		1600000	C	6.51	A		
Benzo(k)fluoranthene	207-08-9	252	4.30E-03	C	5.10E-07	C	3.94E-05		550000	C	6.06	C		
Benzotrichloride	98-07-7	195												
Benzyl Chloride	100-44-7	127	3.30E+03	F	1.00E+00	E	5.06E-05		50	&	2.63	F		
Beryllium and Compounds	7440-41-7	9			0.00E+00	E	NA						19	H
1,1-Biphenyl	92-52-4	154												
Bis(2-chloroethyl)ether	111-44-4	143	1.02E+04	C	7.10E-01	C	1.31E-05		13.9	C	1.50	C	6.9	H
Bis(2-chloroisopropyl)ether	108-60-1	171	1.70E+03	C	8.50E-01	C	1.13E-04		61	C	2.10	C	0	D
Bis(chloromethyl)ether	542-88-1	115	2.20E+04	C	3.00E+01	C	2.06E-04		1.2	C	0.38	C	0.63	H
Bis(2-ethylhexyl)phthalate (DEHP)	117-81-7	391												
Bromomethane	74-83-9	95												
Bromoxynil Octanoate	1689-99-2	403												
1,3-Butadiene	106-99-0	54	7.35E+02	F	1.84E+03	F	1.78E-01		120	&	1.99	F		
n-Butanol	71-36-3	74												
Butylphthalyl Butylglycolate	85-70-1	336												
Cacodylic Acid	75-60-5	138	8.30E+05	F			NA		2.4	&	0.00	F		
Cadmium and Compounds	7440-43-9	112			0.00E+00	E	NA						81	H
Captan	133-06-2	301	5.00E-01	C	5.00E-05	E	4.75E-05		6400	&	2.35	F		
Carbaryl	63-25-2	201	4.00E+01	E	5.00E-07	E					2.36	F		
Carbon Disulfide	75-15-0	76	2.94E+03	E	3.60E+02	E	1.23E-02		54	&	2.00	F	0	F
Carbon Tetrachloride	56-23-5	154	7.57E+02	A	9.00E+01	A	2.41E-02		110	&	2.64	A	19	H
Chlordane	57-74-9	410	5.60E-01	A	1.00E-05	A	9.63E-06		140000	C	3.32	A	14000	H
Chlorobenzene	108-90-7	113	4.66E+02	A	1.17E+01	A	3.72E-03		330	C	2.84	A	10	H
Chlorobenzilate	510-15-6	325	2.19E+01	B	1.20E-06	B	2.34E-08		800	&	4.51	B		
Chlorodibromomethane	124-48-1	208			1.50E+01	D	NA				2.09	D		

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Date Prepared: October 1, 1986

EXHIBIT A-1
(Continued)

PHYSICAL, CHEMICAL, AND FATE DATA

Chemical Name	CAS #	Mole Weight (g/mole)	Water Solubility (mg/l)	S*	Vapor Pressure (mm Hg)	S*	Henry's Law Constant (atm-m3/mol)	Koc (ml/g)	S*	Log Kow	S*	Fish BCF (l/kg)	S*
Chloroform	67-66-3	119	8.20E+03	A	1.51E+02	A	2.87E-03	31	&	1.97	A	3.75	H
Chloromethyl Methyl Ether	107-30-2	81					NA			0.00	F		
4-Chloro-o-toluidine Hydrochloride	3165-93-3	142					NA						
Chromium III and Compounds	7440-47-3	52			0.00E+00	E	NA					16	H
Chromium VI and Compounds	7440-47-3	52			0.00E+00	E	NA					16	H
Chrysene	218-01-9	228	1.80E-03	A	6.30E-09	A	1.05E-06	200000	C	5.61	A		
Copper and Compounds	7440-50-8	64			0.30E+00	G	NA					200	D
Creosote	8001-58-9	NA					NA						
Cresol	1319-77-3	108	3.10E+04	E	2.40E-01	J	1.10E-06	500	G	1.97	F	0	F
Crotonaldehyde	123-73-9	70											
Cyanides	57-12-5	NA					NA						
-- Barium Cyanide	542-62-1	189											
-- Calcium Cyanide	592-01-8	92											
-- Copper Cyanide	544-92-3	90											
-- Cyanogen	460-19-5	52	2.50E+05	K									
-- Cyanogen Chloride	506-77-4	61	2.50E+03	F	1.00E+03	J				0.00	F		
-- Hydrogen Cyanide	74-90-8	27	1.00E+06	H	6.20E+02	E				-0.25	F	0	F
-- Nickel Cyanide	557-19-7	182											
-- Potassium Cyanide	151-50-8	65	5.00E+05	K									
-- Potassium Silver Cyanide	506-61-6	199											
-- Silver Cyanide	506-64-9	134											
-- Sodium Cyanide	143-33-9	49	8.20E+05	H									
-- Zinc Cyanide	557-21-1	117											
Cyclophosphamide	50-18-0	261	1.31E+09	B			NA	0.042	&	-3.22	B		
Dalapon	75-99-0	143											
DDD	72-54-8	320	1.00E-01	C	1.89E-06	C	7.96E-06	770000	C	6.20	C		
DDE	72-55-9	318	4.00E-02	C	6.50E-06	C	6.80E-05	4400000	C	7.00	C	51000	G
DDT	50-29-3	355	5.00E-03	A	1.50E-06	A	5.13E-04	243000	C	6.19	J	54000	H
Decabromodiphenyl Ether	1163-19-5	959											
Diallate	2303-16-4	274	1.40E+01	B	6.10E-03	B	1.65E-04	1000	&	0.73	B		
2,4-Diaminotoluene	95-80-7	122	4.77E+04	B	3.60E-05	B	1.28E-10	12	&	0.35	B		
1,2,7,8-Dibenzopyrene	189-55-9	305	1.10E-01	B			NA	1200	&	6.62	B		
Dibenz(a,h)anthracene	53-70-3	278	5.00E-04	C	1.00E-10	C	7.33E-08	3300000	C	6.80	C		
1,2-Dibromo-3-chloropropane	96-12-8	236	1.00E+03	B	1.00E+00	B	3.11E-04	98	&	2.29	B		
Dibutylnitrosamine	924-16-3	152					NA						
Dibutyl Phthalate	84-74-2	278	1.30E+01	C	1.00E-05	C	2.82E-07	170000	C	5.60	C		
1,2-Dichlorobenzene	95-50-1	147	1.00E+02	C	1.00E+00	C	1.93E-03	1700	C	3.60	C	56	H
1,3-Dichlorobenzene	541-73-1	147	1.23E+02	C	2.28E+00	C	3.59E-03	1700	C	3.60	C	56	H
1,4-Dichlorobenzene	106-46-7	147	7.90E+01	C	1.18E+00	C	2.89E-03	1700	C	3.60	C	56	H
3,3'-Dichlorobenzidine	91-94-1	253	4.00E+00	C	1.00E-05	C	8.33E-07	1553	C	3.50	C	312	H
Dichlorodifluoromethane	75-71-8	121	2.80E+02	C	4.87E+03			58	C	2.16	D		
1,1-Dichloroethane	75-34-3	99	5.50E+03	A	1.82E+02	A	4.31E-03	30	C	1.79	A		
1,2-Dichloroethane (EDC)	107-06-2	99	8.52E+03	A	6.40E+01	A	9.78E-04	14	C	1.48	A	1.2	H
[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]

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Date Prepared: October 1, 1986

EXHIBIT A-1
(Continued)

PHYSICAL, CHEMICAL, AND FATE DATA

Chemical Name	CAS #	Mole Weight (g/mole)	Water Solubility (mg/l)	S*	Vapor Pressure (mm Hg)	S*	Henry's Law Constant (atm-m3/mol)	Koc (ml/g)	S*	Log Kow	S*	Fish BCF (l/kg)	S*
1,3-Dichloropropene	542-75-6	111	2.80E+03	C	2.50E+01	C	1.30E-03	48	C	2.00	C	1.9	H
Dieldrin	60-57-1	381	1.95E-01	C	1.78E-07	C	4.58E-07	1700	C	3.50	C	4760	H
Diepoxybutane	1464-53-5	86					NA						
Diethanolnitrosamine	1116-54-7	134					NA						
Diethyl Arsine	692-42-2	134	4.17E+02	B	3.50E+01	B	1.48E-02	160	&	2.97	B		
1,2-Diethylhydrazine	1615-80-1	88	2.88E+07	B			NA	0.3	&	-1.68	B		
Diethylnitrosamine	55-18-5	102			5.00E+00	F	NA			0.48	F		
Diethyl Phthalate	84-66-2	222	8.96E+02	C	3.50E-03	C	1.14E-06	142	C	2.50	C	117	G
Diethylstilbestrol (DES)	56-53-1	268	9.60E-03	B			NA	28	&	5.46	B		
Dihydrosafrole	94-58-6	164	1.50E+03	B			NA	78	&	2.56	B		
Dimethoate	60-51-5	229	2.50E+04	J	2.50E-02	J				2.71	J		
3,3'-Dimethoxybenzidine	119-90-4	244					NA						
Dimethylamine	124-40-3	45	1.00E+06	F	1.52E+03	F	9.02E-05	2.2	&	-0.38	F	0	F
Dimethyl Sulfate	77-78-1	126	3.24E+05	B	6.80E-01	B	3.48E-07	4.1	&	-1.24	B		
Dimethyl Terephthalate	120-61-6	194											
Dimethylaminoazobenzene	60-11-7	225	1.36E+01	B	3.30E-07	B	7.19E-09	1000	&	3.72	B		
7,12-Dimethylbenz(a)anthracene	57-97-6	256	4.40E-03	B			NA	476000	C	6.94	B		
3,3'-Dimethylbenzidine	119-93-7	212											
Dimethylcarbamoyl Chloride	79-44-7	108	1.44E+07	B	1.95E+00	B	1.92E-08	0.5	&	-1.32	B		
1,1-Dimethylhydrazine	57-14-4	60	1.24E+08	B	1.57E+02	B	1.00E-07	0.2	&	-2.42	B		
1,2-Dimethylhydrazine	540-73-8	60					NA						
Dimethylnitrosamine	62-75-9	74	1.00E+06	#	8.30E+00	C	7.90E-07	0.1	C	-0.68	C	0	D
1,3-Dinitrobenzene	99-65-0	168	4.70E+02	J			NA	150	&	1.62	F		
4,6-Dinitro-o-cresol	534-52-1	198	2.90E+02	C	5.00E-02	C	4.49E-05	240	C	2.70	C	0	E
2,4-Dinitrophenol	51-28-5	184	5.60E+03	C	1.49E-05	C	6.45E-10	16.6	C	1.50	C	0	D
2,3-Dinitrotoluene	602-01-7	182	3.10E+03	B			NA	53	&	2.29	B	3.8	H
2,4-Dinitrotoluene	121-14-2	182	2.40E+02	C	5.10E-03	C	5.09E-06	45	C	2.00	C	3.8	H
2,5-Dinitrotoluene	619-15-8	182	1.32E+03	B			NA	84	&	2.28	B	3.8	H
2,6-Dinitrotoluene	606-20-2	182	1.32E+03	B	1.80E-02	C	3.27E-06	92	C	2.00	C	3.8	H
3,4-Dinitrotoluene	610-39-9	182	1.08E+03	B			NA	94	&	2.29	B	3.8	H
Dinoseb	88-85-7	240	5.00E+01	J									
1,4-Dioxane	123-91-1	88	4.31E+05	B	3.99E+01	B	1.07E-05	3.5	&	0.01	B		
N,N-Diphenylamine	122-39-4	169	5.76E+01	B	3.80E-05	B	1.47E-07	470	&	3.60	B	30	G
1,2-Diphenylhydrazine	122-66-7	184	1.84E+03	C	2.60E-05	C	3.42E-09	418	C	2.90	C	25	H
Dipropylnitrosamine	621-64-7	130	9.90E+03	C	4.00E-01	C	6.92E-06	15	C	1.50	C		
Disulfoton	298-04-4	274											
Endosulfan	115-29-7	407											
Epichlorohydrin	106-89-8	93	6.00E 04	J	1.57E+01	B	3.19E-05	10	&	0.35	B		
Ethanol	64-17-5	46	1.00E+06	#	7.40E+02	G	4.48E-05	2.2	&	-0.32	J		
Ethyl Acetate	141-78-6	88											
Ethyl Methanesulfonate	62-50-0	124	3.69E+05	B	2.06E-01	B	9.12E-08	3.8	&	0.21	B		
Ethylbenzene	100-41-4	106	1.52E+02	A	7.00E+00	A	6.43E-03	1100	C	3.15	A	37.5	H
Ethyl-4,4'-dichlorobenzilate	510-15-6	352											
Ethylene Dibromide (EDB)	106-93-4	188	4.30E+03	J	1.17E+01	B	6.73E-04	44	C	1.76	B		
Ethylene Oxide	75-21-8	44	1.00E+06	B	1.31E+03	B	7.56E-05	2.2	&	-0.22	B		
Ethylenethiourea	96-45-7	102	2.00E+03	F			NA	67	&	-0.66	J	0	F
1-Ethyl-nitrosourea	759-73-9	117	3.31E+08	B			NA	0.1	&				
Ethylphthalyl Ethyl Glycolate	84-72-0	280											
Ferric Dextran	9004-66-4	7500					NA						
Fluoranthene	206-44-0	202	2.06E-01	A	5.00E-06	A	6.46E-06	38000	C	4.90	A	1150	H
Fluorene	86-73-7	116	1.69E+00	C	7.10E-04	C	6.42E-05	7300	C	4.20	C	1300	G
Fluorides	7782-41-4	NA					NA						
Fluridone	59756-60-4	329											
Formaldehyde	50-00-0	30	4.00E+05	K	1.00E+01	E	9.87E-07	3.6	&	0.00	F	0	F

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EXHIBIT A-1
(Continued)

PHYSICAL, CHEMICAL, AND FATE DATA

Chemical Name	CAS #	Mole Weight (g/mole)	Water Solubility (mg/l)	S*	Vapor Pressure (mm Hg)	S*	Henry's Law Constant (atm-m3/mol)	Koc (ml/g)	S*	Log Kow	S*	Fish BCF (l/kg)	S*
Formic Acid	64-18-6	46	1.00E+06		4.00E+01	E				-0.54	F	0	F
Furan	110-00-9	68											
Glycidaldehyde	765-34-4	72	1.70E+08	B	1.97E+01	B	1.10E-08	0.1	&	-1.55	B		
Glycol Ethers	NA	NA					NA						
-- Diethylene Glycol, Monoethyl Ether	111-90-0	134											
-- 2-Ethoxyethanol	110-80-5	90	1.00E+06	F						0.00	F		
-- Ethylene Glycol, Monobutyl Ether	111-76-2	118	1.00E+06	F						0.00	F		
-- 2-Methoxyethanol	109-86-4	76	1.00E+06	K									
-- Propylene Glycol, Monoethyl Ether	52125-53-8	104											
-- Propylene Glycol, Monomethyl Ether	107-98-2	90											
Heptachlor	76-44-8	374	1.80E-01	C	3.00E-04	C	8.19E-04	12000	C	4.40	C	15700	H
Heptachlor Epoxide	1024-57-3	389	3.50E-01	C	3.00E-04	C	4.39E-04	220	C	2.70	C	14400	G
Hexachlorobenzene	118-74-1	285	6.00E-03	A	1.09E-05	A	6.81E-04	3900	C	5.23	A	8690	H
Hexachlorobutadiene	87-68-3	261	1.50E-01	A	2.00E+00	A	4.57E+00	29000	C	4.78	A	2.8	H
Hexachlorocyclopentadiene	77-47-4	273	2.10E+00	A	8.00E-02	A	1.37E-02	4800	C	5.04	A	4.3	H
alpha-Hexachlorocyclohexane (HCCH)	319-84-6	291	1.63E+00	C	2.50E-05	C	5.87E-06	3800	C	3.90	C	130	H
beta-HCCH	319-85-7	291	2.40E-01	C	2.80E-07	C	4.47E-07	3800	C	3.90	C	130	H
gamma-HCCH (Lindane)	58-89-9	291	7.80E+00	C	1.60E-04	C	7.85E-06	1080	C	3.90	C	130	H
delta-HCCH	319-86-8	291	3.14E+01	C	1.70E-05	C	2.07E-07	6600	C	4.10	C	130	H
Hexachloroethane	67-72-1	237	5.00E+01	C	4.00E-01	C	2.49E-03	20000	C	4.60	C	87	H
Hexachlorophene	70-30-4	407	4.00E-03	F			NA	91000	&	7.54	F		
Hydrazine	302-01-1	32	3.41E+08	B	1.40E+01	B	1.73E-09	0.1	&	-3.08	B		
Hydrogen Sulfide	7783-06-4	34	4.13E+03	K									
Indeno(1,2,3-cd)pyrene	193-39-5	276	5.30E-04	C	1.00E-10	C	6.86E-08	1600000	C	6.50	C		
Iodomethane	77-88-4	142	1.40E+04	J	4.00E+02	J	5.34E-03	23	&	1.69	J		
Iron and Compounds	15438-31-0	56					NA						
Isobutanol	78-83-1	74											
Isoprene	78-79-5	68			1.00E+02	E	NA						
Isosafrole	120-58-1	168	1.09E+03	B	1.60E-08	B	3.25E-12	93	&	2.66	B		
Isophorone	78-59-1	138											
Isopropalin	33820-53-0	309											
Kepone	143-50-0	491	9.90E-03	B			NA	55000	&	2.00	B	8400	G
Lasiocarpine	303-34-4	412	1.60E+03	B			NA	76	&	0.99	B		
Lead and Compounds (Inorganic)	7439-92-1	207			4.00E+00	E	NA					49	H
Linuron	330-55-2	249											
Malathion	121-75-7	330	1.45E+02	E	4.00E-05	E				2.89	J	0	F
Manganese and Compounds	7439-96-5	55					NA						
Melphalan	148-82-3	305											
Mercury and Compounds (Alkyl)	7439-97-6						NA					3750	H
Mercury and Compounds (Inorganic)	7439-97-6	201			2.00E-03	E	NA					5500	H
Mercury Fulminate	[illegible]	[illegible]											
Methanol	[illegible]	[illegible]											

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EXHIBIT A-1
(Continued)

PHYSICAL, CHEMICAL, AND FATE DATA

Chemical Name	CAS #	Mole Weight (g/mole)	Water Solubility (mg/l)	S*	Vapor Pressure (mm Hg)	S*	Henry's Law Constant (atm-m3/mol)	Koc (ml/g)	S*	Log Kow	S*	Fish BCF (l/kg)	S*
Tetraethyl Lead	78-00-2	323	8.00E-01	J	1.50E-01	J	7.97E-02	4900	&				
Thallium and Compounds	7440-28-0	204			0.00E+00	E							
-- Thallium Acetate	563-68-8	263											
-- Thallium Carbonate	6533-73-9	469											
-- Thallium Chloride	7791-12-0	240	2.90E+03	E	0.00E+00	E							
-- Thallium Nitrate	10102-45-1	266											
-- Thallic Oxide	1314-32-5	457											
-- Thallium Sulfate	7446-18-6	505	2.00E+02	E	0.00E+00	E							
Thioacetamide	62-55-5	75					NA			-0.46	J		
Thiourea	62-56-6	76	1.72E+06	B			NA	1.6	&	-2.05	B		
o-Tolidine	119-93-7	212	7.35E+01	B			NA	410	&	2.88	B		
Toluene	108-88-3	92	5.35E+02	A	2.81E+01	A	6.37E-03	300	C	2.73	A	10.7	H
o-Toluidine Hydrochloride	636-21-5	144	1.50E+04	J	1.00E-01	J	9.39E-07	22	&	1.29	J		
Toxaphene	8001-35-2	414	5.00E-01	C	4.00E-01	C	4.36E-01	964	C	3.3	C	13100	H
Tribromomethane (Bromoform)	75-25-2	253	3.01E+03	C	5.00E+00	C	5.52E-04	116	C	2.4	C		
1,2,4-Trichlorobenzene	120-82-1	181	3.00E+01	C	2.90E-01	C	2.31E-03	9200	C	4.3	C	2800	G
1,1,1-Trichloroethane	71-55-6	133	1.50E+03	A	1.23E+02	A	1.44E-02	152	C	2.5	C	5.6	H
1,1,2-Trichloroethane	79-00-5	133	4.50E+03	A	3.00E+01	A	1.17E-03	56	C	2.47	A	5	H
Trichloroethylene	79-01-6	131	1.10E+03	A	5.79E+01	A	9.10E-03	126	C	2.38	A	10.6	H
Trichlorfon	52-68-6	257	1.54E+05	E	7.80E-06	E	1.71E-11	6.1	&	2.29	A		
Trichloromonofluoromethane	75-69-4	137	1.10E+03	C	6.67E+02	C		159	C	2.53	D		
2,4,5-Trichlorophenol	95-95-4	197	1.19E+03	A	1.00E+00	A	2.18E-04	89	&	3.72	A	110	H
2,4,6-Trichlorophenol	88-06-2	197	8.00E+02	A	1.20E-02	A	3.90E-06	2000	C	3.87	A	150	H
2,4,5-Trichlorophenoxyacetic Acid	93-76-5	255											
1,2,3-Trichloropropane	96-18-4	147											
1,1,2-Trichloro-1,2,2,-trifluoroethane	76-13-1	187	1.00E+01	F	2.70E+02	F				2.00	F		
Tris(2,3-dibromopropyl)phosphate	126-72-7	698	1.20E+02	B			NA	310	&	4.12	B	2.7	G
Trinitrotoluene (TNT)	118-96-7	227											
Trypan Blue	72-57-1	961					NA						
Uracil Mustard	66-75-1	252	6.41E+02	B			NA	120	&	-1.09	B		
Uranium and Compounds	7440-61-1	238					NA						
Urethane	51-79-6	89					NA						
Vanadium and Compounds	7440-62-2	51					NA						
Vinyl Chloride	75-01-4	63	2.67E+03	A	2.66E+03	A	8.19E-02	57	&	1.38	A	1.17	H
Warfarin	81-81-2	308											
o-Xylene	95-47-6	106	1.75E+02	F	1.00E+01	F				2.95	F		
m-Xylene	108-38-3	106	1.30E+02	F	1.00E+01	F				3.26	F		
p-Xylene	106-42-3	106	1.98E+02	F	1.00E+01	F				3.15	F		
Xylene (mixed)	1330-20-7	106	1.98E+02	F	1.00E+01	F	7.04E-03	240	&	3.26	F		
Zinc and Compounds	7440-66-6	65			0.00E+00	D	NA					47	H
-- Zinc Phosphide	1314-84-7	258											
Zineb	12122-67-7	276											

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* Letters denote the source of the data, as listed in Section 3.1.
\# Solubility of 1,000,000 mg/l assigned because of reported "infinite solubility" in the literature.
& Koc estimated by the following equation: log Koc = (-0.55*logS) + 3.64 (Note: S in mg/l).

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EXHIBIT A-1
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PHYSICAL, CHEMICAL, AND FATE DATA

Chemical Name	CAS #	Mole Weight (g/mole)	Water Solubility (mg/l)	S*	Vapor Pressure (mm Hg)	S*	Henry's Law Constant (atm-m3/mol)	Koc (ml/g)	S*	Log Kow	S*	Fish BCF (l/kg)	S*
3-Methylcholanthrene	56-49-3	268					NA						
4,4'-Methylene-bis-2-chloroaniline	101-14-4	267					NA						
Methylnitrosourea	684-93-5	103	6.89E+08	B			NA	0.1	&	-3.81	B		
Methylthiouracil	56-04-2	142					NA						
Methylvinylnitrosamine	4549-40-0	86	7.60E+05	B	1.23E+01	B	1.83E-06	2.5	&	-0.23	B		
N-Methyl-N'-nitro-N-nitrosoguanadin	70-25-7	147					NA						
Mitomycin C	50-07-7	334					NA						
Mustard Gas	505-60-2	159	8.00E+02	B	1.70E-01	B	4.45E-05	110	&	1.37	B		
1-Napthylamine	134-32-7	143	2.35E+03	B	6.50E-05	B	5.21E-09	61	&	2.07	B		
2-Napthylamine	91-59-8	143	5.86E+02	B	2.56E-04	B	8.23E-08	130	&	2.07	B		
Nickel and Compounds	7440-02-0	59			0.00E+00	D	NA					47	H
Nitric Oxide	10102-43-9	30											
Nitrobenzene	98-95-3	123	1.90E+03	C	1.50E-01	B		36	C	1.85	D		
Nitrogen Dioxide	10102-44-0	46											
Nitrosomethylurethane	615-53-2	132					NA						
N-Nitrosopiperidine	100-75-4	114	1.90E+06	B	1.40E-01	B	1.11E-08	1.5	&	-0.49	B		
N-Nitrosopyrrolidine	930-55-2	100	7.00E+06	B	1.10E-01	B	2.07E-09	0.8	&	-1.06	B		
5-Nitro-o-toluidine	99-55-8	152					NA						
Osmium Tetroxide	20816-12-0	254											
Pentachlorobenzene	608-93-5	250	1.35E-01	F			NA	13000	&	5.19	F	2125	H
Pentachloronitrobenzene	82-68-8	295	7.11E-02	B	1.13E-04	B	6.18E-04	19000	&	5.45	B		
Pentachlorophenol	87-86-5	266	1.40E+01	C	1.10E-04	C	2.75E-06	53000	C	5	C	770	G
Phenacetin	62-44-2	179					NA						
Phenanthrene	85-01-8	178	1.00E+00	A	6.80E-04	A	1.59E-04	14000	C	4.46	A	2630	G
Phenobarbital	50-06-6	232	1.00E+03	B			NA	98	&	-0.19	B		
Phenol	108-95-2	94	9.30E+04	A	3.41E-01	A	4.54E-07	14.2	C	1.46	A	1.4	H
Phenylalanine Mustard	148-82-3	305					NA						
m-Phenylenediamine	108-45-2	108											
Phenyl Mercuric Acetate	62-38-4	337	1.67E+03	K									
Phosphine	7803-51-2	34											
Polychlorinated Biphenyls (PCBs)	1336-36-3	328	3.10E-02	C	7.70E-05	C	1.07E-03	530000	C	6.04	C	100000	G
Propane Sultone	1120-71-4	122					NA						
Propylenimine	75-55-8	57	9.44E+05	B	1.41E+02	B	1.12E-05	2.3	&	-0.48	B		
Pyrene	129-00-0	202	1.32E-01	A	2.50E-06	A	5.04E-06	38000	C	4.88	A		
Pyridine	110-86-1	79	1.00E+06	F	2.00E+01	F				0.66	F		
Saccharin	81-07-2	183					NA						
Safrole	94-59-7	162	1.50E+03	B	1.10E-04	B	1.29E-07	78	&	2.53	B		
Selenium and Compounds	7782-49-2	79			1.60E+00	E	NA					16	H
-- Selenious Acid	7783-00-8	129											
-- Selenourea	630-10-4	123											
-- Thallium Selenite	12039-52-0	488											
Silver and Compounds	7440-22-4	108			0.00E+00	D	NA					3080	D
Sodium Diethyldithiocarbamate	148-18-5	171											
Streptozocin	18883-66-4	457					NA						
Strychnine	[illegible]	[illegible]	[illegible]	[illegible]									

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Date Prepared: October 1, 1986

EXHIBIT A-2

HALF-LIVES IN VARIOUS MEDIA

Chemical Name	CAS #	Half-Life Range (Days) Soil Low	Soil High	Soil S*	Air Low	Air High	Air S*	Surface Water Low	Surface Water High	Surface Water S*	Ground Water Low	Ground Water High	Ground Water S*
Acenaphthene	83-32-9												
Acenaphthylene	208-96-8				5.50	-	M	0.125	-	M			
Acetone	67-64-1												
Acetonitrile	75-05-8				390.00	-	M	7.00	-	M			
2-Acetylaminofluorene	53-96-3												
Acrylic Acid	79-10-7												
Acrylonitrile	107-13-1				3.90	-	M	2.10	7.00	M			
Aflatoxin B1	1162-65-8												
Aldicarb	116-06-3												
Aldrin	309-00-2												
Allyl Alcohol	107-18-6							5.00	-	M			
Aluminum Phosphide	20859-73-8												
4-Aminobiphenyl	92-67-1												
Amitrole	61-82-5												
Ammonia	7664-41-7												
Anthracene	120-12-7												
Antimony and Compounds	7440-36-0				4.80	-	M	PERS**	-	M			
Arsenic and Compounds	7440-38-2				5.00	-	M	PERS	-	M			
Asbestos	1332-21-4				4.80	-	M	PERS	-	M			
Auramine	2465-27-2												
Azaserine	115-02-6												
Aziridine	151-56-4												
Barium and Compounds	7440-39-3				4.80	-	M	PERS	-	M			
Benefin	1861-40-1												
Benzene	71-43-2				6.00	-	A	1.00	6.00	A			
Benzidine	92-87-5												
Benz(a)anthracene	56-55-3				5.50	-	M	0.10	5.00	M			
Benz(c)acridine	225-51-4												
Benzo(a)pyrene	50-32-8	420.00	480.00	A	1.00	6.00	A	0.40	-	A			
Benzo(b)fluoranthene	205-99-2				5.50	-	M	1.00	2.00	M			
Benzo(ghi)perylene	191-24-2												
Benzo(k)fluoranthene	207-08-9												
Benzotrichloride	98-07-7												
Benzyl Chloride	100-44-7							1.50	-	M			
Beryllium and Compounds	7440-41-7												
1,1-Biphenyl	92-52-4												
Bis(2-chloroethyl)ether	111-44-4												
Bis(2-chloroisopropyl)ether	108-60-1												
Bis(chloromethyl)ether	542-88-1				0.14	2.00	M	0.0007	-	M			
Bis(2-ethylhexyl)phthalate (DEHP)	117-81-7												
Bromomethane	74-83-9												
Bromoxynil Octanoate	1689-99-2												
1,3-Butadiene	106-99-0												
n-Butanol	71-36-3												
Butylphthalyl Butylglycolate	85-70-1												
Cacodylic Acid	75-60-5												
Cadmium and Compounds	7440-43-9				4.80	-	M	PERS	-	M			
Captan	133-06-2												
Carbaryl	63-25-2												
Carbon Disulfide	75-15-0												
Carbon Tetrachloride	56-23-5				8030.00	-	A	0.30	300.00	A			
Chlordane	57-74-9				40.00	-	M	420.00	500.00	A			
Chlorobenzene	108-90-7				3.50	-	A	0.30	-	A			
Chlorobenzilate	510-15-6												

Date Prepared: October 1, 1986

EXHIBIT A-2
(Continued)

HALF-LIVES IN VARIOUS MEDIA

Chemical Name	CAS #	Half-Life Range (Days) Soil Low	Soil High	Soil S*	Air Low	Air High	Air S*	Surface Water Low	Surface Water High	Surface Water S*	Ground Water Low	Ground Water High	Ground Water S*
Chlorodibromomethane	124-48-1												
Chloroform	67-66-3				10.00	-	A	0.30	30.00	A			
Chloromethyl Methyl Ether	107-30-2												
4-Chloro-o-toluidine Hydrochloride	3165-93-3												
Chromium III and Compounds	7440-47-3												
Chromium VI and Compounds	7440-47-3				4.80	-	M	3.00	-	M			
Chrysene	218-01-9				5.50	-	M	0.20	-	M			
Copper and Compounds	7440-50-8												
Creosote	8001-58-9												
Cresol	1319-77-3												
Crotonaldehyde	123-73-9												
Cyanides	57-12-5				73000.00	-	M	0.33	0.80	M			
-- Barium Cyanide	542-62-1												
-- Calcium Cyanide	592-01-8												
-- Copper Cyanide	544-92-3												
-- Cyanogen	460-19-5												
-- Cyanogen Chloride	506-77-4												
-- Hydrogen Cyanide	74-90-8												
-- Nickel Cyanide	557-19-7												
-- Potassium Cyanide	151-50-8												
-- Potassium Silver Cyanide	506-61-6												
-- Silver Cyanide	506-64-9												
-- Sodium Cyanide	143-33-9												
-- Zinc Cyanide	557-21-1												
Cyclophosphamide	50-18-0												
Dalapon	75-99-0												
DDD	72-54-8												
DDE	72-55-9												
DDT	50-29-3	1000.00	5500.00	A				56.00	110.00	A			
Decabromodiphenyl Ether	1163-19-5												
Diallate	2303-16-4												
2,4-Diaminotoluene	95-80-7												
1,2,7,8-Dibenzopyrene	189-55-9												
Dibenz(a,h)anthracene	53-70-3				5.50	-	M	0.0208	2.08	M			
1,2-Dibromo-3-chloropropane	96-12-8												
Dibutylnitrosamine	924-16-3												
Dibutyl Phthalate	84-74-2												
1,2-Dichlorobenzene	95-50-1				26.00	-	M	1.50	8.50	M			
1,3-Dichlorobenzene	541-73-1												
1,4-Dichlorobenzene	106-46-7				23.00	-	M	1.50	8.50	M			
3,3'-Dichlorobenzidine	91-94-1												
Dichlorodifluoromethane	75-71-8												
1,1-Dichloroethane	75-34-3				45.00	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]			
1,2-Dichloroethane (EDC)	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]

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Date Prepared: October 1, 1986

EXHIBIT A-2
(Continued)

HALF-LIVES IN VARIOUS MEDIA

Chemical Name	CAS #	Half-Life Range (Days) Soil Low	Soil High	Soil S*	Air Low	Air High	Air S*	Surface Water Low	Surface Water High	Surface Water S*	Ground Water Low	Ground Water High	Ground Water S*
Dichlorophenylarsine	696-28-6												
1,2-Dichloropropane	78-87-5				80.00	-	M	1.40	7.70	M			
1,3-Dichloropropene	542-75-6							1.00	-	M			
Dieldrin	60-57-1												
Diepoxybutane	1464-53-5												
Diethanolnitrosamine	1116-54-7												
Diethyl Arsine	692-42-2												
1,2-Diethylhydrazine	1615-80-1												
Diethylnitrosamine	55-18-5												
Diethyl Phthalate	84-66-2												
Diethylstilbestrol (DES)	56-53-1												
Dihydrosafrole	94-58-6												
Dimethoate	60-51-5												
3,3'-Dimethoxybenzidine	119-90-4												
Dimethylamine	124-40-3												
Dimethyl Sulfate	77-78-1												
Dimethyl Terephthalate	120-61-6												
Dimethylaminoazobenzene	60-11-7												
7,12-Dimethylbenz(a)anthracene	57-97-6												
3,3'-Dimethylbenzidine	119-93-7												
Dimethylcarbamoyl Chloride	79-44-7												
1,1-Dimethylhydrazine	57-14-4												
1,2-Dimethylhydrazine	540-73-8												
Dimethylnitrosamine	62-75-9												
1,3-Dinitrobenzene	99-65-0							96.00	-	M			
4,6-Dinitro-o-cresol	534-52-1												
2,4-Dinitrophenol	51-28-5												
2,3-Dinitrotoluene	602-01-7												
2,4-Dinitrotoluene	121-14-2				133.00	-	M	0.40	10.00	M			
2,5-Dinitrotoluene	619-15-8												
2,6-Dinitrotoluene	606-20-2												
3,4-Dinitrotoluene	610-39-9												
Dinoseb	88-85-7												
1,4-Dioxane	123-91-1												
N,N-Diphenylamine	122-39-4												
1,2-Diphenylhydrazine	122-66-7												
Dipropylnitrosamine	621-64-7												
Disulfoton	298-04-4												
Endosulfan	115-29-7												
Epichlorohydrin	106-89-8				2.70	-	M	3.50	10.80	M			
Ethanol	64-17-5												
Ethyl Acetate	141-78-6												
Ethyl Methanesulfonate	62-50-0												
Ethylbenzene	100-41-4				1.46	-	A	1.50	7.50	A			
Ethyl-4,4'-dichlorobenzilate	510-15-6												
Ethylene Dibromide (EDB)	106-93-4												
Ethylene Oxide	75-21-8												
Ethylenethiourea	96-45-7												
1-Ethyl-nitrosourea	759-73-9												
Ethylphthalyl Ethyl Glycolate	84-72-0												
Ferric Dextran	9004-66-4												
Fluoranthene	206-44-0				5.50	-	M	1.00	2.00	M			
Fluorene	86-73-7												

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Date Prepared: October 1, 1986

EXHIBIT A-2
(Continued)

HALF-LIVES IN VARIOUS MEDIA

Chemical Name	CAS #	Half-Life Range (Days) Soil Low	Soil High	Soil S*	Air Low	Air High	Air S*	Surface Water Low	Surface Water High	Surface Water S*	Ground Water Low	Ground Water High	Ground Water S*
Fluorides	7782-41-4												
Fluridone	59756-60-4												
Formaldehyde	50-00-0				0.80	-	M	0.90	3.50	M			
Formic Acid	64-18-6												
Furan	110-00-9												
Glycidaldehyde	765-34-4												
Glycol Ethers	NA												
-- Diethylene Glycol, Monoethyl Ether	111-90-0												
-- 2-Ethoxyethanol	110-80-5												
-- Ethylene Glycol, Monobutyl Ether	111-76-2												
-- 2-Methoxyethanol	109-86-4												
-- Propylene Glycol, Monoethyl Ether	52125-53-8												
-- Propylene Glycol, Monomethyl Ether	107-98-2												
Heptachlor	76-44-8				40.00	-	M	0.96	-	M			
Heptachlor Epoxide	1024-57-3												
Hexachlorobenzene	118-74-1	1100.00	2200.00	A	80.00	-	M	0.30	300.00	A			
Hexachlorobutadiene	87-68-3				0.20	-	M	29.00	2300.00	A			
Hexachlorocyclopentadiene	77-47-4				0.14		M	0.007	-	M			
alpha-Hexachlorocyclohexane (HCCH)	319-84-6												
beta-HCCH	319-85-7												
gamma-HCCH (Lindane)	58-89-9												
delta-HCCH	319-86-8												
Hexachloroethane	67-72-1				7900	-	M	1.10	9.50	M			
Hexachlorophene	70-30-4												
Hydrazine	302-01-1												
Hydrogen Sulfide	7783-06-4												
Indeno(1,2,3-cd)pyrene	193-39-5				5.50	-	M	0.0208	2.08	M			
Iodomethane	77-88-4												
Iron and Compounds	15438-31-0												
Isobutanol	78-83-1												
Isoprene	78-79-5												
Isosafrole	120-58-1												
Isophorone	78-59-1												
Isopropalin	33820-53-0												
Kepone	143-50-0												
Lasiocarpine	303-34-4												
Lead and Compounds (Inorganic)	7439-92-1				4.80	-	M	PERS	-	M			
Linuron	330-55-2												
Malathion	121-75-7												
Manganese Compounds	7439-[illegible]												

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Date Prepared: October 1, 1986

EXHIBIT A-2
(Continued)

HALF-LIVES IN VARIOUS MEDIA

Chemical Name	CAS #	Half-Life Range (Days) Soil Low	Soil High	Soil S*	Air Low	Air High	Air S*	Surface Water Low	Surface Water High	Surface Water S*	Ground Water Low	Ground Water High	Ground Water S*
Methyl Methacrylate	80-62-6							15.00	-	M			
Methyl Parathion	298-00-0												
2-Methyl-4-chlorophenoxyacetic Acid	94-74-6												
2(2-Methyl)-4-Chlorophenoxy-propionic Acid	93-65-2												
3-Methylcholanthrene	56-49-3												
4,4'-Methylene-bis-2-chloroaniline	101-14-4												
Methylnitrosourea	684-93-5												
Methylthiouracil	56-04-2												
Methylvinylnitrosamine	4549-40-0												
N-Methyl-N'-nitro-N-nitrosoguanadin	70-25-7												
Mitomycin C	50-07-7												
Mustard Gas	505-60-2												
1-Napthylamine	134-32-7												
2-Napthylamine	91-59-8												
Nickel and Compounds	7440-02-0												
Nitric Oxide	10102-43-9												
Nitrobenzene	98-95-3							12.50	-	M			
Nitrogen Dioxide	10102-44-0												
Nitrosomethylurethane	615-53-2												
N-Nitrosopiperidine	100-75-4												
N-Nitrosopyrrolidine	930-55-2												
5-Nitro-o-toluidine	99-55-8												
Osmium Tetroxide	20816-12-0												
Pentachlorobenzene	608-93-5												
Pentachloronitrobenzene	82-68-8												
Pentachlorophenol	87-86-5				21.00	-	M	5.00	-	M			
Phenacetin	62-44-2												
Phenanthrene	85-01-8							0.38	2.00	A			
Phenobarbital	50-06-6												
Phenol	108-95-2				0.62	9.00	A	0.62	9.00	A			
Phenylalanine Mustard	148-82-3												
m-Phenylenediamine	108-45-2												
Phenyl Mercuric Acetate	62-38-4												
Phosphine	7803-51-2												
Polychlorinated Biphenyls (PCBs)	1336-36-3				58.00	-	M	2.00	12.90	M			
Propane Sultone	1120-71-4												
Propyleneimine	75-55-8												
Pyrene	129-00-0				0.08	2.00	A						
Pyridine	110-86-1							2.00	-	M			
Saccharin	81-07-2												
Safrole	94-59-7												
Selenium and Compounds	7782-49-2												
-- Selenious Acid	7783-00-8												
-- Selenourea	630-10-4												
-- Thallium Selenite	12039-52-0												
Silver and Compounds	7440-22-4												
Sodium Diethyldithiocarbamate	148-18-5												
Streptozocin	18883-66-4												
Strychnine	57-24-9												
Styrene	100-42-5												
1,2,4,5-Tetrachlorobenzene	95-94-3												
2,3,7,8-TCDD (Dioxin)	1746-01-6	3650.00	4380.00	A				365.00	730.00	A			

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EXHIBIT A 2
(Continued)

Date Prepared: October 1, 1986

HALF-LIVES IN VARIOUS MEDIA

Chemical Name	CAS #	Half-Life Range (Days) Soil Low	Soil High	Soil S*	Air Low	Air High	Air S*	Surface Water Low	Surface Water High	Surface Water S*	Ground Water Low	Ground Water High	Ground Water S*
1,1,1,2-Tetrachloroethane	630-20-6												
1,1,2,2-Tetrachloroethane	79-34-5												
Tetrachloroethylene	127-18-4				594.00	-	A	1.40	-	M			
2,3,4,6-Tetrachlorophenol	58-90-2				[illegible].00	-	A	0.08	-	A			
2,3,5,6-Tetrachloroterephthalate Acid (DCPA)								1.00	30.00	A			
Tetraethyl Lead	1861-32-1												
Thallium and Compounds	78-00-2												
-- Thallium Acetate	7440-28-0												
-- Thallium Carbonate	563-68-8												
-- Thallium Chloride	6533-73-9												
-- Thallium Nitrate	7791-12-0												
-- Thallic Oxide	10102-45-1												
-- Thallium Sulfate	1314-32-5												
Thioacetamide	7446-18-6												
Thiourea	62-55-5												
o-Tolidine	62-56-6												
Toluene	119-93-7												
o-Toluidine Hydrochloride	108-88-3												
Toxaphene	636-21-5				1.30	-	A	0.17	-	A			
Tribromomethane (Bromoform)	8001-35-2												
1,2,4-Trichlorobenzene	75-25-2				40.00	-	M	2.00	14.20	M			
1,1,1-Trichloroethane	120-82-1												
1,1,2-Trichloroethane	71-55-6												
Trichloroethylene	79-00-5				803.00	-	A	1.20	-	M			
Trichlorfon	79-01-6				24.00	-	A	0.14	7.00	A			
Trichloromonofluoromethane	52-68-6				3.70	-	A	1.90	-	A			
2,4,5-Trichlorophenol	75-69-4							1.00	90.00	A			
2,4,6-Trichlorophenol	95-95-4	72.00	-	A									
2,4,5-Trichlorophenoxyacetic Acid	88-06-2	5.00	-	A									
1,2,3-Trichloropropane	93-76-5				1.00	-	A	1.00	19.00	A			
1,1,2-Trichloro-1,2,2,-trifluoroethane	96-18-4												
Tris(2,3-dibromopropyl)phosphate	76-13-1												
Trinitrotoluene (TNT)	126-72-7												
Trypan Blue	118-96-7												
Uracil Mustard	72-57-1												
Uranium and Compounds	66-75-1												
Urethane	7440-61-1												
Vanadium and Compounds	51-79-6												
Vinyl Chloride	7440-62-2												
Warfarin	75-01-4												
o-Xylene	81-81-2				1.20	-	A	1.00	5.00	A			
m-Xylene	95-47-6												
[redacted]-Xy[redacted]	108-38-3												
[redacted]	[redacted]-42-[redacted]												

Date Prepared October 1, 1986

EXHIBIT A-3

TOXICITY DATA FOR POTENTIAL CARCINOGENIC EFFECTS -- SELECTION OF INDICATOR CHEMICALS ONLY [1]

Chemical Name	Oral Route: 10% Effective Dose (ED10) mg/kg/day	Oral Route: Toxicity Constant Water (wTc) 1/mg	Oral Route: Toxicity Constant Soil (sTc) kg/mg	Inhalation Route: 10% Effective Dose (ED10) mg/kg/day	Inhalation Route: Air Toxicity Constant (aTc) (m3/mg)
2-Acetylaminofluorene	2.60E-02	1.10E+00	5.50E-05	2.60E-02	1.10E+01
Acrylonitrile	4.39E-01	6.51E-02	3.26E-06	4.39E-01	6.51E-01
Aflatoxin B1	NA	NA	NA	NA	NA
Aldrin	1.52E-02	1.88E+00	9.40E-05	1.52E-02	1.88E+01
Amitrole	1.89E-01	1.51E-01	7.56E-06	1.89E-01	1.51E+00
Arsenic and Compounds	7.03E-03	4.07E+00	2.03E-04	7.03E-03	4.07E+01
Asbestos	NA	NA	NA	NA	NA
Auramine	1.08E+00	2.66E-02	1.33E-06	1.08E+00	2.66E-01
Azaserine	NA	NA	NA	NA	NA
Aziridine	3.60E-03	7.93E+00	3.97E-04	3.60E-03	7.93E+01
Benzene	3.70E+00	7.71E-03	3.86E-07	3.70E+00	7.71E-02
Benzidine	4.50E-04	6.34E+01	3.17E-03	4.50E-04	6.34E+02
Benz(a)anthracene	4.92E-02	5.81E-01	2.91E-05	4.92E-02	5.81E+00
Benz(c)acridine	6.67E-05	4.29E+02	2.14E-02	6.67E-05	4.29E+03
Benzo(a)pyrene	6.28E-03	4.55E+00	2.28E-04	6.28E-03	4.55E+01
Benzo(b)fluoranthene	NA	NA	NA	NA	NA
Benzo(k)fluoranthene	NA	NA	NA	NA	NA
Benzotrichloride	8.91E-03	3.21E+00	1.60E-04	8.91E-03	3.21E+01
Benzyl Chloride	NA	NA	NA	NA	NA
Beryllium and Compounds	NA	NA	NA	1.25E-02	2.28E+01
Bis(2-chloroethyl)ether	8.23E-02	3.47E-01	1.74E-05	8.23E-02	3.47E+00
Bis(chloromethyl)ether	7.22E-04	3.96E+01	1.98E-03	7.22E-04	3.96E+02
Bis(2-ethylhexyl)phthalate (DEHP)	5.00E+01	5.71E-04	2.86E-08	5.00E+01	5.71E-03
Cacodylic Acid	NA	NA	NA	NA	NA
Cadmium and Compounds	NA	NA	NA	1.73E-02	1.65E+01
Carbon Tetrachloride	1.52E-02	1.88E+00	9.41E-05	1.52E-02	1.88E+01
Chlordane	6.61E-02	4.32E-01	2.16E-05	6.61E-02	4.32E+00
Chloroform	5.08E-01	5.63E-02	2.81E-06	5.08E-01	5.63E-01
4-Chloro-o-toluidine Hydrochloride	8.13E-01	3.51E-02	1.76E-06	8.13E-01	3.51E-01
Chromium VI and Compounds	NA	NA	NA	2.57E-03	1.11E+02
Chrysene	NA	NA	NA	NA	NA
Cyclophosphamide	5.70E-02	5.01E-01	2.50E-05	5.70E-02	5.01E+00
DDD	7.69E-01	3.71E-02	1.86E-06	7.69E-01	3.71E-01
DDE	2.53E-01	1.13E-01	5.64E-06	2.53E-01	1.13E+00
DDT	1.79E-01	1.59E-01	7.97E-06	1.79E-01	1.59E+00
Diallate	4.24E-01	6.74E-02	3.37E-06	4.24E-01	6.74E-01

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Date Prepared:

EXHIBIT A-3
(Continued)

TOXICITY DATA FOR POTENTIAL CARCINOGENIC EFFECTS
-- SELECTION OF INDICATOR CHEMICALS ONLY

Chemical Name	Oral Route: 10% Effective Dose (ED10) mg/kg/day	Oral Route: Toxicity Constant: Water (wTc) 1/mg	Oral Route: Toxicity Constant: Soil (sTc) kg/mg	Inh: 10% Effect Dose (ED10) mg/kg/
Diaminotoluene (mixed)	3.40E-01	8.40E-02	4.20E-06	3.40
1,2,7,8-Dibenzopyrene	NA	NA	NA	
Dibenz(a,h)anthracene	2.83E-03	1.01E+01	5.04E-04	2.83E
1,2-Dibromo-3-chloropropane	6.00E-03	4.76E+00	2.38E-04	6.00
Dibutylnitrosamine	2.29E-02	1.25E+00	6.24E-05	2.29
3,3'-Dichlorobenzidine	1.20E-01	2.39E-01	1.19E-05	1.20E
1,2-Dichloroethane (EDC)	4.88E-01	5.86E-02	2.93E-06	4.88E
1,1-Dichloroethylene	2.33E-01	1.23E-01	6.14E-06	2.3
Dichloromethane	NA	NA	NA	
Dieldrin	7.81E-03	3.66E+00	1.83E-04	7.81E
Diepoxybutane	3.58E-02	7.98E-01	3.99E-05	3.58
Diethanolnitrosamine	NA	NA	NA	
Diethyl Arsine	NA	NA	NA	
1,2-Diethylhydrazine	NA	NA	NA	
Diethylnitrosamine	1.03E-03	2.77E+01	1.38E-03	1.03
Diethylstilbestrol (DES)	2.11E-04	1.35E+02	6.77E-03	2.11E
Dihydrosafrole	9.26E-01	3.09E-02	1.54E-06	9.26E
3,3'-Dimethoxybenzidine	2.00E+01	1.43E-03	7.14E-08	2.00
Dimethyl Sulfate	NA	NA	NA	
Dimethylaminoazobenzene	9.52E-03	3.00E+00	1.50E-04	9.52E
7,12-Dimethylbenz(a)anthracene	5.23E-06	5.46E+03	2.73E-01	5.23
3,3'-Dimethylbenzidene	3.70E-02	7.71E-01	3.86E-05	3.70
Dimethylcarbamoyl Chloride	1.98E-03	1.44E+01	7.22E-04	1.98E
1,1-Dimethylhydrazine	7.44E-02	3.84E-01	1.92E-05	7.44
1,2-Dimethylhydrazine	1.87E-04	1.53E+02	7.65E-03	1.87
Dimethylnitrosamine	3.91E-02	7.30E-01	3.65E-05	3.91E
Dinitrotoluene (mixed)	2.62E-01	1.09E-01	5.46E-06	2.62E
2,4-Dinitrotoluene	2.62E-01	1.09E-01	5.46E-06	2.62
2,6-Dinitrotoluene	NA	NA	NA	
1,4-Dioxane	2.94E+01	9.71E-04	4.85E-08	2.94E-
1,2-Diphenylhydrazine	2.19E-01	1.31E-01	6.53E-06	2.19
Dipropylnitrosamine	NA	NA	NA	
Epichlorohydrin	2.70E+00	1.06E-02	5.29E-07	2.70E-
Ethyl-4,4'-dichlorobenzilate	5.59E-01	5.11E-02	2.56E-06	5.59E
Ethylene Dibromide (EDB)	2.56E-03	1.11E+01	5.57E-04	2.56
Ethylene Oxide	4.13E-01	6.91E-02	3.46E-06	4.13E

Date Prepared: October 1, 1986

EXHIBIT A-3
(Continued)

TOXICITY DATA FOR POTENTIAL CARCINOGENIC EFFECTS
-- SELECTION OF INDICATOR CHEMICALS ONLY

Chemical Name	Oral Route: 10% Effective Dose (ED10) mg/kg/day	Oral Route: Toxicity Constant: Water (wTc) 1/mg	Oral Route: Toxicity Constant: Soil (sTc) kg/mg	Inhalation Route: 10% Effective Dose (ED10) mg/kg/day	Inhalation Route: Air Toxicity Constant (aTc) m3/mg
Ethylenethiourea	7.69E-01	3.71E-02	1.86E-06	7.69E-01	3.71E-01
Ethyl Methanesulfonate	5.58E-03	5.12E+00	2.56E-04	5.58E-03	5.12E+01
1-Ethyl-nitrosourea	1.14E-01	2.50E-01	1.25E-05	1.14E-01	2.50E+00
Formaldehyde	4.90E-02	5.83E-01	2.92E-05	4.90E-02	5.83E+00
Glycidaldehyde	3.45E-01	8.29E-02	4.14E-06	3.45E-01	8.29E-01
Heptachlor	8.93E-03	3.20E+00	1.60E-04	8.93E-03	3.20E+01
Heptachlor Epoxide	3.45E-03	8.28E+00	4.14E-04	3.45E-03	8.28E+01
Hexachlorobenzene	8.51E-02	3.36E-01	1.68E-05	8.51E-02	3.36E+00
Hexachlorobutadiene	1.69E+00	1.69E-02	8.43E-07	1.69E+00	1.69E-01
alpha-Hexachlorocyclohexane (HCCH)	1.83E-02	1.56E+00	7.79E-05	1.83E-02	1.56E+01
beta-HCCH	5.75E-01	4.97E-02	2.49E-06	5.75E-01	4.97E-01
gamma-HCCH (Lindane)	5.46E-01	5.23E-02	2.61E-06	5.46E-01	5.23E-01
Hexachloroethane	1.25E+01	2.29E-03	1.14E-07	1.25E+01	2.29E-02
Hydrazine	1.27E-02	2.25E+00	1.13E-04	1.27E-02	2.25E+01
Indeno(1,2,3-cd)pyrene	NA	NA	NA	NA	NA
Iodomethane	NA	NA	NA	NA	NA
Isosafrole	1.67E+00	1.71E-02	8.57E-07	1.67E+00	1.71E-01
Kepone	2.09E-02	1.37E+00	6.85E-05	2.09E-02	1.37E+01
Lasiocarpine	2.66E-02	1.08E+00	5.38E 05	2.66E-02	1.08E+01
Melphalan	9.09E-04	3.14E+01	1.57E-03	9.09E-04	3.14E+02
Methyl Chloride	1.05E+01	2.71E-03	1.36E-07	1.05E+01	2.71E-02
3-Methylcholanthrene	4.64E-02	6.16E-01	3.08E-05	4.64E-02	6.16E+00
4,4'-Methylene-bis-2-chloroaniline	8.20E-01	3.49E-02	1.74E-06	8.20E-01	3.49E-01
Methylnitrosourea	9.48E-05	3.01E+02	1.51E-02	9.48E-05	3.01E+03
Methylnitrosourethane	NA	NA	NA	NA	NA
Methylthiouracil	3.50E-02	8.16E-01	4.08E-05	3.50E-02	8.16E+00
Methylvinylnitrosamine	NA	NA	NA	NA	NA
N-Methyl-N'-nitro-N-nitrosoguanadine	1.79E-02	1.59E+00	7.97E-05	1.79E-02	1.59E+01
Mitomycin C	NA	NA	NA	NA	NA
1-Napthylamine	NA	NA	NA	NA	NA
2-Napthylamine	1.98E-01	1.44E-01	7.21E-06	1.98E-01	1.44E+00
Nickel and Compounds	NA	NA	NA	1.00E-01	2.85E+00
N-Nitrosopiperidine	3.88E-02	7.37E-01	3.68E-05	3.88E-02	7.37E+00
N-Nitrosopyrrolidine	5.36E-03	5.33E+00	2.66E-04	5.36E-03	5.33E+01
5-Nitro-o-toluidine	7.14E+00	4.00E-03	2.00E-07	7.14E+00	4.00E-02
Pentachloronitrobenzene	7.04E-01	4.06E-02	2.03E-06	7.04E-01	4.06E-01

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Date Prepared: Oc

EXHIBIT A-3
(Continued)

TOXICITY DATA FOR POTENTIAL CARCINOGENIC EFFECTS
-- SELECTION OF INDICATOR CHEMICALS ONLY

Chemical Name	Oral Route: 10% Effective Dose (ED10) mg/kg/day	Oral Route: Toxicity Constant Water (wTc) l/mg	Oral Route: Toxicity Constant Soil (sTc) kg/mg	Inhal: 10% Effecti Dose (ED10 mg/kg/da
Pentachlorophenol	NA	NA	NA	
Phenacetin	1.25E+01	2.29E-03	1.14E-07	1.25E+
Polychlorinated Biphenyls (PCBs)	5.00E-02	5.71E-01	2.86E-05	5.00E-0
Polynuclear Aromatic Hydrocarbons	NA	NA	NA	
Propane Sultone	2.85E-02	1.00E+00	5.01E-05	2.85E
1,2-Propylenimine	3.35E-02	8.53E-01	4.27E-05	3.35E-0
Saccharin	2.44E+02	1.17E-04	5.86E-09	2.44E
Safrole	5.00E+00	5.71E-03	2.86E-07	5.00E
Streptozocin	9.17E-03	3.12E+00	1.56E-04	9.17E-0
2,3,7,8-TCDD (Dioxin)	8.33E-06	3.43E+03	1.71E-01	8.33E-0
1,1,1,2-Tetrachloroethane	1.20E+00	2.37E-02	1.19E-06	1.20E
1,1,2,2-Tetrachloroethane	6.02E-01	4.74E-02	2.37E-06	6.02E
Tetrachloroethylene	3.23E+00	8.86E-03	4.43E-07	3.23E+0
Thioacetamide	4.04E-02	7.07E-01	3.54E-05	4.04E
Thiourea	9.52E-01	3.00E-02	1.50E-06	9.52E
o-Toluidine hydrochloride	6.37E-01	4.49E-02	2.24E-06	6.37E-0
Toxaphene	1.02E-01	2.80E-01	1.40E-05	1.02E-0
1,1,2-Trichloroethane	2.78E+00	1.03E-02	5.14E-07	2.78E
Trichloroethylene	6.67E+00	4.29E-03	2.14E-07	6.67E+0
2,4,6-Trichlorophenol	1.25E+01	2.29E-03	1.14E-07	1.25E+0
Tris(2,3-dibromopropyl)phosphate	1.02E-01	2.79E-01	1.39E-05	1.02E
Trypan Blue	2.78E+00	1.03E-02	5.14E-07	2.78E
Uracil Mustard	NA	NA	NA	N
Urethane	1.56E+00	1.83E-02	9.14E-07	1.56E
Vinyl Chloride	6.67E+00	4.29E-03	2.14E-07	6.67E

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[1] The list of chemicals presented in this exhibit is based on EPA's Re Quantities Analysis and should not be considered an all-inclusive list of sus carcinogens. Refer to Exhibit A-4 for toxicity data for risk characterizat chemicals listed here.

Date Prepared: October 1, 1986

EXHIBIT A-4

TOXICITY DATA FOR POTENTIAL CARCINOGENIC EFFECTS -- RISK CHARACTERIZATION [1]

Chemical Name	Oral Route: Potency Factor (PF) (mg/kg/d)-1	Oral Route: Source[2]	Oral Route: EPA Weight of Evidence	Inhalation Route: Potency Factor (PF) (mg/kg/d)-1	Inhalation Route: Source[2]	Inhalation Route: EPA Weight of Evidence
2-Acetylaminofluorene			B2			B2
Acrylonitrile			B1	2.40E-01	CAG	B1
Aflatoxin B1	2.90E+03	CAG	B2			B2
Aldrin	1.14E+01	CAG	B2			B2
Amitrole			B2			B2
Arsenic and Compounds	1.50E+01	HEA	A	5.00E+01	HEA	A
Asbestos			A			A
Auramine			B2			B2
Azaserine			B2			B2
Aziridine			B2			B2
Benzene	5.20E-02	HEA	A	2.60E-02	HEA	A
Benzidine			A	2.30E+02	CAG	A
Benz(a)anthracene			B2			B2
Benz(c)acridine			C			C
Benzo(a)pyrene	1.15E+01	HEA	B2	6.10E+00	HEA	B2
Benzo(b)fluoranthene			B2			B2
Benzo(k)fluoranthene			D			D
Benzotrichloride			B2			B2
Benzyl Chloride			C			C
Beryllium and Compounds	NA		B1	4.86E+00	CAG	B1
Bis(2-chloroeth,l)ether	1.10E+00	CAG	B2			B2
Bis(chloromethyl)ether			A	9.30E+03	CAG	A
Bis(2-ethylhexyl)phthalate (DEHP)	6.84E-04	CAG	B2			B2
Cacodylic Acid			D			D
Cadmium and Compounds	NA			6.10E+00	HEA	B1
Carbon Tetrachloride	1.30E-01	HEA	B2			B2
Chlordane	1.61E+00	HEA	B2			B2
Chloroform	8.10E-02	HEA	B2			B2
4-Chloro-o-toluidine Hydrochloride			B2			B2
Chromium VI and Compounds	NA			4.10E+01	HEA	A
Chrysene			B2			B2
Cyclophosphamide			B1			B1
DDD			B2			B2
DDE			B2			B2
DDT	3.40E-01	HEA	B2			B2

Date Prepared: [illegible]

EXHIBIT A-4
(Continued)

TOXICITY DATA FOR POTENTIAL CARCINOGENIC EFFECTS -- RISK CHARACTERIZATION

Chemical Name	Oral Route: Potency Factor (PF) (mg/kg/d)-1	Oral Route: Source[1]	Oral Route: EPA Weight of Evidence	Inhalation: Potency Factor (PF) (mg/kg/d)-1	Inhalation: Sc
Diallate			C		
Diaminotoluene (mixed)			B2		
1,2,7,8-Dibenzopyrene			B2		
Dibenz(a,h)anthracene			B2		
1,2-Dibromo-3-chloropropane			B2		
Dibutylnitrosamine	5.40E+00	CAG	B2		
3,3'-Dichlorobenzidine	1.70E+00	CAG	B2		
1,2-Dichloroethane (EDC)	9.10E-02	HEA	B2	3.50E-02	
1,1-Dichloroethylene	5.80E-01	HEA	C	1.16E+00	
Dichloromethane	7.50E-03	HEA	B2	1.43E-02	
Dieldrin	3.00E+01	CAG	B2		
Diepoxybutane			B2		
Diethanolnitrosamine			B2		
Diethyl Arsine			D		
1,2-Diethylhydrazine			B2		
Diethylnitrosamine	4.40E+01	CAG	B2		
Diethylstilbestrol (DES)			A		
Dihydrosafrole			B2		
3,3'-Dimethoxybenzidine			B2		
Dimethyl Sulfate			B2		
Dimethylaminoazobenzene			B2		
7,12-Dimethylbenz(a)anthracene			B2		
3,3'-Dimethylbenzidene			B2		
Dimethylcarbamoyl Chloride			B2		
1,1-Dimethylhydrazine			B2		
1,2-Dimethylhydrazine			B2		
Dimethylnitrosamine	2.60E+01	CAG	B2		
Dinitrotoluene (mixed)			B2		
2,4-Dinitrotoluene	3.10E-01	CAG	B2		
2,6-Dinitrotoluene			C		
1,4-Dioxane			B2		
1,2-Diphenylhydrazine	7.70E-01	CAG	B1		
Dipropylnitrosamine			B2		
Epichlorohydrin	9.90E-04	CAG	B2		
Ethyl-4,4'-dichlorobenzilate			B2		
Ethylene Dibromide (EDB)	4.10E+01	CAG	B2		

Date Prepared: October 1, 1986

EXHIBIT A-4
(Continued)

TOXICITY DATA FOR POTENTIAL CARCINOGENIC EFFECTS -- RISK CHARACTERIZATION

Chemical Name	Oral Route: Potency Factor (PF) (mg/kg/d)-1	Oral Route: Source[1]	Oral Route: EPA Weight of Evidence	Inhalation Route: Potency Factor (PF) (mg/kg/d)-1	Inhalation Route: Source[1]	Inhalation Route: EPA Weight of Evidence
Ethylene Oxide			B1/B2	3.50E-01	CAG	B1/B2
Ethylenethiourea			B2			B2
Ethyl Methanesulfonate			B2			B2
1-Ethyl-nitrosourea	3.30E+01	CAG	B2			B2
Formaldehyde			B2			B2
Glycidaldehyde			B2			B2
Heptachlor	3.40E+00	CAG	B2			B2
Heptachlor Epoxide	2.60E+00	CAG	B2			B2
Hexachlorobenzene	1.69E+00	HEA	B2			B2
Hexachlorobutadiene	7.75E-03	HEA	C			C
alpha-Hexachlorocyclohexane (HCCH)	1.10E+01	CAG	B2			B2
beta-HCCH	1.80E+00	CAG	C			C
gamma-HCCH (Lindane)	1.33E+00	HEA	B2/C			B2/C
Hexachloroethane	1.40E-02	CAG	C			C
Hydrazine			B2			B2
Indeno(1,2,3-cd)pyrene			C			C
Iodomethane			C			C
Isosafrole			B2			C
Kepone			B2			B2
Lasiocarpine			B2			B2
Melphalan			B1			B1
Methyl Chloride			C			C
3-Methylcholanthrene			B2			B2
4,4'-Methylene-bis-2-chloroaniline			B2			B2
Methylnitrosourea	3.00E+02	CAG	B2			B2
Methylnitrosourethane			B2			B2
Methylthiouracil			B2			B2
Methylvinylnitrosamine			B2			B2
N-Methyl-N'-nitro-N-nitrosoguanadine			B2			B2
Mitomycin C			B2			B2
1-Napthylamine			C			C
2-Napthylamine			A			A
Nickel and Compounds	NA		A	1.19E+00	HEA	A
N-Nitrosopiperidine			B2			B2
N-Nitrosopyrrolidine	2.10E+00	CAG	B2			B2
5-Nitro-o-toluidine			C			C

Date Prepared: Oct

EXHIBIT A-4
(Continued)

TOXICITY DATA FOR POTENTIAL CARCINOGENIC EFFECTS -- RISK CHARACTERIZATION

	Oral Route			Inhalat	
Chemical Name	Potency Factor (PF) (mg/kg/d)-1	Source[2]	EPA Weight of Evidence	Potency Factor (PF) (mg/kg/d)-1	Sour
Pentachloronitrobenzene			C		
Pentachlorophenol			D		
Phenacetin			B2		
Polychlorinated Biphenyls (PCBs)	4.34E+00	HEA	B2		
Polynuclear Aromatic Hydrocarbons	1.15E+01	HEA		6.11E+00	
Propane Sultone			B2		
1,2-Propylenimine			B2		
Saccharin			C		
Safrole			B2		
Streptozocin			B2		
2,3,7,8-TCDD (Dioxin)	1.56E+05	HEA	B2		
1,1,1,2-Tetrachloroethane			B2		
1,1,2,2-Tetrachloroethane	2.00E-01	HEA	C		
Tetrachloroethylene	5.10E-02	HEA	B2	1.70E-03	HE
Thioacetamide			B2		
Thiourea			B2		
o-Toluidine hydrochloride			B2		
Toxaphene	1.10E+00	CAG	B2		
1,1,2-Trichloroethane	5.73E-02	HEA	C		
Trichloroethylene	1.10E-02	HEA	B2	4.60E-03	
2,4,6-Trichlorophenol	1.98E-02	HEA	B2		
Tris(2,3-dibromopropyl)phosphate			B2		
Trypan Blue			B2		
Uracil Mustard			B2		
Urethane			B2		
Vinyl Chloride	2.30E+00	HEA	A	2.50E-02	

[1] The list of chemicals presented in this exhibit is based on EPA's Report Analysis and should not be considered an all-inclusive list of suspected carcin to Exhibit A-3 for toxicity constants for indicator selection for the chemicals l

[2] Sources for Exhibit A-4:

HEA = Health Effects Assessment, prepared by the Environmental Criteria Assessment Office, U.S. EPA, Cincinnati, Ohio, 1985 (updated in

CAG = Evaluation by Carcinogen Assessment Group, U.S. EPA, Washington, D

Date Prepared: October 1, 1986

EXHIBIT A-5

TOXICITY DATA FOR NONCARCINOGENIC EFFECTS -- SELECTION OF INDICATOR CHEMICALS ONLY [1]

Chemical Name	Oral Route: Minimum Effective Dose (MED) mg/day	RVe	Toxicity Constant: Water (wTn) l/mg	Toxicity Constant: Soil (sTn) kg/mg	Inhalation Route: Minimum Effective Dose (MED) mg/day	RVe	Air Toxicity Constant (aTn) m3/kg
Acemaphthene @							
Acemaphthylene @							
Acetone					1.23E+02	8	1.31E+00
Acetonitrile							
2-Acetylaminofluorene @							
Acrylic Acid	2.99E+01	9	6.02E-01	3.01E-05	4.34E+01	10	4.61E+00
Acrylonitrile @							
Aflatoxin B1 @							
Aldicarb							
Aldrin @	3.54E+00 *	6	3.39E+00	1.69E-04	3.54E+00	6	3.39E+01
Allyl Alcohol							
Aluminum Phosphide							
4-Aminobiphenyl @							
Amitrole @	8.80E-01	3	6.82E+00	3.41E-04	4.25E+01	5	2.35E+00
Ammonia							
Anthracene @	4.60E+00	10	4.35E+00	2.17E-04	7.00E-01	8	2.29E+02
Antimony and Compounds	1.00E+00	9	1.80E+01	9.00E-04	1.00E+00 *	9	1.80E+02
Arsenic and Compounds @					2.70E-02	10	7.41E+03
Asbestos @							
Auramine @							
Azaserine @							
Aziridine @	4.90E+00	10	4.08E+00	2.04E-04	4.90E+00 *	10	4.08E+01
Barium and Compounds							
Benefin	8.55E+01	5	1.17E-01	5.85E-06	1.70E+00	10	1.18E+02
Benzene @	2.24E+01	8	7.14E-01	3.57E-05	1.19E+01	7	1.18E-01
Benzidine @							
Benz(a)anthracene @							
Benz(c)acridine @	6.00E-01	8	2.67E+01	1.33E-03	6.28E+00	6	1.91E+01
Benzo(a)pyrene @							
Benzo(b)fluoranthene @							
Benzo(ghi)perylene @							
Benzo(k)fluoranthene @							
Benzotrichloride @							
Benzyl Chloride @					1.10E-02	8	1.45E+04
Beryllium and Compounds @							
1,1-Biphenyl							
Bis(2-chloroethyl)ether @	7.43E+02	10	2.69E-02	1.35E-06	7.43E+02 *	10	2.69E-01
Bis(2-chloroisopropyl)ether							
Bis(chloromethyl)ether @							
Bis(2-ethylhexyl)phthalate (DEHP) @							
Bromomethane							

Date Prepared: 0

EXHIBIT A-5
(Continued)

TOXICITY DATA FOR NONCARCINOGENIC EFFECTS -- SELECTION OF INDICATOR CHEMICALS ONLY

Chemical Name	Oral Route: Minimum Effective Dose (MED) mg/day	RVe	Toxicity Constant: Water (wTn) l/mg	Toxicity Constant: Soil (sTn) kg/mg	Inhala: Minimum Effective Dose (MED) mg/day
Bromoxynil Octanoate					
1,3-Butadiene	2.39E+00	4	3.35E+00	1.67E-04	2.39E+00 *
n-Butanol					
Butylphthalyl Butylglycolate					
Cacodylic Acid @					
Cadmium and Compounds @	4.49E+00	10	4.45E+00	2.23E-04	4.06E-01
Captan	9.85E+02	10	2.03E-02	1.02E-06	9.85E+02
Carbaryl					
Carbon Disulfide	3.30E+01 *	7	4.24E-01	2.12E-05	3.30E+01
Carbon Tetrachloride @	6.30E+01 *	10	3.17E-01	1.59E-05	6.30E+01
Chlordane @					
Chlorobenzene	5.60E+01	4	1.43E-01	7.14E-06	7.18E+01
Chlorobenzilate @					
Chlorodibromomethane	6.60E+00	6	1.82E+00	9.09E-05	6.60E+..
Chloroform @					
Chloromethyl Methyl Ether @					5.90E+00
4-Chloro-o-toluidine Hydrochloride@					
Chromium III and Compounds					
Chromium VI and Compounds @					6.40E+00
Chrysene @					
Copper and Compounds	1.40E+01	5	7.14E-01	3.57E-05	1.40E+01 *
Creosote @					
Cresol	1.34E+00 *	4	5.97E+00	2.99E-04	1.34E+00
Crotonaldehyde					
Cyanides (n.o.s.) [2]					
-- Barium Cyanide					
-- Calcium Cyanide					
-- Cyanogen					
-- Cyanogen Chloride					
-- Copper Cyanide					
-- Hydrogen Cyanide					
-- Nickel Cyanide					
-- Potassium Cyanide					
-- Potassium Silver Cyanide					
-- Silver Cyanide					
-- Sodium Cyanide					
-- Zinc Cyanide					
Cyclophosphamide @					
Dalapon					
DDD @					

Date Prepared: October 1, 1986

EXHIBIT A-5
(Continued)

TOXICITY DATA FOR NONCARCINOGENIC EFFECTS
-- SELECTION OF INDICATOR CHEMICALS ONLY

Chemical Name	Oral Route: Minimum Effective Dose (MED) mg/day	RVe	Toxicity Constant: Water (wTn) l/mg	Toxicity Constant: Soil (sTn) kg/mg	Inhalation Route: Minimum Effective Dose (MED) mg/day	RVe	Air Toxicity Constant (aTn) m3/kg
DDE @							
DDT @							
Decabromodiphenyl Ether							
Diallate @							
2,4-Diaminotoluene @							
1,2,7,8-Dibenzopyrene @							
Dibenz(a,h)anthracene @							
1,2-Dibromo-3-chloropropane @							
Dibutylnitrosamine @							
Dibutyl Phthalate	4.20E+02	8	3.81E-02	1.90E-06	4.20E+02 *	8	3.81E-01
1,2-Dichlorobenzene	1.54E+02	4	5.19E-02	2.60E-06	2.77E+02 *	5	3.61E-01
1,3-Dichlorobenzene	1.54E+02	4	5.19E-02	2.60E-06	2.77E+02	5	3.61E-01
1,4-Dichlorobenzene	1.54E+02	4	5.19E-02	2.60E-06	2.77E+02	5	3.61E-01
3,3'-Dichlorobenzidine @							
Dichlorodifluoromethane							
1,1-Dichloroethane	5.42E+02 *	7	2.58E-02	1.29E-06	5.42E+02	7	2.58E-01
1,2-Dichloroethane (EDC) @	1.14E+03	10	1.76E-02	8.80E-07	1.45E+02	8	1.10E+00
1,1-Dichloroethylene @	3.77E+01	7	3.71E-01	1.86E-05	1.77E+01	5	5.65E+00
1,2-Dichloroethylene (cis)	1.89E+02 *	5	5.29E-02	2.65E-06	1.89E+02	5	5.29E-01
1,2-Dichloroethylene (trans)	1.89E+02 *	5	5.29E-02	2.65E-06	1.89E+02	5	5.29E-01
Dichloromethane @	2.18E+04	10	9.20E-04	4.60E-08	2.18E+04 *	10	9.20E-03
2,4-Dichlorophenol	1.21E+02	5	8.26E-02	4.13E-06	1.21E+02 *	5	8.26E-01
2,4-Dichlorophenoxyacetic Acid (2,4-D)	1.29E+02	8	1.24E-01	6.20E-06	1.29E+02 *	8	1.24E+00
4-(2,4-Dichlorophenoxy)butyric Acid (2,4-DB)							
Dichlorophenylarsine @							
1,2-Dichloropropane	2.00E+02 *	10	1.00E-01	5.00E-06	2.00E+02	10	1.00E+00
1,3-Dichloropropene	6.00E-01	1	3.33E+00	1.67E-04	3.24E+00	5	3.09E+01
Dieldrin @							
Diepoxybutane @							
Diethanolnitrosamine @							
Diethyl Arsine @							
1,2-Diethylhydrazine @							
Diethylnitrosamine @							
Diethyl Phthalate	2.99E+04	4	2.67E-04	1.34E-08	2.99E+04 *	4	2.67E-03
Diethylstilbestrol (DES) @							
Dihydrosafrole @							
Dimethoate							
3,3'-Dimethoxybenzidine @							

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Date Prepared:

EXHIBIT A-5
(Continued)

TOXICITY DATA FOR NONCARCINOGENIC EFFECTS
-- SELECTION OF INDICATOR CHEMICALS ONLY

Chemical Name	Oral Route: Minimum Effective Dose (MED) mg/day	RVe	Toxicity Constant: Water (wTn) l/mg	Toxicity Constant: Soil (sTn) kg/mg	Inhal: Minimum Effectiv Dose (MED) mg/day
Dimethylamine					
Dimethyl Sulfate @	3.70E+01 *	6	3.24E-01	1.62E-05	3.70E+01
Dimethyl Terephthalate					
Dimethylaminoazobenzene @					
7,12-Dimethylbenz(a)anthracene @					
3,3'-Dimethylbenzidine @					
Dimethylcarbamoyl Chloride @					
1,1-Dimethylhydrazine @					
1,2-Dimethylhydrazine @					
Dimethylnitrosamine @					
1,3-Dinitrobenzene	1.35E+00	6	8.89E+00	4.44E-04	1.35E+00 *
4,6-Dinitro-o-cresol	2.45E+00	8	6.53E+00	3.27E-04	2.45E+00 *
2,4-Dinitrophenol	1.40E+01	8	1.14E+00	5.71E-05	1.40E+01 *
2,3-Dinitrotoluene @					
2,4-Dinitrotoluene @	2.05E+01	9	8.78E-01	4.39E-05	2.05E+01 *
2,5-Dinitrotoluene @					
2,6-Dinitrotoluene @	2.99E+01	9	6.02E-01	3.01E-05	2.99E+01 *
3,4-Dinitrotoluene @					
Dinoseb					
1,4-Dioxane @					
N,N-Diphenylamine @					
1,2-Diphenylhydrazine @	5.98E+01	10	3.34E-01	1.67E-05	5.98E+01 *
Dipropylnitrosamine @					
Disulfoton					
Endosulfan					
Epichlorohydrin @					
Ethanol	2.40E+04	10	8.33E-04	4.17E-08	2.40E+04 *
Ethyl Acetate					
Ethyl Methanesulfonate @					
Ethylbenzene	7.24E+02 *	4	1.10E-02	5.52E-07	7.24E+02
Ethyl-4,4'-dichlorobenzilate @					
Ethylene Dibromide (EDB) @					
Ethylene Oxide @					
Ethylenethiourea @					
1-Ethyl-nitrosourea @					
Ethylphthalyl Ethyl Glycolate					
Ferric Dextran @					
Fluoranthene @					
Fluorene @					
Fluorides	8.01E+00	5	1.25E+00	6.24E-05	

Date Prepared: October 1, 1986

EXHIBIT A-5
(Continued)

TOXICITY DATA FOR NONCARCINOGENIC EFFECTS
-- SELECTION OF INDICATOR CHEMICALS ONLY

Chemical Name	Oral Route: Minimum Effective Dose (MED) mg/day	RVe	Toxicity Constant: Water (wTn) l/mg	Toxicity Constant: Soil (sTn) kg/mg	Inhalation Route: Minimum Effective Dose (MED) mg/day	RVe	Air Toxicity Constant (aTn) m3/kg
Fluridone					1.00E+00	7	1.40E+02
Formaldehyde							
Formic Acid							
Furan							
Glycidaldehyde @							
Glycol Ethers (n.o.s.)							
-- Diethylene Glycol, Monoethyl Ether							
-- 2-Ethoxyethanol							
-- Ethylene Glycol, Monobutyl Ether							
-- 2-Methoxyethanol							
-- Propylene Glycol, Monoethyl Ether							
-- Propylene Glycol, Monomethyl Ether							
Heptachlor @							
Heptachlor Epoxide @							
Hexachlorobenzene @	5.00E+01	10	4.00E-01	2.00E-05	5.00E+01 *	10	4.00E+00
Hexachlorobutadiene @							
Hexachlorocyclopentadiene							
alpha-Hexachlorocyclohexane (HCCH)@							
beta-HCCH @							
gamma-HCCH (Lindane) @							
delta-HCCH @							
Hexachloroethane @	1.81E+03	6	6.62E-03	3.31E-07	4.49E+02	10	4.45E-01
Hexachlorophene	2.99E+01	9	6.02E-01	3.01E-05	2.99E+01 *	9	6.02E+00
Hydrazine @							
Hydrogen Sulfide							
Indeno(1,2,3-cd)pyrene @							
Iodomethane @							
Iron and Compounds							
Isobutanol							
Isoprene	5.50E+02 *	4	1.45E-02	7.27E-07	5.50E+02	4	1.45E-01
Isosafrole @							
Isophorone							
Isopropalin							
Kepone @							
Lasiocarpine @							
Lead and Compounds (Inorganic)	2.24E+01	10	8.93E-01	4.46E-05	2.24E+01 *	10	8.93E+00
Linuron							
Malathion							
Manganese and Compounds							
Melphalan @							

Date Prepared: 0

EXHIBIT A-5
(Continued)

TOXICITY DATA FOR NONCARCINOGENIC EFFECTS
-- SELECTION OF INDICATOR CHEMICALS ONLY

Chemical Name	Oral Route: Minimum Effective Dose (MED) mg/day	RVe	Toxicity Constant: Water (wTn) 1/mg	Toxicity Constant: Soil (sTn) kg/mg	Inhalation: Minimum Effective Dose (MED) mg/day
Mercury and Compounds (Alkyl)					
Mercury and Compounds (Inorganic)	7.60E-01	7	1.84E+01	9.21E-04	8.60E-01
Mercury Fulminate					
Methanol					
Methyl Chloride	2.21E+02 *	10	9.05E-02	4.52E-06	2.51E+02
Methyl Ethyl Ketone	2.58E+03 *	10	7.7[illegible]-03	3.87E-07	2.[illegible]E+03
Methyl Ethyl Ketone Peroxide					
Methyl Isobutyl Ketone					
Methyl Methacrylate	1.[illegible]5E+03	4	4.55E-03	2.28E-07	1.22E+02
Methyl Parathion	1.07E+01	10	1.87E+00	9.35E-05	2.40E-02
2-Methyl-4-Chlorophenoxyacetic Acid					
2(2-Methyl-4-Chlorophenoxy) propionic Acid					
3-Methylcholanthrene @					
4,4'-Methylene-bis-2-chloroaniline@					
Methylnitrosourea @					
Methylthiouracil @					
Methylvinylnitrosamine @					
N-Methyl-N'-nitro-N-nitrosoguanadine@					
Mitomycin C @					
Mustard Gas @					
1-Napthylamine @					
2-Napthylamine @					
Nickel and Compounds @	4.70E+00	10	4.26E+00	2.13E-04	1.27E+00
Nitric Oxide					
Nitrobenzene					
Nitrogen Dioxide					
Nitrosomethylurethane @					
N-Nitrosopiperidine @					
N-Nitrosopyrrolidine @					
5-Nitro-o-toluidine @					
Osmium Tetroxide					
Pentachlorobenzene	8.67E+02	10	2.3[illegible]E-02	1.16E-06	8.62E+02 *
Pentachloronitrobenzene @	2.20E-01	6	5.45E+01	2.73E-03	2.20E-01 *
Pentachlorophenol					
Phenacetin @					
Phenanthrene @					
Phenobarbital @					
Phenol	5.98E+01	3	1.00E-01	5.02E-06	8.02E+01
Phenylalanine Mustard @					

Date Prepared: October 1, 1986

EXHIBIT A-5
(Continued)

TOXICITY DATA FOR NONCARCINOGENIC EFFECTS
-- SELECTION OF INDICATOR CHEMICALS ONLY

Chemical Name	Oral Route: Minimum Effective Dose (MED) mg/day	RVe	Toxicity Constant: Water (wTn) l/mg	Toxicity Constant: Soil (sTn) kg/mg	Inhalation Route: Minimum Effective Dose (MED) mg/day	RVe	Air Toxicity Constant (aTn) m3/kg
m-Phenylenediamine							
Phenyl Mercuric Acetate							
Phosphine							
Polychlorinated Biphenyls (PCBs) @							
Propane Sultone @							
Propylenimine @							
Pyrene @							
Pyridine							
Saccharin @							
Safrole @							
Selenium and Compounds (n.o.s.)	1.90E-01	10	1.05E+02	5.26E-03	1.90E-01 *	10	1.05E+03
-- Selenious Acid							
-- Selenourea							
-- Thallium Selenite							
Silver and Compounds	1.00E-01	1	2.00E+01	1.00E-03	1.00E-01 *	1	2.00E+02
Sodium Diethyldithiocarbamate							
Streptozocin @							
Strychnine							
Styrene							
1,2,4,5-Tetrachlorobenzene	2.05E+01	1	9.76E-02	4.88E-06	2.05E+01 *	1	9.76E-01
2,3,7,8-TCDD (Dioxin) @							
1,1,1,2-Tetrachloroethane @							
1,1,2,2-Tetrachloroethane @	2.20E+01 *	5	4.55E-01	2.27E-05	2.20E+01	5	4.55E+00
Tetrachloroethylene @	1.46E+03	7	9.62E-03	4.81E-07	7.27E+03	10	2.75E-02
2,3,4,6-Tetrachlorophenol	1.07E+01	8	1.50E+00	7.48E-05	1.07E+01 *	8	1.50E+01
2,3,5,6-Tetrachloroterephthalate Acid (DCPA)							
Tetraethyl Lead @	1.40E-03	5	7.14E+03	3.57E-01	2.50E+00	5	4.00E-01
Thallium and Compounds (n.o.s.)							
-- Thallium Acetate							
-- Thallium Carbonate							
-- Thallium Chloride							
-- Thallium Nitrate							
-- Thallic Oxide							
-- Thallium Sulfate							
Thioacetamide @							
Thiourea @							
o-Tolidine @							
Toluene	2.69E+03 *	7	5.20E-03	2.60E-07	2.69E+03	7	5.20E-02
o-Toluidine Hydrochloride @							

Date Prepared:

EXHIBIT A-5
(Continued)

TOXICITY DATA FOR NONCARCINOGENIC EFFECTS
-- SELECTION OF INDICATOR CHEMICALS ONLY

Chemical Name	Oral Route: Minimum Effective Dose (MED) mg/day	RVe	Toxicity Constant: Water (wTn) l/mg	Toxicity Constant: Soil (sTn) kg/mg	Inhal: Minimum Effectiv Dose (MED) mg/day
Toxaphene @					
Tribromomethane (Brom form)	6.60E+00	6	1.82E+00	9.09E-05	6.60E+00 *
1,2,4-Trichlorobenzene	3.73E+01	4	2.14E-01	1.07E-05	1.32E+01
1,1,1-Trichloroethane	5.45E+03 *	2	7.33E-04	3.67E-08	5.45E+03
1,1,2-Trichloroethane @					
Trichloroethylene @	9.50E+00	5	1.05E+00	5.26E-05	2.90E+00
Trichlorofon	4.52E+01	10	4.42E-01	2.21E-05	4.52E+01
Trichloromonofluoromethane					
2,4,5-Trichlorophenol					
2,4,6-Trichlorophenol @	1.18E+02	6	1.02E-01	5.10E-06	1.18E+02 *
2,4,5-Trichlorophenoxyacetic Acid					
1,2,3-Trichloropropane					
1,1,2-Trichloro-1,2,2-trifluoroethane					
Tris(2,3-dibromopropyl)phosphate @					
Trinitrotoluene (TNT)					
Trypan Blue @					
Uracil Mustard @					
Uranium and Compounds					
Urethane @	1.70E+00	6	7.06E+00	3.53E-04	1.70E+00
Vanadium and Compounds					
Vinyl Chloride @	1.40E+01	1	1.43E-01	7.14E-06	1.40E+01 *
Warfarin	2.28E+02 *	10	8.77E-02	4.39E-06	2.28E+02
o-Xylene					
m-Xylene					
p-Xylene					
Xylenes (mixed)					
Zinc and Compounds					
-- Zinc Phosphide	1.50E+02	8	1.07E-01	5.33E-06	1.50E+02
Zineb					

@ Potential carcinogenic effects also. See Exhibits A-3 and A-4.

* MED and RVe values marked with an asterisk are based on values for the other route.

1/ Refer to Exhibit A-6 for toxicity data for risk characterization for the listed here.

2/ N.O.S = not otherwise specified.

Date Prepared: October 1, 1986

EXHIBIT A-6

TOXICITY DATA FOR NONCARCINOGENIC EFFECTS -- RISK CHARACTERIZATION [1]

Chemical Name	Oral Route: Acceptable Intake Subchron (AIS) --mg/kg/day--	Oral Route: Acceptable Intake Chronic (AIC) --mg/kg/day--	Oral Route: Source[1]	Inhalation Route: Acceptable Intake Subchron (AIS) --mg/kg/day--	Inhalation Route: Acceptable Intake Chronic (AIC) --mg/kg/day--	Inhalation Route: Source[1]
Acenaphthene @						
Acenaphthylene @						
Acetone		1.00E-01	RfD	3.00E+01	3.00E+00	HEA
Acetonitrile						
2-Acetylaminofluorene @						
Acrylic Acid		8.00E-02	RfD[1]			
Acrylonitrile @						
Aflatoxin B1 @						
Aldicarb		1.00E-02	RfD			
Aldrin @		3.00E-05	RfD			
Allyl Alcohol		5.00E-03	RfD			
Aluminum Phosphide		4.00E-04	RfD			
4-Aminobiphenyl @						
Amitrole @						
Ammonia						
Anthracene @						
Antimony and Compounds		4.00E-04	RfD			
Arsenic and Compounds @						
Asbestos @						
Auramine @						
Azaserine @						
Aziridine @						
Barium and Compounds		5.10E-02	HEA	1.4E-3(T)**	1.40E-04	HEA
Benefin		3.00E-01	RfD			
Benzene @						
Benzidine @						
Benz(a)anthracene @						
Benz(c)acridine @						
Benzo(a)pyrene @						
Benzo(b)fluoranthene @						
Benzo(ghi)perylene @						
Benzo(k)fluoranthene @						
Benzotrichloride @						
Benzyl Chloride @						
Beryllium and Compounds @		5.00E-04	RfD			
1,1-Biphenyl		5.00E-02	RfD			
Bis(2-chloroethyl)ether @						
Bis(2-chloroisopropyl)ether						
Bis(chloromethyl)ether @						
Bis(2-ethylhexyl)phthalate (DEHP) @		2.00E-02	RfD			
Bromomethane		4.00E-04	RfD			
Bromoxynil Octanoate		3.00E-02	RfD			
1,3-Butadiene						

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Date Prepared: 0

EXHIBIT A-6
(Continued)

TOXICITY DATA FOR NONCARCINOGENIC EFFECTS -- RISK CHARACTERIZATION

Chemical Name	Oral Route: Acceptable Intake Subchron (AIS) --mg/kg/day--	Oral Route: Acceptable Intake Chronic (AIC) --mg/kg/day--	Source	Inhalation: Acceptable Intake Subchron (AIS) --mg/kg/day--	Inhalation: Acceptable Intake Chronic (AIC) --mg/kg/day--
n-Butanol		1.00E-01	RfD		
Butylpthalyl Butylglycolate		1.00E+00	RfD		
Cacodylic Acid @		1.00E-02	RfD		
Cadmium and Compounds @		2.90E-04	HEA		
Captan					
Carbaryl		1.00E-01	RfD		
Carbon Disulfide		1.00E-01	RfD		
Carbon Tetrachloride @					
Chlordane @		5.00E-05	RfD		
Chlorobenzene	2.70E-01	2.70E-02	HEA	5.30E-02	5.70E-
Chlorobenzilate @					
Chlorodibromomethane					
Chloroform @					
Chloromethyl Methyl Ether @		1.00E-02	RfD		
4-Chloro-o-toluidine Hydrochloride@					
Chromium III and Compounds	1.40E+01	1.00E+00	RfD		
Chromium VI and Compounds @	2.50E-02	5.00E-03	HEA		5.10E
Chrysene @					
Copper and Compounds	3.70E-02	3.70E-02	HEA		
Creosote @					1.00
Cresol		5.00E-02	RfD		
Crotonaldehyde		1.00E-02	RfD		1.00E
Cyanides (n.o.s.) $J		2.00E-02	RfD		
-- Barium Cyanide		7.00E-02	RfD		
-- Calcium Cyanide		4.00E-02	RfD		
-- Cyanogen		4.00E-02	RfD		
-- Cyanogen Chloride		5.00E-02	RfD		
-- Copper Cyanide		7.00E-02	RfD		
-- Hydrogen Cyanide		2.00E-02	RfD		
-- Nickel Cyanide		2.00E-02	RfD		
-- Potassium Cyanide		5.00E-02	RfD		
-- Potassium Silver Cyanide		2.00E-01	RfD		
-- Silver Cyanide		1.00E-01	RfD		
-- Sodium Cyanide		4.00E-02	RfD		
-- Zinc Cyanide		5.00E-02	RfD		
Cyclophosphamide @					
Dalapon					
DDD @		8.00E-02	RfD		
DDE @					
DDT @					
Decabromodiphenyl Ether		5.00E-04	RfD		
Diallate @		1.00E-02	RfD		

Date Prepared: October 1, 1986

EXHIBIT A-6
(Continued)

TOXICITY DATA FOR NONCARCINOGENIC EFFECTS -- RISK CHARACTERIZATION

Chemical Name	Oral Route: Acceptable Intake Subchron (AIS) --mg/kg/day--	Oral Route: Acceptable Intake Chronic (AIC) --mg/kg/day--	Oral Route: Source	Inhalation Route: Acceptable Intake Subchron (AIS) --mg/kg/day--	Inhalation Route: Acceptable Intake Chronic (AIC) --mg/kg/day--	Inhalation Route: Source
2,4-Diaminotoluene @						
1,2,7,8-Dibenzopyrene @						
Dibenz(a,h)anthracene @						
1,2-Dibromo-3-chloropropane @						
Dibutylnitrosamine @						
Dibutyl Phthalate		1.00E-01	RfD			
1,2-Dichlorobenzene						
1,3-Dichlorobenzene						
1,4-Dichlorobenzene						
3,3'-Dichlorobenzidine @						
Dichlorodifluoromethane		2.00E-01	RfD			
1,1-Dichloroethane	1.20E+00	1.20E-01	HEA	1.38E+00	1.38E-01	HEA
1,2-Dichloroethane (EDC) @						
1,1-Dichloroethylene @		9.00E-03	RfD			
1,2-Dichloroethylene (cis)						
1,2-Dichloroethylene (trans)						
Dichloromethane @		6.00E-02	RfD			
2,4-Dichlorophenol		3.00E-03	RfD			
2,4-Dichlorophenoxyacetic Acid (2,4-D)						
4-(2,4-Dichlorophenoxy)butyric Acid (2,4-DB)		8.00E-03	RfD			
Dichlorophenylarsine @						
1,2-Dichloropropane						
1,3-Dichloropropene						
Dieldrin @						
Diepoxybutane @						
Diethanolnitrosamine @						
Diethyl Arsine @						
1,2-Diethylhydrazine @						
Diethylnitrosamine @						
Diethyl Phthalate		1.30E+01	RfD			
Diethylstilbestrol (DES) @						
Dihydrosafrole @						
Dimethoate		2.00E-02	RfD			
3,3'-Dimethoxybenzidine @						
Dimethylamine						
Dimethyl Sulfate @						
Dimethyl Terephthalate		1.00E-01	RfD			
Dimethylaminoazobenzene @						
7,12-Dimethylbenz(a)anthracene @						
3,3'-Dimethylbenzidine @						

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Date Prepared:

EXHIBIT A-6
(Continued)

TOXICITY DATA FOR NONCARCINOGENIC EFFECTS -- RISK CHARACTERIZATION

Chemical Name	Oral Route: Acceptable Intake: Subchron (AIS) --mg/kg/day--	Oral Route: Acceptable Intake: Chronic (AIC) --mg/kg/day--	Oral Route: Source	Inhalat: Acceptable I: Subchron (AIS) (A --mg/kg/d	
Dimethylcarbamoyl Chloride @					
1,1-Dimethylhydrazine @					
1,2-Dimethylhydrazine @					
Dimethylnitrosamine @					
1,3-Dinitrobenzene					
4,6-Dinitro-o-cresol					
2,4-Dinitrophenol					
2,3-Dinitrotoluene @		2.00E-03	RfD		
2,4-Dinitrotoluene @					
2,5-Dinitrotoluene @					
2,6-Dinitrotoluene @					
3,4-Dinitrotoluene @					
Dinoseb					
1,4-Dioxane @		1.00E-03	RfD		
N,N-Diphenylamine @					
1,2-Diphenylhydrazine @					
Dipropylnitrosamine @					
Disulfoton					
Endosulfan		4.00E-03	RfD		
Epichlorohydrin @		1.50E-05	RfD		
Ethanol		2.00E-03	RfD		
Ethyl Acetate					
Ethyl Methanesulfonate @		9.00E-01	RfD		
Ethylbenzene					
Ethyl-4,4'-dichlorobenzilate @	9.70E-01	1.00E-01	RfD		
Ethylene Dibromide (EDB) @					
Ethylene Oxide @					
Ethylenethiourea @					
1-Ethyl-nitrosourea @					
Ethylphthalyl Ethyl Glycolate					
Ferric Dextran @		3.00E+00	RfD		
Fluoranthene @					
Fluorene @					
Fluorides					
Fluridone		6.00E-02	RfD		
Formaldehyde		8.00E-02	RfD		
Formic Acid					
Furan		2.00E+00	RfD		
Glycidaldehyde @		1.00E-03	RfD		
Glycol Ethers (n.o.s.)					
-- Diethylene Glycol, Monoethyl Ether	5.00E+00	2.00E+00	HEA		

Date Prepared: October 1, 1986

EXHIBIT A-6
(Continued)

TOXICITY DATA FOR NONCARCINOGENIC EFFECTS -- RISK CHARACTERIZATION

Chemical Name	Oral Route: Acceptable Intake Subchron (AIS) --mg/kg/day--	Oral Route: Acceptable Intake Chronic (AIC) --mg/kg/day--	Oral Route: Source	Inhalation Route: Acceptable Intake Subchron (AIS) --mg/kg/day--	Inhalation Route: Acceptable Intake Chronic (AIC) --mg/kg/day--	Inhalation Route: Source
-- 2-Ethoxyethanol	4.7E-1(T)	3.60E-01	HEA	6.9E-2(T)	5.00E-02	HEA
-- Ethylene Glycol, Monobutyl Ether				1.60E-01	1.60E-02	HEA
-- 2-Methoxyethanol				5.9E-2(T)	2.40E-02	HEA
-- Propylene Glycol, Monoethyl Ether	6.80E+00	6.80E-01	HEA			
-- Propylene Glycol, Monomethyl Ether	6.80E+00	6.80E-01	HEA	4.90E+00	4.90E-01	HEA
Heptachlor @						
Heptachlor Epoxide @		3.00E-05	RfD			
Hexachlorobenzene @						
Hexachlorobutadiene @		2.00E-03	RfD			
Hexachlorocyclopentadiene	7.00E-02	7.00E-03	RfD	2.90E-03	6.60E-05	HEA
alpha-Hexachlorocyclohexane (HCCH)@						
beta-HCCH @						
gamma-HCCH (Lindane) @		3.00E-04	RfD			
delta-HCCH @						
Hexachloroethane @						
Hexachlorophene						
Hydrazine @						
Hydrogen Sulfide		3.00E-03	RfD			
Indeno(1,2,3-cd)pyrene @						
Iodomethane @						
Iron and Compounds						
Isobutanol					8.60E-03	HEA
Isoprene		3.00E-01	RfD			
Isosafrole @						
Isophorone		2.00E-01	RfD			
Isopropalin		3.00E-02	RfD			
Kepone @						
Lasiocarpine @						
Lead and Compounds (Inorganic)		1.40E-03	HEA		4.30E-04	HEA
Linuron						
Malathion		2.00E-02	RfD			
Manganese and Compounds	5.30E-01	2.20E-01	HEA	3.00E-04	3.00E-04	HEA
Melphalan @						
Mercury and Compounds (Alkyl)	2.80E-04	3.00E-04	RfD	1.00E-04	1.00E-04	HEA
Mercury and Compounds (Inorganic)	2.00E-03	2.00E-03	RfD	5.10E-04	5.10E-05	HEA
Mercury Fulminate		3.00E-03	RfD			
Methanol		5.00E-01	RfD			
Methyl Chloride						
Methyl Ethyl Ketone		5.00E-02	RfD	2.20E+00	2.20E-01	HEA

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Date Prepared: Oc

EXHIBIT A-6
(Continued)

TOXICITY DATA FOR NONCARCINOGENIC EFFECTS -- RISK CHARACTERIZATION

Chemical Name	Oral Route: Acceptable Intake Subchron (AIS) --mg/kg/day--	Oral Route: Acceptable Intake Chronic (AIC) --mg/kg/day--	Source	Inhalati: Acceptable In: Subchron (AIS) --mg/kg/da	Inhalati: Acceptable In: Ch (AI
Methyl Ethyl Ketone Perioxide		8.00E-03	RfD		
Methyl Isobutyl Ketone		5.00E-02	RfD		
Methyl Methacrylate					
Methyl Parathion					
2-Methyl-4-Chlorophenoxyacetic Acid		1.00E-03	RfD		
2(2-Methyl-4-Chlorophenoxy) propionic Acid		3.00E-03	RfD		
3-Methylcholanthrene @					
4,4 -Methylene-bis-2-chloroaniline @					
Methylnitrosourea @					
Methylthiouracil @					
Methylvinylnitrosamine @					
N-Methyl-N'-nitro-N-nitrosoguanadine @					
Mitomycin C @					
Mustard Gas @					
1-Napthylamine @					
2-Napthylamine @					
Nickel and Compounds @	2.00E-02	1.00E-02	HEA		
Nitric Oxide		1.00E-01	RfD		
Nitrobenzene		5.00E-04	RfD		
Nitrogen Dioxide		1.00E+00	RfD		
Nitrosomethylurethane @					
N-Nitrosopiperidine @					
N-Nitrosopyrrolidine @					
5-Nitro-o-toluidine @					
Osmium Tetroxide		1.00E-05	RfD		
Pentachlorobenzene		8.00E-04	RfD		
Pentachloronitrobenzene @		8.00E-03	RfD		
Pentachlorophenol	3.0E-2(T)	3.00E-02	RfD		
Phenacetin @					
Phenanthrene @					
Phenobarbital @					
Phenol	1.00E-01	1.00E-01	RfD	1.90E-01	2.0
Phenylalanine Mustard @					
m-Phenylenediamine		6.00E-03	RfD		
Phenyl Mercuric Acetate		8.00E-05	RfD		
Phosphine		3.00E-04	RfD		
Polychlorinated Biphenyls (PCBs) @					
Propane Sultone @					
Propylenimine @					
Pyrene @					
Pyridine		2.00E-03	RfD		

Date Prepared: October 1, 1986

EXHIBIT A-6
(Continued)

TOXICITY DATA FOR NONCARCINOGENIC
EFFECTS -- RISK CHARACTERIZATION

Chemical Name	Oral Route: Acceptable Intake Subchron (AIS) --mg/kg/day--	Oral Route: Acceptable Intake Chronic (AIC) --mg/kg/day--	Oral Route: Source	Inhalation Route: Acceptable Intake Subchron (AIS) --mg/kg/day--	Inhalation Route: Acceptable Intake Chronic (AIC) --mg/kg/day--	Inhalation Route: Source
Saccharin @						
Safrole @						
Selenium and Compounds (n.o.s.)	3.20E-03	3.00E-03	HEA		1.00E-03	HEA
-- Selenious Acid		3.00E-03	RfD			
-- Selenourea		5.00E-03	RfD			
-- Thallium Selenite		5.00E-04	RfD			
Silver and Compounds		3.00E-03	RfD			
Sodium Diethyldithiocarbamate		3.00E-02	RfD			
Streptozocin @						
Strychnine		3.00E-04	RfD			
Styrene		2.00E-01	RfD			
1,2,4,5-Tetrachlorobenzene		3.00E-04	RfD			
2,3,7,8-TCDD (Dioxin) @						
1,1,1,2-Tetrachloroethane @						
1,1,2,2-Tetrachloroethane @						
Tetrachloroethylene @		2.00E-02	RfD			
2,3,4,6-Tetrachlorophenol		1.00E-02	RfD			
2,3,5,6-Tetrachloroterephthalate Acid (DCPA)		5.00E-02	RfD			
Tetraethyl Lead @		1.00E-07	RfD			
Thallium and Compounds (n.o.s.)		4.00E-04	RfD			
-- Thallium Acetate		5.00E-04	RfD			
-- Thallium Carbonate		4.00E-04	RfD			
-- Thallium Chloride		5.00E-04	RfD			
-- Thallium Nitrate		5.00E-04	RfD			
-- Thallic Oxide		4.00E-04	RfD			
-- Thallium Sulfate		5.00E-04	RfD			
Thioacetamide @						
Thiourea @						
o-Tolidine @						
Toluene	4.30E-01	3.00E-01	RfD	1.50E+00	1.50E+00	HEA
o-Toluidine Hydrochloride @						
Toxaphene @						
Tribromomethane (Bromoform)						
1,2,4-Trichlorobenzene		2.00E-02	RfD			
1,1,1-Trichloroethane		5.40E-01	HEA	1.10E+01	6.30E+00	HEA
1,1,2-Trichloroethane @						
Trichloroethylene @						
Trichlorofon						
Trichloromonofluoromethane		3.00E-01	RfD			
2,4,5-Trichlorophenol	1.00E+00	1.00E-01	RfD			
2,4,6-Trichlorophenol @						

EXHIBIT A-6
(Continued)

Date Prepared: Octo

TOXICITY DATA FOR NONCARCINOGENIC EFFECTS -- RISK CHARACTERIZATION

Chemical Name	Oral Route: Acceptable Intake Subchron (AIS) --mg/kg/day--	Oral Route: Acceptable Intake Chronic (AIC) --mg/kg/day--	Source	Inhalation: Acceptable Intake Subchron (AIS) --mg/kg/day--	Inhalation: Acceptable Intake Chronic (AIC) --mg/kg/day--
2,4,5-Trichlorophenoxyacetic Acid		3.00E-02	RfD		
1,2,3-Trichloropropane		1.00E-01	RfD		
1,1,2-Trichloro-1,2,2-Trifluoroethane		3.00E+01	RfD		
Tris(2,3-dibromopropyl)phosphate @					
Trinitrotoluene (TNT)		2.00E-04	RfD		
Trypan Blue @					
Uracil Mustard @					
Uranium and Compounds					
Urethane @					
Vanadium and Compounds					
Vinyl Chloride @		2.00E-02	RfD		
Warfarin					
o-Xylene		3.00E-04	RfD		
m-Xylene	1.00E-01	1.00E-02	HEA	9.6E-1(T)	2.00E-(
p-Xylene	1.00E-01	1.00E-02	HEA	1.00E+00	2.00E
Xylenes (mixed)	1.00E-01	1.00E-02	HEA	6.9E-1(T)	4.00E-(
Zinc and Compounds	2.10E-01	2.10E-01	HEA	1.00E-01	1.00E-(
-- Zinc Phosphide		3.00E-04	RfD		
Zineb		5.00E-02	RfD		

@ Potential carcinogenic effects also. See Exhibits A-3 and A-4.

[1] Refer to Exhibit A-5 for toxicity data for indicator selection for the chemicals listed here.

[2] Sources for Exhibit A-6:

RfD = Agency-wide reference dose value, developed by an inter-office wo chaired by the Office of Research and Development, U.S. EPA, Washingto 1986.

HEA = Health Effects Assessment document, prepared by the Environmental and Assessment Office, U.S. EPA, Cincinnati, Ohio, 1985 (updated in M

[3] The RfD values listed here are EPA-verified numbers. All RfD values w derived based on oral exposure; however, in the absence of other more specif these values may also be useful in assessing risks of inhalation exposure.

[4] T indicates that teratogenic or fetotoxic effects are the basis for the value listed.

[5] N.O.S. = not otherwise specified.

EXHIBIT A-7

CHEMICALS AND CHEMICAL GROUPS HAVING EPA HEALTH EFFECTS ASSESSMENT (HEA) DOCUMENTS [1]

CHEMICAL	NTIS[2] PB NUMBER
Acetone	86 134277/AS
Arsenic and Compounds	86 134319/AS
Asbestos	86 134608/AS
Barium and Compounds	86 134327/AS
Benzene	86 134483/AS
Benzo(a)pyrene	86 134335/AS
Cadmium and Compounds	86 134491/AS
Carbon Tetrachloride	86 134509/AS
Chlordane	86 134343/AS
Chlorobenzene	86 134517/AS
Chloroform	86 134210/AS
Chromium III and Compounds	86 134467/AS
Chromium VI and Compounds	86 134301/AS
Coal Tars	86 134350/AS
Copper and Compounds	86 134368/AS
Cresol	86 134616/AS
Cyanides	86 134228/AS
DDT	86 134376/AS
1,1-Dichloroethane	86 134384/AS
1,2-Dichloroethane (EDC)	86 134137/AS
1,1-Dichloroethylene	86 134624/AS
1,2-cis-Dichloroethylene	86 134269/AS
1,2-trans-Dichloroethylene	86 134525/AS
Dichloromethane	86 134392/AS
Ethylbenzene	86 134194/AS
Glycol Ethers	86 134632/AS
Hexachlorobenzene	86 134285/AS
Hexachlorobutadiene	86 134640/AS
Hexachlorocyclopentadiene	86 134129/AS
gamma-Hexachlorocyclohexane (Lindane)	86 134673/AS
Iron and Compounds	86 134657/AS
Lead and Compounds (Inorganic)	86 134665/AS
Manganese and Compounds	86 134681/AS
Mercury	86 134533/AS
Methyl Ethyl Ketone	86 134145/AS
Naphthalene	86 134251/AS
Nickel and Compounds	86 134293/AS
Pentachlorophenol	86 134541/AS
Phenanthrene	86 134400/AS
Phenol	86 134186/AS
Polychlorinated Biphenyls (PCBs)	86 134152/AS

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EXHIBIT A-7
(Continued)

CHEMICALS AND CHEMICAL GROUPS HAVING EPA HEALTH EFFECTS ASSESSMENT (HEA) DOCUMENTS [1]

CHEMICAL	NTIS[2] PB NUMBER
Polynuclear Aromatic Hydrocarbons	86 134244/AS
Pyrene	86 134418/AS
Selenium and Compounds	86 134699/AS
Sodium Cyanide	86 134236/AS
Sulfuric Acid	86 134426/AS
2,3,7,8-TCDD (Dioxin)	86 134558/AS
1,1,2,2-Tetrachloroethane	86 134434/AS
Tetrachloroethylene	86 134202/AS
Toluene	86 134442/AS
1,1,1-Trichloroethane	86 134160/AS
1,1,2-Trichloroethane	86 134566/AS
Trichloroethylene	86 134574/AS
2,4,5-Trichlorophenol	86 134459/AS
2,4,6-Trichlorophenol	86 134582/AS
Vinyl Chloride	86 134475/AS
Xylene	86 134178/AS
Zinc and Compounds	86 134590/AS
Complete Set of 58 HEAs	86 134111/AS

[1] As of the date of publication for this manual.

[2] National Technical Information Service.

APPENDIX D

Glossary of Toxicological Terminology

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GLOSSARY

Toxicological Terminology

Amphoteric - capable of reacting chemically as an acid or base.

Argyria - permanent dark discoloration of the skin.

Carcinogenicity - the ability of a chemical to induce neoplasms (the growth of new tissue, i.e., tumors).

Digitalis - like toxicity - acting as a cardiac stimulant and diuretic.

Dyspnea - the feeling of an inability to breathe.

Erythema - abnormal redness of the skin due to capillary congestion (inflammation).

Fibrosis - formation of fibrous tissue in a reparative or reactive process.

Hematotoxic - relating to toxicity of the blood.

Lachrymation - producing tears.

Metabolism - the sum of the processes by which a foreign chemical is subjected to chemical change by living organisms; also the process by which organisms extract energy from food.

Mutagenicity - the ability of a chemical to cause changes in the genetic material in the cell nucleus in such ways that the changes can be transmitted during cell division.

Neuropathy - disease of the nervous system.

Organic ligand - group, ion or molecule coordinated to the central atom in a coordination complex.

Photolysis - chemical decomposition or dissociation by the action of radiant energy.

Squamous cell carcinoma - a malignant tumor affecting the outer layers of small scale-like cells of the stratified epithelium (epidermis of human skin).

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Glossary (Continued)

Teratogenicity - the ability of a chemical to effect the development of an organism between conception and birth.

Toxicity - the adverse effect of chemicals on living organisms. Exposure may be through skin contact, injection, ingestion or inhalation. Effects of exposure may range from life-threatening and injurious to irritation or behavioral changes.

Acute Toxicity - refers to the effects of a chemical which results from a single exposure lasting seconds, minutes or hours (up to 24 hours).

Chronic Toxicity - refers to the effects of a chemical which results from repeated exposure over a period greater than three months.

Subacute Toxicity - refers to the effects of a chemical which results from repeated exposure for a period of one month or less.

Subchronic Toxicity - refers to the effects of a chemical which results from repeated exposure over a period of one to three months.

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APPENDIX E-1

Calculations for Representative Concentrations
in Chapter 9, Table 9-2

Table E1-1: Summary of Inorganic Analyses of Dike Soils

Table E1-2: Summary of Average Dike Soil Concentration Using BDL Values

Table E1-3: Summary of Data for Pond Sludge

Table E1-4: Summary of REI and ERM Data for Evaporation System Soils

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TABLE E1-1
Summary of Inorganic Analyses of Dike Soils
Used to Calculate Representative
Dike Concentrations Found in Table 9-2

Chemical Name	DS-1 Dike 11	DS-1 Dike 12	DS-1 Dike 2011	DS-1 Dike 2012	DS-1 Dike 2013	DS-1 Dike 2014	DS-1 Dike 2015	AVERAGE DS-1
Depth of Sample	0-4'	4-8'	10-12'	12-14'	14-16'	16-18'	18-20'	
Sample Type	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	
Total Organic Carbon (%)	1.51	1.43	0.9	0.67	0.53	0.5	0.13	0.81
pH	8.53	8.25	8.09	8.35	7.81	7.38	7.56	8.00
METALS (mg/kg)								
Chromium	NT	NT	NT	NT	NT	NT	5	5.00
Lead	NT	NT	NT	NT	NT	NT	8	8.00
Nickel	NT	NT	NT	NT	NT	NT	8	8.00
Zinc	52	43	33	30	33	26	16	34.14

Chemical Name	DS-2 Dike 21	DS-2 Dike 2021	DS-2 Dike 2022	DS-2 Dike 2023	DS-2 Dike 2024	DS-2 Dike 2025	AVERAGE DS-2
Depth of Sample	0-3'	10-12'	12-14'	14-16'	16-18'	18-20'	
Sample Type	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	
Total Organic Carbon (%)	0.11	0.32	0.38	0.38	0.11	0.01	0.22
pH	8.7	7.6	7.54	8.16	8.5	8.72	8.21
METALS (mg/kg)							
Chromium	NT	NT	NT	NT	NT	4	4
Lead	NT	NT	NT	NT	NT	<5	<5
Nickel	NT	NT	NT	NT	NT	5	5
Zinc	32	19	15	13	11	10	16.67

Chemical Name	DS-3 Dike 31	DS-3 Dike 2031	DS-3 Dike 2032	DS-3 Dike 2033	DS-3 Dike 2034	DS-3 Dike 2035	AVERAGE DS-3
Depth of Sample	0-3'	10-12'	12-14'	14-16'	16-18'	18-20'	
Sample Type	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	
Total Organic Carbon (%)	0.86	0.3	0.2	0.06	0.02 ND	0.8	0.32
pH	8.98	7.86	8.36	8	8.44	9.23	8.31
METALS (mg/kg)							
Chromium	NT	NT	NT	NT	NT	11	11
Lead	NT	NT	NT	NT	NT	13	13
Nickel	NT	NT	NT	NT	NT	16	16
Zinc	23	20	12	13	12	33	18.83

Chemical Name	DS-4 Dike 2041	DS-4 Dike 2043	DS-4 Dike 2044	DS-4 Dike 2045	DS-4 Dike 1002	AVERAGE DS-4
Depth of Sample	10-12'	14-16'	16-18'	18-20'	22-24'	
Sample Type	SOIL	SOIL	SOIL	SOIL	SOIL	
Total Organic Carbon (%)	0.43	0.08	0.04 ND	0.06	0.09	0.12
pH	8.36	8.12	8.84	8.98	8.91	8.64
METALS (mg/kg)						
Chromium	NT	8	NT	NT	NT	8
Lead	NT	10	NT	NT	NT	10
Nickel	NT	12	NT	NT	NT	12
Zinc	41	22	11	10	17	20.20

Chemical Name	DS-5 Dike 51	DS-5 Dike 2052	DS-5 Dike 2053	DS-5 Dike 2054	DS-5 Dike 2055	DS-5 Dike 2056	AVERAGE DS-5
Depth of Sample	0-3'	12-14'	14-19'	19-21'	21-23'	23-25'	
Sample Type	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	
Total Organic Carbon (%)	0.88	1.75	0.5	0.41	0.04	0.34	0.65
pH	8.85	8.58	8.5	7.78	8.32	8.5	8.42
METALS (mg/kg)							
Chromium	NT	NT	NT	NT	NT	7	7
Lead	NT	NT	NT	NT	NT	6	6
Nickel	NT	NT	NT	NT	NT	9	9
Zinc	2900	60	51	30	25	17	513.83

Chemical Name	DS-6 Dike 61	DS-6 Dike 2061	DS-6 Dike 2062	DS-6 Dike 2063	DS-6 Dike 2064	DS-6 Dike 2065	DS-6 Dike 1004	AVERAGE DS-6
Depth of Sample	0-3'	9-11'	11-13'	13-15'	15-17'	17-19'	20-24'	
Sample Type	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	
Total Organic Carbon (%)	0.59	0.98	0.96	0.49	0.23	0.21	0.02 ND	0.50
pH	7.84	8.14	7.53	8.16	7.81	8	8.53	8.00
METALS (mg/kg)								
Chromium	NT	NT	NT	NT	NT	NT	5	5
Lead	NT	NT	NT	NT	NT	NT	8	8
Nickel	NT	NT	NT	NT	NT	NT	8	8
Zinc	24	23	49	40	17	17	15	26.57

TABLE E1-1 (Continued)
Summary of Inorganic Analyses of Dike Soils
Used to Calculate Representative
Dike Concentrations Found in Table 9-2

Chemical Name	DS-7 Dike 71	DS-7 Dike 72	DS-7 Dike 2071	DS-7 Dike 2072	DS-7 Dike 2073	DS-7 Dike 2074	AVERAGE DS-7	DS-8 Dike 81	DS-8 Dike 2082	DS-8 Dike 2083	DS-8 Dike 2084	DS-8 Dike 2085	DS-8 Dike 2086	AVERAGE DS-8
Depth of Sample	0-4'	4-7'	8-12'	12-14'	14-16'	16-18'		0-3'	10-12'	12-14'	14-16'	16-18'	18-20'	
Sample Type	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL		SOIL	SOIL	SOIL/ORG	SOIL	SOIL	SOIL	
Total Organic Carbon [%]	0.53	0.88	0.33	0.37	1.55	0.08	0.59	0.53	0.51	0.31	0.16	0.04 ND	0.04 ND	0.23
pH	8.59	8.08	7.89	7.48	8	7.89	8.00	8.1	7.54	8.1	8.46	8.36	8.39	8.16
METALS [mg/kg]														
Chromium	NT	NT	NT	NT	NT	5	5	NT	NT	10	NT	NT	NT	10
Lead	NT	NT	NT	NT	NT	7	7	NT	NT	9	NT	NT	NT	9
Nickel	NT	NT	NT	NT	NT	8	8	NT	NT	13	NT	NT	NT	13
Zinc	26	18	22	24	17	15	20.33	38	15	23	14	20	14	20.67

Chemical Name	DS-9 Dike 91	DS-9 Dike 2091	DS-9 Dike 2092	DS-9 Dike 2093	DS-9 Dike 2094	DS-9 Dike 2095	DS-9 Dike 2096	DS-9 Dike 2097	AVERAGE DS-9	AVERAGE "Unaffected"
Depth of Sample	0-3'	3-10'	10-12'	12-14'	14-16'	16-18'	20-22'	22-24'		
Sample Type	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL		
Total Organic Carbon [%]	0.63	1.32	0.44	0.17	0.44	0.07	0.13	0.03	0.40	0.63
pH	8.65	8.75	7.9	7.9	8.22	8.15	8.09	8.4	8.26	8.22
METALS [mg/kg]										
Chromium	NT	NT	NT	8	NT	NT	NT	NT	6	6.78
Lead	NT	NT	NT	6	NT	NT	NT	NT	6	7.44
Nickel	NT	NT	NT	7	NT	NT	NT	NT	7	9.56
Zinc	42	40	17	15	31	17	21	20	25.38	77.29

Chemical Name	DS-7 Dike 1003	DS-9 Dike 92	DS-8 Dike 82	DS-8 Dike 2081	DS-5 Dike 52	DS-5 Dike 2051	DS-6 Dike 62	DS-4 Dike 41	DS-4 Dike 42	DS-4 Dike 2042	DS-3 Dike 32	DS-1 Dike 1001	DS-2 Dike 22	AVERAGE Visible Waste	REPRES DIKE VALUES
Depth of Sample	7-9'	3-9'	3-8'	8-10'	5-10'	10-12'	3-6'	0-4'	4-9'	12-14'	4-8'	8-10'	4-8'		
Sample Type	WASTE	SLUDGE	SOIL/SLUDG	SLUDGE	WASTE	WASTE	SLUDGE	SOIL/SLUDG	SLUDGE	FREE OIL	SLUDGE	SLUDGE	SLUDGE		
Total Organic Carbon [%]	6.71	23.3	0.08	17.02	8.81	1.73	1.02	0.64	3.42	0.47	16.66	19.6	3.15	7.85	4.2
pH	8.32	8.61	8.25	6.2	7.19	8.5	4.61	8.87	7.57	8.72	8.45	8.73	8.57	8.09	8.2
METALS [mg/kg]															
Chromium	7	12	8	14	50		13		60		19	8	7	19.80	13
Lead	21	8	8	870	1200	NT	740	NT	18	NT	19	10	10	290.40	149
Nickel	7	16	10	9	38	NT	13	NT	20	NT	9	9	10	14.10	12
Zinc	670	1000	24	530	340	67	84	30	70	46	1100	2400	38	492.23	285

TABLE E1-2

Summary of Average Dike Soil Concentrations for Indicator Organics Using BDL Values.
Complete Data Analyses Are Summarized In Table 3-9.
These Data Used to Calculate Representative Dike Concentrations Found in Table 9-2.

CALCULATION OF AVERAGE DIKE SOIL CONCENTRATIONS FOR INDICATOR ORGANICS: BDLs INCLUDED (From Table 3-9)

Total Number of Samples analyzed for HSL Organics = 15

Number of Samples Labeled "sludge" or "waste" or "soil/sludge" = 10
Number of Samples Labeled "Soil" = 5

Overall dike average = [[SUM(sludge DLs & 1/2* BDLs)/10] + [SUM(soil DLs & 1/2*BDLs)/5]]/2.

Calculation of SUM(sludge DLs & 1/2*BDLs)/10

Chemical Name	Sample ID: Dike 1001	Dike 22	Dike 32	Dike 42	Dike 52	Dike 62	Dike 1003	Dike 82	Dike P081	Dike 92	SUM	No.=ND	AVERAGE	Overall Average Dike Conc.
Benzene	0.1	1.3	6	0.4 ND	210	1.7	1	11 ND	6	0.076	238	2	23	12
2,4-dimethylphenol	33 ND	3.3 ND	13 ND	16 ND	87	8.6 ND	33 ND	3.3 ND	3.3 ND	33 ND	202	8	16	8
Ethylbenzene	0.045 ND	2.8	2.8 ND	1.4	100	1.1	0.15 ND	11 ND	0.6	0.05 ND	120	5	11	6
Naphthalene	33 ND	3.3 ND	13 ND	16 ND	47	8.8 ND	33 ND	3.3	3.3 ND	33 ND	192	6	12	6
Total PCBs	10.7 ND	10.7 ND	107 ND	7.8	45	7.6	5.1 ND	7.7	107 ND	11 ND	316	6	19	10
Phenol	33 ND	20	57	22	640	87	33 ND	11	6.4	33 ND	852	3	80	45
Tetrachloroethylene	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0	10	ND	ND
Toluene	0.094	0.95	ND	8.9	180	1.5	ND	ND	3.6	0.081	195	3	19	10
Trichloroethylene	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0	10	ND	ND

Calculation of SUM(soil DLs & 1/2 BDLs)/5

Chemical Name	Sample ID: Dike 2042	Dike 2058	Dike 1004	Dike 2083	Dike 2093	SUM	No.=ND	AVERAGE
Benzene	0.013	0.005 ND	0.005 ND	0.005 ND	0.005 ND	0.033	4	0.005
2,4-dimethylphenol	1.6 ND	0.66 ND	0.33 ND	0.66 ND	0.33 ND	3.58	5	0.358 ND
Ethylbenzene	0.022	0.005 ND	0.005 ND	0.005 ND	0.005 ND	0.042	4	0.006
Naphthalene	1.6 ND	0.66 ND	0.33 ND	0.66 ND	0.33 ND	3.58	5	0.358 ND
Total PCBs	0.5 ND	1.1 ND	0.11 ND	0.11 ND	0.11 ND	1.92	5	0.192 ND
Phenol	1.6 ND	0.66 ND	0.33 ND	0.66 ND	0.33 ND	3.58	5	0.358 ND
Tetrachloroethylene	ND	ND	ND	ND	ND	0	5	ND
Toluene	0.016	0.005 ND	0.005 ND	0.005 ND	0.005 ND	0.036	4	0.005
Trichloroethylene	ND	ND	ND	ND	ND	0	5	ND

NOTES:

ND = Not Detected; Equivalent to BDL. Number next to ND is Detection Limit.

Tetrachloroethylene and Trichloroethylene were not detected in any samples; hence, no value is assigned to their ND designation.

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TABLE E1-3

Summary of Data for Pond Sludge (From Lab Sheets, Appendix 3, RI, 1987, and ERM/RMAL, 1988)
Data Used to Calculate Pond Sludge Concentrations Used in Table 9-2

Parameter	Sample ID - Units = mg/kg - SPL Data						ETC Data	TWDB Data		ERM Data	Overall	Overall
								03/01/76				(Excluding
	Composite 03/27/84	LS-7 03/27/84	LS-8 03/27/84	LS-2 03/27/84	LS-3 03/27/84	LS-5 03/27/84	Lagoon 1 05/30/84	North	South	Composite 06/18/87	Overall Average	Outliers)
Benzene	480						2500			170	1050	
2,4-Dimethylphenol							224			460	342	
Ethylbenzene	740						8480			580	3267	
Naphthalene	410						92			270	257	
Total PCBs	187	149	223	132	137	158	219			68	159	
Phenol	1150	378	73.1	272	261	588	1340			1500	695	
Tetrachloroethene	60						251			51	121	
Toluene	1750						36600 (outlier)			700	13017	1225
Trichloroethene	100										50 *	
Aroclor 1242	143	73	154	132	81	123	219				132	
Aroclor 1260	44	78	69	ND	56	35	ND			13	37	
Cr	302							183.1	300.6	160	236	
Pb								537.1	365.3	310	404	
Ni	52							69.5	76.3	69	67	
Zn	13800 (outlier)							633.9	115.6	970	3880	573

* = 1/2 of detected value.

TABLE E3-4

Summary of REI and ERM Data
for Evaporation System Soils

REI Data for Evaporation System Soils and Water

Evaporation System Samples Taken 03/28/84 (none in infill area)

Parameter	LP1 Soil	LP2 Soil	LP3 Soil	LP4 Soil	LP5 Soil	LP6 Soil	LP7 Brine	LP8 Sludge	
Percent H2O	11.6	22.7	14.2	29.2	31.5	14.8	41	16.4	
pH	6.7	8.0	8.5	8.5	8.5	8.8	6	8.7	
CEC (meq/100g)	57.7	54.6	56.7	50.1	35.6	53.7	25.1	52	
MAR	2.62	2.46	2.62	2.45	2.53	3	1.47	3.06	
Na (meq/100g)	11.8	16.1	10.9	14.5	17.5	15.5	4.9	24.1	
Ca (meq/100g)	37.2	41.4	43.4	41.9	40.8	41.7	19.8	37.1	
Mg (meq/100g)	4.2	3.46	4.48	5.47	6.37	6.88	3.77	6.66	
K (meq/100g)	1.35	2.34	1.7	1.4	1.84	1.09	1.57	3	
TDS (ppm)	1480	1160	844	1590	1900	1330	1760	1310	
SO4= (ppm)	455	190	312	674	902	867	464	565	
Cl- (ppm)	635	1222	1012	1014	1211	1095	124.4	670.1	
Arsenic (mg/kg)	<1.45	<1.44	<1.41	<1.41	<1.41	<1.41	<1.41	<1.41	
Cadmium (mg/kg)	<1.41	<1.41	<1.41	<1.45	1.14	1.41	11.4	1.75	
Chromium (mg/kg)	16.6	21.9	30	16.1	21.9	<1.41	7.2	21.1	DATA USED
Copper (mg/kg)	32.9	51.4	17.8	12.4	11.1	17.9	41.4	12.1	
Nickel (mg/kg)	<1.45	1.86	11.4	7.14	<1.41	<1.45	<1.45	<1.41	DATA USED
Lead (mg/kg)	<1.45	<1.41	<1.41	<1.42	<1.42	<1.41	<1.41	<1.45	*NOT USED*
Zinc (mg/kg)	107	41	65	77	110	61	40	66	
Exchg bases (meq/100g)	54.91	44.3	41.7	44.1	46	51	24.4	41.7	
PCBs	<1.0	NT	NT	NT	NT	<1.0	<1.0	<1.0	
Lead (TCLP) (ug/l)	102	55	70	66	46	42	121	42	DATA USED
Oil and Grease (ppm)	624	153	156	4900	4100	616	12100	57	
Phenol (mg/kg)	5.56	3.95	4.0	1.2	3.61	1.17	55.1	1.94	

Evaporation System Samples Taken 05/10/84 (none in infill area)

Parameter	LP1-100 Soil	LP2-B01 Soil	LP3-100 Soil	LP3 B01 Soil	LP6 100 Soil	LP6 B01 Soil	
Percent H2O	18.2	20.6	16	30.9	31.5	22.1	
Oil & Grease (%)	0.76	0.3	0.71	0.38	0.65	0.37	
Cl- (mg/kg)	2200	1450	3000	1510	1310	1130	
Zinc (mg/kg)	545	87	165	52	106	46	DATA USED
Chromium (mg/kg)	73	54	64	62	76	51	DATA USED
Lead (mg/kg)	160	85	60	42	54	46	DATA USED

ERM Data for Indicator Organics in Evaporation System Soils

Indicator Chemical	Evap-211 0.5'	Evap 211 2'	Evap-211 3	Evap 211 4	Evap II Evap Side AVERAGE	Evap 331 0.5	Evap-332 2	Evap-333 3	Evap 334 4	Evap-II Evap Side AVERAGE	No. of	OVERALL With 1/2 DL Evap Side AVERAGE	OVERALL Detected only Evap Side AVERAGE
Benzene	16	0.012	0.005 ND	0.005 ND	4.30	2.3 ND	0.06 ND	0.005 ND	0.005 ND	0.57 ND	8	2.62	0.01
2,4-DMP	33 ND	0.33 ND	0.33 ND	0.33 ND	8.50 ND	15 ND	0.33 ND	0.33 ND	1.5 ND	3.50 ND	8	3.73 ND	
Ethylbenzene	300	0.098	0.04	0.030	75	35	0.12	0.15	0.0047	5.40	8	44.06	64.00
Naphthalene	33 ND	0.33 ND	0.33 ND	0.33 ND	8.50 ND	15 ND	0.33 ND	0.33 ND	1.5 ND	3.13 ND	8	5.81 ND	
Total PCBs	14	NT	NT	NT	14	36	NT	NT	NT	36	2	25	25
Phenol	44	0.33 ND	0.33 ND	1.7	11.51	4.3 ND	0.47	0.36	3.3 ND	2.15	8	6.86	11.66
TetPCE	54 ND	0.005 ND	0.005 ND	0.005 ND	3.50 ND	1.5 ND	0.02 ND	0.005 ND	0.005 ND	0.17 ND	8	1.56 ND	
Toluene	67	0.054	0.011	0.005 ND	16.77	1.3 ND	0.01 ND	0.0069	0.005 ND	0.11	8	8.41	16.77
TCE	14 ND	0.005 ND	0.005 ND	0.005 ND	3.50 ND	1.3 ND	0.02 ND	0.005 ND	0.005 ND	0.17 ND	8	1.18 ND	

NOTE These samples were not tested for metals because of extensive metals testing done by REI

REI Data-Organics

Chemical						AVERAGE
Benzene	67.9	NT	NT	<0.022	NT	33.95
Ethylbenzene	519	NT	NT	<0.016	NT	259.5
Tetrachloroethylene	43.5	NT	NT	<0.21	NT	21.75
Toluene	263	NT	NT	<0.30	NT	131.5
2,4 dimethylphenol	49.4 56.2*	NT	NT	<0.090	NT	24.7
Phenol	5470 1400*	NT	NT	0.136	NT	735
N-Nitrosodiphenylamine	<30000	NT	NT	0.0751	NT	ND
Methylene chloride	<14	NT	NT	<0.014	NT	ND
Naphthalene	<4800	NT	NT	<0.051	NT	ND
Trichloroethene	<9.5	NT	NT	<0.0095	NT	ND
PCBs	<1.1E-05	NT	NT	<1.2	NT	ND

AVERAGE OF VISIBLE SLUDGE DETECTIONS ONLY (RMW & REI RESULT)

Chemical				
Benzene	67.9	16	1.5 ND	41.95
2,4 dimethylphenol	49.4	33 ND	11 ND	24.7
Ethylbenzene	519	100	21	301
Naphthalene	ND	33 ND	13 ND	ND
PCBs	ND	14	36	25
Phenol	1470	44	11 ND	757
Tetrachloroethylene	43.5	54 ND	1.5 ND	21.75
Toluene	263	67	1.5 ND	165
Trichloroethylene	ND	14 ND	1.5 ND	ND

* Second number is a QA/QC replicate by lab

Evaporation System Samples Taken 12/17/85 (one in infill area-ES13 - ES13 from infill)

Parameter	ES-13A Soil Comp 0-8"	ES-13B Soil-Grab 8-12"	ES-13C Soil-Grab 12-16"	ES-13D Soil-Grab 36-40"	ES-13E Soil-Grab 48-52"	AVERAGE	ES-14A Soil Comp 0-6"	ES-14B Soil-Grab 6-12"	ES-14C Soil-Grab 12-18"	ES-14D Soil-Grab 36-?"	ES-15A Soil Comp 0-6"	ES-15B Soil-Grab 6-11"	ES-15C Soil-Grab 12-18"	ES-15D Soil-Grab 35-39"	ES-16A Soil Comp 0-6"	ES-16B Soil-Grab 6-11	ES-16C Soil Grab 12-16"	ES-16D Soil Grab 35-39	ES-17A Soil Comp 0-6"	ES-17B Soil Comp 6-12"	ES-17C Soil Grab 16-20	ES-17D Soil-Grab "36"	AVERAGE (ALL)	AVERAGE (BACKGROUND)
Oil & Grease (mg/kg)	92000	11000	19900	350	385		14000	1051	416	150	599	235	456	489	401	752	127	570	49000	10000	3534	776		
% moisture	37	22	16	17	14		40	32	27	14	30	26	21	36	30	30	15	15	34	33	27	33		
Free Water (ppm)	5-10	5	50	2.0	3.5		NR	NR	NR	1.6	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	0.6	0.6		
Nickel (mg/kg)	42.9	40.6	41.7	15.1	11	31.5	25	17	35.7	13.7	22.6	21.6	21.9	33.9	21.7	34.6	29	29.6	36.3	26.3	24	10.5	24.5	
Chromium (mg/kg)	107	61.3	71.1	14.7	9	72.6	36.1	20.6	30	11	25.5	35.9	25.9	30.1	25.7	26	26.1	29.5	55.3	36.2	12	11	27.2	
Lead (mg/kg)	491	76.2	36.6	12.8	2.1	163.7	25.1	17.2	17.7	6.5	10.3	19.6	9.6	11.2	20.3	21	16.5	31.6	51	14.6	10.3	6	17.8	
Zinc (mg/kg)	1260	1160	1310	43.2	21.1	751.1	116	76.9	60.3	21.7	64.2	56.1	55.6	65.4	55.9	56.4	63.9	64.3	141	53.3	47.1	35.3	64.3	
ORGANICS (mg/kg)						AVERAGE																		
Benzene	67.9	NT	NT	<0.022	NT	33.95	NT	NT	NT	NT	NT	NT	NT	<0.022	NT	NT	NT	NT	NT	NT	NT	<0.022		
Ethylbenzene	519	NT	NT	<0.016	NT	259.5	NT	NT	NT	NT	NT	NT	NT	<0.016	NT	NT	NT	NT	NT	NT	NT	<0.016		
Tetrachloroethylene	43.5	NT	NT	<0.21	NT	21.75	NT	NT	NT	NT	NT	NT	NT	<0.21	NT	NT	NT	NT	NT	NT	NT	<0.021		
Toluene	263	NT	NT	<0.30	NT	131.5	NT	NT	NT	NT	NT	NT	NT	<0.30	NT	NT	NT	NT	NT	NT	NT	<0.030		
2,4-dimethylphenol	49.4-56.2	NT	NT	<0.090	NT	24.7	NT	NT	NT	NT	NT	NT	NT	<0.090	NT	NT	NT	NT	NT	NT	NT	<0.096		
Phenol	5470-1400	NT	NT	0.136	NT	735	NT	NT	NT	NT	NT	NT	NT	<0.050	NT	NT	NT	NT	NT	NT	NT	<0.054		
N-nitrosodiphenylamine	<30000	NT	NT	0.0751	NT	7500	NT	NT	NT	NT	NT	NT	NT	<0.061	NT	NT	NT	NT	NT	NT	NT	<0.061		
methylene chloride	<14	NT	NT	<0.014	NT	ND	NT	NT	NT	NT	NT	NT	NT	0.0601	NT	NT	NT	NT	NT	NT	NT	0.111		
															NT	NT	NT	NT	NT	NT	NT			

AVERAGES FOR BACKGROUND & INDICATOR METALS

Parameter	ES-13A	ES-13B	ES-13C	ES-13D	ES-13E	AVERAGE	ES-14A	ES-14B	ES-14C	ES-14D	ES-15A	ES-15B	ES-15C	ES-15D	ES-16A	ES-16B	ES-16C	ES-16D	ES-17A	ES-17B	ES-17C	ES-17D	AVERAGE (ALL)	AVERAGE (BACKGROUND)
Chromium (mg/kg)	Data for infill cell (see above ES-13A-13-E)						20.6	22.9	30	14.3	12.9	0.795	6.7	47.1										
Chromium (mg/kg)							71	54	64	62	76	55												
Chromium (mg/kg)	107	61.3	71.1	14.7	9	72.6	24.9	20.4	30	11	25.4	35.9	25.9	30.6	25.7	26	26.1	29.5	55.3	36.2	12	11	33.4	55.4
Zinc (mg/kg)							102	81	61	77	510	61	50	66										
Zinc (mg/kg)							145	52	101	51	100	46												
Zinc (mg/kg)	1260	1160	1310	43.2	21.1	751.1	116	76.9	60.3	21.7	64.2	56.1	55.6	65.4	55.9	56.4	63.9	64.3	141	53.3	47.1	35.3	150.6	72.4
Lead (mg/kg)	491	76.5	36.6	12.8	2.1	163.7	25.1	17.2	17.7	6.5	10.5	19.6	9.6	11.2	20.3	21	16.5	31.6	51	14.6	10.3	6		
Lead (TCLP) (ug/l)							102	55	70	66	46	42	121	62										
Lead (mg/kg)							160	85	60	47	54	46											56	45.7
Nickel (mg/kg)	42.9	41.6	41.7	15.1	11	30.5	25	17	35.2	19.7	30.6	21.6	22.9	33.9	21.7	34.6	29	29.6	36.3	26.3	24	10.5		
Nickel (mg/kg) (DL/2)							0.715	2.86	51.4	2.14	0.715	0.715	0.715	0.195									24.4	37.6

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APPENDIX E-2

Analytical Results of Soil Samples from Borrow Ditch

011530

Rocky Mountain
Analytical Laboratory

Enseco Incorporated

Enseco

ANALYTICAL RESULTS

FOR

ERM-SOUTHWEST, INC.

SEPTEMBER 10, 1987

011531

Reviewed by: Jean Zimmerman

Jerry L. Parr

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303/421-6611

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I. OVERVIEW

On August 8, 1987, Enseco-Rocky Mountain Analytical Laboratory received four soil samples from ERM-Southwest, Inc. A complete listing of tests requested, by sample, is given in Section III.

This report presents the analytical results as well as supporting information to aid in the evaluation and interpretation of the data and is arranged in the following order:

I. Overview
II. Sample Description Information
III. Analytical Tests Assigned
IV. Analytical Results
V. Quality Control Report
VI. Description of Analytical Methodology

Standard analytical protocols were followed in the analysis of the samples and no problems were encountered or anomalies observed. All laboratory QC samples analyzed in conjunction with the samples in this project were within established control limits.

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II. SAMPLE DESCRIPTION INFORMATION

The Sample Description Information lists all of the samples received in this project together with the internal laboratory identification number assigned for each sample. Each project received at Enseco - RMAL is assigned a unique five digit number. Samples within the project are numbered sequentially. The laboratory identification number is a combination of the five digit project code and the sample sequence number.

Also given in the Sample Description Information is the Sample Type (matrix), Date of Sampling (if known) and Date of Receipt at the laboratory.

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SAMPLE DESCRIPTION INFORMATION

for

ERM SOUTHWEST INC

RMAL Sample No.	Sample Description	Sample Type	Date Sampled	Date Received
64258-001	S-8 0-1	Soil	08/06/87	08/08/87
64258-002	S-8 3-4	Soil	08/06/87	08/08/87
64258-003	S-9 0-1	Soil	08/07/87	08/08/87
64258-004	S-9 4-5	Soil	08/07/87	08/08/87

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III. ANALYTICAL TESTS ASSIGNED

The following section presents all of the tests assigned to each of the samples in the project. The tests are listed in the order in which data is presented in Section IV. (Analytical Results).

In addition to a test description, information is provided concerning whether the test has been changed, or customized, to accommodate specific needs of the client. Customization can involve changes in the analyte list (addition or deletion of standard analytes) or changes in the standard detection limit.

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ANALYTICAL TESTS ASSIGNED

for

ERM SOUTHWEST INC

RMAL Sample No.	Analysis Description	Custom Test*
64258-001	PRIORITY POLLUTANT VOLATILE ORGANICS	NO
	PRIORITY POLLUTANT SEMIVOLATILE ORGANICS	NO
	ORGANOCHLORINE PESTICIDES/PCB's 608	NO
	MERCURY, COLD VAPOR AA TOTAL METALS	NO
	ARSENIC, FURNACE AA TOTAL METALS	NO
	SELENIUM, FURNACE AA TOTAL METALS	NO
	THALLIUM, FURNACE AA TOTAL METALS	NO
	PRIORITY POLLUTANT METALS TOTAL METALS	NO
	CYANIDE, TOTAL	NO
64258-002	PRIORITY POLLUTANT VOLATILE ORGANICS	NO
	PRIORITY POLLUTANT SEMIVOLATILE ORGANICS	NO
	ORGANOCHLORINE PESTICIDES/PCB's 608	NO
	MERCURY, COLD VAPOR AA TOTAL METALS	NO
	ARSENIC, FURNACE AA TOTAL METALS	NO
	SELENIUM, FURNACE AA TOTAL METALS	NO
	THALLIUM, FURNACE AA TOTAL METALS	NO
	PRIORITY POLLUTANT METALS TOTAL METALS	NO
	CYANIDE, TOTAL	NO
64258-003	PRIORITY POLLUTANT VOLATILE ORGANICS	NO
	PRIORITY POLLUTANT SEMIVOLATILE ORGANICS	NO
	ORGANOCHLORINE PESTICIDES/PCB's 608	NO
	MERCURY, COLD VAPOR AA TOTAL METALS	NO
	ARSENIC, FURNACE AA TOTAL METALS	NO

*This test has been customized in terms of analyte list or detection limit to accommodate special needs of the client.

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ANALYTICAL TESTS ASSIGNED (cont.)

for

ERM SOUTHWEST INC

RMAL Sample No.	Analysis Description	Custom Test*
64258-003	SELENIUM, FURNACE AA TOTAL METALS	NO
	THALLIUM, FURNACE AA TOTAL METALS	NO
	PRIORITY POLLUTANT METALS TOTAL METALS	NO
	CYANIDE, TOTAL	NO
64258-004	PRIORITY POLLUTANT VOLATILE ORGANICS	NO
	PRIORITY POLLUTANT SEMIVOLATILE ORGANICS	NO
	ORGANOCHLORINE PESTICIDES/PCB's 608	NO
	MERCURY, COLD VAPOR AA TOTAL METALS	NO
	ARSENIC, FURNACE AA TOTAL METALS	NO
	SELENIUM, FURNACE AA TOTAL METALS	NO
	THALLIUM, FURNACE AA TOTAL METALS	NO
	PRIORITY POLLUTANT METALS TOTAL METALS	NO
	CYANIDE, TOTAL	NO

*This test has been customized in terms of analyte list or detection limit to accommodate special needs of the client

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IV. ANALYTICAL RESULTS

The analytical results for this project are presented in the following data tables. The results are presented by sample, by test, with tests reported in the following order: GC/MS, Chromatography, Metals and Inorganics.

Each data table includes sample identification information, and when available and appropriate, dates sampled, received, authorized, prepared and analyzed. The authorization data is the date when the project was defined by the client such that laboratory work could begin.

Data sheets contain a listing of the parameters measured in each test, the analytical results and the Enseco reporting limit. Reporting limits are adjusted to reflect dilution of the sample, when appropriate. Solid and waste samples are reported on an "as received" basis, i.e. no correction is made for moisture content. All data is "blank corrected", i.e. the level of contamination, if any, found in the laboratory blank is subtracted from the analytical result before it is reported.

In addition, surrogate recovery data is presented for all GC/MS analyses. The surrogate recovery is an indication of the affect of the sample matrix on the performance of the method. The results from the Standard Enseco QA/QC Program, which generates data which are independent of matrix effects, is given in Section V.

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PRIORITY POLLUTANT VOLATILE ORGANICS

EPA METHOD 8240

Client Name: ERM SOUTHWEST INC

Client ID: S-8 0-1

Laboratory ID: 64258-001 Enseco ID: 64258-001

Matrix: Soil Sampled: 08/06/87 Received: 08/08/87

Authorized: 08/10/87 Prepared: 08/12/87 Analyzed: 08/28/87

Parameter	Result	Units (as received)	Reporting Limit
Benzene	N.D.	ug/kg	500
Bromoform	N.D.	ug/kg	500
Carbon tetrachloride	N.D.	ug/kg	500
Chlorobenzene	N.D.	ug/kg	500
Dibromochloromethane	N.D.	ug/kg	500
Chloroethane	N.D.	ug/kg	1000
2-Chloroethyl vinyl ether	N.D.	ug/kg	1000
Chloroform	N.D.	ug/kg	500
Bromodichloromethane	N.D.	ug/kg	500
1,1-Dichloroethane	N.D.	ug/kg	500
1,2-Dichloroethane	N.D.	ug/kg	500
1,1-Dichloroethene	N.D.	ug/kg	500
1,2-Dichloropropane	N.D.	ug/kg	500
Ethyl benzene	N.D.	ug/kg	500
Bromomethane	N.D.	ug/kg	1000
Chloromethane	N.D.	ug/kg	1000
Methylene chloride	N.D.	ug/kg	2500
1,1,2,2-Tetrachloroethane	N.D.	ug/kg	500
Tetrachloroethene	N.D.	ug/kg	500
Toluene	N.D.	ug/kg	500
trans-1,2-Dichloroethene	N.D.	ug/kg	500
1,1,1-Trichloroethane	N.D.	ug/kg	500
1,1,2-Trichloroethane	N.D.	ug/kg	500
Trichloroethene	N.D.	ug/kg	500
Vinyl chloride	N.D.	ug/kg	1000
trans-1,3-Dichloropropene	N.D.	ug/kg	500
cis-1,3-Dichloropropene	N.D.	ug/kg	500

N.D. = Not detected

011543

PRIORITY POLLUTANT VOLATILE ORGANICS (CONT.)

EPA METHOD 8240

Client Name: ERM SOUTHWEST INC

Client ID: S-8 0-1

Laboratory ID: 64258-001 Enseco ID: 64258-001

Matrix: Soil Sampled: 08/06/87 Received: 08/08/87

Authorized: 08/10/87 Prepared: 08/12/87 Analyzed: 08/28/87

Surrogate	Result	Units (as received)	Reporting Limit
Toluene-D8	107	%	-
Bromofluorobenzene(BFB)	98	%	-
1,2-Dichloroethane-D4	93	%	-

011544

N.D. = Not detected

Reported by: Julie Niermann Approved by: Michael Brooks

PRIORITY POLLUTANT SEMIVOLATILE ORGANICS

EPA METHOD 8270

Client Name: ERM SOUTHWEST INC

Client ID: S-8 0-1

Laboratory ID: 64258-001 Enseco ID: 64258-001

Matrix: Soil Sampled: 08/06/87 Received: 08/08/87

Authorized: 08/10/87 Prepared: 08/11/87 Analyzed: 08/25/87

Parameter	Result	Units (as received)	Reporting Limit
Acenaphthene	N.D.	ug/kg	660
Acenaphthylene	N.D.	ug/kg	660
Anthracene	N.D.	ug/kg	660
Benzo(a)anthracene	N.D.	ug/kg	660
Benzo(a)pyrene	N.D.	ug/kg	660
Benzo(b)fluoranthene	N.D.	ug/kg	660
Benzo(g,h,i)perylene	N.D.	ug/kg	660
Benzo(k)fluoranthene	N.D.	ug/kg	660
bis(2-Chloroethoxy) methane	N.D.	ug/kg	660
bis(2-Chloroethyl) ether	N.D.	ug/kg	660
bis(2-Chloroisopropyl) ether	N.D.	ug/kg	660
bis(2-Ethylhexyl) phthalate	N.D.	ug/kg	660
4-Bromophenyl phenyl ether	N.D.	ug/kg	660
Butyl benzyl phthalate	N.D.	ug/kg	660
2-Chloronaphthalene	N.D.	ug/kg	660
4-Chlorophenyl phenyl ether	N.D.	ug/kg	660
Chrysene	N.D.	ug/kg	660
Dibenzo(a,h)anthracene	N.D.	ug/kg	660
1,2-Dichlorobenzene	N.D.	ug/kg	660
1,3-Dichlorobenzene	N.D.	ug/kg	660
1,4-Dichlorobenzene	N.D.	ug/kg	660
3,3'-Dichlorobenzidine	N.D.	ug/kg	1300
Diethyl phthalate	N.D.	ug/kg	660
Dimethyl phthalate	N.D.	ug/kg	660
Di-n-butyl phthalate	N.D.	ug/kg	660
2,4-Dinitrotoluene	N.D.	ug/kg	660
2,6-Dinitrotoluene	N.D.	ug/kg	660
Di-n-octyl phthalate	N.D.	ug/kg	660
1,2-Diphenylhydrazine	N.D.	ug/kg	660
Fluoranthene	N.D.	ug/kg	660
Fluorene	N.D.	ug/kg	660

N.D. = Not detected

011545

PRIORITY POLLUTANT SEMIVOLATILE ORGANICS (CONT.)

EPA METHOD 8270

Client Name: ERM SOUTHWEST INC

Client ID: S-8 0-1

Laboratory ID: 64258-001 Enseco ID: 64258-001

Matrix: Soil Sampled: 08/06/87 Received: 08/08/87

Authorized: 08/10/87 Prepared: 08/11/87 Analyzed: 08/25/87

Parameter	Result	Units (as received)	Reporting Limit
Hexachlorobenzene	N.D.	ug/kg	660
Hexachlorobutadiene	N.D.	ug/kg	660
Hexachlorocyclopentadiene	N.D.	ug/kg	660
Hexachloroethane	N.D.	ug/kg	660
Indeno(1,2,3-c,d)pyrene	N.D.	ug/kg	660
Isophorone	N.D.	ug/kg	660
Naphthalene	N.D.	ug/kg	660
Nitrobenzene	N.D.	ug/kg	660
N-Nitroso-dipropylamine	N.D.	ug/kg	660
N-Nitrosodiphenylamine	N.D.	ug/kg	660
Phenanthrene	N.D.	ug/kg	660
Pyrene	N.D.	ug/kg	660
1,2,4-Trichlorobenzene	N.D.	ug/kg	660
2-Chlorophenol	N.D.	ug/kg	660
2,4-Dichlorophenol	N.D.	ug/kg	660
2,4-Dimethylphenol	N.D.	ug/kg	660
4,6-Dinitro-2-methylphenol	N.D.	ug/kg	3200
2,4-Dinitrophenol	N.D.	ug/kg	3200
2-Nitrophenol	N.D.	ug/kg	660
4-Nitrophenol	N.D.	ug/kg	3200
4-Chloro-3-methylphenol	N.D.	ug/kg	660
Pentachlorophenol	N.D.	ug/kg	3200
Phenol	N.D.	ug/kg	660
2,4,6-Trichlorophenol	N.D.	ug/kg	660
Surrogate			
Nitrobenzene-D5	81	%	-
2-Fluorobiphenyl	88	%	-
Terphenyl-D14	80	%	-
Phenol-D5	71	%	-

N.D. = Not detected

011546

PRIORITY POLLUTANT SEMIVOLATILE ORGANICS (CONT.)

EPA METHOD 8270

Client Name: ERM SOUTHWEST INC

Client ID: S-8 0-1

Laboratory ID: 64258-001 Enseco ID: 64258-001

Matrix: Soil Sampled: 08/06/87 Received: 08/08/87

Authorized: 08/10/87 Prepared: 08/11/87 Analyzed: 08/25/87

Surrogate	Result	Units (as received)	Reporting Limit
2-Fluorophenol	63	%	-
2,4,6-Tribromophenol	103	%	-

N.D. = Not detected

Reported by: Kevin Schilling Approved by: Michael Brooks

011547

Enseco

ORGANOCHLORINE PESTICIDES/PCB's 608

EPA METHOD 8080

Client Name: ERM SOUTHWEST INC

Client ID: S-8 0-1

Laboratory ID: 64258-001 Enseco ID: 64258-001

Matrix: Soil Sampled: 08/06/87 Received: 08/08/87

Authorized: 08/10/87 Prepared: 08/11/87 Analyzed: 09/03/87

Parameter	Result	Units (as received)	Reporting Limit
Aldrin	N.D.	ug/kg	400
alpha BHC	N.D.	ug/kg	400
beta BHC	N.D.	ug/kg	400
gamma BHC (Lindane)	N.D.	ug/kg	400
delta BHC	N.D.	ug/kg	400
Chlordane	6900	ug/kg	4000
4,4'-DDT	N.D.	ug/kg	800
4,4'-DDE	N.D.	ug/kg	800
4,4'-DDD	2700	ug/kg	800
Dieldrin	1700	ug/kg	800
Endosulfan I	N.D.	ug/kg	400
Endosulfan II	N.D.	ug/kg	800
Endosulfan sulfate	N.D.	ug/kg	800
Endrin	N.D.	ug/kg	800
Endrin Aldehyde	N.D.	ug/kg	800
Heptachlor	N.D.	ug/kg	400
Heptachlor Epoxide	N.D.	ug/kg	400
Aroclor-1242	N.D.	ug/kg	4000
Aroclor-1254	N.D.	ug/kg	8000
Aroclor-1221	N.D.	ug/kg	4000
Aroclor-1232	N.D.	ug/kg	4000
Aroclor-1248	N.D.	ug/kg	4000
Aroclor-1260	N.D.	ug/kg	8000
Aroclor-1016	N.D.	ug/kg	4000
Toxaphene	N.D.	ug/kg	8000
Methoxychlor	N.D.	ug/kg	4000

011548

N.D. = Not detected

Reported by: Margaret May

Approved by: Maureen McDevitt

Sample: 64258-001

METALS PARAMETERS
TOTAL METALS

Client Name: ERM SOUTHWEST INC

Client ID: S-8 0-1

Laboratory ID: 64258-001 Enseco ID: 64258-001

Matrix: Soil Sampled: 08/06/87 Received: 08/08/87

Authorized: 08/10/87

Parameter	Result	Units (as received)	Reporting Limit	Analytical Method	Analyzed
Antimony	N.D.	mg/kg	5	6010	08/24/87
Arsenic	12	mg/kg	0.6	7060	08/17/87
Beryllium	0.9	mg/kg	0.1	6010	08/24/87
Cadmium	N.D.	mg/kg	0.5	6010	08/24/87
Chromium	9	mg/kg	2	6010	08/24/87
Copper	45	mg/kg	0.6	6010	08/24/87
Lead	17	mg/kg	5	6010	08/24/87
Mercury	0.10	mg/kg	0.05	7471	08/25/87
Nickel	22	mg/kg	4	6010	08/24/87
Selenium	N.D.	mg/kg	0.8	7740	08/17/87
Silver	N.D.	mg/kg	0.5	200.7	08/24/87
Thallium	N.D.	mg/kg	0.8	7841	08/17/87
Zinc	60	mg/kg	1	6010	08/24/87

N.D. = Not detected

Approved by: Will Pratt

Sample: 64258-001

INORGANIC PARAMETERS

Client Name: ERM SOUTHWEST INC
Client ID: S-8 0-1
Laboratory ID: 64258-001 Enseco ID: 64258-001
Matrix: Soil Sampled: 08/06/87 Received: 08/08/87
Authorized: 08/10/87

Parameter	Result	Units (as received)	Reporting Limit	Analytical Method	Analyzed
Total Cyanide	N.D.	mg/kg	1	9010	08/24/87

011150

N.D. = Not detected

Approved by: Lindsay Breyer

Sample: 64258-001

PRIORITY POLLUTANT VOLATILE ORGANICS

EPA METHOD 8240

Client Name: ERM SOUTHWEST INC

Client ID: S-8 3-4

Laboratory ID: 64258-002 Enseco ID: 64258-002

Matrix: Soil Sampled: 08/06/87 Received: 08/08/87

Authorized: 08/10/87 Prepared: 08/12/87 Analyzed: 08/27/87

Parameter	Result	Units (as received)	Reporting Limit
Benzene	N.D.	ug/kg	500
Bromoform	N.D.	ug/kg	500
Carbon tetrachloride	N.D.	ug/kg	500
Chlorobenzene	N.D.	ug/kg	500
Dibromochloromethane	N.D.	ug/kg	500
Chloroethane	N.D.	ug/kg	1000
2-Chloroethyl vinyl ether	N.D.	ug/kg	1000
Chloroform	N.D.	ug/kg	500
Bromodichloromethane	N.D.	ug/kg	500
1,1-Dichloroethane	N.D.	ug/kg	500
1,2-Dichloroethane	N.D.	ug/kg	500
1,1-Dichloroethene	N.D.	ug/kg	500
1,2-Dichloropropane	N.D.	ug/kg	500
Ethyl benzene	N.D.	ug/kg	500
Bromomethane	N.D.	ug/kg	1000
Chloromethane	N.D.	ug/kg	1000
Methylene chloride	N.D.	ug/kg	2500
1,1,2,2-Tetrachloroethane	N.D.	ug/kg	500
Tetrachloroethene	N.D.	ug/kg	500
Toluene	N.D.	ug/kg	500
trans-1,2-Dichloroethene	N.D.	ug/kg	500
1,1,1-Trichloroethane	N.D.	ug/kg	500
1,1,2-Trichloroethane	N.D.	ug/kg	500
Trichloroethene	N.D.	ug/kg	500
Vinyl chloride	N.D.	ug/kg	1000
trans-1,3-Dichloropropene	N.D.	ug/kg	500
cis-1,3-Dichloropropene	N.D.	ug/kg	500

N.D. = Not detected

011551

PRIORITY POLLUTANT VOLATILE ORGANICS (CONT.)

EPA METHOD 8240

Client Name: ERM SOUTHWEST INC

Client ID: S-8 3-4

Laboratory ID: 64258-002 Enseco ID: 64258-002

Matrix: Soil Sampled: 08/06/87 Received: 08/08/87

Authorized: 08/10/87 Prepared: 08/12/87 Analyzed: 08/27/87

Surrogate	Result	Units (as received)	Reporting Limit
Toluene-D8	104	%	-
Bromofluorobenzene(BFB)	96	%	-
1,2-Dichloroethane-D4	94	%	-

011552

N.D. = Not detected

Reported by: Julie Niermann Approved by: Michael Brooks

PRIORITY POLLUTANT SEMIVOLATILE ORGANICS

EPA METHOD 8270

Client Name: ERM SOUTHWEST INC

Client ID: S-8 3-4

Laboratory ID: 64258-002 Enseco ID: 64258-002

Matrix: Soil Sampled: 08/06/87 Received: 08/08/87

Authorized: 08/10/87 Prepared: 08/11/87 Analyzed: 08/26/87

Parameter	Result	Units (as received)	Reporting Limit
Acenaphthene	N.D.	ug/kg	330
Acenaphthylene	N.D.	ug/kg	330
Anthracene	N.D.	ug/kg	330
Benzo(a)anthracene	N.D.	ug/kg	330
Benzo(a)pyrene	N.D.	ug/kg	330
Benzo(b)fluoranthene	N.D.	ug/kg	330
Benzo(g,h,i)perylene	N.D.	ug/kg	330
Benzo(k)fluoranthene	N.D.	ug/kg	330
bis(2-Chloroethoxy) methane	N.D.	ug/kg	330
bis(2-Chloroethyl) ether	N.D.	ug/kg	330
bis(2-Chloroisopropyl) ether	N.D.	ug/kg	330
bis(2-Ethylhexyl) phthalate	N.D.	ug/kg	330
4-Bromophenyl phenyl ether	N.D.	ug/kg	330
Butyl benzyl phthalate	N.D.	ug/kg	330
2-Chloronaphthalene	N.D.	ug/kg	330
4-Chlorophenyl phenyl ether	N.D.	ug/kg	330
Chrysene	N.D.	ug/kg	330
Dibenzo(a,h)anthracene	N.D.	ug/kg	330
1,2-Dichlorobenzene	N.D.	ug/kg	330
1,3-Dichlorobenzene	N.D.	ug/kg	330
1,4-Dichlorobenzene	N.D.	ug/kg	330
3,3'-Dichlorobenzidine	N.D.	ug/kg	660
Diethyl phthalate	N.D.	ug/kg	330
Dimethyl phthalate	N.D.	ug/kg	330
Di-n-butyl phthalate	N.D.	ug/kg	330
2,4-Dinitrotoluene	N.D.	ug/kg	330
2,6-Dinitrotoluene	N.D.	ug/kg	330
Di-n-octyl phthalate	N.D.	ug/kg	330
1,2-Diphenylhydrazine	N.D.	ug/kg	330
Fluoranthene	N.D.	ug/kg	330
Fluorene	N.D.	ug/kg	330

N.D. = Not detected

011553

PRIORITY POLLUTANT SEMIVOLATILE ORGANICS (CONT.)

EPA METHOD 8270

Client Name: ERM SOUTHWEST INC

Client ID: S-8 3-4

Laboratory ID: 64258-002 Enseco ID: 64258-002

Matrix: Soil Sampled: 08/06/87 Received: 08/08/87

Authorized: 08/10/87 Prepared: 08/11/87 Analyzed: 08/26/87

Parameter	Result	Units (as received)	Reporting Limit
Hexachlorobenzene	N.D.	ug/kg	330
Hexachlorobutadiene	N.D.	ug/kg	330
Hexachlorocyclopentadiene	N.D.	ug/kg	330
Hexachloroethane	N.D.	ug/kg	330
Indeno(1,2,3-c,d)pyrene	N.D.	ug/kg	330
Isophorone	N.D.	ug/kg	330
Naphthalene	N.D.	ug/kg	330
Nitrobenzene	N.D.	ug/kg	330
N-Nitroso-dipropylamine	N.D.	ug/kg	330
N-Nitrosodiphenylamine	N.D.	ug/kg	330
Phenanthrene	N.D.	ug/kg	330
Pyrene	N.D.	ug/kg	330
1,2,4-Trichlorobenzene	N.D.	ug/kg	330
2-Chlorophenol	N.D.	ug/kg	330
2,4-Dichlorophenol	N.D.	ug/kg	330
2,4-Dimethylphenol	N.D.	ug/kg	330
4,6-Dinitro-2-methylphenol	N.D.	ug/kg	1600
2,4-Dinitrophenol	N.D.	ug/kg	1600
2-Nitrophenol	N.D.	ug/kg	330
4-Nitrophenol	N.D.	ug/kg	1600
4-Chloro-3-methylphenol	N.D.	ug/kg	330
Pentachlorophenol	N.D.	ug/kg	1600
Phenol	N.D.	ug/kg	330
2,4,6-Trichlorophenol	N.D.	ug/kg	330
Surrogate			
Nitrobenzene-D5	74	%	-
2-Fluorobiphenyl	89	%	-
Terphenyl-D14	84	%	-
Phenol-D5	66	%	-

N.D. = Not detected

011554

PRIORITY POLLUTANT SEMIVOLATILE ORGANICS (CONT.)

EPA METHOD 8270

Client Name: ERM SOUTHWEST INC

Client ID: S-8 3-4

Laboratory ID: 64258-002 Enseco ID: 64258-002

Matrix: Soil Sampled: 08/06/87 Received: 08/08/87

Authorized: 08/10/87 Prepared: 08/11/87 Analyzed: 08/26/87

Surrogate	Result	Units (as received)	Reporting Limit
2-Fluorophenol	63	%	-
2,4,6-Tribromophenol	100	%	-

011555

N.D. = Not detected

Reported by: Kevin Schilling Approved by: Michael Brooks

Enseco

ORGANOCHLORINE PESTICIDES/PCB's 608

EPA METHOD 8080

Client Name: ERM SOUTHWEST INC

Client ID: S-8 3-4

Laboratory ID: 64258-002 Enseco ID: 64258-002

Matrix: Soil Sampled: 08/06/87 Received: 08/08/87

Authorized: 08/10/87 Prepared: 08/11/87 Analyzed: 09/03/87

Parameter	Result	Units (as received)	Reporting Limit
Aldrin	N.D.	ug/kg	8.0
alpha BHC	N.D.	ug/kg	8.0
beta BHC	N.D.	ug/kg	8.0
gamma BHC (Lindane)	N.D.	ug/kg	8.0
delta BHC	N.D.	ug/kg	8.0
Chlordane	N.D.	ug/kg	80
4,4'-DDT	N.D.	ug/kg	16
4,4'-DDE	N.D.	ug/kg	16
4,4'-DDD	N.D.	ug/kg	16
Dieldrin	N.D.	ug/kg	16
Endosulfan I	N.D.	ug/kg	8.0
Endosulfan II	N.D.	ug/kg	16
Endosulfan sulfate	N.D.	ug/kg	16
Endrin	N.D.	ug/kg	16
Endrin Aldehyde	N.D.	ug/kg	16
Heptachlor	N.D.	ug/kg	8.0
Heptachlor Epoxide	N.D.	ug/kg	8.0
Aroclor-1242	N.D.	ug/kg	80
Aroclor-1254	N.D.	ug/kg	160
Aroclor-1221	N.D.	ug/kg	80
Aroclor-1232	N.D.	ug/kg	80
Aroclor-1248	N.D.	ug/kg	80
Aroclor-1260	N.D.	ug/kg	160
Aroclor-1016	N.D.	ug/kg	80
Toxaphene	N.D.	ug/kg	160
Methoxychlor	N.D.	ug/kg	80

011556

N.D. = Not detected

Reported by: Margaret May Approved by: Maureen McDevitt

Sample: 64258-002

Enseco

METALS PARAMETERS
TOTAL METALS

Client Name: ERM SOUTHWEST INC

Client ID: S-8 3-4

Laboratory ID: 64258-002 Enseco ID: 64258-002

Matrix: Soil Sampled: 08/06/87 Received: 08/08/87

Authorized: 08/10/87

Parameter	Result	Units (as received)	Reporting Limit	Analytical Method	Analyzed
Antimony	N.D.	mg/kg	5	6010	08/24/87
Arsenic	4.0	mg/kg	0.6	7060	08/17/87
Beryllium	0.4	mg/kg	0.1	6010	08/24/87
Cadmium	N.D.	mg/kg	0.5	6010	08/24/87
Chromium	3	mg/kg	2	6010	08/24/87
Copper	5.2	mg/kg	0.6	6010	08/24/87
Lead	7	mg/kg	5	6010	08/24/87
Mercury	N.D.	mg/kg	0.05	7471	08/25/87
Nickel	6	mg/kg	4	6010	08/24/87
Selenium	N.D.	mg/kg	0.4	7740	08/17/87
Silver	N.D.	mg/kg	0.5	200.7	08/24/87
Thallium	N.D.	mg/kg	0.8	7841	08/17/87
Zinc	12	mg/kg	1	6010	08/24/87

N.D. = Not detected

Approved by: Will Pratt

Sample: 64258-002

Enseco

INORGANIC PARAMETERS

Client Name: ERM SOUTHWEST INC
Client ID: S-8 3-4
Laboratory ID: 64258-002 Enseco ID: 64258-002
Matrix: Soil Sampled: 08/06/87 Received: 08/08/87
Authorized: 08/10/87

Parameter	Result	Units (as received)	Reporting Limit	Analytical Method	Analyzed
Total Cyanide	N.D.	mg/kg	1	9010	08/24/87

0115588

N.D. = Not detected

Approved by: Lindsay Breyer

Sample: 64258-002

Enseco

PRIORITY POLLUTANT VOLATILE ORGANICS

EPA METHOD 8240

Client Name: ERM SOUTHWEST INC

Client ID: S-9 0-1

Laboratory ID: 64258-003 Enseco ID: 64258-003

Matrix: Soil Sampled: 08/07/87 Received: 08/08/87

Authorized: 08/10/87 Prepared: 08/12/87 Analyzed: 08/28/87

Parameter	Result	Units (as received)	Reporting Limit
Benzene	N.D.	ug/kg	500
Bromoform	N.D.	ug/kg	500
Carbon tetrachloride	N.D.	ug/kg	500
Chlorobenzene	N.D.	ug/kg	500
Dibromochloromethane	N.D.	ug/kg	500
Chloroethane	N.D.	ug/kg	1000
2-Chloroethyl vinyl ether	N.D.	ug/kg	1000
Chloroform	N.D.	ug/kg	500
Bromodichloromethane	N.D.	ug/kg	500
1,1-Dichloroethane	N.D.	ug/kg	500
1,2-Dichloroethane	N.D.	ug/kg	500
1,1-Dichloroethene	N.D.	ug/kg	500
1,2-Dichloropropane	N.D.	ug/kg	500
Ethyl benzene	N.D.	ug/kg	500
Bromomethane	N.D.	ug/kg	1000
Chloromethane	N.D.	ug/kg	1000
Methylene chloride	N.D.	ug/kg	2500
1,1,2,2-Tetrachloroethane	N.D.	ug/kg	500
Tetrachloroethene	N.D.	ug/kg	500
Toluene	N.D.	ug/kg	500
trans-1,2-Dichloroethene	N.D.	ug/kg	500
1,1,1-Trichloroethane	N.D.	ug/kg	500
1,1,2-Trichloroethane	N.D.	ug/kg	500
Trichloroethene	N.D.	ug/kg	500
Vinyl chloride	N.D.	ug/kg	1000
trans-1,3-Dichloropropene	N.D.	ug/kg	500
cis-1,3-Dichloropropene	N.D.	ug/kg	500

N.D. = Not detected

011559

Enseco

PRIORITY POLLUTANT VOLATILE ORGANICS (CONT.)

EPA METHOD 8240

Client Name: ERM SOUTHWEST INC

Client ID: S-9 0-1

Laboratory ID: 64258-003 Enseco ID: 64258-003

Matrix: Soil Sampled: 08/07/87 Received: 08/08/87

Authorized: 08/10/87 Prepared: 08/12/87 Analyzed: 08/28/87

Surrogate	Result	Units (as received)	Reporting Limit
Toluene-D8	108	%	-
Bromofluorobenzene(BFB)	99	%	-
1,2-Dichloroethane-D4	93	%	-

011560

N.D. = Not detected

Reported by: Julie Niermann Approved by: Michael Brooks

Enseco

PRIORITY POLLUTANT SEMIVOLATILE ORGANICS

EPA METHOD 8270

Client Name: ERM SOUTHWEST INC

Client ID: S-9 0-1

Laboratory ID: 64258-003 Enseco ID: 64258-003

Matrix: Soil Sampled: 08/07/87 Received: 08/08/87

Authorized: 08/10/87 Prepared: 08/11/87 Analyzed: 08/26/87

Parameter	Result	Units (as received)	Reporting Limit
Acenaphthene	N.D.	ug/kg	330
Acenaphthylene	N.D.	ug/kg	330
Anthracene	N.D.	ug/kg	330
Benzo(a)anthracene	N.D.	ug/kg	330
Benzo(a)pyrene	N.D.	ug/kg	330
Benzo(b)fluoranthene	N.D.	ug/kg	330
Benzo(g,h,i)perylene	N.D.	ug/kg	330
Benzo(k)fluoranthene	N.D.	ug/kg	330
bis(2-Chloroethoxy) methane	N.D.	ug/kg	330
bis(2-Chloroethyl) ether	N.D.	ug/kg	330
bis(2-Chloroisopropyl) ether	N.D.	ug/kg	330
bis(2-Ethylhexyl) phthalate	N.D.	ug/kg	330
4-Bromophenyl phenyl ether	N.D.	ug/kg	330
Butyl benzyl phthalate	N.D.	ug/kg	330
2-Chloronaphthalene	N.D.	ug/kg	330
4-Chlorophenyl phenyl ether	N.D.	ug/kg	330
Chrysene	N.D.	ug/kg	330
Dibenzo(a,h)anthracene	N.D.	ug/kg	330
1,2-Dichlorobenzene	N.D.	ug/kg	330
1,3-Dichlorobenzene	N.D.	ug/kg	330
1,4-Dichlorobenzene	N.D.	ug/kg	330
3,3'-Dichlorobenzidine	N.D.	ug/kg	660
Diethyl phthalate	N.D.	ug/kg	330
Dimethyl phthalate	N.D.	ug/kg	330
Di-n-butyl phthalate	N.D.	ug/kg	330
2,4-Dinitrotoluene	N.D.	ug/kg	330
2,6-Dinitrotoluene	N.D.	ug/kg	330
Di-n-octyl phthalate	N.D.	ug/kg	330
1,2-Diphenylhydrazine	N.D.	ug/kg	330
Fluoranthene	N.D.	ug/kg	330
Fluorene	N.D.	ug/kg	330

N.D. = Not detected

011561

Enseco

PRIORITY POLLUTANT SEMIVOLATILE ORGANICS (CONT.)

EPA METHOD 8270

Client Name: ERM SOUTHWEST INC

Client ID: S-9 0-1

Laboratory ID: 64258-003 Enseco ID: 64258-003

Matrix: Soil Sampled: 08/07/87 Received: 08/08/87

Authorized: 08/10/87 Prepared: 08/11/87 Analyzed: 08/26/87

Parameter	Result	Units (as received)	Reporting Limit
Hexachlorobenzene	N.D.	ug/kg	330
Hexachlorobutadiene	N.D.	ug/kg	330
Hexachlorocyclopentadiene	N.D.	ug/kg	330
Hexachloroethane	N.D.	ug/kg	330
Indeno(1,2,3-c,d)pyrene	N.D.	ug/kg	330
Isophorone	N.D.	ug/kg	330
Naphthalene	N.D.	ug/kg	330
Nitrobenzene	N.D.	ug/kg	330
N-Nitroso-dipropylamine	N.D.	ug/kg	330
N-Nitrosodiphenylamine	N.D.	ug/kg	330
Phenanthrene	N.D.	ug/kg	330
Pyrene	N.D.	ug/kg	330
1,2,4-Trichlorobenzene	N.D.	ug/kg	330
2-Chlorophenol	N.D.	ug/kg	330
2,4-Dichlorophenol	N.D.	ug/kg	330
2,4-Dimethylphenol	N.D.	ug/kg	330
4,6-Dinitro-2-methylphenol	N.D.	ug/kg	330
2,4-Dinitrophenol	N.D.	ug/kg	1600
2-Nitrophenol	N.D.	ug/kg	1600
4-Nitrophenol	N.D.	ug/kg	330
4-Chloro-3-methylphenol	N.D.	ug/kg	1600
Pentachlorophenol	N.D.	ug/kg	330
Phenol	N.D.	ug/kg	1600
2,4,6-Trichlorophenol	N.D.	ug/kg	330
	N.D.	ug/kg	330
Surrogate			
Nitrobenzene-D5	83	%	-
2-Fluorobiphenyl	101	%	-
Terphenyl-D14	72	%	-
Phenol-D5	72	%	-

N.D. = Not detected

011562

PRIORITY POLLUTANT SEMIVOLATILE ORGANICS (CONT.)

EPA METHOD 8270

Client Name: ERM SOUTHWEST INC

Client ID: S-9 0-1

Laboratory ID: 64258-003 Enseco ID: 64258-003

Matrix: Soil Sampled: 08/07/87 Received: 08/08/87

Authorized: 08/10/87 Prepared: 08/11/87 Analyzed: 08/26/87

Surrogate	Result	Units (as received)	Reporting Limit
2-Fluorophenol	67	%	-
2,4,6-Tribromophenol	100	%	-

011563

N.D. = Not detected

Reported by: Kevin Schilling Approved by: Michael Brooks

Enseco

ORGANOCHLORINE PESTICIDES/PCB's 608

EPA METHOD 8080

Client Name: ERM SOUTHWEST INC

Client ID: S-9 0-1

Laboratory ID: 64258-003 Enseco ID: 64258-003

Matrix: Soil Sampled: 08/07/87 Received: 08/08/87

Authorized: 08/10/87 Prepared: 08/11/87 Analyzed: 09/03/87

Parameter	Result	Units (as received)	Reporting Limit
Aldrin	N.D.	ug/kg	400
alpha BHC	N.D.	ug/kg	400
beta BHC	N.D.	ug/kg	400
gamma BHC (Lindane)	N.D.	ug/kg	400
delta BHC	N.D.	ug/kg	400
Chlordane	6300	ug/kg	4000
4,4'-DDT	1100	ug/kg	800
4,4'-DDE	1000	ug/kg	800
4,4'-DDD	3500	ug/kg	800
Dieldrin	1200	ug/kg	800
Endosulfan I	N.D.	ug/kg	400
Endosulfan II	N.D.	ug/kg	800
Endosulfan sulfate	N.D.	ug/kg	800
Endrin	N.D.	ug/kg	800
Endrin Aldehyde	N.D.	ug/kg	800
Heptachlor	N.D.	ug/kg	400
Heptachlor Epoxide	N.D.	ug/kg	400
Aroclor-1242	N.D.	ug/kg	4000
Aroclor-1254	N.D.	ug/kg	8000
Aroclor-1221	N.D.	ug/kg	4000
Aroclor-1232	N.D.	ug/kg	4000
Aroclor-1248	N.D.	ug/kg	4000
Aroclor-1260	N.D.	ug/kg	8000
Aroclor-1016	N.D.	ug/kg	4000
Toxaphene	N.D.	ug/kg	8000
Methoxychlor	N.D.	ug/kg	4000

011564

N.D. = Not detected

Reported by: Margaret May Approved by: Maureen McDevitt

Sample: 64258-003

Enseco

METALS PARAMETERS
TOTAL METALS

Client Name: ERM SOUTHWEST INC

Client ID: S-9 0-1

Laboratory ID: 64258-003 Enseco ID: 64258-003

Matrix: Soil Sampled: 08/07/87 Received: 08/08/87

Authorized: 08/10/87

Parameter	Result	Units (as received)	Reporting Limit	Analytical Method	Analyzed
Antimony	N.D.	mg/kg	5	6010	08/24/87
Arsenic	8.0	mg/kg	0.6	7060	08/17/87
Beryllium	0.7	mg/kg	0.1	6010	08/24/87
Cadmium	N.D.	mg/kg	0.5	6010	08/24/87
Chromium	6	mg/kg	2	6010	08/24/87
Copper	48	mg/kg	0.6	6010	08/24/87
Lead	14	mg/kg	5	6010	08/24/87
Mercury	0.06	mg/kg	0.05	7471	08/25/87
Nickel	16	mg/kg	4	6010	08/24/87
Selenium	N.D.	mg/kg	0.8	7740	08/17/87
Silver	N.D.	mg/kg	0.5	200.7	08/24/87
Thallium	N.D.	mg/kg	0.8	7841	08/17/87
Zinc	52	mg/kg	1	6010	08/24/87

N.D. = Not detected

Approved by: Will Pratt

Sample: 64258-003

INORGANIC PARAMETERS

Client Name: ERM SOUTHWEST INC
Client ID: S-9 0-1
Laboratory ID: 64258-003 Enseco ID: 64258-003
Matrix: Soil Sampled: 08/07/87 Received: 08/08/87
Authorized: 08/10/87

Parameter	Result	Units (as received)	Reporting Limit	Analytical Method	Analyzed
Total Cyanide	N.D.	mg/kg	1	9010	08/24/87

011566

N.D. = Not detected

Approved by: Lindsay Breyer

Sample: 64258-003

Enseco

PRIORITY POLLUTANT VOLATILE ORGANICS

EPA METHOD 8240

Client Name: ERM SOUTHWEST INC

Client ID: S-9 4-5

Laboratory ID: 64258-004 Enseco ID: 64258-004

Matrix: Soil Sampled: 08/07/87 Received: 08/08/87

Authorized: 08/10/87 Prepared: 08/12/87 Analyzed: 08/28/87

Parameter	Result	Units (as received)	Reporting Limit
Benzene	N.D.	ug/kg	500
Bromoform	N.D.	ug/kg	500
Carbon tetrachloride	N.D.	ug/kg	500
Chlorobenzene	N.D.	ug/kg	500
Dibromochloromethane	N.D.	ug/kg	500
Chloroethane	N.D.	ug/kg	1000
2-Chloroethyl vinyl ether	N.D.	ug/kg	1000
Chloroform	N.D.	ug/kg	500
Bromodichloromethane	N.D.	ug/kg	500
1,1-Dichloroethane	N.D.	ug/kg	500
1,2-Dichloroethane	N.D.	ug/kg	500
1,1-Dichloroethene	N.D.	ug/kg	500
1,2-Dichloropropane	N.D.	ug/kg	500
Ethyl benzene	N.D.	ug/kg	500
Bromomethane	N.D.	ug/kg	1000
Chloromethane	N.D.	ug/kg	1000
Methylene chloride	N.D.	ug/kg	2500
1,1,2,2-Tetrachloroethane	N.D.	ug/kg	500
Tetrachloroethene	N.D.	ug/kg	500
Toluene	N.D.	ug/kg	500
trans-1,2-Dichloroethene	N.D.	ug/kg	500
1,1,1-Trichloroethane	N.D.	ug/kg	500
1,1,2-Trichloroethane	N.D.	ug/kg	500
Trichloroethene	N.D.	ug/kg	500
Vinyl chloride	N.D.	ug/kg	1000
trans-1,3-Dichloropropene	N.D.	ug/kg	500
cis-1,3-Dichloropropene	N.D.	ug/kg	500

N.D. = Not detected

011567

PRIORITY POLLUTANT VOLATILE ORGANICS (CONT.)

EPA METHOD 8240

Client Name: ERM SOUTHWEST INC

Client ID: S-9 4-5

Laboratory ID: 64258-004 Enseco ID: 64258-004

Matrix: Soil Sampled: 08/07/87 Received: 08/08/87

Authorized: 08/10/87 Prepared: 08/12/87 Analyzed: 08/28/87

Surrogate	Result	Units (as received)	Reporting Limit
Toluene-D8	101	%	-
Bromofluorobenzene(BFB)	105	%	-
1,2-Dichloroethane-D4	91	%	-

N.D. = Not detected

Reported by: Julie Niermann

Approved by: Michael Brooks

Enseco

PRIORITY POLLUTANT SEMIVOLATILE ORGANICS

EPA METHOD 8270

Client Name: ERM SOUTHWEST INC

Client ID: S-9 4-5

Laboratory ID: 64258-004 Enseco ID: 64258-004

Matrix: Soil Sampled: 08/07/87 Received: 08/08/87

Authorized: 08/10/87 Prepared: 08/11/87 Analyzed: 08/26/87

Parameter	Result	Units (as received)	Reporting Limit
Acenaphthene	N.D.	ug/kg	330
Acenaphthylene	N.D.	ug/kg	330
Anthracene	N.D.	ug/kg	330
Benzo(a)anthracene	N.D.	ug/kg	330
Benzo(a)pyrene	N.D.	ug/kg	330
Benzo(b)fluoranthene	N.D.	ug/kg	330
Benzo(g,h,i)perylene	N.D.	ug/kg	330
Benzo(k)fluoranthene	N.D.	ug/kg	330
bis(2-Chloroethoxy) methane	N.D.	ug/kg	330
bis(2-Chloroethyl) ether	N.D.	ug/kg	330
bis(2-Chloroisopropyl) ether	N.D.	ug/kg	330
bis(2-Ethylhexyl) phthalate	2900	ug/kg	330
4-Bromophenyl phenyl ether	N.D.	ug/kg	330
Butyl benzyl phthalate	N.D.	ug/kg	330
2-Chloronaphthalene	N.D.	ug/kg	330
4-Chlorophenyl phenyl ether	N.D.	ug/kg	330
Chrysene	N.D.	ug/kg	330
Dibenzo(a,h)anthracene	N.D.	ug/kg	330
1,2-Dichlorobenzene	N.D.	ug/kg	330
1,3-Dichlorobenzene	N.D.	ug/kg	330
1,4-Dichlorobenzene	N.D.	ug/kg	330
3,3'-Dichlorobenzidine	N.D.	ug/kg	660
Diethyl phthalate	N.D.	ug/kg	330
Dimethyl phthalate	N.D.	ug/kg	330
Di-n-butyl phthalate	N.D.	ug/kg	330
2,4-Dinitrotoluene	N.D.	ug/kg	330
2,6-Dinitrotoluene	N.D.	ug/kg	330
Di-n-octyl phthalate	N.D.	ug/kg	330
1,2-Diphenylhydrazine	N.D.	ug/kg	330
Fluoranthene	N.D.	ug/kg	330
Fluorene	N.D.	ug/kg	330

N.D. = Not detected

011569

Enseco

PRIORITY POLLUTANT SEMIVOLATILE ORGANICS (CONT.)

EPA METHOD 8270

Client Name: ERM SOUTHWEST INC

Client ID: S-9 4-5

Laboratory ID: 64258-004 Enseco ID: 64258-004

Matrix: Soil Sampled: 08/07/87 Received: 08/08/87

Authorized: 08/10/87 Prepared: 08/11/87 Analyzed: 08/26/87

Parameter	Result	Units (as received)	Reporting Limit
Hexachlorobenzene	N.D.	ug/kg	330
Hexachlorobutadiene	N.D.	ug/kg	330
Hexachlorocyclopentadiene	N.D.	ug/kg	330
Hexachloroethane	N.D.	ug/kg	330
Indeno(1,2,3-c,d)pyrene	N.D.	ug/kg	330
Isophorone	N.D.	ug/kg	330
Naphthalene	N.D.	ug/kg	330
Nitrobenzene	N.D.	ug/kg	330
N-Nitroso-dipropylamine	N.D.	ug/kg	330
N-Nitrosodiphenylamine	N.D.	ug/kg	330
Phenanthrene	N.D.	ug/kg	330
Pyrene	N.D.	ug/kg	330
1,2,4-Trichlorobenzene	N.D.	ug/kg	330
2-Chlorophenol	N.D.	ug/kg	330
2,4-Dichlorophenol	N.D.	ug/kg	330
2,4-Dimethylphenol	N.D.	ug/kg	330
4,6-Dinitro-2-methylphenol	N.D.	ug/kg	330
2,4-Dinitrophenol	N.D.	ug/kg	330
2-Nitrophenol	N.D.	ug/kg	1600
4-Nitrophenol	N.D.	ug/kg	1600
4-Chloro-3-methylphenol	N.D.	ug/kg	330
Pentachlorophenol	N.D.	ug/kg	1600
Phenol	N.D.	ug/kg	330
2,4,6-Trichlorophenol	N.D.	ug/kg	1600
	N.D.	ug/kg	330
	N.D.	ug/kg	330
Surrogate			
Nitrobenzene-D5	81	%	-
2-Fluorobiphenyl	101	%	-
Terphenyl-D14	87	%	-
Phenol-D5	71	%	-

N.D. = Not detected

011570

PRIORITY POLLUTANT SEMIVOLATILE ORGANICS (CONT.)

EPA METHOD 8270

Client Name: ERM SOUTHWEST INC

Client ID: S-9 4-5

Laboratory ID: 64258-004 Enseco ID: 64258-004

Matrix: Soil Sampled: 08/07/87 Received: 08/08/87

Authorized: 08/10/87 Prepared: 08/11/87 Analyzed: 08/26/87

Surrogate	Result	Units (as received)	Reporting Limit
2-Fluorophenol	67	%	-
2,4,6-Tribromophenol	106	%	-

011571

N.D. = Not detected

Reported by: Kevin Schilling Approved by: Michael Brooks

Enseco

ORGANOCHLORINE PESTICIDES/PCB's 608

EPA METHOD 8080

Client Name: ERM SOUTHWEST INC

Client ID: S-9 4-5

Laboratory ID: 64258-004 Enseco ID: 64258-004

Matrix: Soil Sampled: 08/07/87 Received: 08/08/87

Authorized: 08/10/87 Prepared: 08/11/87 Analyzed: 09/03/87

Parameter	Result	Units (as received)	Reporting Limit
Aldrin	N.D.	ug/kg	8.0
alpha BHC	N.D.	ug/kg	8.0
beta BHC	N.D.	ug/kg	8.0
gamma BHC (Lindane)	N.D.	ug/kg	8.0
delta BHC	N.D.	ug/kg	8.0
Chlordane	N.D.	ug/kg	80
4,4'-DDT	N.D.	ug/kg	16
4,4'-DDE	N.D.	ug/kg	16
4,4'-DDD	N.D.	ug/kg	16
Dieldrin	N.D.	ug/kg	16
Endosulfan I	N.D.	ug/kg	16
Endosulfan II	N.D.	ug/kg	8.0
Endosulfan sulfate	N.D.	ug/kg	16
Endrin	N.D.	ug/kg	16
Endrin Aldehyde	N.D.	ug/kg	16
Heptachlor	N.D.	ug/kg	16
Heptachlor Epoxide	N.D.	ug/kg	8.0
Aroclor-1242	N.D.	ug/kg	8.0
Aroclor-1254	N.D.	ug/kg	80
Aroclor-1221	N.D.	ug/kg	160
Aroclor-1232	N.D.	ug/kg	80
Aroclor-1248	N.D.	ug/kg	80
Aroclor-1260	N.D.	ug/kg	80
Aroclor-1016	N.D.	ug/kg	160
Toxaphene	N.D.	ug/kg	80
Methoxychlor	N.D.	ug/kg	160

011572

N.D. = Not detected

Reported by: Margaret May

Approved by: Maureen McDevitt

Sample: 64258-004

Enseco

METALS PARAMETERS
TOTAL METALS

Client Name: ERM SOUTHWEST INC

Client ID: S-9 4-5

Laboratory ID: 64258-004 Enseco ID: 64258-004

Matrix: Soil Sampled: 08/07/87 Received: 08/08/87

Authorized: 08/10/87

Parameter	Result	Units (as received)	Reporting Limit	Analytical Method	Analyzed
Antimony	N.D.	mg/kg	5	6010	08/24/87
Arsenic	8.0	mg/kg	0.6	7060	08/17/87
Beryllium	0.9	mg/kg	0.1	6010	08/24/87
Cadmium	N.D.	mg/kg	0.5	6010	08/24/87
Chromium	7	mg/kg	2	6010	08/24/87
Copper	12	mg/kg	0.6	6010	08/24/87
Lead	11	mg/kg	5	6010	08/24/87
Mercury	N.D.	mg/kg	0.05	7471	08/25/87
Nickel	17	mg/kg	4	6010	08/24/87
Selenium	N.D.	mg/kg	0.8	7740	08/17/87
Silver	N.D.	mg/kg	0.5	200.7	08/24/87
Thallium	N.D.	mg/kg	0.8	7841	08/17/87
Zinc	32	mg/kg	1	6010	08/24/87

N.D. = Not detected

Approved by: Will Pratt

Sample: 64258-004

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INORGANIC PARAMETERS

Client Name: ERM SOUTHWEST INC
Client ID: S-9 4-5
Laboratory ID: 64258-004 Enseco ID: 64258-004
Matrix: Soil Sampled: 08/07/87 Received: 08/08/87
Authorized: 08/10/87

Parameter	Result	Units (as received)	Reporting Limit	Analytical Method	Analyzed
Total Cyanide	N.D.	mg/kg	1	9010	08/24/87

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N.D. = Not detected

Approved by: Lindsay Breyer

Sample: 64258-004

V. QUALITY CONTROL REPORT

The Enseco laboratories operate under a vigorous QA/QC program designed to ensure the generation of scientifically valid, legally defensible data by monitoring every aspect of laboratory operations. Routine QA/QC procedures include the use of approved methodologies, independent verification of analytical standards, use of duplicate Laboratory Control Samples to assess the precision and accuracy of the methodology on a routine basis, and a rigorous system of data review.

In addition, the Enseco laboratories maintain a comprehensive set of certifications from both state and federal governmental agencies which require frequent analyses of blind audit samples. Enseco - Rocky Mountain Analytical Laboratory is certified by the EPA under the EPA/CLP program for both Organic and Inorganic analyses, under the USATHAMA (U.S. Army) program, by the Army Corps of Engineers, and the states of Colorado, New Jersey, New York, Utah, and Florida, among others.

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The standard laboratory QC package is designed to:

1) establish a strong, cost-effective QC program that ensures the generation of scientifically valid, legally defensible data

2) assess the laboratory's performance of the analytical method using control limits generated with a well-defined matrix

3) establish clear-cut guidelines for acceptability of analytical data so that QC decisions can be made immediately at the bench, and

4) provide a standard set of reportables which assures the client of the quality of his data.

The Enseco QC program is based upon monitoring the precision and accuracy of an analytical method by analyzing a set of duplicate Laboratory Control Samples (LCS) at frequent, well-defined intervals. An LCS is a well-characterized matrix which is spiked with target compounds at 5-100 times the reporting limit, depending upon the methodology being monitored. The purpose of the LCS is not to duplicate the sample matrix, but rather to provide an interference-free, homogeneous matrix from which to gather data to establish control limits. These limits are used to determine whether data generated by the laboratory on any given day is in control.

Control limits for accuracy (percent recovery) are based on the average, historical percent recovery +/- 3 standard deviation units. Control limits for precision (relative percent difference) range from 0 (identical duplicate LCS results) to the average, historical relative percent difference + 3 standard deviation units. These control limits are fairly narrow based on the consistency of the matrix being monitored and are updated on a quarterly basis.

For Organic analyses an additional control measure is taken in the form of a Surrogate Control Sample (SCS). The SCS is a control sample spiked with surrogate standards which is analyzed with every analytical lot. The recovery of the SCS is charted in exactly the same manner as described f the LCS, and provides a daily check on the performance of the method.

Accuracy for LCS and SCS is measured by Percent Recovery.

$$\% \text{ Recovery} = \frac{\text{Measured Concentration}}{\text{Actual Concentration}} \times 100$$

Precision for LCS is measured by Relative Percent Difference (RPD).

$$\text{RPD} = \frac{\text{Measured Concentration LCS1} - \text{Measured Concentration LCS2}}{(\text{Measured Concentration LCS1} + \text{Measured Concentration LCS2})/2}$$

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All samples analyzed concurrently by the same test are assigned the same QC lot number. Projects which contain numerous samples, analyzed over several days, may have multiple QC lot numbers associated with each test. The QC information which follows includes a listing of the QC lot numbers associated with each of the samples reported, LCS and SCS (where applicable) recoveries from the QC lots associated with the samples, and control limits for these lots. The QC data is reported by test code, in the order that the tests are reported in the analytical results section of this report. The test codes assigned are defined in Section VI., Analytical Methodology.

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QC LOT ASSIGNMENT REPORT
GAS CHROMATOGRAPHY/MASS SPECTROMETRY

Laboratory Sample Number	QC Matrix	Test	QC Lot Number LCS	QC Lot Number SCS
64258-001	Standard Soil	BNA	BNA 053AA	BNA 053AA
64258-001	Standard Soil	VOA	VOA 031AW	VOA 031BW
64258-002	Standard Soil	BNA	BNA 053AA	BNA 053AA
64258-002	Standard Soil	VOA	VOA 031AW	VOA 031BW
64258-003	Standard Soil	BNA	BNA 053AA	BNA 053AA
64258-003	Standard Soil	VOA	VOA 031AW	VOA 031BW
64258-004	Standard Soil	BNA	BNA 053AA	BNA 053AA
64258-004	Standard Soil	VOA	VOA 031AW	VOA 031BW

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LABORATORY CONTROL SAMPLE REPORT
GAS CHROMATOGRAPHY/MASS SPECTROMETRY

Analyte	Concentration Spiking	Measured LCS1	Measured LCS2	Accuracy(%) LCS1	Accuracy(%) LCS2	Accuracy(%) Limits	Precision(RPD) LCS	Precision(RPD) Limits
Test: BNA on Standard Soil								
QC Lot: BNA 053AA								
Concentration Units: (ug/kg)								
Pentachlorophenol	6670	4640	4800	70	72	17-109	3.4	47
Phenol	6670	4500	4470	67	67	26- 90	0.7	35
2-Chlorophenol	6670	4850	4620	73	69	25-102	4.9	50
4-Chloro-3-cresol	6670	5080	4990	76	75	26-103	1.8	33
4-Nitrophenol	6670	5270	4860	79	73	11-114	8.1	50
1,2,4-Trichlorobenzene	3330	2650	2480	80	74	38-107	6.6	23
Acenaphthene	3330	2980	2760	89	83	31-137	7.7	19
2,4-Dinitrotoluene	3330	2750	2360	83	71	28- 89	15.3	47
Pyrene	3330	3610	3610	108	108	35-142	0.0	36
N-nitrosodi-n-propylamine	3330	3070	2910	92	87	41-126	5.4	38
1,4-Dichlorobenzene	3330	2450	2260	74	68	28-104	8.1	27
Test: VOA on Standard Soil								
QC Lot: VOA 031AW								
Concentration Units: (ug/kg)								
1,1-Dichloroethene	5000	4500	4470	90	89	59-172	0.7	22
Trichloroethene	5000	5250	5310	105	106	62-137	1.1	24
Chlorobenzene	5000	5140	5290	103	106	60-133	2.9	21
Toluene	5000	4690	4810	94	96	59-139	2.5	21
Benzene	5000	4720	4790	94	96	66-142	1.5	21

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SURROGATE CONTROL SAMPLE REPORT
GAS CHROMATOGRAPHY/MASS SPECTROMETRY

Analyte	Concentration Spiking	Concentration Measured	Accuracy(%) SCS	Accuracy(%) Limits
Test: BNA on Standard Soil				
QC Lot: BNA 053AA				
Concentration Units: (ug/kg)				
Phenol-D5	3330	2540	76	24-113
2-Fluorophenol	3330	2360	71	25-121
2,4,6-Tribromophenol	3330	2710	81	19-122
Nitrobenzene-D5	1670	1270	76	23-120
2-Fluorobiphenyl	1670	1480	89	30-115
Terphenyl-D14	1670	1670	100	18-137
Test: VOA on Standard Soil				
QC Lot: VOA 031BW				
Concentration Units: (ug/kg)				
Toluene-D8	5000	4900	98	81-117
Bromofluorobenzene (BFB)	5000	5530	111	74-121
1,2-Dichloroethane-D4	5000	4650	93	70-121

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QC LOT ASSIGNMENT REPORT
GAS CHROMATOGRAPHY

Laboratory Sample Number	QC Matrix	Test	QC Lot Number LCS	QC Lot Number SCS
64258-001	Standard Soil	OCP	OCP 007AE	OCP 007AE
64258-002	Standard Soil	OCP	OCP 007AE	OCP 007AE
64258-003	Standard Soil	OCP	OCP 007AE	OCP 007AE
64258-004	Standard Soil	OCP	OCP 007AE	OCP 007AE

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LABORATORY CONTROL SAMPLE REPORT
GAS CHROMATOGRAPHY

Analyte	Concentration Spiking	Measured LCS1	Measured LCS2	Accuracy(%) LCS1	Accuracy(%) LCS2	Accuracy(%) Limits	Precision(RPD) LCS	Precision(RPD) Limits
Test: OCP on Standard Soil								
QC Lot: OCP 007AE								
Concentration Units: (ug/kg)								
Lindane	27	31.0	30.2	115	112	46-127	2.6	50
Heptachlor	27	32.4	31.6	120	117	35-130	2.5	31
Aldrin	27	31.6	30.8	117	114	34-132	2.6	43
Dieldrin	67	64.3	63.0	96	94	31-134	2.0	38
Endrin	67	60.3	59.0	90	88	42-139	2.2	45
p,p'-DDT	67	68.3	67.0	102	100	23-134	1.9	50

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SURROGATE CONTROL SAMPLE REPORT
GAS CHROMATOGRAPHY

Analyte	Concentration Spiking	Concentration Measured	Accuracy(%) SCS	Accuracy(%) Limits
Test: OCP on Standard Soil				
QC Lot: OCP 007AE				
Concentration Units: (ug/kg)				
Dibutylchlorendate	67	72	107	20-150

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QC LOT ASSIGNMENT REPORT
INORGANICS - METALS

Laboratory Sample Number	QC Matrix	Test	QC Lot Number LCS
64258-001	Standard Soil	FAST	FAST098AA
64258-001	Standard Soil	FSET	FSET098AA
64258-001	Standard Soil	FTLT	FTLT098AA
64258-001	Standard Soil	HGT	HGT 104AB
64258-001	Standard Soil	ICPT	ICPT114AA
64258-002	Standard Soil	FAST	FAST098AA
64258-002	Standard Soil	FSET	FSET098AA
64258-002	Standard Soil	FTLT	FTLT098AA
64258-002	Standard Soil	HGT	HGT 104AB
64258-002	Standard Soil	ICPT	ICPT114AA
64258-003	Standard Soil	FAST	FAST098AA
64258-003	Standard Soil	FSET	FSET098AA
64258-003	Standard Soil	FTLT	FTLT098AA
64258-003	Standard Soil	HGT	HGT 104AB
64258-003	Standard Soil	ICPT	ICPT114AA
64258-004	Standard Soil	FAST	FAST098AA
64258-004	Standard Soil	FSET	FSET098AA
64258-004	Standard Soil	FTLT	FTLT098AA
64258-004	Standard Soil	HGT	HGT 104AB
64258-004	Standard Soil	ICPT	ICPT114AA

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LABORATORY CONTROL SAMPLE REPORT
INORGANICS - METALS

Analyte	Concentration Spiking	Measured LCS1	Measured LCS2	Accuracy(%) LCS1	LCS2	Limits	Precision(RPD) LCS	Limits
Test: FAST on Standard Soil QC Lot: FAST098AA Concentration Units: (mg/kg)								
Arsenic	40	40	41	100	103	75-125	2.5	20
Test: FSET on Standard Soil QC Lot: FSET098AA Concentration Units: (mg/kg)								
Selenium	10	10	10	100	100	75-125	0.0	20
Test: FTLT on Standard Soil QC Lot: FTLT098AA Concentration Units: (mg/kg)								
Thallium	50	50	50	100	100	75-125	0.0	20
Test: HGT on Standard Soil QC Lot: HGT 104AB Concentration Units: (mg/kg)								
Mercury	1.0	0.9	0.9	90	90	75-125	0.0	20
Test: ICPT on Standard Soil QC Lot: ICPT114AA Concentration Units: (mg/kg)								
Antimony	0.50	0.47	0.51	94	102	75-125	8.2	20
Arsenic	2.0	1.7	1.8	85	90	75-125	5.7	20
Barium	2.0	1.9	2.0	95	100	75-125	5.1	20
Beryllium	0.05	0.045	0.048	90	96	75-125	6.5	20
Cadmium	0.05	0.043	0.048	86	96	75-125	11.0	20
Chromium	0.20	0.21	0.22	105	110	75-125	4.7	20
Cobalt	0.50	0.45	0.48	90	96	75-125	6.5	20
Copper	0.25	0.24	0.26	96	104	75-125	8.0	20
Lead	0.50	0.46	0.49	92	98	75-125	6.3	20
Manganese	0.50	0.49	0.52	98	104	75-125	5.9	20
Nickel	0.50	0.46	0.50	92	100	75-125	8.3	20
Silver	0.05	0.050	0.050	100	100	75-125	0.0	20

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LABORATORY CONTROL SAMPLE REPORT
INORGANICS - METALS

Analyte	Concentration Spiking	Measured LCS1	Measured LCS2	Accuracy(%) LCS1	Accuracy(%) LCS2	Accuracy(%) Limits	Precision(RPD) LCS	Precision(RPD) Limits
Test: ICPT on Standard Soil								
QC Lot: ICPT114AA								
Concentration Units: (mg/kg)								
Tin	0.50	0.54	0.56	108	112	75-125	3.6	20
Vanadium	0.50	0.48	0.50	96	100	75-125	4.1	20
Zinc	0.50	0.44	0.48	88	96	75-125	8.7	20

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QC LOT ASSIGNMENT REPORT
INORGANICS - NON-METALS

Laboratory Sample Number	QC Matrix	Test	QC Lot Number LCS
64258-001	Standard Soil	CNT	CNT 068AB
64258-002	Standard Soil	CNT	CNT 068AB
64258-003	Standard Soil	CNT	CNT 068AB
64258-004	Standard Soil	CNT	CNT 068AB

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LABORATORY CONTROL SAMPLE REPORT
INORGANICS - NON-METALS

Analyte	Concentration Spiking	Measured LCS1	Measured LCS2	Accuracy(%) LCS1	Accuracy(%) LCS2	Accuracy(%) Limits	Precision(RPD) LCS	Precision(RPD) Limits
Test: CNT on Standard Soil QC Lot: CNT 068AB Concentration Units: (mg/kg)								
Cyanide	0.058	0.066	0.061	114	105	75-125	7.9	20

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VI. ANALYTICAL METHODOLOGY

Enseco - Rocky Mountain Analytical Laboratory performs analytical services according to methods approved by EPA and other regulatory agencies, whenever possible.

Methods for metals and organic compounds are primarily derived from three sources of EPA methods, 1) the methods promulgated in 40 CFR 136 for priority pollutants, 2) the methods published in SW-846 and 3) methods developed by the EPA-EMSL/LV for Superfund investigations, as well as several documents published by the EPA and Enseco - Rocky Mountain Analytical Laboratory in 1984 and 1985. These methods all use the same generic technology as summarized below:

- Metals: acid digestion followed by analyses by ICP supported by graphite furnace AA
- Volatile Organics: purge and trap GC/MS or purge and trap GC with a selective detector.
- Semivolatile (base/neutral and acid) organics: solvent extraction followed by capillary column GC/MS, and
- Pesticides/Herbicides: solvent extraction, followed by gas chromatography.

Exact method references are given in the following tables.

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ANALYTICAL METHODOLOGY - ORGANIC TESTS

Test	Description	Methodology	Reference
VOA	Volatile Organics	Purge & Trap, GC/MS	624(1)/8240(2)
BNA	Semivolatile Organics	Extraction, GC/MS	625(1)/8270(2)
DXN	Dioxin	Extraction, GC/MS	613(1)/8280(2)
601	Halogenated Volatile Organics	Purge & Trap GC/Hall	601(1)/8010(2)
THM	Trihalomethanes	Purge & Trap GC/Hall	601(1)/8010(2)
602	Aromatic Volatile Organics	Purge & Trap GC/PID	602(1)/8020(2)
OCP	Organochlorine Pesticides	Extraction, GC/ECD	608(1)/8080(2)
OPP	Organophosphate Pesticides	Extraction, GC/FPD	614(1)/8140(2)
619	Triazine Pesticides	Extraction, GC/NPD	619(1)
LC CARB	Carbamate and Urea Pesticides	Extraction, HPLC	632(1)
PCB	PCB's	Extraction, GC/ECD	608(1)/8080(2)
HRB	Phenoxyacid Herbicides	Extraction, GC/ECD	615(1)/8150(2)
603	Acrolein & Acrylonitrile	Purge & Trap GC/FID	603(1)/8030(2)
604	Phenols	Extraction, GC/FID	604(1)/8040(2)
605	Benzidines	Extraction, HPLC	605(1)/8050(2)
606	Phthalate Esters	Extraction, GC/FID	606(1)/8060(2)
607	Nitrosamines	Extraction, GC/NPD	607(1)
609	Nitroaromatics & Cyclic Ketones	Extraction, GC/NPD	609(1)/8090(2)
PNA	Polynuclear Aromatic Hydrocarbons	Extraction, HPLC	610(1)/8310(2)
611	Haloethers	Extraction, GC/ECD	611(1)
612	Chlorinated Hydrocarbons	Extraction, GC/ECD	612(1)/8120(2)
GD FID	Hydrocarbon Scan	Extraction, GC/FID	D3328-78(3)
GC BPD	Boiling Point Determination	Extraction, GC/FID	D2887-84(4)

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References

(1) Code of Federal Regulations, Chapter 40, Part 136 (40 CFR 136).
(2) SW-846, 2nd Edition, 1984.
(3) "Annual Book of ASTM Standards", Volume 11.01, 1985.
(4) "Annual Book of ASTM Standards", Volume 05.02, 1984.

ANALYTICAL METHODOLOGY - INORGANIC TESTS

Test	Description	Methodology	Reference
ICP	Trace Metals	ICP Emission Spectroscopy	200.7(1)/6010(2)
FSB	Antimony	Furnace Atomic Absorption	204.2(1)/7041(2)
FAS	Arsenic	Furnace Atomic Absorption	206.2(1)/7060(2)
FCD	Cadmium	Furnace Atomic Absorption	213.2(1)/7131(2)
FPB	Lead	Furnace Atomic Absorption	239.2(1)/7421(2)
FSE	Selenium	Furnace Atomic Absorption	270.2(1)/7740(2)
FAG	Silver	Furnace Atomic Absorption	272.2(1)/7761(2)
FTL	Thallium	Furnace Atomic Absorption	279.2(1)/7841(2)
CVHG	Mercury	Cold Vapor Atomic	245.1(1)/7471(2)
CR + 6	Chromium (VI)	Colorimetric	312B(3)
IC CL	Chloride	Ion Chromatography	300.0(1)
BURCL	Chloride	Manual Titrimetric	325.3(1)
METF	Fluoride	Electrode	340.2(1)
IC S04	Sulfate	IC	300.0(1)
SPES04	Sulfate	Manual Turbidimetric	375.4(1)
METALK	Alkalinity, Total	Titrimetric	310.1(1)
METACK	Alkalinity, Forms	Titrimetric	403(3)
TECNOXT	Nitrate+Nitrite as N	Cd Reduction Colorimetric	353.2(1)
METPH	pH	Meter	150.1(1)/9045(2)
CELSP	Specific Conductance @ 25C	Bridge	120.1(1)
BALTDS	Total Dissolved Solids	Gravimetric, 180C	160.1(1)
BALTSS	Total Suspended Solids	Gravimetric, 105C	160.2(1)
BALTS	Total Solids	Gravimetric, 105C	160.3(1)
BALTVS	Total Volatile Solids	Gravimetric, 550C	160.4(1)
TECO P	Ortho-Phosphate as P	Two Reagent Colorimetric	365.3(1)
TECT P	Total Phosphorus as P	Digestion-Colorimetric	365.3(1)
ICP	Total Phosphorus as P	Digestion-ICP/AES	200.7(1)
ICP	Silica as SiO_2	ICP/AES	200.7(1)
SPESI02	Silica as SiO_2	Colorimetric	370.1(1)
METBOD	Biochemical Oxygen Demand	Dilution Bottle-D.O. probe	405.1(1)
METCOD	Chemical Oxygen Demand	Micro Colorimetric	410.4(1)
TOCTOC	Total Organic Carbon	UV Oxidation-IR	415.2(1)
METNH3	Ammonia as N	Electrode	350.3(1)
TECNH3	Ammonia as N	Automated Colorimetric	350.1(1)
METTKN	Total Kjeldahl Nitrogen as N	Digestion-Electrode	351.4(1)
TECTKN	Total Kjeldahl Nitrogen as N	Digestion-Colorimetric	351.2(1)
TOXTOX	Total Organic Halogen	Combustion-Titrimetric	9020(2)
TONO1	Total Organic Nitrogen	Calculation ($TKN-NH_3$)	-
BAL O&G	Oil and Grease	Freon Extraction-Gravimetric	413.1(1)
IR AO&G	Oil and Grease	Freon Extraction-IR	413.2(1)
TECCN F	Cyanide Amendable to Chlorination	Chlorination-Distillation-Colorimetric	335.1(1)
TECCN W	Weak & Dissolved Cyanide	Distillation-Colorimetric	412H(3)
TECCN T	Total Cyanide	Distillation-Colorimetric	335.2(1)/9010(2)
STEPHEN	Phenolics	Distillation-Colorimetric	420.1(1)
COLIF F	Fecal Coliform	Membrane Filter	909C(3)
COLIF T	Total Coliform	Membrane Filter	909A(3)

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ANALYTICAL METHODOLOGY - INORGANIC TESTS (CONT.)

Test	Description	Methodology	Reference
IC BR	Bromide	Ion Chromatography	300.0(1)
POTCL2R	Residual Chlorine	Amperometric	330.2(1)
NESCOLR	Color	Pt-Co Colorimetric	110.2(1)
ICPHAR	Hardness as $CaCo_3$	Calculation	200.7(1)/314A(3)
TECNO2	Nitrite as N	Colorimetric	354.1(1)
SPES	Sulfide	Colorimetric	376.2(1)/9030(2)
BURSO3	Sulfite	Titrimetric	377.1(1)
SPEMBAS	MBAS (Surfactants)	Colorimetric	425.1(1)
SPETURB	Turbidity	Turbidimeter	180.1(1)
Gross Alpha		Proportional Counter	703(3)
Gross Beta		Proportional Counter	703(3)
Radium 226		Separation - Counter	705(3)
Radium 228		Separation - Counter	707(3)
Uranium		Fluorimetric	D2907.75(4)

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References

(1) Code of Federal Regulations, Chapter 40, Part 136 (40 CFR 136).
(2) SW-846, 2nd Edition, 1984.
(3) "Standard Methods for the Examination of Water and Wastewater", 15th Edition, 1980.
(4) "Annual Book of ASTM Standards", Part 31, Water, 1980.

APPENDIX F

Pathway Analysis and Exposure Assessment: Site Condition 3 - Unrestricted Site and Worst-Case Improbable Landuse

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APPENDIX F

PATHWAY ANALYSIS AND EXPOSURE ASSESSMENT:
SITE CONDITION 3 -
UNRESTRICTED SITE AND WORST-CASE IMPROBABLE LANDUSE

In accordance with the rationale discussed in Section 9, this appendix presents a pathway analysis and exposure assessment for the SDS site under assumed future Site Condition 3. The general assumptions necessary for the evaluation of this site condition are:

1) Unrestricted site access - the disposal area is open and abandoned. The surrounding land has been sold to a developer for residential housing.

2) A single well has been installed in the shallow unconfined aquifer at the northwest edge of the disposal area.

3) The main pond and evaporation system dikes are not maintained in any way. Therefore, the dikes gradually erode and the main pond fills to the decant level, as per Site Condition 2.

4) Residential development occurs at the edge of the borrow pit areas.

5) All ages from two years old to adults are considered capable of accessing all areas of the site.

These general assumptions set the stage for development of specific exposure scenarios for each completed pathway under Site Condition 3. As shown in Table 9-1, all pathways except IIIC are assumed to be complete. Pathway IIIC is not complete because the assumption of residential development precludes the use of the land for agricultural purposes.

Many of the exposure scenarios previously presented in Section 11 for Site Condition 2 apply also to Site Condition 3, specifically air Pathways IA through IC, surface water Pathways IIA, IIB and IID and ground water Pathway IVB. Direct contact exposure to soil/sludges (Pathway IIIA) differ from Site Condition 2 only in frequency of exposure and affected age groups. Age-specific body metrics used in calculating dermal exposure to soil and sludges are summarized in Table F-1. Where necessary, assumptions have been made regarding such factors as visitation frequency, play time, etc. in order to evaluate total life-time exposures for the hypothetical residents adjacent to the site; these factors are listed in Table F-2.

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TABLE F-1

Summary of Age-Specific Human Body Metrics

Age Group	Average Weight (Kg)	Average Skin Surface Areas (m2) for Extremities: Arms & Hands	Forearms & Hands	Hands	Legs & Feet	Feet	SUBTOTAL	TOTAL Body Surface (m2)	Estimated Torsal Surface (m2)
Averages for Ages 2-5 [1]	13.2 [1]	0.1 [1]	NA	0.03 [1]	0.18 [1]	0.039 [1]	0.28 [1]	0.57 [1]	0.29 [6]
(all data for 2-1/2 years)	% of TOTAL [2]	18%	NA	5%	32%	7%	49%		
Averages for ages 6-9 [1]	20.8 [1]	0.125 [1]	NA	0.04 [1]	0.28 [1]	0.056 [1]	0.405 [1]	0.82 [1]	0.415 [6]
(all data for 6 years)	% of TOTAL [2]	15%	NA	5%	34%	7%	49%		
Averages for ages 10-12	45.4 [3]	0.20 [3]	NA	0.07 [3]	0.45 [3]	0.09 [3]	0.65 [3]	1.32 [3]	0.67 [6]
	% of TOTAL [2]	17%	NA	5%	32%	7%[4]	49% [4]		
Adult [1]	70 [1]	0.34 [1]	0.17 [1]	0.091 [1]	0.54 [5]	0.13 [4]	0.89 [4]	1.81 [1]	0.92 [6]
	% of TOTAL [2]	19%	9.5%	5%	30%[5]	7%[4]	49% [4]		

NOTES:

[1] Source: Hawley, John K., 1985. Assessment of Health Risk from Exposure to Contaminated Soil. Risk Analysis 5(4): 289-302. All data presented with this footnote are as published in Table 1 of Hawley's paper, or elsewhere in that document. All other data are calculated from data in Table 1 of Hawley's paper, as noted below.

[2] Percentages are calculated as (surface area of body part(s))/(total body surface area)*100.

[3] Data are calculated as (adult value + [6-year-old value])/2 from data as reported in Hawley or as noted below.

[4] Percentage is assumed to be the same as calculated values for 2-1/2 year-olds and 6-year-olds in Hawley 1985.

[5] Percentage is calculated as SUBTOTAL % (49%) - ARMS & Hands % (19%) = 30%. Surface area for Legs & Feet is then calculated as 0.30*1.81 = 0.56 m2 (percent times total body area).

[6] Torsal surface estimated by sutracting subtotal for extremities from total body surface.

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TABLE F-2

Summary of Assumptions for Direct Exposure to Children and Adults
Unrestricted Site - EPA Worst-Case Improbable Future Landuse Scenario

CLIMATOLOGICAL AND SOCIOLOGICAL CONDITIONS (Assumes Walking Pre-teens ages 2 12 inclusive, and Adults, ages 13-70)		Assumed Value
Total number of years of play		18
Number of inclement days/year [1]		93
Number school days/year [2]		180
Number of non-school days/year		185
Number of days away from home [3]		14
Total Number of Possible Days of Play		256
Average playtime/day (hours) -	PRESCHOOL, clement weather	7 [4]
	PRESCHOOL, clement weather, unsupervised	1
Avg hrs playtime/school day	KINDERGARTEN clement weather	6 5 [5]
	KINDERGARTEN, clement weather, unsupervised	2
Avg hrs play/non-school day -	KINDERGARTEN, clement weather	8 [6]
	KINDERGARTEN, clement weather, unsupervised	3
Avg hrs playtime/school day -	ELEMENTARY clement weather	3 5 [7]
	ELEMENTARY, clement weather, unsupervised	1
Avg hrs play/non-school day -	ELEMENTARY clement weather	9 [8]
	ELEMENTARY, clement weather, unsupervised	4 5
Total hours/year unsupervised play, clement weather	2-4 years old	258
	5 years old	648
	6-12 years old	971
Percent of unsupervised Play in Disposal Areas		10%
Resultant Exposure Hours per Year	2-4 years old	26
	5-years old	65
	6-12 years old	97
Average Number of days/child-year in disposal area		26
Average number of days/adult-year in disposal area (see Section 11 3)		52

EXPOSURE CONDITIONS		Assumed Values by Age Group: Ages 2-5	Ages 6-9	Ages 10-12	Adult
Dermal area of hands and arms (m2) (see Table F-1) [9]		0 1	0 125	0 2	0 17
Dermal exposure - extremities (mg/day as soil) [10]		512	640	1023	670
Incidental ingestion of soil/sludge (mg/day) [11]		50	50	50	50
Intentional ingestion of soil/sludge (mg/day) [12]		10000	0	0	0
Total no years intentional ingestion (ages 2 & 3 only)		2	0	0	0
Absorption Factors for Non-PCBs					
Absorption as pure compound (% in 12 hours) [Hawley 1985]		12%			
Absorption factors for soil [13] (as % of pure compound absorption per 12 hours)	volatiles	10-25%			
	semivolatiles	1 0-10%			
	inorganics	0 1-1 0%			
Ingestion absorption factor [14]	PAHs	50%			
	All other organics	100%			
	inorganics	1 0-50%			
Absorption Factors for PCBs [15]					
Dermal		5%			
Gastrointestinal		30%			

[1] NOAA Climatological Data Annual Summary with Comparative Data for Austin
inclement weather = days of rain (0.2 7 days with >0 01 inches) + days with temperatures at or below freezing (22 7 days) Assumes sick time is included in total
[2] Houston Independent School System, official number of classroom days per year
[3] Assumes off-site visits (e g relatives family vacation non custodial parent) and/or babysitters
[4] Assumes 12 daylight hours - 2 nap hours - 3 meal/indoor hrs
[5] Assumes 12 daylight hours - 4 school hours - 1 nap hour - 0 5 bus hours
[6] Assumes 12 daylight hours - 3 meal/indoor hours - 1 nap hour
[7] Assumes 12 daylight hours - 7 school hours - 1 meal/indoor hour - 0 5 bus hour
[8] Assumes 12 daylight hours - 3 meal/indoor hours

[9] Exposure for adults assumes hands and forearms only (Hawley, 1985)
See Section 11 for detailed explanation
[10] Dermal exposure From Hawley (1985), 11 mg of soil is collected per 3) 5 cm2 of skin. For example
For sludge exposure = (extremities surface (m2)/23 5 cm2) * 11 mg * sludge concentration (mg/kg) * 12% * soil absorption factor [13]
[11] Incidental ingestion soil/sludge adhering to hands and transferred to mouth or mucosa
[12] Intentional ingestion deliberate eating of soil by picapatie (limited to ages 2 & 3)
Assumes improbable value from EPA draft documents (received from EPA Region IV, Feb 22, 1988)
[13] Ryan, Hawkins, Magee & Santos, 1987 Health Assessment 166-168
[14] Health Effects Assessment Documents, EPA/540/1-86/(multiple listings)
[15] PCB absorption factors from ORNA Document EPA/600/6-86/002, May 1986

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The three pathways that are significantly different or which did not occur under Site Conditions 1 and 2 are:

Pathways IIC and IIIA: Direct contact with water and sludges in the main pond by children assumed to be living in a hypothetical residential development immediately adjacent to the disposal facilities, which are assumed to be abandoned. Adult direct contact exposures are assumed to be the same frequency as for Site Condition 2.

Pathway IIIB: Intentional ingestion of soils and sludges from all waste compartments by a picaphile (soil-eating child).

Pathway IVA: Presence of a water well at the edge of the disposal area.

These three pathways are addressed in the following sections.

F.1 Surface Water Exposure Pathway

As shown in Table 9-1, all four potential surface water pathways are complete for Site Condition 3 and are the same conditions and exposures as discussed for Site Condition 2 with the following exceptions:

1) Direct contact exposure related to water in the main pond applies to a much broader range of ages.

2) Because of the residential development, utilization of Clark Lake by cattle does not occur.

Because of these assumptions, Pathways IIA and IIB are complete only to fish or wildlife. Since Clark Lake would still not be a drinking water source, the only exposure to humans would be through potential ingestion of fish. No edible species of fish occur in Clark Lake so it is unlikely that any would be consumed. Regular hunting of wildlife is unlikely, given the assumed residential development of the site area.

Pathway IIC (direct contact with or ingestion of water in the main pond) is complete to all exposure age groups who are old enough to access the site (two years old or older) except two through four year olds who are not likely to survive a fall into the pond under the (assumed) unsupervised conditions. Exposures for this pathway are not quantified in the risk analysis because the concentrations of indicator constituents in pond water are very low in comparison to the concentration of these same constituents in pond sludges. Hence, the calculated risk due to

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exposure to pond water is insignificant when compared to the risks associated with exposure to pond sludge, and would not impact the overall risk calculated due to exposure to sludge.

The fourth pathway, Pathway IID (Brazos River Bank failure), is identical for Site Conditions 2 and 3 and is addressed in Section 11.2.3.3.

F.2 Direct Contact Exposures

Given the scenario of an adjacent residential development and unrestricted site access, it is assumed that all age groups capable of walking unattended could have access to each site compartment (main pond and evaporative system) once a week for 52 visits per year.

Incidental dermal exposures for the main pond and evaporative system are assumed. These incidental exposures involve the hands and forearms in adults and the entire hands and arms in children (see Table F-2). This distinction is made because of the nature of activities involving these age groups. Adults will be engaged in only occasional activities that will expose their hands and forearms to soil and sludges as explained in Section 11.3.1, while children will be engaged in recreational, protracted contact with soils and sludges that will more likely involve their entire arms.

Using these assumptions, subchronic and chronic exposures for each indicator chemical for each age group indicated in Table F-3 and for each compartment have been calculated (Tables F-4A through F-4M). Total lifetime risk is calculated by using average exposures weighted by the number of years at the exposure level for each age group, up to a total of 68 years. (It is assumed that there is no exposure for the first two years of life.) These data, along with the hazard indices for non-carcinogens, are summarized in Tables F-5A and F-5B.

A summary of total carcinogenic risk and total hazard index is presented below for each compartment. Calculations were performed according to the procedure described in Section 11.3.3

Compartment	Total Hazard Index	Total Carcinogenic Risk
Main Pond Sludge	9.31%	5.72E-04
Evaporation System Sludge	0.97%	6.39E-05

Table F-6 summarizes the upper bound cancer risk and hazard index for each indicator chemical in each site compartment.

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Table F-3

Summary of Conditions Assumed for Calculations of Direct Contact Exposure
Unrestricted Site - Improbable Worst-Case Future Landuse

Type of Exposure	Body Surface Area Exposed (m2)	Resultant Unit Soil Exposure (mg/day)	Main Pond Sludges Frequency (days/yr)	Main Pond Sludges Duration (hrs)	Evaporation Sludges Frequency (days/yr)	Evaporation Sludges Duration (hrs)
DERMAL EXPOSURE	Adult					
Hands and forearms	0.17	870	52	12	52	12
	Ages 2-4 yrs					
Hands and arms	0.1	512	52	12	26	2
	Age 5 yrs					
Hands and arms	0.1	512	26	5	26	5.0
	Ages 6-9 yrs					
Hands and arms	0.125	640	26	7.5	26	7.5
	Ages 10-12 yrs					
Hands and arms	0.2	1023	26	7.5	26	7.5
INGESTION EXPOSURE	Adult					
Hands and forearms	NA	50	52	NA	52	NA
	Ages 2-4 yrs					
Hands and arms	NA	50	26	NA	26	NA
	Age 5 yrs					
Hands and arms	NA	50	26	NA	26	NA
	Ages 6-9 yrs					
Hands and arms	NA	50	26	NA	26	NA
	Ages 10-12 yrs					
Hands and arms	NA	50	26	NA	26	NA
Intentional Dirt (ages 2 & 3 only)		10000	26	NA	26	NA

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TABLE F-4A

Summary of Calculations of Direct Exposure Risks for Children and Adults: BENZENE
Unrestricted Site -- Improbable Future Landuse

Type of Exposure		Exposures for Specific Waste Compartments: Main Pond Sludges (mg/kg)		Evaporation Sludges (mg/kg)
Concentration in Disposal Compartment		1050		42.95
RESULTANT YEARLY EXPOSURE - ADULT				
Resultant Exposure (mg/year) - incidental dermal		1.425		0.058
Resultant Exposure (mg/year) - incidental ingestion		0.683		0.028
	Average Daily =	0.041	Average Daily =	0.002
Subchronic Daily Intake (SDI), mg/kg-day		5.79E-04		2.37E-05
Chronic Daily Intake (CDI), mg/kg-day		8.25E-05		3.37E-06
Body Weight (kg)	70			
RESULTANT YEARLY EXPOSURE - AGES 2-4 YEARS				
Resultant Exposure (mg/year) - incidental dermal		0.070		0.003
Resultant Exposure (mg/year) - incidental ingestion		0.341		0.014
	Average Daily =	0.0158	Average Daily =	0.0006
Subchronic Daily Intake (SDI), mg/kg-day		1.20E-03		4.90E-05
Chronic Daily Intake (CDI), mg/kg-day		8.53E-05		3.49E-06
Body Weight (kg)	13.2			
RESULTANT YEARLY EXPOSURE - AGE 5 YEARS				
Resultant Exposure (mg/year) - incidental dermal		0.175		0.007
Resultant Exposure (mg/year) - incidental ingestion		0.341		0.014
	Average Daily =	0.0198	Average Daily =	0.0008
Subchronic Daily Intake (SDI), mg/kg-day		1.50E-03		6.15E-05
Chronic Daily Intake (CDI), mg/kg-day		1.07E-04		4.38E-06
Body Weight (kg)	13.2			
RESULTANT YEARLY EXPOSURE - AGE 6-9 YEARS				
Resultant Exposure (mg/year) - incidental dermal		0.328		0.013
Resultant Exposure (mg/year) - incidental ingestion		0.341		0.014
	Average Daily =	0.0257	Average Daily =	0.0011
Subchronic Daily Intake (SDI), mg/kg-day		1.24E-03		5.06E-05
Chronic Daily Intake (CDI), mg/kg-day		8.81E-05		3.60E-06
Body Weight (kg)	20.8			
RESULTANT YEARLY EXPOSURE - AGE 10-12 YEARS				
Resultant Exposure (mg/year) - incidental dermal		0.524		0.021
Resultant Exposure (mg/year) - incidental ingestion		0.341		0.014
	Average Daily =	0.0333	Average Daily =	0.0014
Subchronic Daily Intake (SDI), mg/kg-day		7.33E-04		3.00E-05
Chronic Daily Intake (CDI), mg/kg-day		5.22E-05		2.13E-06
Body Weight (kg)	45.4			
Resultant Exposure - Intentional Ingestion (Pica)		68.250		2.792
(ages 2 & 3 only)	Average Daily =	2.625		0.107
Body Weight (kg)	13.2	SDI(mg/kg-day) 1.99E-01		8.13E-03
		CDI(mg/kg-day) 1.42E-02		5.79E-04

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TABLE F-43

Summary of Calculations of Direct Exposure Risks for Children and Adults: 2,4-DIMETHYLPHENOL
Unrestricted Site -- Improbable Future Landuse

Type of Exposure	Exposures for Specific Waste Compartments: Main Pond Sludges (mg/kg)	Evaporation Sludges (mg/kg)
Concentration in Disposal Compartment	342	24.7
RESULTANT YEARLY EXPOSURE - ADULT		
Resultant Exposure (mg/year) - incidental dermal	0.186	0.013
Resultant Exposure (mg/year) - incidental ingestion	0.089	0.006
Average Daily =	0.005	Average Daily = 0.0004
Subchronic Daily Intake (SDI), mg/kg-day	7.54E-05	5.45E-06
Chronic Daily Intake (CDI), mg/kg-day	1.07E-05	7.76E-07
Body Weight (kg) 70		
RESULTANT YEARLY EXPOSURE - AGES 2-4 YEARS		
Resultant Exposure (mg/year) - incidental dermal	0.009	0.001
Resultant Exposure (mg/year) - incidental ingestion	0.044	0.003
Average Daily =	0.0021	Average Daily = 0.0001
Subchronic Daily Intake (SDI), mg/kg-day	1.56E-04	1.13E-05
Chronic Daily Intake (CDI), mg/kg-day	1.11E-05	8.03E-07
Body Weight (kg) 13.2		
RESULTANT YEARLY EXPOSURE - AGE 5 YEARS		
Resultant Exposure (mg/year) - incidental dermal	0.023	0.002
Resultant Exposure (mg/year) - incidental ingestion	0.044	0.003
Average Daily =	0.0026	Average Daily = 0.0002
Subchronic Daily Intake (SDI), mg/kg-day	1.96E-04	1.41E-05
Chronic Daily Intake (CDI), mg/kg-day	1.40E-05	1.01E-06
Body Weight (kg) 13.2		
RESULTANT YEARLY EXPOSURE - AGE 6-9 YEARS		
Resultant Exposure (mg/year) - incidental dermal	0.043	0.003
Resultant Exposure (mg/year) - incidental ingestion	0.044	0.003
Average Daily =	0.0034	Average Daily = 0.0002
Subchronic Daily Intake (SDI), mg/kg-day	1.61E-04	1.16E-05
Chronic Daily Intake (CDI), mg/kg-day	1.15E-05	8.29E-07
Body Weight (kg) 20.8		
RESULTANT YEARLY EXPOSURE - AGE 10-12 YEARS		
Resultant Exposure (mg/year) - incidental dermal	0.068	0.005
Resultant Exposure (mg/year) - incidental ingestion	0.044	0.003
Average Daily =	0.0043	Average Daily = 0.0003
Subchronic Daily Intake (SDI), mg/kg-day	9.55E-05	6.89E-06
Chronic Daily Intake (CDI), mg/kg-day	6.80E-06	4.91E-07
Body Weight (kg) 45.4		
Resultant Exposure - Intentional Ingestion (Pica)	8.892	0.642
(ages 2 & 3 only) Average Daily =	0.342	0.025
Body Weight (kg) 13.2 SDI(mg/kg-day)	2.59E-02	1.87E-03
CDI(mg/kg-day)	1.85E-03	1.33E-04

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TABLE F-4C

Summary of Calculations of Direct Exposure Risks for Children and Adults: ETHYLBENZENE
Unrestricted Site -- Improbable Future Landuse

Type of Exposure	Exposures for Specific Waste Compartments: Main Pond Sludges (mg/kg)	Evaporation Sludges (mg/kg)
Concentration in Disposal Compartment	3267	301
RESULTANT YEARLY EXPOSURE - ADULT		
Resultant Exposure (mg/year) - incidental dermal	4.434	0.409
Resultant Exposure (mg/year) - incidental ingestion	2.124	0.196
Average Daily =	0.126	0.012
Subchronic Daily Intake (SDI), mg/kg-day	1.80E-03	1.66E-04
Chronic Daily Intake (CDI), mg/kg-day	2.57E-04	2.36E-05
Body Weight (kg) 70		
RESULTANT YEARLY EXPOSURE - AGES 2-4 YEARS		
Resultant Exposure (mg/year) - incidental dermal	0.217	0.020
Resultant Exposure (mg/year) - incidental ingestion	1.062	0.098
Average Daily =	0.0492	0.0045
Subchronic Daily Intake (SDI), mg/kg-day	3.73E-03	3.43E-04
Chronic Daily Intake (CDI), mg/kg-day	2.66E-04	2.45E-05
Body Weight (kg) 13.2		
RESULTANT YEARLY EXPOSURE - AGE 5 YEARS		
Resultant Exposure (mg/year) - incidental dermal	0.544	0.050
Resultant Exposure (mg/year) - incidental ingestion	1.062	0.098
Average Daily =	0.0617	0.0057
Subchronic Daily Intake (SDI), mg/kg-day	4.68E-03	4.31E-04
Chronic Daily Intake (CDI), mg/kg-day	3.33E-04	3.07E-05
Body Weight (kg) 13.2		
RESULTANT YEARLY EXPOSURE - AGE 6-9 YEARS		
Resultant Exposure (mg/year) - incidental dermal	1.019	0.094
Resultant Exposure (mg/year) - incidental ingestion	1.062	0.098
Average Daily =	0.0800	0.0074
Subchronic Daily Intake (SDI), mg/kg-day	[illegible].85E-03	3.55E-04
Chronic Daily Intake (CDI), mg/kg-day	2.74E-04	2.53E-05
Body Weight (kg) 20.8		
RESULTANT YEARLY EXPOSURE - AGE 10-12 YEARS		
Resultant Exposure (mg/year) - incidental dermal	1.629	0.150
Resultant Exposure (mg/year) - incidental ingestion	1.062	0.098
Average Daily =	0.1035	0.0095
Subchronic Daily Intake (SDI), mg/kg-day	2.28E-03	2.10E-04
Chronic Daily Intake (CDI), mg/kg-day	1.62E-04	1.50E-05
Body Weight (kg) 45.4		
Resultant Exposure - Intentional Ingestion (Pica)	212.355	19.565
(ages 2 & 3 only) Average Daily =	8.168	0.753
Body Weight (kg) 13.2 SDI(mg/kg-day)	6.19E-01	5.70E-02
CDI(mg/kg-day)	4.41E-02	4.06E-03

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TABLE F-4D

Summary of Calculations of Direct Exposure Risks for Children and Adults: NAPHTHALENE
Unrestricted Site -- Improbable Future Landuse

Type of Exposure	Exposures for Specific Waste Compartments: Main Pond Sludges (mg/kg)	Evaporation Sludges (mg/kg)
Concentration in Disposal Compartment	257	ND
RESULTANT YEARLY EXPOSURE - ADULT		
Resultant Exposure (mg/year) - incidental dermal	0.140	0.000
Resultant Exposure (mg/year) - incidental ingestion	0.033	0.000
Average Daily =	0.003	0.0000
Subchronic Daily Intake (SDI), mg/kg-day	4.75E-05	0.00E+00
Chronic Daily Intake (CDI), mg/kg-day	6.77E-06	0.00E+00
Body Weight (kg) 70		
RESULTANT YEARLY EXPOSURE - AGES 2-4 YEARS		
Resultant Exposure (mg/year) - incidental dermal	0.007	0.000
Resultant Exposure (mg/year) - incidental ingestion	0.017	0.000
Average Daily =	0.0009	0.0000
Subchronic Daily Intake (SDI), mg/kg-day	6.86E-05	0.00E+00
Chronic Daily Intake (CDI), mg/kg-day	4.89E-06	0.00E+00
Body Weight (kg) 13.2		
RESULTANT YEARLY EXPOSURE - AGE 5 YEARS		
Resultant Exposure (mg/year) - incidental dermal	0.017	0.000
Resultant Exposure (mg/year) - incidental ingestion	0.017	0.000
Average Daily =	0.0013	0.0000
Subchronic Daily Intake (SDI), mg/kg-day	9.85E-05	0.00E+00
Chronic Daily Intake (CDI), mg/kg-day	7.02E-06	0.00E+00
Body Weight (kg) 13.2		
RESULTANT YEARLY EXPOSURE - AGE 6-9 YEARS		
Resultant Exposure (mg/year) - incidental dermal	0.032	0.000
Resultant Exposure (mg/year) - incidental ingestion	0.017	0.000
Average Daily =	0.0019	0.0000
Subchronic Daily Intake (SDI), mg/kg-day	9.02E-05	0.00E+00
Chronic Daily Intake (CDI), mg/kg-day	6.43E-06	0.00E+00
Body Weight (kg) 20.8		
RESULTANT YEARLY EXPOSURE - AGE 10-12 YEARS		
Resultant Exposure (mg/year) - incidental dermal	0.051	0.000
Resultant Exposure (mg/year) - incidental ingestion	0.017	0.000
Average Daily =	0.0026	0.0000
Subchronic Daily Intake (SDI), mg/kg-day	5.76E-05	0.00E+00
Chronic Daily Intake (CDI), mg/kg-day	4.10E-06	0.00E+00
Body Weight (kg) 45.4		
Resultant Exposure - Intentional Ingestion (Pica)	3.341	0.000
(ages 2 & 3 only) Average Daily =	0.129	0.000
Body Weight (kg) 13.2 SDI(mg/kg-day)	9.73E-03	0.00E+00
CDI(mg/kg-day)	6.93E-04	0.00E+00

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TABLE F-4E

Summary of Calculations of Direct Exposure Risks for Children and Adults: PCBs (Total)
Unrestricted Site -- Improbable Future Landuse

Type of Exposure	Exposures for Specific Waste Compartments: Main Pond Sludges (mg/kg)	Evaporation Sludges (mg/kg)
Concentration in Disposal Compartment	159	25
RESULTANT YEARLY EXPOSURE - ADULT		
Resultant Exposure (mg/year) - incidental dermal	0.360	0.057
Resultant Exposure (mg/year) - incidental ingestion	0.124	0.020
Average Daily =	0.009	Average Daily = 0.0015
Subchronic Daily Intake (SDI), mg/kg-day	1.33E-04	2.09E-05
Chronic Daily Intake (CDI), mg/kg-day	1.89E-05	2.98E-06
Body Weight (kg) 70		
RESULTANT YEARLY EXPOSURE - AGES 2-4 YEARS		
Resultant Exposure (mg/year) - incidental dermal	0.018	0.003
Resultant Exposure (mg/year) - incidental ingestion	0.062	0.010
Average Daily =	0.0031	Average Daily = 0.0005
Subchronic Daily Intake (SDI), mg/kg-day	2.32E-04	3.65E-05
Chronic Daily Intake (CDI), mg/kg-day	1.65E-05	2.60E-06
Body Weight (kg) 13.2		
RESULTANT YEARLY EXPOSURE - AGE 5 YEARS		
Resultant Exposure (mg/year) - incidental dermal	0.044	0.007
Resultant Exposure (mg/year) - incidental ingestion	0.062	0.010
Average Daily =	0.0041	Average Daily = 0.0006
Subchronic Daily Intake (SDI), mg/kg-day	3.09E-04	4.86E-05
Chronic Daily Intake (CDI), mg/kg-day	2.20E-05	3.46E-06
Body Weight (kg) 13.2		
RESULTANT YEARLY EXPOSURE - AGE 6-9 YEARS		
Resultant Exposure (mg/year) - incidental dermal	0.083	0.013
Resultant Exposure (mg/year) - incidental ingestion	0.062	0.010
Average Daily =	0.0056	Average Daily = 0.0009
Subchronic Daily Intake (SDI), mg/kg-day	2.68E-04	4.21E-05
Chronic Daily Intake (CDI), mg/kg-day	1.91E-05	3.00E-06
Body Weight (kg) 20.8		
RESULTANT YEARLY EXPOSURE - AGE 10-12 YEARS		
Resultant Exposure (mg/year) - incidental dermal	0.132	0.021
Resultant Exposure (mg/year) - incidental ingestion	0.062	0.010
Average Daily =	0.0075	Average Daily = 0.0012
Subchronic Daily Intake (SDI), mg/kg-day	1.64E-04	2.59E-05
Chronic Daily Intake (CDI), mg/kg-day	1.17E-05	1.84E-06
Body Weight (kg) 45.4		
Resultant Exposure - Intentional Ingestion (Pica)	12.402	1.950
(ages 2 & 3 only) Average Daily =	0.477	0.075
Body Weight (kg) 13.2 SDI(mg/kg-day)	3.61E-02	5.68E-03
CDI(mg/kg-day)	2.57E-03	4.05E-04

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TABLE F-4F

Summary of Calculations of Direct Exposure Risks for Children and Adults: PHENOL
Unrestricted Site -- Improbable Future Landuse

Type of Exposure	Exposures for Specific Waste Compartments: Main Pond Sludges (mg/kg)	Evaporation Sludges (mg/kg)
Concentration in Disposal Compartment	695	757
RESULTANT YEARLY EXPOSURE - ADULT		
Resultant Exposure (mg/year) - incidental dermal	0.377	0.411
Resultant Exposure (mg/year) - incidental ingestion	0.181	0.197
Average Daily =	0.011	Average Daily = 0.0117
Subchronic Daily Intake (SDI), mg/kg-day	1.53E-04	1.67E-04
Chronic Daily Intake (CDI), mg/kg-day	2.18E-05	2.38E-05
Body Weight (kg) 70		
RESULTANT YEARLY EXPOSURE - AGES 2-4 YEARS		
Resultant Exposure (mg/year) - incidental dermal	0.019	0.020
Resultant Exposure (mg/year) - incidental ingestion	0.090	0.098
Average Daily =	0.0042	Average Daily = 0.0046
Subchronic Daily Intake (SDI), mg/kg-day	3.17E-04	3.45E-04
Chronic Daily Intake (CDI), mg/kg-day	2.26E-05	2.46E-05
Body Weight (kg) 13.2		
RESULTANT YEARLY EXPOSURE - AGE 5 YEARS		
Resultant Exposure (mg/year) - incidental dermal	0.046	0.050
Resultant Exposure (mg/year) - incidental ingestion	0.090	0.098
Average Daily =	0.0053	Average Daily = 0.0057
Subchronic Daily Intake (SDI), mg/kg-day	3.98E-04	4.34E-04
Chronic Daily Intake (CDI), mg/kg-day	2.84E-05	3.09E-05
Body Weight (kg) 13.2		
RESULTANT YEARLY EXPOSURE - AGE 6-9 YEARS		
Resultant Exposure (mg/year) - incidental dermal	0.087	0.094
Resultant Exposure (mg/year) - incidental ingestion	0.090	0.098
Average Daily =	0.0068	Average Daily = 0.0074
Subchronic Daily Intake (SDI), mg/kg-day	3.27E-04	3.57E-04
Chronic Daily Intake (CDI), mg/kg-day	2.33E-05	2.54E-05
Body Weight (kg) 20.8		
RESULTANT YEARLY EXPOSURE - AGE 10-12 YEARS		
Resultant Exposure (mg/year) - incidental dermal	0.139	0.151
Resultant Exposure (mg/year) - incidental ingestion	0.090	0.098
Average Daily =	0.0088	Average Daily = 0.0096
Subchronic Daily Intake (SDI), mg/kg-day	1.94E-04	2.11E-04
Chronic Daily Intake (CDI), mg/kg-day	1.38E-05	1.51E-05
Body Weight (kg) 45.4		
Resultant Exposure - Intentional Ingestion (Pica)	18.070	19.682
(ages 2 & 3 only) Average Daily =	0.695	0.757
Body Weight (kg) 13.2 SDI(mg/kg-day)	5.27E-02	5.73E-02
CDI(mg/kg-day)	3.75E-03	4.09E-03

011607

TABLE F-4G

Summary of Calculations of Direct Exposure Risks for Children and Adults: TETRACHLOROETHYLENE
Unrestricted Site -- Improbable Future Landuse

Type of Exposure		Exposures for Specific Waste Compartments: Main Pond Sludges (mg/kg)		Evaporation Sludges (mg/kg)
Concentration in Disposal Compartment		121		21.3
RESULTANT YEARLY EXPOSURE - ADULT				
Resultant Exposure (mg/year) - incidental dermal		0.164		0.029
Resultant Exposure (mg/year) - incidental ingestion		0.079		0.014
	Average Daily =	0.005	Average Daily =	0.001
Subchronic Daily Intake (SDI), mg/kg-day		6.67E-05		1.17E-05
Chronic Daily Intake (CDI), mg/kg-day		9.51E-06		1.67E-06
Body Weight (kg)	70			
RESULTANT YEARLY EXPOSURE - AGES 2-4 YEARS				
Resultant Exposure (mg/year) - incidental dermal		0.008		0.001
Resultant Exposure (mg/year) - incidental ingestion		0.039		0.007
	Average Daily =	0.0018	Average Daily =	0.0003
Subchronic Daily Intake (SDI), mg/kg-day		1.38E-04		2.43E-05
Chronic Daily Intake (CDI), mg/kg-day		9.83E-06		1.73E-06
Body Weight (kg)	13.2			
RESULTANT YEARLY EXPOSURE - AGE 5 YEARS				
Resultant Exposure (mg/year) - incidental dermal		0.020		0.004
Resultant Exposure (mg/year) - incidental ingestion		0.039		0.007
	Average Daily =	0.0023	Average Daily =	0.0004
Subchronic Daily Intake (SDI), mg/kg-day		1.73E-04		3.05E-05
Chronic Daily Intake (CDI), mg/kg-day		1.23E-05		2.17E-06
Body Weight (kg)	13.2			
RESULTANT YEARLY EXPOSURE - AGE 6-9 YEARS				
Resultant Exposure (mg/year) - incidental dermal		0.038		0.007
Resultant Exposure (mg/year) - incidental ingestion		0.039		0.007
	Average Daily =	0.0030	Average Daily =	0.0005
Subchronic Daily Intake (SDI), mg/kg-day		1.43E-04		2.51E-05
Chronic Daily Intake (CDI), mg/kg-day		1.02E-05		1.79E-06
Body Weight (kg)	20.8			
RESULTANT YEARLY EXPOSURE - AGE 10-12 YEARS				
Resultant Exposure (mg/year) - incidental dermal		0.060		0.011
Resultant Exposure (mg/year) - incidental ingestion		0.039		0.007
	Average Daily =	0.0038	Average Daily =	0.0007
Subchronic Daily Intake (SDI), mg/kg-day		8.44E-05		1.49E-05
Chronic Daily Intake (CDI), mg/kg-day		6.01E-06		1.06E-06
Body Weight (kg)	45.4			
Resultant Exposure - Intentional Ingestion (Pica)		7.865		1.385
(ages 2 & 3 only)	Average Daily =	0.303		0.053
Body Weight (kg)	13.2	SDI(mg/kg-day) 2.29E-02		4.03E-03
		CDI(mg/kg-day) 1.63E-03		2.87E-04

011608

TABLE F-4K

Summary of Calculations of Direct Exposure Risks for Children and Adults: TOLUENE
Unrestricted Site -- Improbable Future Landuse

Type of Exposure	Exposures for Specific Waste Compartments: Main Pond Sludges (mg/kg)	Evaporation Sludges (mg/kg)
Concentration in Disposal Compartment	1225	165
RESULTANT YEARLY EXPOSURE - ADULT		
Resultant Exposure (mg/year) - incidental dermal	1.663	0.224
Resultant Exposure (mg/year) - incidental ingestion	0.796	0.107
Average Daily =	0.047	Average Daily = 0.006
Subchronic Daily Intake (SDI), mg/kg-day	6.76E-04	9.10E-05
Chronic Daily Intake (CDI), mg/kg-day	9.62E-05	1.30E-05
Body Weight (kg) 70		
RESULTANT YEARLY EXPOSURE - AGES 2-4 YEARS		
Resultant Exposure (mg/year) - incidental dermal	0.082	0.011
Resultant Exposure (mg/year) - incidental ingestion	0.398	0.054
Average Daily =	0.0184	Average Daily = 0.0025
Subchronic Daily Intake (SDI), mg/kg-day	1.40E-03	1.88E-04
Chronic Daily Intake (CDI), mg/kg-day	9.96E-05	1.34E-05
Body Weight (kg) 13.2		
RESULTANT YEARLY EXPOSURE - AGE 5 YEARS		
Resultant Exposure (mg/year) - incidental dermal	0.204	0.027
Resultant Exposure (mg/year) - incidental ingestion	0.398	0.054
Average Daily =	0.0232	Average Daily = 0.0031
Subchronic Daily Intake (SDI), mg/kg-day	1.75E-03	2.36E-04
Chronic Daily Intake (CDI), mg/kg-day	1.25E-04	1.68E-05
Body Weight (kg) 13.2		
RESULTANT YEARLY EXPOSURE - AGE 6-9 YEARS		
Resultant Exposure (mg/year) - incidental dermal	0.382	0.051
Resultant Exposure (mg/year) - incidental ingestion	0.398	0.054
Average Daily =	0.0300	Average Daily = 0.0040
Subchronic Daily Intake (SDI), mg/kg-day	1.44E-03	1.94E-04
Chronic Daily Intake (CDI), mg/kg-day	1.03E-04	1.38E-05
Body Weight (kg) 20.8		
RESULTANT YEARLY EXPOSURE - AGE 10-12 YEARS		
Resultant Exposure (mg/year) - incidental dermal	0.611	0.082
Resultant Exposure (mg/year) - incidental ingestion	0.398	0.054
Average Daily =	0.0388	Average Daily = 0.0052
Subchronic Daily Intake (SDI), mg/kg-day	8.55E-04	1.15E-04
Chronic Daily Intake (CDI), mg/kg-day	6.09E-05	8.20E-06
Body Weight (kg) 45.4		
Resultant Exposure - Intentional Ingestion (Pica)	79.625	10.725
(ages 2 & 3 only) Average Daily =	3.063	0.413
Body Weight (kg) 13.2 SDI(mg/kg-day)	2.32E-01	3.13E-02
CDI(mg/kg-day)	1.65E-02	2.23E-03

011609

TABLE F-41

Summary of Calculations of Direct Exposure Risks for Children and Adults: TRICHLOROETHYLENE
Unrestricted Site -- Improbable Future Landuse

Type of Exposure	Exposures for Specific Waste Compartments: Main Pond Sludges (mg/kg)	Evaporation Sludges (mg/kg)
Concentration in Disposal Compartment	50	ND
RESULTANT YEARLY EXPOSURE - ADULT		
Resultant Exposure (mg/year) - incidental dermal	0.068	0.000
Resultant Exposure (mg/year) - incidental ingestion	0.033	0.000
Average Daily =	0.002	Average Daily = 0.000
Subchronic Daily Intake (SDI), mg/kg-day	2.76E-05	0.00E+00
Chronic Daily Intake (CDI), mg/kg-day	3.93E-06	0.00E+00
Body Weight (kg) 70		
RESULTANT YEARLY EXPOSURE - AGES 2-4 YEARS		
Resultant Exposure (mg/year) - incidental dermal	0.003	0.000
Resultant Exposure (mg/year) - incidental ingestion	0.016	0.000
Average Daily =	0.0008	Average Daily = 0.0000
Subchronic Daily Intake (SDI), mg/kg-day	5.70E-05	0.00E+00
Chronic Daily Intake (CDI), mg/kg-day	4.06E-06	0.00E+00
Body Weight (kg) 13.2		
RESULTANT YEARLY EXPOSURE - AGE 5 YEARS		
Resultant Exposure (mg/year) - incidental dermal	0.008	0.000
Resultant Exposure (mg/year) - incidental ingestion	0.016	0.000
Average Daily =	0.0009	Average Daily = 0.0000
Subchronic Daily Intake (SDI), mg/kg-day	7.16E-05	0.00E+00
Chronic Daily Intake (CDI), mg/kg-day	5.10E-06	0.00E+00
Body Weight (kg) 13.2		
RESULTANT YEARLY EXPOSURE - AGE 6-9 YEARS		
Resultant Exposure (mg/year) - incidental dermal	0.016	0.000
Resultant Exposure (mg/year) - incidental ingestion	0.016	0.000
Average Daily =	0.0012	Average Daily = 0.0000
Subchronic Daily Intake (SDI), mg/kg-day	5.89E-05	0.00E+00
Chronic Daily Intake (CDI), mg/kg-day	4.20E-06	0.00E+00
Body Weight (kg) 20.8		
RESULTANT YEARLY EXPOSURE - AGE 10-12 YEARS		
Resultant Exposure (mg/year) - incidental dermal	0.025	0.000
Resultant Exposure (mg/year) - incidental ingestion	0.016	0.000
Average Daily =	0.0016	Average Daily = 0.0000
Subchronic Daily Intake (SDI), mg/kg-day	3.49E-05	0.00E+00
Chronic Daily Intake (CDI), mg/kg-day	2.49E-06	0.00E+00
Body Weight (kg) 45.4		
Resultant Exposure - Intentional Ingestion (Pica)	3.250	0.000
(ages 2 & 3 only) Average Daily =	0.125	0.000
Body Weight (kg) 13.2 SDI(mg/kg-day)	9.47E-03	0.00E+00
CDI(mg/kg-day)	6.79E-04	0.00E+00

011610

TABLE F-4J

Summary of Calculations of Direct Exposure Risks for Children and Adults: CHROMIUM
Unrestricted Site -- Improbable Future Landuse

Type of Exposure		Exposures for Specific Waste Compartments: Main Pond Sludges (mg/kg)		Evaporation Sludges (mg/kg)
Concentration in Disposal Compartment		236		72.6
RESULTANT YEARLY EXPOSURE - ADULT				
Resultant Exposure (mg/year) - incidental dermal		0.013		0.0039
Resultant Exposure (mg/year) - incidental ingestion		0.002		0.0005
	Average Daily =	0.0003	Average Daily =	0.0001
Subchronic Daily Intake (SDI), mg/kg-day		3.94E-06		1.21E-06
Chronic Daily Intake (CDI), mg/kg-day		5.61E-07		1.73E-07
Body Weight (kg)	70			
RESULTANT YEARLY EXPOSURE - AGES 2-4 YEARS				
Resultant Exposure (mg/year) - incidental dermal		0.0006		0.00019
Resultant Exposure (mg/year) - incidental ingestion		0.0008		0.00024
	Average Daily =	0.00005	Average Daily =	0.00002
Subchronic Daily Intake (SDI), mg/kg-day		4.07E-06		1.25E-06
Chronic Daily Intake (CDI), mg/kg-day		2.90E-07		8.91E-08
Body Weight (kg)	13.2			
RESULTANT YEARLY EXPOSURE - AGE 5 YEARS				
Resultant Exposure (mg/year) - incidental dermal		0.0016		0.00048
Resultant Exposure (mg/year) - incidental ingestion		0.0008		0.00024
	Average Daily =	0.00009	Average Daily =	0.00003
Subchronic Daily Intake (SDI), mg/kg-day		6.81E-06		2.10E-06
Chronic Daily Intake (CDI), mg/kg-day		4.85E-07		1.49E-07
Body Weight (kg)	13.2			
RESULTANT YEARLY EXPOSURE - AGE 6-9 YEARS				
Resultant Exposure (mg/year) - incidental dermal		0.0029		0.00091
Resultant Exposure (mg/year) - incidental ingestion		0.0008		0.00024
	Average Daily =	0.00014	Average Daily =	0.00004
Subchronic Daily Intake (SDI), mg/kg-day		6.86E-06		2.11E-06
Chronic Daily Intake (CDI), mg/kg-day		4.89E-07		1.50E-07
Body Weight (kg)	20.8			
RESULTANT YEARLY EXPOSURE - AGE 10-12 YEARS				
Resultant Exposure (mg/year) - incidental dermal		0.0047		0.00145
Resultant Exposure (mg/year) - incidental ingestion		0.0008		0.00024
	Average Daily =	0.0002	Average Daily =	0.00006
Subchronic Daily Intake (SDI), mg/kg-day		4.64E-06		1.43E-06
Chronic Daily Intake (CDI), mg/kg-day		3.30E-07		1.02E-07
Body Weight (kg)	45.4			
Resultant Exposure - Intentional Ingestion (Pica)		0.153		0.047
(ages 2 & 3 only)	Average Daily =	0.006		0.002
Body Weight (kg)	13.2	SDI(mg/kg-day)	4.47E-04	1.38E-04
		CDI(mg/kg-day)	3.18E-05	9.79E-06

TABLE F-4K

Summary of Calculations of Direct Exposure Risks for Children and Adults: LEAD
Unrestricted Site -- Improbable Future Landuse

Type of Exposure	Exposures for Specific Waste Compartments: Main Pond Sludges (mg/kg)	Evaporation Sludges (mg/kg)
Concentration in Disposal Compartment	404	164
RESULTANT YEARLY EXPOSURE - ADULT		
Resultant Exposure (mg/year) - incidental dermal	0.022	0.0089
Resultant Exposure (mg/year) - incidental ingestion	0.003	0.0011
Average Daily =	0.0005	Average Daily = 0.0002
Subchronic Daily Intake (SDI), mg/kg-day	6.75E-06	2.74E-06
Chronic Daily Intake (CDI), mg/kg-day	9.61E-07	3.90E-07
Body Weight (kg) 70		
RESULTANT YEARLY EXPOSURE - AGES 2-4 YEARS		
Resultant Exposure (mg/year) - incidental dermal	0.0011	0.00044
Resultant Exposure (mg/year) - incidental ingestion	0.0013	0.00053
Average Daily =	0.00009	Average Daily = 0.00004
Subchronic Daily Intake (SDI), mg/kg-day	6.96E-06	2.83E-06
Chronic Daily Intake (CDI), mg/kg-day	4.96E-07	2.01E-07
Body Weight (kg) 13.2		
RESULTANT YEARLY EXPOSURE - AGE 5 YEARS		
Resultant Exposure (mg/year) - incidental dermal	0.0027	0.00109
Resultant Exposure (mg/year) - incidental ingestion	0.0013	0.00053
Average Daily =	0.00015	Average Daily = 0.00006
Subchronic Daily Intake (SDI), mg/kg-day	1.17E-05	4.73E-06
Chronic Daily Intake (CDI), mg/kg-day	8.31E-07	3.37E-07
Body Weight (kg) 13.2		
RESULTANT YEARLY EXPOSURE - AGE 6-9 YEARS		
Resultant Exposure (mg/year) - incidental dermal	0.0050	0.00205
Resultant Exposure (mg/year) - incidental ingestion	0.0013	0.00053
Average Daily =	0.00024	Average Daily = 0.00010
Subchronic Daily Intake (SDI), mg/kg-day	1.18E-05	4.77E-06
Chronic Daily Intake (CDI), mg/kg-day	8.37E-07	3.40E-07
Body Weight (kg) 20.8		
RESULTANT YEARLY EXPOSURE - AGE 10-12 YEARS		
Resultant Exposure (mg/year) - incidental dermal	0.0081	0.00327
Resultant Exposure (mg/year) - incidental ingestion	0.0013	0.00053
Average Daily =	0.0004	Average Daily = 0.00015
Subchronic Daily Intake (SDI), mg/kg-day	7.94E-06	3.22E-06
Chronic Daily Intake (CDI), mg/kg-day	5.66E-07	2.30E-07
Body Weight (kg) 45.4		
Resultant Exposure - Intentional Ingestion (Pica)	0.263	0.107
(ages 2 & 3 only) Average Daily =	0.010	0.004
Body Weight (kg) 13.2 SDI(mg/kg-day)	7.65E-04	3.11E-04
CDI(mg/kg-day)	5.45E-05	2.21E-05

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TABLE F-4L

Summary of Calculations of Direct Exposure Risks for Children and Adults: NICKEL
Unrestricted Site -- Improbable Future Landuse

Type of Exposure	Exposures for Specific Waste Compartments: Main Pond Sludges (mg/kg)	Evaporation Sludges (mg/kg)
Concentration in Disposal Compartment	67	31.5
RESULTANT YEARLY EXPOSURE - ADULT		
Resultant Exposure (mg/year) - incidental dermal	0.0036	0.0017
Resultant Exposure (mg/year) - incidental ingestion	0.0004	0.0002
Average Daily =	0.0001	Average Daily = 0.00004
Subchronic Daily Intake (SDI), mg/kg-day	1.12E-06	5.26E-07
Chronic Daily Intake (CDI), mg/kg-day	1.59E-07	7.49E-08
Body Weight (kg) 70		
RESULTANT YEARLY EXPOSURE - AGES 2-4 YEARS		
Resultant Exposure (mg/year) - incidental dermal	0.0002	0.00008
Resultant Exposure (mg/year) - incidental ingestion	0.0002	0.00010
Average Daily =	0.00002	Average Daily = 0.00001
Subchronic Daily Intake (SDI), mg/kg-day	1.15E-06	5.43E-07
Chronic Daily Intake (CDI), mg/kg-day	8.22E-08	3.87E-08
Body Weight (kg) 13.2		
RESULTANT YEARLY EXPOSURE - AGE 5 YEARS		
Resultant Exposure (mg/year) - incidental dermal	0.0004	0.00021
Resultant Exposure (mg/year) - incidental ingestion	0.0002	0.00010
Average Daily =	0.00003	Average Daily = 0.00001
Subchronic Daily Intake (SDI), mg/kg-day	1.93E-06	9.09E-07
Chronic Daily Intake (CDI), mg/kg-day	1.38E-07	6.48E-08
Body Weight (kg) 13.2		
RESULTANT YEARLY EXPOSURE - AGE 6-9 YEARS		
Resultant Exposure (mg/year) - incidental dermal	0.0008	0.00039
Resultant Exposure (mg/year) - incidental ingestion	0.0002	0.00010
Average Daily =	0.00004	Average Daily = 0.00002
Subchronic Daily Intake (SDI), mg/kg-day	1.95E-06	9.16E-07
Chronic Daily Intake (CDI), mg/kg-day	1.39E-07	6.53E-08
Body Weight (kg) 20.8		
RESULTANT YEARLY EXPOSURE - AGE 10-12 YEARS		
Resultant Exposure (mg/year) - incidental dermal	0.0013	0.00063
Resultant Exposure (mg/year) - incidental ingestion	0.0002	0.00010
Average Daily =	0.0001	Average Daily = 0.00003
Subchronic Daily Intake (SDI), mg/kg-day	1.32E-06	6.19E-07
Chronic Daily Intake (CDI), mg/kg-day	9.38E-08	4.41E-08
Body Weight (kg) 45.4		
Resultant Exposure - Intentional Ingestion (Pica)	0.044	0.020
(ages 2 & 3 only) Average Daily =	0.002	0.001
Body Weight (kg) 13.2 SDI(mg/kg-day)	1.27E-04	5.97E-05
CDI(mg/kg-day)	9.04E-06	4.25E-06

011613

TABLE F-4H

Summary of Calculations of Direct Exposure Risks for Children and Adults: ZINC
Unrestricted Site -- Improbable Future Landuse

Type of Exposure	Exposures for Specific Waste Compartments: Main Pond Sludges (mg/kg)	Evaporation Sludges (mg/kg)
Concentration in Disposal Compartment	573	751
RESULTANT YEARLY EXPOSURE - ADULT		
Resultant Exposure (mg/year) - incidental dermal	0.0311	0.0408
Resultant Exposure (mg/year) - incidental ingestion	0.0037	0.0049
Average Daily =	0.0007	Average Daily = 0.00088
Subchronic Daily Intake (SDI), mg/kg-day	9.57E-06	1.25E-05
Chronic Daily Intake (CDI), mg/kg-day	1.36E-06	1.79E-06
Body Weight (kg) 70		
RESULTANT YEARLY EXPOSURE - AGES 2-4 YEARS		
Resultant Exposure (mg/year) - incidental dermal	0.0015	0.0020
Resultant Exposure (mg/year) - incidental ingestion	0.0019	0.0024
Average Daily =	0.0001	Average Daily = 0.0002
Subchronic Daily Intake (SDI), mg/kg-day	9.87E-06	1.29E-05
Chronic Daily Intake (CDI), mg/kg-day	7.03E-07	9.22E-07
Body Weight (kg) 13.2		
RESULTANT YEARLY EXPOSURE - AGE 5 YEARS		
Resultant Exposure (mg/year) - incidental dermal	0.0038	0.0050
Resultant Exposure (mg/year) - incidental ingestion	0.0019	0.0024
Average Daily =	0.0002	Average Daily = 0.0003
Subchronic Daily Intake (SDI), mg/kg-day	1.65E-05	2.17E-05
Chronic Daily Intake (CDI), mg/kg-day	1.18E-06	1.54E-06
Body Weight (kg) 13.2		
RESULTANT YEARLY EXPOSURE - AGE 6-9 YEARS		
Resultant Exposure (mg/year) - incidental dermal	0.0072	0.0094
Resultant Exposure (mg/year) - incidental ingestion	0.0019	0.0024
Average Daily =	0.0003	Average Daily = 0.0005
Subchronic Daily Intake (SDI), mg/kg-day	1.67E-05	2.18E-05
Chronic Daily Intake (CDI), mg/kg-day	1.19E-06	1.56E-06
Body Weight (kg) 20.8		
RESULTANT YEARLY EXPOSURE - AGE 10-12 YEARS		
Resultant Exposure (mg/year) - incidental dermal	0.0114	0.0150
Resultant Exposure (mg/year) - incidental ingestion	0.0019	0.0024
Average Daily =	0.0005	Average Daily = 0.0007
Subchronic Daily Intake (SDI), mg/kg-day	1.13E-05	1.48E-05
Chronic Daily Intake (CDI), mg/kg-day	8.02E-07	1.05E-06
Body Weight (kg) 45.4		
Resultant Exposure - Intentional Ingestion (Pica)	0.372	0.488
(ages 2 & 3 only) Average Daily =	0.014	0.019
Body Weight (kg) 13.2 SDI(mg/kg-day)	1.09E-03	1.42E-03
CDI(mg/kg-day)	7.73E-05	1.01E-04

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TABLE F-5A

Summary of Estimated Exposures and Calculated Risks for Indicator Chemicals
52 days/year Exposure to Main Pond Sludges

Indicator Chemical	Age Group Exposed	SDI Maximum Subchronic Daily Exposure (mg/kg-day)	EPA Published AIS (mg/kg-day)	CDI Daily Chronic Exposure (mg/kg-day)	EPA Published AIC (mg/kg-day)	Hazard Index HI = CDI/AIC (Percent)	Carcinogenicity CPF (mg/kg-d)^-1	Carcinogenicity Resultant Lifetime Risk	No. Years at Exposure Level	TOTAL Upper Bound Lifetime Cancer Risk
BENZENE	2-4 Years	1.20E-03	NA	8.53E-05	NA	NA	0.052 (A)	4.44E-06	3	1.90E-07
	Picaphite	1.99E-01	NA	1.42E-02	NA	NA	0.052 (A)	7.38E-04	2	2.11E-05
	5 Years	1.50E-03	NA	1.07E-04	NA	NA	0.052 (A)	5.56E-06	1	7.95E-08
	6-9 Years	1.24E-03	NA	8.81E-05	NA	NA	0.052 (A)	4.58E-06	4	2.62E-07
	10-12 Years	7.33E-04	NA	5.22E-05	NA	NA	0.052 (A)	2.71E-06	3	1.16E-07
	Adult	5.79E-04	NA	8.25E-05	NA	NA	0.052 (A)	4.29E-06	58	3.55E-06
TOTAL RISK LEVELS									68	2.53E-05
(A) EPA Weight of Evidence Ranking (see Table 7-6 & Appendix C).										
2,4-DIMETHYLPHENOL	2-4 Years	1.56E-04	0.014 *	1.11E-05	0.0014 *	0.79%	Non-carcinogen	NA	3	NA
	Picaphite	2.59E-02	0.014 *	1.85E-03	0.0014 *	132.14%	Non-carcinogen	NA	2	NA
	5 Years	1.96E-04	0.014 *	1.40E-05	0.0014 *	1.00%	Non-carcinogen	NA	1	NA
	6-9 Years	1.61E-04	0.014 *	1.15E-04	0.0014 *	8.21%	Non-carcinogen	NA	4	NA
	10-12 Years	9.55E-05	0.014 *	6.80E-06	0.0014 *	0.49%	Non-carcinogen	NA	3	NA
	Adult	7.54E-05	0.014 *	1.07E-05	0.0014 *	0.76%	Non-carcinogen	NA	58	NA
TOTAL RISK LEVELS						4.95%			68	
* Value from Region VI notes, Feb 22 1988.										
ETHYLBENZENE	2-4 Years	3.73E-03	0.97	2.66E-04	0.1	0.27%	Non-carcinogen	NA	3	NA
	Picaphite	6.19E-01	0.97	4.41E-02	0.1	44.10%	Non-carcinogen	NA	2	NA
	5 Years	4.68E-03	0.97	3.33E-04	0.1	0.33%	Non-carcinogen	NA	1	NA
	6-9 Years	3.85E-03	0.97	2.74E-04	0.1	0.27%	Non-carcinogen	NA	4	NA
	10-12 Years	2.28E-03	0.97	1.62E-04	0.1	0.16%	Non-carcinogen	NA	3	NA
	Adult	1.80E-03	0.97	2.57E-04	0.1	0.26%	Non-carcinogen	NA	58	NA
TOTAL RISK LEVELS						1.51%			68	

TABLE F-5A (Continued)

Summary of Estimated Exposures and Calculated Risks for Indicator Chemicals
Exposure to Main Pond Sludges

Indicator Chemical	Age Group Exposed	SDI Maximum Subchronic Daily Exposure (mg/kg-day)	EPA Published AIS (mg/kg-day)	CDI Daily Chronic Exposure (mg/kg-day)	EPA Published AIC (mg/kg-day)	Hazard Index HI = CDI/AIC (Percent)	Carcinogenicity CPF (mg/kg-d)^-1	Carcinogenicity Resultant Lifetime Risk	No. Years at Exposure Level	TOTAL Upper Bound Lifetime Cancer Risk
NAPHTHALENE	2-4 Years	6.86E-05	0.41 *	4.89E-06	0.41 *	0.0012%	Non-carcinogen	NA	3	NA
	Picaphile	9.73E-03	0.41 *	6.93E-04	0.41 *	0.1690%	Non-carcinogen	NA	2	NA
	5 Years	9.85E-05	0.41 *	7.02E-06	0.41 *	0.0017%	Non-carcinogen	NA	1	NA
	6-9 Years	9.02E-05	0.41 *	6.43E-06	0.41 *	0.0016%	Non-carcinogen	NA	4	NA
	10-12 Years	5.76E-05	0.41 *	4.01E-06	0.41 *	0.0010%	Non-carcinogen	NA	3	NA
	Adult	4.75E-05	0.41 *	6.77E-06	0.41 *	0.0017%	Non-carcinogen	NA	58	NA
TOTAL RISK LEVELS						0.01%			68	
* Value from EPA Region VI notes, February 1988.										
PCBs (Total)	2-4 Years	2.32E-04	NA	1.65E-05	NA	NA	4.34	7.16E-05	3	3.07E-06
	Picaphile	3.61E-02	NA	2.57E-03	NA	NA	4.34	1.12E-02	2	3.19E-04
	5 Years	3.09E-04	NA	2.20E-05	NA	NA	4.34	9.55E-05	1	1.36E-06
	6-9 Years	2.68E-04	NA	1.91E-05	NA	NA	4.34	8.29E-05	4	4.74E-06
	10-12 Years	1.64E-04	NA	1.17E-05	NA	NA	4.34	5.08E-05	3	2.18E-06
	Adult	1.33E-04	NA	1.89E-05	NA	NA	4.34	8.20E-05	58	6.80E-05
TOTAL RISK LEVELS									68	3.98E-04
PHENOL	2-4 Years	3.17E-04	0.04	2.26E-05	0.04	0.0565%	Non-carcinogen	NA	3	NA
	Picaphile	5.27E-02	0.04	3.75E-03	0.04	9.3750%	Non-carcinogen	NA	2	NA
	5 Years	3.98E-04	0.04	2.84E-05	0.04	0.0710%	Non-carcinogen	NA	1	NA
	6-9 Years	3.27E-04	0.04	2.33E-05	0.04	0.0583%	Non-carcinogen	NA	4	NA
	10-12 Years	1.94E-04	0.04	1.38E-05	0.04	0.0345%	Non-carcinogen	NA	3	NA
	Adult	1.53E-04	0.04	2.18E-05	0.04	0.0545%	Non-carcinogen	NA	58	NA
TOTAL RISK LEVELS						0.32%			68	

TABLE F-5A (Continued)

Summary of Estimated Exposures and Calculated Risks for Indicator Chemicals
Exposure to Main Pond Sludges

Indicator Chemical	Age Group Exposed	SDI Maximum Subchronic Daily Exposure (mg/kg-day)	EPA Published AIS (mg/kg-day)	CDI Daily Chronic Exposure (mg/kg-day)	EPA Published AIC (mg/kg-day)	Hazard Index HI = CDI/AIC (Percent)	Carcinogenicity CPF (mg/kg-d)^-1	Carcinogenicity Resultant Lifetime Risk	No. Years at Exposure Level	TOTAL Upper Bound Lifetime Cancer Risk
TETRACHLOROETHYLENE	2-4 Years	1.38E-04	NA	9.83E-06	0.02	0.0492%	0.051 (B2)	4.83E-09	3	2.07E-10
	Picaphile	2.29E-02	NA	1.63E-03	0.02	8.1500%	0.051 (B2)	1.33E-04	2	3.80E-06
	5 Years	1.73E-04	NA	1.23E-05	0.02	0.0615%	0.051 (B2)	7.56E-09	1	1.08E-10
	6-9 Years	1.43E-04	NA	1.02E-05	0.02	0.0510%	0.051 (B2)	5.20E-09	4	2.97E-10
	10-12 Years	8.44E-05	NA	6.01E-06	0.02	0.0301%	0.051 (B2)	1.81E-09	3	7.74E-11
	Adult	6.67E-05	NA	9.51E-06	0.02	0.0476%	0.051 (B2)	4.52E-09	58	3.75E-09
TOTAL RISK LEVELS						0.28%			68	3.80E-06
(B2) EPA Weight of Evidence Ranking (see Table 7-6 & Appendix C).										
TOLUENE	2-4 Years	1.40E-03	0.43	9.96E-05	0.3	0.0332%	Non-carcinogen	NA	3	NA
	Picaphile	2.32E-01	0.43	1.65E-02	0.3	5.5000%	Non-carcinogen	NA	2	NA
	5 Years	1.75E-03	0.43	1.25E-04	0.3	0.0417%	Non-carcinogen	NA	1	NA
	6-9 Years	1.44E-03	0.43	1.03E-04	0.3	0.0343%	Non-carcinogen	NA	4	NA
	10-12 Years	8.55E-04	0.43	6.09E-05	0.3	0.0203%	Non-carcinogen	NA	3	NA
	Adult	6.76E-04	0.43	9.62E-05	0.3	0.0321%	Non-carcinogen	NA	58	NA
TOTAL RISK LEVELS						0.19%			68	
TRICHLOROETHYLENE	2-4 Years	5.70E-05	NA	4.06E-06	NA	NA	0.011 (B2)	4.47E-08	3	1.91E-09
	Picaphile	9.47E-03	NA	6.75E-04	NA	NA	0.011 (B2)	7.43E-06	2	2.12E-07
	5 Years	7.16E-05	NA	5.10E-06	NA	NA	0.011 (B2)	5.61E-08	1	8.01E-10
	6-9 Years	5.89E-05	NA	4.20E-06	NA	NA	0.011 (B2)	4.62E-08	4	2.64E-09
	10-12 Years	3.49E-05	NA	2.49E-06	NA	NA	0.011 (B2)	2.74E-08	3	1.17E-09
	Adult	2.76E-05	NA	3.93E-06	NA	NA	0.011 (B2)	4.32E-08	58	3.58E-08
									68	2.54E-07

(B2) EPA Weight of Evidence Ranking (see Table 7-6 & Appendix C).

TABLE F-5A (Continued)

Summary of Estimated Exposures and Calculated Risks for Indicator Chemicals
Exposure to Main Pond Sludges

Indicator Chemical	Age Group Exposed	SDI Maximum Subchronic Daily Exposure (mg/kg-day)	EPA Published AIS (mg/kg-day)	CDI Daily Chronic Exposure (mg/kg-day)	EPA Published AIC (mg/kg-day)	Hazard Index HI = CDI/AIC (Percent)	Carcinogenicity CPF (mg/kg-d)^-1	Carcinogenicity Resultant Lifetime Risk	Carcinogenicity No. Years at Exposure Level	TOTAL Upper Bound Lifetime Cancer Risk
CHROMIUM	2-4 Years	4.07E-06	1.4 *	2.90E-07	1.00 *	.0000%	Non-carcinogen	NA	3	NA
	Picaphite	4.47E-04	1.4 *	3.18E-05	1.00 *	0.0032%	Non-carcinogen	NA	2	NA
	5 Years	6.18E-06	1.4 *	4.85E-07	1.00 *	.0000%	Non-carcinogen	NA	1	NA
	6-9 Years	6.86E-06	1.4 *	4.89E-07	1.00 *	.0000%	Non-carcinogen	NA	4	NA
	10-12 Years	4.64E-06	1.4 *	3.30E-07	1.00 *	.0000%	Non-carcinogen	NA	3	NA
	Adult	3.94E-06	1.4 *	5.61E-07	1.00 *	0.0001%	Non-carcinogen	NA	58	NA
TOTAL RISK LEVELS						0.0001%			68	
		** As Chromium VI	0.015 **		0.005		**Non-carcinogen for oral exposures			
LEAD	2-4 Years	6.96E-06	NA	4.96E-07	0.0014	0.0354%	Non-carcinogen	NA	3	NA
	Picaphite	7.65E-04	NA	5.45E-05	0.0014	3.8929%	Non-carcinogen	NA	2	NA
	5 Years	1.17E-05	NA	8.31E-07	0.0014	0.0594%	Non-carcinogen	NA	1	NA
	6-9 Years	1.18E-05	NA	8.37E-07	0.0014	0.0598%	Non-carcinogen	NA	4	NA
	10-12 Years	7.94E-06	NA	5.66E-07	0.0014	0.0404%	Non-carcinogen	NA	3	NA
	Adult	6.75E-06	NA	9.61E-07	0.0014	0.0686%	Non-carcinogen	NA	58	NA
TOTAL RISK LEVELS						0.18%			68	
NICKEL	2-4 Years	1.15E-06	0.014	8.82E-08	0.01	0.0009%	Non-carcinogen	NA	3	NA
	Picaphite	1.27E-04	0.014	9.04E-06	0.01	0.0904%	Non-carcinogen	NA	2	NA
	5 Years	1.93E-06	0.014	1.38E-07	0.01	0.0014%	Non-carcinogen	NA	1	NA
	6-9 Years	1.95E-06	0.014	1.39E-07	0.01	0.0014%	Non-carcinogen	NA	4	NA
	10-12 Years	1.32E-06	0.014	9.38E-08	0.01	0.0009%	Non-carcinogen	NA	3	NA
	Adult	1.12E-06	0.014	1.59E-07	0.01	0.0016%	Non-carcinogen	NA	58	NA
TOTAL RISK LEVELS						0.0041%			68	
ZINC	2-4 Years	9.87E-06	0.21	7.03E-07	0.21	0.0003%	Non-carcinogen	NA	3	NA
	Picaphite	1.09E-03	0.21	7.73E-05	0.21	0.0368%	Non-carcinogen	NA	2	NA
	5 Years	1.65E-04	0.21	1.18E-06	0.21	0.0006%	Non-carcinogen	NA	1	NA
	6-9 Years	1.67E-05	0.21	1.19E-06	0.21	0.0006%	Non-carcinogen	NA	4	NA
	10-12 Years	1.13E-05	0.21	8.02E-07	0.21	0.0004%	Non-carcinogen	NA	3	NA
	Adult	9.57E-06	0.21	1.36E-06	0.21	0.0006%	Non-carcinogen	NA	58	NA
TOTAL RISK LEVELS						0.0017%			68	

TABLE F-5B

Summary of Estimated Exposures and Calculated Risks for Indicator Chemicals
52 days/year Exposure to Evaporation System Sludges

Indicator Chemical	Age Group Exposed	SDI Maximum Subchronic Daily Exposure (mg/kg-day)	EPA Published AIS (mg/kg-day)	CDI Daily Chronic Exposure (mg/kg-day)	EPA Published AIC (mg/kg-day)	Hazard Index HI = CDI/AIC (Percent)	Carcinogenicity CPF (mg/kg-d)^-1	Carcinogenicity Resultant Lifetime Risk	No. Years at Exposure Level	TOTAL Upper Bound Lifetime Cancer Risk
BENZENE	2-4 Years	4.90E-05	NA	3.49E-06	NA	NA	0.052 (A)	1.81E-07	3	7.78E-09
	Picaphite	8.13E-03	NA	5.79E-04	NA	NA	0.052 (A)	3.01E-05	2	8.60E-07
	5 Years	6.15E-05	NA	4.38E-06	NA	NA	0.052 (A)	2.28E-07	1	3.25E-09
	6-9 Years	5.06E-05	NA	3.60E-06	NA	NA	0.052 (A)	1.87E-07	4	1.07E-08
	10-12 Years	3.00E-05	NA	2.13E-06	NA	NA	0.052 (A)	1.11E-07	3	4.75E-09
	Adult	2.37E-05	NA	3.37E-06	NA	NA	0.052 (A)	1.75E-07	58	1.45E-07
TOTAL RISK LEVELS									68	1.03E-06
(A) EPA Weight of Evidence Ranking (see Table 7-6 & Appendix C).										
2,4-DIMETHYLPHENOL	2-4 Years	1.13E-05	0.014 *	8.03E-07	0.0014 *	0.06%	Non-carcinogen	NA	3	NA
	Picaphite	1.87E-03	0.014 *	1.33E-04	0.0014 *	9.50%	Non-carcinogen	NA	2	NA
	5 Years	1.41E-05	0.014 *	1.01E-06	0.0014 *	0.07%	Non-carcinogen	NA	1	NA
	6-9 Years	1.16E-05	0.014 *	8.29E-07	0.0014 *	0.06%	Non-carcinogen	NA	4	NA
	10-12 Years	6.89E-06	0.014 *	4.91E-07	0.0014 *	0.04%	Non-carcinogen	NA	3	NA
	Adult	5.45E-06	0.014 *	7.76E-07	0.0014 *	0.06%	Non-carcinogen	NA	58	NA
TOTAL RISK LEVELS						0.33%			68	
* Value from Region VI notes, Feb 22 1988.										
ETHYLBENZENE	2-4 Years	3.43E-04	0.97	2.45E-05	0.1	0.02%	Non-carcinogen	NA	3	NA
	Picaphite	5.70E-02	0.97	4.06E-03	0.1	4.06%	Non-carcinogen	NA	2	NA
	5 Years	4.31E-04	0.97	3.07E-05	0.1	0.03%	Non-carcinogen	NA	1	NA
	6-9 Years	3.55E-04	0.97	2.53E-05	0.1	0.03%	Non-carcinogen	NA	4	NA
	10-12 Years	2.10E-04	0.97	1.50E-05	0.1	0.02%	Non-carcinogen	NA	3	NA
	Adult	1.66E-04	0.97	2.36E-05	0.1	0.02%	Non-carcinogen	NA	58	NA
TOTAL RISK LEVELS						0.14%			68	

TABLE F-5B (Continued)

Summary of Estimated Exposures and Calculated Risks for Indicator Chemicals
52 Days/Year Exposure to Evaporation System Sludges

Indicator Chemical	Age Group Exposed	SDI Maximum Subchronic Daily Exposure (mg/kg-day)	EPA Published AIS (mg/kg-day)	CDI Daily Chronic Exposure (mg/kg-day)	EPA Published AIC (mg/kg-day)	Hazard Index HI = CDI/AIC (Percent)	Carcinogenicity CPF (mg/kg-d)^-1	Carcinogenicity Resultant Lifetime Risk	No. Years at Exposure Level	TOTAL Upper Bound Lifetime Cancer Risk
NAPHTHALENE	2-4 Years	NA	0.41 *	NA	0.41 *	NA	Non-carcinogen	NA	3	NA
	Picaphile	NA	0.41 *	NA	0.41 *	NA	Non-carcinogen	NA	2	NA
	5 Years	NA	0.41 *	NA	0.41 *	NA	Non-carcinogen	NA	1	NA
	6-9 Years	NA	0.41 *	NA	0.41 *	NA	Non-carcinogen	NA	4	NA
	10-12 Years	NA	0.41 *	NA	0.41 *	NA	Non-carcinogen	NA	3	NA
	Adult	NA	0.41 *	NA	0.41 *	NA	Non-carcinogen	NA	58	NA
TOTAL RISK LEVELS									68	
* Value from EPA Region VI notes, February 1988.										
PCBs (Total)	2-4 Years	3.65E-05	NA	2.60E-06	NA	NA	4.34	1.13E-05	3	4.84E-07
	Picaphile	5.68E-03	NA	4.05E-04	NA	NA	4.34	1.76E-03	2	5.02E-05
	5 Years	4.86E-05	NA	3.46E-06	NA	NA	4.34	1.50E-05	1	2.15E-07
	6-9 Years	4.21E-05	NA	3.00E-06	NA	NA	4.34	1.30E-05	4	7.44E-07
	10-12 Years	2.59E-05	NA	1.84E-06	NA	NA	4.34	7.99E-06	3	3.42E-07
	Adult	2.09E-05	NA	2.98E-06	NA	NA	4.34	1.29E-05	58	1.07E-05
TOTAL RISK LEVELS									68	6.27E-05
PHENOL	2-4 Years	3.45E-04	0.04	2.46E-05	0.04	0.0615%	Non-carcinogen	NA	3	NA
	Picaphile	5.73E-02	0.04	4.09E-03	0.04	10.2250%	Non-carcinogen	NA	2	NA
	5 Years	4.34E-04	0.04	3.09E-05	0.04	0.0773%	Non-carcinogen	NA	1	NA
	6-9 Years	3.57E-04	0.04	2.54E-05	0.04	0.0635%	Non-carcinogen	NA	4	NA
	10-12 Years	2.11E-04	0.04	1.51E-05	0.04	0.0378%	Non-carcinogen	NA	3	NA
	Adult	1.67E-04	0.04	2.38E-05	0.04	0.0595%	Non-carcinogen	NA	58	NA
TOTAL RISK LEVELS						0.35%			68	

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TABLE F-58 (Continued)

Summary of Estimated Exposures and Calculated Risks for Indicator Chemicals
52 Days/Year Exposure to Evaporation System Sludges

Indicator Chemical	Age Group Exposed	SDI Maximum Subchronic Daily Exposure (mg/kg-day)	EPA Published AIS (mg/kg-day)	CDI Daily Chronic Exposure (mg/kg-day)	EPA Published AIC (mg/kg-day)	Hazard Index HI = CDI/AIC (Percent)	Carcinogenicity CPF (mg/kg-d)^-1	Carcinogenicity Resultant Lifetime Risk	No. Years at Exposure Level	TOTAL Upper Bound Lifetime Cancer Risk
TETRACHLOROETHYLENE	2-4 Years	2.43E-05	NA	1.73E-06	0.02	0.0087%	0.051 (B2)	1.50E-10	3	6.41E-12
	Picaphite	4.03E-03	NA	2.87E-04	0.02	1.4350%	0.051 (B2)	4.12E-06	2	1.18E-07
	5 Years	3.05E-05	NA	2.17E-06	0.02	0.0109%	0.051 (B2)	2.35E-10	1	3.36E-12
	6-9 Years	2.51E-05	NA	1.79E-06	0.02	0.0090%	0.051 (B2)	1.60E-10	4	9.15E-12
	10-12 Years	1.49E-05	NA	1.06E-06	0.02	0.0053%	0.051 (B2)	5.62E-11	3	2.41E-12
	Adult	1.17E-05	NA	1.67E-06	0.02	0.0084%	0.051 (B2)	1.39E-10	58	1.16E-10
TOTAL RISK LEVELS						0.05%			68	1.18E-07
(B2) EPA Weight of Evidence Ranking (see Table 7-6 & Appendix C).										
TOLUENE	2-4 Years	1.88E-04	0.43	1.34E-05	0.3	0.0045%	Non-carcinogen	NA	3	NA
	Picaphite	3.13E-02	0.43	2.23E-03	0.3	0.7433%	Non-carcinogen	NA	2	NA
	5 Years	2.36E-04	0.43	1.68E-05	0.3	0.0056%	Non-carcinogen	NA	1	NA
	6-9 Years	1.94E-04	0.43	1.38E-05	0.3	0.0046%	Non-carcinogen	NA	4	NA
	10-12 Years	1.15E-04	0.43	8.20E-06	0.3	0.0027%	Non-carcinogen	NA	3	NA
	Adult	9.10E-05	0.43	1.30E-05	0.3	0.0043%	Non-carcinogen	NA	58	NA
TOTAL RISK LEVELS						0.03%			68	
TRICHLOROETHYLENE	2-4 Years	NA	NA	NA	NA	NA	0.011 (B2)	NA	3	NA
	Picaphite	NA	NA	NA	NA	NA	0.011 (B2)	NA	2	NA
	5 Years	NA	NA	NA	NA	NA	0.011 (B2)	NA	1	NA
	6-9 Years	NA	NA	NA	NA	NA	0.011 (B2)	NA	4	NA
	10-12 Years	NA	NA	NA	NA	NA	0.011 (B2)	NA	3	NA
	Adult	NA	NA	NA	NA	NA	0.011 (B2)	NA	58	NA
									68	NA
(B2) EPA Weight of Evidence Ranking (see Table 7-6 & Appendix C).										

TABLE F-5B (Continued)

Summary of Estimated Exposures and Calculated Risks for Indicator Chemicals
52 Days/Year Exposure to Evaporation System Sludges

Indicator Chemical	Age Group Exposed	SDI Maximum Subchronic Daily Exposure (mg/kg-day)	EPA Published AIS (mg/kg-day)	CDI Daily Chronic Exposure (mg/kg-day)	EPA Published AIC (mg/kg-day)	Hazard Index HI = CDI/AIC (Percent)	Carcinogenicity CPF (mg/kg-d)^-1	Carcinogenicity Resultant Lifetime Risk	No. Years at Exposure Level	TOTAL Upper Bound Lifetime Cancer Risk
CHROMIUM	2-4 Years	1.25E-06	1.4 *	8.91E-08	1.00 *	0.00001%	Non-carcinogen	NA	3	NA
	Picaphile	1.38E-04	1.4 *	9.79E-06	1.00 *	0.00098%	Non-carcinogen	NA	2	NA
	5 Years	2.10E-06	1.4 *	1.49E-07	1.00 *	0.00001%	Non-carcinogen	NA	1	NA
	6-9 Years	2.11E-06	1.4 *	1.40E-07	1.00 *	0.00001%	Non-carcinogen	NA	4	NA
	10-12 Years	1.43E-06	1.4 *	1.02E-07	1.00 *	0.00001%	Non-carcinogen	NA	3	NA
	Adult	1.21E-06	1.4 *	1.73E-07	1.00 *	0.00002%	Non-carcinogen	NA	58	NA
TOTAL RISK LEVELS						0.00004%			68	
* As Chromium III		** As Chromium VI	0.015 **		0.005		** Non-carcinogen for oral exposures			
LEAD	2-4 Years	2.83E-06	NA	2.01E-07	0.0014	0.0144%	Non-carcinogen	NA	3	NA
	Picaphile	3.11E-04	NA	2.21E-05	0.0014	1.5786%	Non-carcinogen	NA	2	NA
	5 Years	4.73E-06	NA	3.37E-07	0.0014	0.0241%	Non-carcinogen	NA	1	NA
	6-9 Years	4.77E-06	NA	3.40E-07	0.0014	0.0243%	Non-carcinogen	NA	4	NA
	10-12 Years	3.22E-06	NA	2.30E-07	0.0014	0.0164%	Non-carcinogen	NA	3	NA
	Adult	2.74E-06	NA	3.90E-07	0.0014	0.0279%	Non-carcinogen	NA	58	NA
TOTAL RISK LEVELS						0.07%			68	
NICKEL	2-4 Years	5.34E-07	0.014	3.87E-08	0.01	0.0004%	Non-carcinogen	NA	3	NA
	Picaphile	5.97E-05	0.014	4.25E-06	0.01	0.0425%	Non-carcinogen	NA	2	NA
	5 Years	9.09E-07	0.014	6.48E-08	0.01	0.0006%	Non-carcinogen	NA	1	NA
	6-9 Years	9.16E-07	0.014	6.53E-08	0.01	0.0007%	Non-carcinogen	NA	4	NA
	10-12 Years	6.19E-07	0.014	4.41E-08	0.01	0.0004%	Non-carcinogen	NA	3	NA
	Adult	5.26E-07	0.014	7.49E-08	0.01	0.0007%	Non-carcinogen	NA	58	NA
TOTAL RISK LEVELS						0.0019%			68	
ZINC	2-4 Years	1.29E-05	0.21	9.22E-07	0.21	0.0004%	Non-carcinogen	NA	3	NA
	Picaphile	1.42E-03	0.21	1.01E-04	0.21	0.0481%	Non-carcinogen	NA	2	NA
	5 Years	2.17E-04	0.21	1.54E-06	0.21	0.0007%	Non-carcinogen	NA	1	NA
	6-9 Years	2.18E-05	0.21	1.56E-06	0.21	0.0007%	Non-carcinogen	NA	4	NA
	10-12 Years	1.48E-05	0.21	1.05E-06	0.21	0.0005%	Non-carcinogen	NA	3	NA
	Adult	1.25E-05	0.21	1.79E-06	0.21	0.0009%	Non-carcinogen	NA	58	NA
TOTAL RISK LEVELS						0.0022%			68	

D803

TABLE F-6

Summary of Total Hazard Index and Total Upper Bound Carcinogenic Risk for Each Waste Compartment
Unrestricted Site - Worst Case Future Landuse

Indicator Chemical	Main Pond Sludges		Evaporation System Sludges	
	Hazard Index (in percent)	Upper Bound Cancer Risk	Hazard Index (in percent)	Upper Bound Cancer Risk
Benzene	NA	2.55E-05	NA	1.03E-06
2,4-Dimethylphenol	4.95%	NA	0.33%	NA
Ethylbenzene	1.51%	NA	0.14%	NA
Naphthalene	0.01%	NA	NA	NA
PCBs (Total)	NA	3.98E-04	NA	6.27E-05
Phenol	0.32%	NA	0.35%	NA
Tetrachloroethylene	0.28%	3.80E-06	0.05%	1.18E-07
Toluene	0.19%	NA	0.03%	NA
Trichloroethylene	NA	2.54E-07	NA	NA
Chromium	0.0002%	NA	0.00004%	NA
Lead	0.18%	NA	0.07%	NA
Nickel	0.0058%	NA	0.0019%	NA
Zinc	0.0024%	NA	0.0022%	NA
TOTAL	7.45%	4.28E-04	0.97%	6.38E-05

011623

The total Hazard Index for all indicator parameters is much less than one hundred percent (or a total value of 1) and indicates that the non-carcinogens pose a negligible risk to human health or the environment. The total time-weighted cancer risk is greater than 1E-05 for each compartment, due primarily to exposures to PCBs. The highest risk at the Sheridan Site is due to exposure to PCBs in the sludges of the main pond. It is unlikely that this PCB-related risk would be realized because the 1987 data indicate that concentrations are much less than the 159 mg/kg assumed for this exercise. Risks from PCB exposure are due to assumed picaphile behavior: ingestion of 10 grams/day (EPA value) of main pond sludge. If more reasonable literature values for ingestion of soil of 250 mg/day (Hawley, 1985) were used to assess risk, the time-weighted cancer risk would be even lower than the values calculated here. However, any remedial measures that include eliminating the direct exposure to the main pond and evaporation system would mitigate these risks.

As stated previously, the assumption of residential development adjacent to a totally unrestricted site is improbable. Therefore, the exposure levels calculated in Tables F-4A through F-4M and F-5 are unlikely.

011624

F.3 Ground Water Exposure Pathways

The ground water pathway for Site Condition 3 remains the same as for conditions 1 and 2: namely, the primary receptor in the dominant flow direction is the Brazos River. However, if a well were to be completed at the edge of the disposal area under assumed abandoned future conditions, the well might produce ground water with constituent concentrations as predicted by the models presented in Section 10.3. These concentrations are shown in Appendix H-2, Table H2-1 for the VHS model and in Appendix H-3, Figures H3-1 through H3-14 for WMPLUME.

Constituent concentrations predicted by WMPLUME at the downgradient EPA receptor well and final Maximum Contaminant Levels (MCLs) are summarized in Table F-7. The well location is shown in Figures H3-1 through H3-14 (Appendix H-3). Under the conservative leaching rate assumptions (Appendix H-3) used for the ground water assessment, only benzene exceeds the available MCLs. The conservativeness of the model is especially true for the longer time for source input, calculated by taking the total site load for a given constituent and dividing by the model input loading rate. For modeling purposes it was assumed that the main pond constituent load would leach constituents for the length of time that the total site load could exist. In this way the constituent source load would exist for longer periods of time, making the modeling even more conservative.

E617

TABLE F-7

Summary of WMPLUME Model Results at EPA Receptor

Sheridan Disposal Services

Constituent	Time of Source Input (yrs)	EPA Receptor # (mg/l)	Final MCL (mg/l)
Benzene	1	0.0000	0.005
	10	0.0051	
	20	0.1465	
	50	2.9305	
2,4-Dimethylphenol	1	0.0000	NA
	10	0.0000	
	20	0.0447	
Ethylbenzene	10	0.0000	NA
	100	0.0100	
Naphthalene	10	0.0000	NA
	100	0.0059	
PCB (Aroclor 1016)	10	0.0000	NA
	100	0.0000	
Phenol	1	0.0000	NA
	10	3.1171	
	20	21.2696	
Tetrachloroethylene	10	0.0000	NA
	20	0.0000	
	50	0.0006	
Toluene	1	0.0000	NA
	10	0.0000	
Trichloroethylene	1	0.0000	0.005
	10	0.0001	
	20	0.0047	
Chromium	1	0.0000	0.05
	10	0.0000	
Lead	10	0.0000	0.05
	30	0.0000	
Nickel	10	0.0000	NA
Zinc	1	0.0000	NA
	10	0.0000	

NOTES:

EPA Receptor (drinking well) location shown in Appendix H-3, Figures H3-1 through H3-14.

011625

It must be emphasized that the assumption of a drinking well located at the edge of the disposal area or downgradient of the facility is highly unlikely and that no risk would be realized under most probable future landuse assumptions (i.e., Site Condition 2), because the pathway would not exit.

F.4 Summary

A pathway analysis and exposure assessment was evaluated for Site Condition 3. General assumptions for this site condition include 1) unrestricted site access, with all age groups from two years to adults having access to the entire site, 2) a residential housing development constructed directly adjacent to the site, 3) a single drinking water well installed downgradient of the site in the shallow aquifer, and 4) the main pond and evaporation system not maintained, with erosion of the main pond dikes and decanting of pond water.

Completed pathways for this scenario that are not already included in Site Conditions 1 and 2 are 1) direct contact with in the main pond by children from the residential housing development, 2) intentional ingestion of soils and sludges by a picaphile, and 3) a drinking water well at the edge of the disposal area.

Risks related to exposure and ingestion of soil and sludges have a total Hazard Index of 7.45% for main pond sludges and 0.97% for evaporation system sludges for the non-carcinogenic indicator compounds. These values are less than 100% and indicate that there are no significant risks to human health or the environment from these compounds. The total time-weighted human cancer risk for carcinogenic indicator compounds in each compartment exceeds a 1E-05 cancer risk. This is due primarily to exposure to PCBs in sludges from the main pond and evaporation system. However, any remedial measures that include eliminating the direct exposure to sludges at the site would mitigate these risks.

Results of ground water modeling using WMPLUME show that only benzene exceeds MCLs at the downgradient receptor well. Predicted concentrations at the receptor location for all other indicator parameters fall below the available MCLs. It is improbable, however, that a domestic water well would be located between the waste facility and the Brazos River due to the proximity of the site to the river, and the improbable location of a residence directly adjacent to the waste site.

011626

APPENDIX G-1

Results of Air Emissions Modeling
of Volatile Organics

By

Pilko & Associates, Inc.
August 21, 1987

011627

G-1B086

PILKO & ASSOCIATES, INC.

Risk Management/Industrial Development/Environmental Management

August 21, 1987

Ms. Georgia A. Bost
ERM Southwest, Inc.
16000 Memorial Drive
Suite 200
Houston, Texas 77079-4006

011628

SUBJECT: SHERIDAN DISPOSAL SERVICES SITE - AMBIENT AIR IMPACTS

This letter summarizes the ambient air impacts from the evaporative emissions of the Sheridan Disposal Services waste pond and includes an analysis of the impacts from a proposed worst case treatment scheme. This analysis includes a summary of the waste pond characteristics, indicator chemicals, evaporative emissions, and short-term (30 minutes and 8 hours) and long-term (annual) ambient air impacts.

BACKGROUND

ERM Southwest, Inc., requested Pilko & Associates, Inc., to determine the short-term and long-term ambient air impacts from the Sheridan Disposal Services waste pond. The waste pond has a nominal surface area of 15 acres. The pond consists of three layers:

EAST COAST OFFICE.
ONE GREENTREE CENTRE, SUITE 201
MARLTON, NEW JERSEY 08053
(609) 596-0333

HEADQUARTERS.
2707 NORTH LOOP WEST, SUITE 960
HOUSTON, TEXAS 77008
(713) 861-1417
TELECOPIER: (713) 861-6210
TELEX: 26-5670

WEST COAST OFFICE.
5330 CANOGA AVE., SUITE 400
WOODLAND HILLS, CALIFORNIA 91367
(818) 716-9011

- Top - Scum/Emulsion
- Middle - Aqueous Phase
- Bottom - Sludge

The top layer floats on the surface and appears to be made of a non-homogeneous mixture of oils and emulsified materials. This layer tends to collect on the ends of the pond depending upon the direction of the wind.

Beneath this layer is the aqueous phase which consists primarily of water and contaminants. Shown on Table 1 is a summary of the pond water concentrations for the indicator chemicals used in this analysis.

The bottom layer consists of heavy oils and sludge which have settled to the bottom of the pond. An analysis of this layer is also included in Table 1. For the purpose of this analysis, it was assumed that the emissions from the emulsified materials do not contribute significantly to the overall evaporative emissions and that the primary source of emissions would be from the aqueous phase.

EVAPORATIVE EMISSIONS

The emissions which emanate from a waste pond can be calculated using equations for volatilization of materials from water. After reviewing several different methods, the method which is recommended for this particular set of conditions, is the method of Liss and Slater, as described in the Handbook of Chemical Property Estimation Methods, 1982. This particular method calculates a half life of the material in the aqueous phase.

011629

The method requires that one calculate the liquid phase exchange coefficient (k_l) and the gas phase exchange coefficient (k_g) for materials which are of high volatility. Volatization from the water is controlled by the liquid phase exchange rate. Using the liquid phase exchange coefficient and gas phase exchange coefficient, one can calculate the overall liquid phase mass transfer coefficient (K_L).

Other variables in the equation include the wind speed, the velocity of the current, and the depth of the water. For this analysis the wind speed was varied from 1 to 3 meters per second. The current of the water was set at a very low rate of 0.01 meters per second, thereby simulating a pond. The depth of the water was set at 5 meters.

Shown on Table 2 is a summary of the emission rate calculations, including the half life of each indicator chemical and the resulting flux rate. To calculate the flux rate the concentration of the indicator chemical in the pond water was multiplied by the total volume of water, (estimated to be 8 million gallons) and then divided by the half life.

Ambient Air Impacts

The ambient air impacts for each indicator chemical was calculated using the flux rate. Two receptor points were of special interest. These were: 1) the dikes surrounding the waste pond where persons working on the project could be exposed, and 2) the trailer located to the south of the pond. For each of these receptor points the maximum 8 hour concentration and the annual average concentrations were calculated.

011630

The Texas Air Control Board air dispersion models were used to determine the maximum concentrations at each receptor. The Texas Climatological Model (TCM-2) was used to calculate the annual concentrations. The Texas Episodic Model (TEM-8AB) was used to calculate the 8 hour averages. Meteorological data from Houston Hobby was used in both cases.

To approximate the emissions from the waste pond, the pond was divided into ten sections, with equal emission rates coming out of each section.

A summary of the maximum concentration is shown in Table 3. This table clearly indicates that no health effects are anticipated from each of the indicator chemicals. A summary of the air dispersion model output is included as an appendix to this letter.

If you have any questions concerning this analysis, please feel free to contact me 713/861-1417.

For PILKO & ASSOCIATES, INC.

Jess A. McAngus

Jess A. McAngus
Vice President
Environmental Management Division

JAM:db (87-809)
Attachments

011631

TABLE 1
SHERIDAN DISPOSAL SERVICES SITE
INDICATOR CHEMICALS - PHYSICAL PROPERTIES

Indicator Chemicals	Pond Water (ug/l)	Pond REI (ug/kg)	Sludge ERM (ug/kg)	Mol Wt	Boil Pt (deg C)	Melt Pt (deg C)	VP @ 20 C (mm Hg)	Solu-bility (ug/l)	Kow	TLV (ppm)	TLV (ug/m**3)
Volatile Organics:											
Benzene	<500	2500	170	78.12	80.1	5.5	75	1780	2.13	1	3194
Tetrachloroethylene	510	251	51	165.85	121.4	-22.7	14	200	2.88	50	338999
Toluene	1600	36600	700	92.15	110.6	-95.0	28.4	534.8	2.69	100	376711
Trichloroethylene	2910	<250		131.38	86.7	-87	57.9	1100	2.29	50	268542
Base/Neutral Extractable Organics:											
Napthalene	<50	410	270	128.16	218.0	80.2	0.0492	40	3.37	10	52392
Isophorone	77	99.8		138.23	215.2	-8.0	0.38	12000	1.70	5	28254
Acid Extractable Organics:											
Phenol	3500	1340	1500	94.12	181.9	40.6	0.36	93000	1.46	5	19238

TABLE 2
SHERIDAN DISPOSAL SERVICES SITE
INDICATOR CHEMICALS - EVAPORATIVE EMISSIONS

Indicator Chemicals	Pond Water (ug/l)	Pond REI (mg/kg)	Sludge ERM (mg/kg)	H	Volatility	H'	Kl	Kg	Vwind (m/sec)	Vcurr (m/sec)	Z (meter)	KL	Half Life (hours)	Maximum Flux (gr/sec)
Volatile Organics:														
Benzene	<500	2500	170	4.3E-03	High	1.8E-01	0.06	551.5	1.0	0.01	5	0.06	5875	3.57E-04
							0.10	1643.5	3.0	0.01	5	0.10	3293	6.37E-04
Tetrachloroethylene	510	251	51	1.5E-02	High	6.4E-01	0.04	378.5	1.0	0.01	5	0.04	8557	2.50E-04
							0.07	1128.0	3.0	0.01	5	0.07	4798	4.46E-04
Toluene	1600	36600	700	6.4E-03	High	2.7E-01	0.05	507.8	1.0	0.01	5	0.05	6380	1.05E-03
							0.10	1513.2	3.0	0.01	5	0.10	3577	1.88E-03
Trichloroethylene	2910	<250		9.1E-03	High	3.8E-01	0.05	425.3	1.0	0.01	5	0.05	7617	1.60E-03
							0.08	1267.3	3.0	0.01	5	0.08	4270	2.86E-03
Base/Neutral Extractable Organics:														
Napthalene	<50	410	270	2.1E-04	Med	8.6E-03	0.05	430.6	1.0	0.01	5	0.05	7614	2.76E-05
							0.08	1283.2	3.0	0.01	5	0.08	4248	4.94E-05
Isophorone	77	99.8		5.8E-06	Low	2.4E-04	0.04	414.6	1.0	0.01	5	0.03	11278	2.87E-05
							0.08	1235.5	3.0	0.01	5	0.06	5543	5.83E-05
Acid Extractable Organics:														
Phenol	3500	1340	1500	4.8E-07	Very Low	2.0E-05	0.05	502.4	1.0	0.01	5	0.01	40823	3.60E-04
							0.10	1497.3	3.0	0.01	5	0.02	15149	9.70E-04

TABLE 3
SHERIDAN DISPOSAL SERVICES SITE
AMBIENT AIR IMPACTS

Indicator Chemicals	Pond Water	Pond REI	Sludge ERM	Vwind	TLV	TLV	Maximum Flux	***** TRAILER **** Maximum 8 Hour	Maximum Annual	****** DIKE ****** Maximum 8 Hour	Maximum Annual
	(ug/l)	(mg/kg)	(mg/kg)	(m/sec)	(ppm)	(ug/m**3)	(gr/sec)	(ug/m**3)	(ug/m**3)	(ug/m**3)	(ug/m**3)
Volatile Organics:											
Benzene	<500	2500	170	1.0	1	3194	3.57E-04	2.91E-02	1.48E-03	2.21E-01	2.92E-02
				3.0			6.37E-04	5.19E-02	2.64E-03	3.94E-01	5.21E-02
Tetrachloroethylene	510	251	51	1.0	50	338999	2.50E-04	2.04E-02	1.04E-03	1.55E-01	2.04E-02
				3.0			4.46E-04	3.63E-02	1.85E-03	2.76E-01	3.65E-02
Toluene	1600	36600	700	1.0	100	376711	1.05E-03	8.57E-02	4.36E-03	6.51E-01	8.60E-02
				3.0			1.88E-03	1.53E-01	7.78E-03	1.16E+00	1.53E-01
Trichloroethylene	2910	<250		1.0	50	268542	1.60E-03	1.31E-01	6.64E-03	9.92E-01	1.31E-01
				3.0			2.86E-03	2.33E-01	1.19E-02	1.77E+00	2.34E-01
Base/Neutral Extractable Organics:											
Napthalene	<50	410	270	1.0	10	52392	2.76E-05	2.24E-03	1.14E-04	1.70E-02	2.25E-03
				3.0			4.94E-05	4.02E-03	2.05E-04	3.06E-02	4.04E-03
Isophorone	77	99.8		1.0	5	28254	2.87E-05	2.33E-03	1.19E-04	1.77E-02	2.34E-03
				3.0			5.83E-05	4.75E-03	2.42E-04	3.61E-02	4.76E-03
Acid Extractable Organics:											
Phenol	3500	1340	1500	1.0	5	19238	3.60E-04	2.93E-02	1.49E-03	2.23E-01	2.94E-02
				3.0			9.70E-04	7.90E-02	4.02E-03	6.00E-01	7.92E-02

ATTACHMENT I

8-HOUR MAXIMUM
TRAILER RECEPTOR
TEM-8AB MODEL

(Concentrations Have Been Multiplied by 1000)

011635

SEQUENTIAL METEOROLOGICAL DATA HAS BEEN USED.

SURFACE WEATHER STATION=12918 YEAR=1964

UPPER AIR STATION= 3937 YEAR=1964

```
DAY--- 0 1 1 1 1 1 1 1 1 1  1 1 1 1 1 1 1 1 1 1  1 1 1 1 1 1 1 1 1 1  1 1 1 1 1 1 1 1 1 1  1 1 1 1 1 1 1 1 1 1
       1 1 1 1 1 1 1 1 1 1  1 1 1 1 1 1 1 1 1 1  1 1 1 1 1 1 1 1 1 1  1 1 1 1 1 1 1 1 1 1  1 1 1 1 1 1 1 1 1 1
       1 1 1 1 1 1 1 1 1 1  1 1 1 1 1 1 1 1 1 1  1 1 1 1 1 1 1 1 1 1  1 1 1 1 1 1 1 1 1 1  1 1 1 1 1 1 1 1 1 1
       1 1 1 1 1 1 1 1 1 1  1 1 1 1 1 1 1 1 1 1  1 1 1 1 1 1 1 1 1 1  1 1 1 1 1 1 1 1 1 1  1 1 1 1 1 1 1 1 1 1
       1 1 1 1 1 1 1 1 1 1  1 1 1 1 1 1 1 1 1 1  1 1 1 1 1 1 1 1 1 1  1 1 1 1 1 1 1 1 1 1  1 1 1 1 1 1 1 1 1 1
       1 1 1 1 1 1 1 1 1 1  1 1 1 1 1 1 1 1 1 1  1 1 1 1 1 1 1 1 1 1  1 1 1 1 1 1 1 1 1 1  1 1 1 1 1 1 1 1 1 1
       1 1 1 1 1 1 1 1 1 1  1 1 1 1 1 1 1 1 1 1  1 1 1 1 1 1 1 1 1 1  1 1 1 1 1 1 1 1 1 1  1 1 1 1 1 1 1 1 1 1
       1 1 1 1 1 1 1 1 1 1  1 1 1 1 1 1
```

URBAN MODE HAS BEEN USED.

REPORTED WIND DIRECTIONS HAVE BEEN USED.

011636

T E X A S E P I S O D I C M O D E L VERSION 8A(P-6)

IBM PC VERSION - PILKO AND ASSOCIATES, INC. COPYRIGHT 1986

CONTROL PARAMETERS: SHERIDAN DISPOSAL SITE - MAXIMUM FLUX CASE - BENZENE - 3 HOUR AVE. - PILKO

AVERAGING TIME OPTION (NTOPT):

ONLY OPTION 9 IS AVAILABLE FOR TEXSAS

OPTION 9: RESULTS CONVERTED TO 1 HOUR AVERAGING TIME AND USED FOR 3 HOUR AND 24 HOUR AVERAGES WITH HOURLY SEQUENTIAL METEOROLOGY

WIND DIRECTION OPTIONS (NWDOPT):

ONLY OPTION 0 IS AVAILABLE FOR TEXSAS

OPTION 0: WIND DIRECTION IN DEGREES

WIND SPEED OPTIONS (NWSOPT):

ONLY OPTION 0 IS AVAILABLE FOR TEXSAS

OPTION 0: WIND SPEED IN METERS PER SECOND

INPUT UNITS OPTION (NSRCOP):

OPTION 1: GRID PARAMETERS AND SOURCE LOCATIONS IN KM. SOURCE PARAMETERS IN M, M/S, GM/S, DEGREES CELSIUS.

OPTION 2: GRID PARAMETERS AND SOURCE LOCATIONS IN FT, SOURCE PARAMETERS IN FT, FT/S, LB/HR, DEGREES FAHRENHEIT.

OPTION3: MIXED UNITS - GRID PARAMETERS AND SOURCE LOCATIONS IN KM, SOURCE PARAMETERS IN FT, FT/S, LB/HR, DEGREES FAHRENHEIT.

(ALL AREA SOURCE INPUT IS IN METRIC UNITS)

OPTION 1 HAS BEEN SELECTED

SURFACE WEATHER STATION=12912, 1964.
UPPER AIR STATION= 3937, 1964

POLLUTANT(S) 1 ON POLLUTANT SOURCE CARDS ARE MODELED IN THIS RUN.

DT/DZ (E STABILITY) = 0.0200
DT/DZ (F STABILITY) = 0.0350

PUNCH INTERVAL = 1.

THE STACK-TIP DOWNWASH ALGORITHM IS IN EFFECT.

RECEPTOR GRID CONSISTS OF 1 COLUMNS AND 1 ROWS OF SPACING = 0.100 KM. SOUTHWEST CORNER OF GRID = 100.240 KM W, 99.350 KM S.

AREA SOURCE SCALING FACTOR, 1ST POLLUTANT, = 1.0000 AREA SOURCE SCALING FACTOR, 2ND POLLUTANT, = 1.0000

CONCENTRATION CALIBRATION FACTORS: A(1) = 0.0000, B(1) = 100.0000; A(2) = 0.0000, B(2) = 100.0000

POL 1 ID:BENZENE POL 1 CAL ID: MULTIPLY BY 100.0 / POL 2 ID: POL 2 CAL ID:

OUTPUT WILL BE PRESENTED IN THE FOLLOWING FORM(S):

MAXIMUM PREDICTED CONCENTRATION(S) FOR EACH SCENARIO

IBM PC VERSION - PILKO AND ASSOCIATES, INC. COPYRIGHT 1986

T.E.X. VERSION 6AB- AREA SOURCE LIST - SHERIDAN DISPOSAL SITE - MAXIMUM FLUX CASE - BENZENE - 8 HOUR AVE. - PILKO

NUMBER	X (KM)	Y (KM)	AREA SIZE (KM)	E1 (G/S)	E2 (G/S)

THE SUM OF THE AREA SOURCE EMISSION RATES IN THIS RUN IS 0.0000(G/S) FOR POLLUTANT 1 AND 0.0000(G/S) FOR POLLUTANT 2.

011638

IBM PC VERSION - PILKO AND ASSOCIATES, INC. COPYRIGHT 1986

T.E.N. VERSION 6A3- POINT SOURCE LIST - SHERIDAN DISPOSAL SITE - MAXIMUM PLUM CASE - BENZENE - 3 HOUR AVE. - PILKO

NUMBER	X (KM)	Y (KM)	E1 (G/S)	E2 (G/S)	HT (M)	DIAM (M)	VEL (M/S)	TEMP (K)	HB(M)	HW(M)	IDENTIFICATION
1	99.92	99.92	0.0637	0.0000	2.74	1.000	0.001	273.150	0.	0.	AREA 1
2	99.95	99.99	0.0637	0.0000	2.74	1.000	0.001	273.150	0.	0.	AREA 2
3	99.99	100.06	0.0637	0.0000	2.74	1.000	0.001	273.150	0.	0.	AREA 3
4	100.02	100.12	0.0637	0.0000	2.74	1.000	0.001	273.150	0.	0.	AREA 4
5	100.06	100.19	0.0637	0.0000	2.74	1.000	0.001	273.150	0.	0.	AREA 5
6	99.84	99.95	0.0637	0.0000	2.74	1.000	0.001	273.150	0.	0.	AREA 6
7	99.83	100.02	0.0637	0.0000	2.74	1.000	0.001	273.150	0.	0.	AREA 7
8	99.92	100.09	0.0637	0.0000	2.74	1.000	0.001	273.150	0.	0.	AREA 8
9	99.95	100.16	0.0637	0.0000	2.47	1.000	0.001	273.150	0.	0.	AREA 9
10	99.99	100.22	0.0637	0.0000	2.74	1.000	0.001	273.150	0.	0.	AREA 10

THE SUM OF THE POINT SOURCE EMISSION RATES IN THIS RUN IS 0.64(G/S) FOR POLLUTANT 1 AND 0.00(G/S) FOR POLLUTANT 2.

011639

TEXAS EPISODIC MODEL

IBM PC VERSION - PILKO AND ASSOCIATES, INC. COPYRIGHT 1986

VERSION SAB F-8.

50 HIGHEST CONCENTRATION DAYS: SHERIDAN DISPOSAL SITE - MAXIMUM FLUX CASE - BENZENE - 8 HOUR AVE. - PILKO

POLLUTANT 1

	DAY NUMBER	CONCENTRATION (UG/M**3)	RECEPTOR X (KM)	COORDINATES Y (KM)
1.	59	12.31	100.240	99.350
2.	182	10.44	100.240	99.350
3.	6	10.29	100.240	99.350
4.	153	9.93	100.240	99.350
5.	325	8.93	100.240	99.350
6.	239	8.42	100.240	99.350
7.	65	8.25	100.240	99.350
8.	272	8.10	100.240	99.350
9.	348	8.03	100.240	99.350
10.	283	8.02	100.240	99.350
11.	340	7.92	100.240	99.350
12.	77	7.86	100.240	99.350
13.	179	7.80	100.240	99.350
14.	287	7.14	100.240	99.350
15.	178	6.89	100.240	99.350
16.	81	6.77	100.240	99.350
17.	99	6.72	100.240	99.350
18.	310	6.66	100.240	99.350
19.	334	6.42	100.240	99.350
20.	49	6.37	100.240	99.350
21.	356	6.28	100.240	99.350
22.	13	6.19	100.240	99.350
23.	283	5.93	100.240	99.350
24.	9	5.51	100.240	99.350
25.	350	5.44	100.240	99.350
26.	52	5.44	100.240	99.350
27.	142	5.41	100.240	99.350
28.	280	5.35	100.240	99.350
29.	72	5.32	100.240	99.350
30.	135	5.25	100.240	99.350
31.	279	5.23	100.240	99.350
32.	324	5.19	100.240	99.350
33.	245	5.17	100.240	99.350
34.	44	5.16	100.240	99.350
35.	311	5.05	100.240	99.350
36.	7	4.96	100.240	99.350
37.	293	4.88	100.240	99.350
38.	330	4.84	100.240	99.350
39.	290	4.83	100.240	99.350
40.	277	4.72	100.240	99.350
41.	38	4.70	100.240	99.350
42.	354	4.70	100.240	99.350
43.	267	4.70	100.240	99.350
44.	339	4.49	100.240	99.350
45.	8	4.45	100.240	99.350
46.	74	4.25	100.240	99.350
47.	303	4.20	100.240	99.350
48.	248	4.17	100.240	99.350
49.	119	4.15	100.240	99.350
50.	278	4.13	100.240	99.350

POLLUTANT 2

DAY NUMBER	CONCENTRATION (UG/M**3)	RECEPTOR X (KM)	COORDINATES Y (KM)

011640

T E X A S E P I S O D I C M O D E L VERSION 88(P-3)

IBM PC VERSION - PILKO AND ASSOCIATES, INC. COPYRIGHT 1986

50 HIGHEST 8 HOUR CONCENTRATIONS: SHERIDAN DISPOSAL SITE - MAXIMUM FLUX CASE - BENZENE - 8 HOUR AVE. - PILKO

	POLLUTANT 1					POLLUTANT 2				
	DAY NUMBER	PERIOD NUMBER	CONCENTRATION (UG/M**3)	RECEPTOR COORDINATES X (KM)	Y (KM)	DAY NUMBER	PERIOD NUMBER	CONCENTRATION (UG/M**3)	RECEPTOR COORDINATES X (KM)	Y (KM)
1.	59	3	29.09	100.240	99.350					
2.	65	1	24.59	100.240	99.350					
3.	77	1	23.49	100.240	99.350					
4.	179	1	21.65	100.240	99.350					
5.	178	1	18.70	100.240	99.350					
6.	356	1	17.72	100.240	99.350					
7.	6	3	16.77	100.240	99.350					
8.	350	1	16.33	100.240	99.350					
9.	334	3	16.25	100.240	99.350					
10.	142	1	16.23	100.240	99.350					
11.	72	1	15.97	100.240	99.350					
12.	135	1	15.63	100.240	99.350					
13.	245	1	15.35	100.240	99.350					
14.	49	1	15.30	100.240	99.350					
15.	7	1	14.89	100.240	99.350					
16.	153	3	14.85	100.240	99.350					
17.	230	3	14.73	100.240	99.350					
18.	52	3	14.62	100.240	99.350					
19.	290	1	14.44	100.240	99.350					
20.	325	1	14.32	100.240	99.350					
21.	182	1	13.95	100.240	99.350					
22.	293	3	13.16	100.240	99.350					
23.	311	1	13.10	100.240	99.350					
24.	74	3	12.74	100.240	99.350					
25.	340	1	12.60	100.240	99.350					
26.	248	1	12.50	100.240	99.350					
27.	153	1	12.20	100.240	99.350					
28.	8	3	12.19	100.240	99.350					
29.	303	1	12.08	100.240	99.350					
30.	237	3	12.06	100.240	99.350					
31.	99	3	11.89	100.240	99.350					
32.	119	3	11.77	100.240	99.350					
33.	154	1	11.75	100.240	99.350					
34.	288	1	11.44	100.240	99.350					
35.	182	3	11.39	100.240	99.350					
36.	355	1	11.35	100.240	99.350					
37.	348	3	11.23	100.240	99.350					
38.	81	3	11.01	100.240	99.350					
39.	324	3	10.72	100.240	99.350					
40.	6	1	10.71	100.240	99.350					
41.	289	3	10.54	100.240	99.350					
42.	98	3	10.34	100.240	99.350					
43.	31	3	10.29	100.240	99.350					
44.	272	1	10.15	100.240	99.350					
45.	64	3	10.14	100.240	99.350					
46.	310	3	10.11	100.240	99.350					
47.	267	1	10.06	100.240	99.350					
48.	235	1	9.67	100.240	99.350					
49.	299	1	9.54	100.240	99.350					
50.	233	1	9.46	100.240	99.350					

011641

ATTACHMENT II

8-HOUR MAXIMUM
DIKE RECEPTORS
TEM-8AB MODEL

(Concentrations Have Been Multiplied by 1000)

011642

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                    T E X A S   E P I S O D I C   M O D E L                    VERSION 8A8(P
          IBM PC VERSION - PILKO AND ASSOCIATES, INC. COPYRIGHT 1986

          SEQUENTIAL METEOROLOGICAL DATA HAS BEEN USED.

   SURFACE WEATHER STATION=12919          UPPER AIR STATION= 3937
                  YEAR=1964                              YEAR=1964

DAY--- 0 1 1 1 1 1 1 1 1 1  1 1 1 1 1 1 1 1 1 1  1 1 1 1 1 1 1 1 1 1  1 1 1 1 1 1 1 1 1 1  1 1 1 1 1 1 1 1 1 1
       1 1 1 1 1 1 1 1 1 1  1 1 1 1 1 1 1 1 1 1  1 1 1 1 1 1 1 1 1 1  1 1 1 1 1 1 1 1 1 1  1 1 1 1 1 1 1 1 1 1
       1 1 1 1 1 1 1 1 1 1  1 1 1 1 1 1 1 1 1 1  1 1 1 1 1 1 1 1 1 1  1 1 1 1 1 1 1 1 1 1  1 1 1 1 1 1 1 1 1 1
       1 1 1 1 1 1 1 1 1 1  1 1 1 1 1 1 1 1 1 1  1 1 1 1 1 1 1 1 1 1  1 1 1 1 1 1 1 1 1 1  1 1 1 1 1 1 1 1 1 1
       1 1 1 1 1 1 1 1 1 1  1 1 1 1 1 1 1 1 1 1  1 1 1 1 1 1 1 1 1 1  1 1 1 1 1 1 1 1 1 1  1 1 1 1 1 1 1 1 1 1
       1 1 1 1 1 1 1 1 1 1  1 1 1 1 1 1 1 1 1 1  1 1 1 1 1 1 1 1 1 1  1 1 1 1 1 1 1 1 1 1  1 1 1 1 1 1 1 1 1 1
       1 1 1 1 1 1 1 1 1 1  1 1 1 1 1 1 1 1 1 1  1 1 1 1 1 1 1 1 1 1  1 1 1 1 1 1 1 1 1 1  1 1 1 1 1 1 1 1 1 1
       1 1 1 1 1 1 1 1 1 1  1 1 1 1 1 1
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URBAN MODE HAS BEEN USED.

REPORTED WIND DIRECTIONS HAVE BEEN USED.

011643

T E X A S E P I S O D I C M O D E L VERSION 3A8

IBM PC VERSION - PILKO AND ASSOCIATES, INC. COPYRIGHT 1986

CONTROL PARAMETERS: SHERIDAN DISPOSAL SITE - MAXIMUM FLUX CASE - BENZENE - 8 HOUR AVE. - PILKO

AVERAGING TIME OPTION (NTOPT):

ONLY OPTION 9 IS AVAILABLE FOR TEM8A8

OPTION 9: RESULTS CONVERTED TO 1 HOUR AVERAGING TIME AND USED FOR 3 HOUR AND 24 HOUR AVERAGES WITH HOURLY SEQUENTIAL METEOROLOGY

WIND DIRECTION OPTIONS (NWDOPT):

ONLY OPTION 0 IS AVAILABLE FOR TEM8A8

OPTION 0: WIND DIRECTION IN DEGREES

WIND SPEED OPTIONS (NWSOPT):

ONLY OPTION 0 IS AVAILABLE FOR TE

OPTION 0: WIND SPEED IN METERS PER SECOND

INPUT UNITS OPTION (NSRCOP):
OPTION 1: GRID PARAMETERS AND SOURCE LOCATIONS IN KM, SOURCE PARAMETERS IN M, M, GM/S, DEGREES CELS
OPTION 2: GRID PARAMETERS AND SOURCE LOCATIONS IN FT, SOURCE PARAMETERS IN FT, FT/S, LB/HR, DEGREE FAHRENHEIT.
OPTION3: MIXED UNITS - GRID PARAMETERS AND SOU LOCATIONS IN KM. SOURCE PARAMETERS FT, FT/S, LB/HR, DEGREES FAHRENHEIT

SURFACE WEATHER STATION=12918, 1964.
UPPER AIR STATION= 3937, 1964

POLLUTANT(S) 1 ON POLLUTANT SOURCE CARDS ARE MODELED IN THIS RUN.

DT/DZ (E STABILITY) = 0.0200
DT/DZ (F STABILITY) = 0.0350

PUNCH INTERVAL = 1.

THE STACK-TIP DOWNWASH ALGORITHM IS IN EFFECT.

(ALL AREA SOURCE INPUT IS IN METRIC UNITS)

OPTION 1 HAS BEEN SELECTED

RECEPTOR GRID CONSISTS OF 4 COLUMNS AND 6 ROWS OF SPACING = 0.100 KM. SOUTHWEST CORNER OF GRID = 99.900 KM W, 99.900 KM S

AREA SOURCE SCALING FACTOR, 1ST POLLUTANT, = 1.0000 AREA SOURCE SCALING FACTOR, 2ND POLLUTANT, = 1.0000

CONCENTRATION CALIBRATION FACTORS: A(1) = 0.0000, B(1) = 100.0000; A(2) = 0.0000, B(2) = 100.0000

POL 1 ID:BENZENE POL 1 CAL ID: MULTIPLY BY 100.0 / POL 2 ID: POL 2 CAL ID:

OUTPUT WILL BE PRESENTED IN THE FOLLOWING FORM(S):
MAXIMUM PREDICTED CONCENTRATION(S) FOR EACH SCENARIO

IBM PC VERSION - PILKO AND ASSOCIATES, INC. COPYRIGHT 1986

T.E.M. VERSION 8AB- AREA SOURCE LIST - SHERIDAN DISPOSAL SITE - MAXIMUM FLUX CASE - BENZENE - 8 HOUR AVE. - PILKO

NUMBER	X (KM)	Y (KM)	AREA SIZE (KM)	E1 (G/S)	E2 (G/S)

THE SUM OF THE AREA SOURCE EMISSION RATES IN THIS RUN IS 0.0000(G/S) FOR POLLUTANT 1 AND 0.0000(G/S) FOR POLLUTANT 2.

011645

IBM PC VERSION - PILKO AND ASSOCIATES, INC. COPYRIGHT 1986

T.E.M. VERSION 8A3- POINT SOURCE LIST - SHERIDAN DISPOSAL SITE - MAXIMUM FLUX CASE - BENZENE - 8 HOUR AVE. - PILKO

NUMBER	X (KM)	Y (KM)	E1 (G/S)	E2 (G/S)	HT (M)	DIAM (M)	VEL (M/S)	TEMP (K)	HB(M)	HW(M)	IDENTIFICATION
1	99.92	99.92	0.0637	0.0000	2.74	1.000	0.001	273.150	0.	0.	AREA 1
2	99.95	99.99	0.0637	0.0000	2.74	1.000	0.001	273.150	0.	0.	AREA 2
3	99.99	100.06	0.0637	0.0000	2.74	1.000	0.001	273.150	0.	0.	AREA 3
4	100.02	100.12	0.0637	0.0000	2.74	1.000	0.001	273.150	0.	0.	AREA 4
5	100.06	100.19	0.0637	0.0000	2.74	1.000	0.001	273.150	0.	0.	AREA 5
6	99.84	99.95	0.0637	0.0000	2.74	1.000	0.001	273.150	0.	0.	AREA 6
7	99.88	100.02	0.0637	0.0000	2.74	1.000	0.001	273.150	0.	0.	AREA 7
8	99.92	100.09	0.0637	0.0000	2.74	1.000	0.001	273.150	0.	0.	AREA 8
9	99.95	100.16	0.0637	0.0000	2.47	1.000	0.001	273.150	0.	0.	AREA 9
10	99.99	100.22	0.0637	0.0000	2.74	1.000	0.001	273.150	0.	0.	AREA 10

THE SUM OF THE POINT SOURCE EMISSION RATES IN THIS RUN IS 0.64(G/S) FOR POLLUTANT 1 AND 0.00(G/S) FOR POLLUTANT 2.

011646

T E X A S E P I S O D I C M O D E L VERSION BASIC

IBM PC VERSION - PILKO AND ASSOCIATES, INC. COPYRIGHT 1986

50 HIGHEST CONCENTRATION DAYS: SHERIDAN DISPOSAL SITE - MAXIMUM FLUX CASE - BENZENE - 8 HOUR AVE. - PILKO

	POLLUTANT 1				POLLUTANT 2			
	DAY NUMBER	CONCENTRATION (UG/M**3)	RECEPTOR COORDINATES X (KM)	Y (KM)	DAY NUMBER	CONCENTRATION (UG/M**3)	RECEPTOR COORDINATES X (KM)	Y (KM)
1.	315	164.95	100.000	100.100				
2.	71	152.12	99.900	100.200				
3.	323	149.52	99.900	100.200				
4.	316	148.29	99.900	100.200				
5.	296	143.26	99.900	100.100				
6.	342	142.92	99.900	99.900				
7.	343	141.25	99.900	99.900				
8.	60	136.32	100.000	100.000				
9.	314	131.54	99.900	100.100				
10.	350	129.61	100.000	100.300				
11.	197	129.50	99.900	100.200				
12.	22	124.70	99.900	100.200				
13.	307	123.72	99.900	100.200				
14.	311	123.62	100.000	100.000				
15.	6	121.36	100.000	100.000				
16.	211	121.08	99.900	100.200				
17.	212	120.60	99.900	100.200				
18.	345	120.43	100.000	100.100				
19.	137	119.96	99.900	100.200				
20.	254	119.12	99.900	100.100				
21.	297	116.08	100.000	100.000				
22.	91	116.05	99.900	100.200				
23.	305	115.91	100.000	100.000				
24.	54	115.60	100.000	100.300				
25.	263	115.59	99.900	100.200				
26.	186	115.30	100.000	100.100				
27.	145	113.35	99.900	100.200				
28.	244	113.02	99.900	100.200				
29.	190	111.71	100.000	100.100				
30.	22	111.64	99.900	100.200				
31.	266	111.43	99.900	100.200				
32.	193	109.85	100.000	100.100				
33.	33	109.84	99.900	100.000				
34.	10	109.50	99.900	100.100				
35.	214	109.20	99.900	100.200				
36.	59	108.15	100.000	100.000				
37.	318	108.13	99.900	100.100				
38.	87	107.68	99.900	100.200				
39.	354	107.43	99.900	99.900				
40.	264	107.21	99.900	100.200				
41.	291	107.11	100.000	100.300				
42.	5	105.05	99.900	100.000				
43.	88	104.66	99.900	100.100				
44.	356	104.34	100.100	100.100				
45.	262	102.76	99.900	100.200				
46.	153	102.34	100.000	100.000				
47.	25	102.24	100.100	100.200				
48.	289	102.18	100.000	100.000				
49.	290	102.10	100.000	100.000				

011647

T E X A S E P I S O D I C M O D E L VERSION 9AB(P-

IBM PC VERSION - PILKO AND ASSOCIATES, INC. COPYRIGHT 1985

50 HIGHEST 8 HOUR CONCENTRATIONS: SHERIDAN DISPOSAL SITE - MAXIMUM FLUX CASE - BENZENE - 8 HOUR AVE. - PILKO

	POLLUTANT 1					POLLUTANT 2				
	DAY NUMBER	PERIOD NUMBER	CONCENTRATION (UG/M**3)	RECEPTOR X (KM)	COORDINATES Y (KM)	DAY NUMBER	PERIOD NUMBER	CONCENTRATION (UG/M**3)	RECEPTOR X (KM)	COORDINATES Y (KM)
1.	33	1	220.09	99.900	99.800					
2.	297	1	143.83	99.900	99.800					
3.	256	1	141.53	99.800	99.800					
4.	290	1	133.38	99.900	99.800					
5.	77	1	129.50	100.000	99.800					
6.	341	3	124.84	99.900	99.800					
7.	267	1	122.42	99.900	99.800					
8.	327	3	116.57	99.900	99.800					
9.	303	1	114.91	99.900	99.800					
10.	322	1	114.70	99.900	99.800					
11.	247	1	110.95	99.900	99.800					
12.	135	1	109.74	99.900	99.800					
13.	82	1	108.16	99.900	99.800					
14.	342	1	107.76	99.800	99.800					
15.	328	1	107.55	99.800	99.800					
16.	293	1	101.82	99.900	99.800					
17.	65	1	97.69	100.000	99.800					
18.	6	3	97.31	100.000	99.800					
19.	76	1	96.41	99.900	99.800					
20.	342	3	96.37	99.800	99.800					
21.	356	1	96.22	100.100	99.800					
22.	343	3	95.42	99.900	99.800					
23.	10	1	94.36	99.800	99.800					
24.	90	1	93.01	99.900	99.800					
25.	141	1	92.03	100.000	99.800					
26.	179	1	91.58	100.000	99.800					
27.	120	1	90.14	99.900	99.800					
28.	104	3	89.41	99.900	99.800					
29.	311	1	88.13	100.000	99.800					
30.	154	1	86.65	100.100	99.800					
31.	59	3	86.37	100.000	99.800					
32.	343	1	85.53	99.800	99.800					
33.	146	1	85.17	99.800	99.800					
34.	249	1	84.33	99.900	99.800					
35.	7	1	84.13	100.000	99.800					
36.	350	1	82.29	100.000	99.800					
37.	252	1	80.99	99.800	99.800					
38.	153	3	80.98	100.000	99.800					
39.	326	1	80.89	99.900	99.800					
40.	268	1	80.62	99.900	99.800					
41.	334	1	80.45	99.800	99.800					
42.	334	3	78.80	99.900	99.800					
43.	177	1	78.63	99.900	99.800					
44.	32	1	77.19	99.900	99.800					
45.	119	3	76.35	100.000	99.800					
46.	176	3	76.13	99.900	99.800					
47.	251	1	75.58	99.900	99.800					
48.	178	1	75.15	100.000	99.800					
49.	244	1	74.40	99.900	99.800					
50.	299	1	74.37	100.000	99.800					

01164 8

ATTACHMENT III

ANNUAL AVERAGE
TRAILER RECEPTOR
TCM-V2 MODEL

(Concentrations Have Been Multiplied by 1000)

011649

T E X A S C L I M A T O L O G I C A L M O D E L - V E R S I O N - 2
IBM PC VERSION - PILKO AND ASSOCIATES, INC. COPYRIGHT 1986
SHERIDAN DISPOSAL SITE - MAXIMUM FLUX CASE - BENZENE CASE I - Pilko & Assoc.

RECEPTOR GRID CONSISTS OF 2 COLUMNS AND 1 ROWS, SPACED 0.100KM. APART. SOUTHWEST CORNER OF GRID = 100.24KM., 99.34KM.

1 RUN(S) WITH THE FIRST POLLUTANT AND INTPUN = 1
RISING STAGE OF PLUME RISE WILL BE USED
URBAN DISPERSION WILL BE USED FOR POINT SOURCES

TYPES OF OUTPUT TO BE PRODUCED BY THIS RUN:
ARRAY MAP
LIST OF MAXIMUM CONCENTRATIONS

DECAY HALF-LIFE OF POLLUTANT 1 = 999.900 HOURS.

RUN NO.	MEAN TEMPERATURE	AREA SOURCE EMISSION SCALING FACTORS P 1	P 2	CONCENTRATION CALIBRATION FACTORS A 1	B 1	A 2	B 2
1	293.65 K	1.0000	0.0000	0.0000	100.0000	0.0000	100.0000

CALIBRATED CONC = A(I) + B(I)*CALCULATED CONC

011650

METEOROLOGICAL JOINT FREQUENCY FUNCTION FOR RUN 1

COMMENT--FILE 12: HOUSTON HOBBY 1961-1969 AVERAGE ANNUAL TEMP=20.5 C

WIND SECTOR	STABILITY CLASS: A	B	C	DD	DN	E+F
1	0.000940	0.005070	0.011270	0.037240	0.023660	0.045410
2	0.000570	0.002950	0.006560	0.012070	0.005610	0.017770
3	0.000680	0.003260	0.005020	0.007190	0.003120	0.010930
4	0.000640	0.002480	0.003770	0.004000	0.001970	0.011720
5	0.000280	0.002710	0.003910	0.005650	0.002160	0.014100
6	0.000260	0.002140	0.003330	0.006570	0.004520	0.010360
7	0.000280	0.001800	0.003040	0.010690	0.009630	0.012150
8	0.000260	0.002190	0.004020	0.018610	0.020330	0.018260
9	0.000150	0.002710	0.005410	0.017360	0.026060	0.026490
10	0.000280	0.001950	0.003790	0.009620	0.012140	0.011150
11	0.000330	0.003100	0.006340	0.010680	0.013400	0.019070
12	0.000350	0.003100	0.006490	0.012910	0.013490	0.017920
13	0.000390	0.002760	0.007740	0.017230	0.014300	0.018270
14	0.000170	0.003160	0.008060	0.023940	0.018370	0.026660
15	0.000390	0.003900	0.008340	0.025150	0.023780	0.040050
16	0.000430	0.004130	0.012020	0.048640	0.037630	0.048910
MEAN WIND SPEEDS, METERS/SECOND	2.0164	2.4773	3.7335	5.4779	4.4290	2.2380

OVERALL MEAN = 3.2706

T E X A S C L I M A T O L O G I C A L M O D E L - V E R S I O N - 2
IBM PC VERSION - PILKO AND ASSOCIATES, INC. COPYRIGHT 1986

POINT SOURCE LIST: SHERIDAN DISPOSAL SITE - MAXIMUM FLUX CASE - BENZENE CASE I - Pilko & Assoc. RUN 1

SOURCE NO.	X (KM)	Y (KM)	HT.(M)	DIAM.(M)	VEL.(M/S)	TEMP.(K)	Z1(G/S)	Z2(G/S)	HB(M)	HW(M)	IDENTIFICATION
1	99.92	99.92	2.74	1.000	0.00	273.15	0.064	0.000	0.	0.	AREA 1
2	99.95	99.99	2.74	1.000	0.00	273.15	0.064	0.000	0.	0.	AREA 2
3	99.99	100.06	2.74	1.000	0.00	273.15	0.064	0.000	0.	0.	AREA 3
4	100.02	100.12	2.74	1.000	0.00	273.15	0.064	0.000	0.	0.	AREA 4
5	100.06	100.19	2.74	1.000	0.00	273.15	0.064	0.000	0.	0.	AREA 5
6	99.84	99.95	2.74	1.000	0.00	273.15	0.064	0.000	0.	0.	AREA 6
7	99.88	100.02	2.74	1.000	0.00	273.15	0.064	0.000	0.	0.	AREA 7
8	99.92	100.09	2.74	1.000	0.00	273.15	0.064	0.000	0.	0.	AREA 8
9	99.95	100.16	2.47	1.000	0.00	273.15	0.064	0.000	0.	0.	AREA 9
10	99.99	100.22	2.74	1.000	0.00	273.15	0.064	0.000	0.	0.	AREA 10

THE SUM OF THE POINT SOURCE EMISSION RATES FOR THIS RUN IS 0.64G/S FOR POLLUTANT 1, 0.00G/S FOR POLLUTANT 2

THE SUM OF THE AREA SOURCE EMISSION RATES FOR THIS RUN IS 0.00G/S FOR POLLUTANT 1, 0.00G/S FOR POLLUTANT 2

011651

TEXAS CLIMATOLOGICAL MODEL - VERSION 2 (URBAN)

IBM PC VERSION - PILKO AND ASSOCIATES, INC. COPYRIGHT 1986
HIGHEST PREDICTED CONCENTRATIONS FOR EACH POLLUTANT FOR EACH SCENARIO

SHERIDAN DISPOSAL SITE - MAXIMUM FLUX CASE - BENZENE CASE I - Pilko & Assoc.

RUN NUMBER	METEOROLOGY
1	COMMENT--FILE 12: HOUSTON HOBBY 1961-1969 AVERAGE ANNUAL TEMP=20.5 C

UNCALIBRATED CONCENTRATIONS IN MICROGRAMS PER CUBIC METER

RUN NUMBER	POLLUTANT 1 CALIBRATION A 1	B 1		POLLUTANT 2 CALIBRATION A 2	B 2
1	0.0000	100.0000	MULTIPLY BY 100.0	0.0000	100.0000

CALIBRATED CONC = A(I) + B(I)*CALCULATED CONC

RUN NUMBER	RECEPTOR COORDINATES X (KM)	Y (KM)	POLLUTANT 1 (BENZENE) UNCALIBRATED CONCENTRATION	CALIBRATED CONCENTRATION	RECEPTOR COORDINATES X (KM)	Y (KM)	POLLUTANT 2 ( ) UNCALIBRATED CONCENTRATION	CALIBRATED CONCENTRATION
1	100.240	99.340	1.4845	148.4502				

011652

SECTION 1 OF 1 RUN NUMBER 1, POLLUTANT 1 (BENZENE) ,UNCALIBRATED CONCENTRATIONS IN UG/M3 TCM-2 URBAN
SHERIDAN DISPOSAL SITE - MAXIMUM FLUX CASE - BENZENE CASE I - Pilko & Assoc.

METEOROLOGY: COMMENT--FILE 12: HOUSTON HOBBY 1961-1969 AVERAGE ANNUAL TEMP=20.5 C

100.24

99.34 1 1 99.34

100.24

011653

SECTION 1 OF 1 RUN NUMBER 1, POLLUTANT 1 (BENZENE) ,CALIBRATED CONCENTRATIONS (MULTIPLY BY 100.0) TCM-2 UBAM
SHERIDAN DISPOSAL SITE - MAXIMUM FLUX CASE - BENZENE CASE I - Pilko & Assoc.

METEOROLOGY: COMMENT--FILE 12: HOUSTON HOBBY 1961-1969 AVERAGE ANNUAL TEMP=20.5 C

100.24

99.34 148 117 99.34

100.24

011654

ATTACHMENT IV

ANNUAL AVERAGE
DIKE RECEPTORS
TCM-V2 MODEL

(Concentrations Have Been Multiplied by 1000)

011655

T E X A S C L I M A T O L O G I C A L M O D E L - V E R S I O N - 2
IBM PC VERSION - PILKO AND ASSOCIATES, INC. COPYRIGHT 1986
SHERIDAN DISPOSAL SITE - MAXIMUM FLUX CASE - BENZENE CASE I - Pilko & Assoc.

RECEPTOR GRID CONSISTS OF 21 COLUMNS AND 21 ROWS, SPACED 0.100KM. APART. SOUTHWEST CORNER OF GRID = 99.30KM., 99.30KM.

1 RUN(S) WITH THE FIRST POLLUTANT AND INTPUN = 1
RISING STAGE OF PLUME RISE WILL BE USED
URBAN DISPERSION WILL BE USED FOR POINT SOURCES

TYPES OF OUTPUT TO BE PRODUCED BY THIS RUN:
ARRAY MAP
LIST OF MAXIMUM CONCENTRATIONS

DECAY HALF-LIFE OF POLLUTANT 1 = 999.900 HOURS.

RUN NO.	MEAN TEMPERATURE	AREA SOURCE EMISSION SCALING FACTORS P 1	P 2	CONCENTRATION CALIBRATION FACTORS A 1	B 1	A 2	B 2
-1	293.65 K	1.0000	0.0000	0.0000	100.0000	0.0000	100.0000

CALIBRATED CONC = A(I) + B(I)*CALCULATED CONC

011656

METEOROLOGICAL JOINT FREQUENCY FUNCTION FOR RUN 1

COMMENT--FILE 12: HOUSTON HOBBY 1961-1969 AVERAGE ANNUAL TEMP=20.5 C

WIND SECTOR	STABILITY CLASS: A	B	C	DD	DN	E+F
1	0.000940	0.005070	0.011270	0.037240	0.023660	0.045410
2	0.000570	0.002950	0.006560	0.012070	0.005610	0.017770
3	0.000630	0.003260	0.005020	0.007190	0.003120	0.010930
4	0.000640	0.002480	0.003770	0.004000	0.001970	0.011720
5	0.000280	0.002710	0.003910	0.005650	0.002160	0.014100
6	0.000260	0.002140	0.003330	0.006570	0.004520	0.010360
7	0.000280	0.001800	0.003040	0.010690	0.009630	0.012150
8	0.000260	0.002190	0.004020	0.018610	0.020330	0.018260
9	0.000150	0.002710	0.005410	0.017360	0.026060	0.026490
10	0.000280	0.001950	0.003790	0.009620	0.012140	0.011150
11	0.000330	0.003100	0.006340	0.010680	0.013400	0.019070
12	0.000350	0.003100	0.006490	0.012910	0.013490	0.017920
13	0.000390	0.002760	0.007740	0.017230	0.014300	0.018270
14	0.000170	0.003160	0.008060	0.023940	0.013370	0.026660
15	0.000390	0.003900	0.008340	0.025150	0.023780	0.040050
16	0.000430	0.004130	0.012020	0.048640	0.037630	0.048910
MEAN WIND SPEEDS, METERS/SECOND	2.0164	2.4773	3.7335	5.4779	4.4290	2.2330

OVERALL MEAN = 3.2706

TEXAS CLIMATOLOGICAL MODEL - VERSION-2
IBM PC VERSION - PILKO AND ASSOCIATES, INC. COPYRIGHT 1986

POINT SOURCE LIST: SHERIDAN DISPOSAL SITE - MAXIMUM FLUX CASE - BENZENE CASE I - Pilko & Assoc. RUN 1

SOURCE NO.	X (KM)	Y (KM)	HT.(M)	DIAM.(M)	VEL.(M/S)	TEMP.(K)	E1(G/S)	E2(G/S)	HB(M)	HW(M)	IDENTIFICATION
1	99.92	99.92	2.74	1.000	0.00	273.15	0.064	0.000	0.	0.	AREA 1
2	99.95	99.99	2.74	1.000	0.00	273.15	0.064	0.000	0.	0.	AREA 2
3	99.99	100.06	2.74	1.000	0.00	273.15	0.064	0.000	0.	0.	AREA 3
4	100.02	100.12	2.74	1.000	0.00	273.15	0.064	0.000	0.	0.	AREA 4
5	100.06	100.19	2.74	1.000	0.00	273.15	0.064	0.000	0.	0.	AREA 5
6	99.84	99.95	2.74	1.000	0.00	273.15	0.064	0.000	0.	0.	AREA 6
7	99.88	100.02	2.74	1.000	0.00	273.15	0.064	0.000	0.	0.	AREA 7
8	99.92	100.09	2.74	1.000	0.00	273.15	0.064	0.000	0.	0.	AREA 8
9	99.95	100.16	2.47	1.000	0.00	273.15	0.064	0.000	0.	0.	AREA 9
10	99.99	100.22	2.74	1.000	0.00	273.15	0.064	0.000	0.	0.	AREA 10

THE SUM OF THE POINT SOURCE EMISSION RATES FOR THIS RUN IS 0.64G/S FOR POLLUTANT 1, 0.00G/S FOR POLLUTANT 2

THE SUM OF THE AREA SOURCE EMISSION RATES FOR THIS RUN IS 0.00G/S FOR POLLUTANT 1, 0.00G/S FOR POLLUTANT 2

011657

SECTION 1 OF 1 RUN NUMBER 1, POLLUTANT 1 (BENZENE) ,UNCALIBRATED CONCENTRATIONS IN UG/M3 TCM-2 URBAN

SHERIDAN DISPOSAL SITE - MAXIMUM FLUX CASE - BENZENE CASE I - Pilko & Assoc.

METEOROLOGY: COMMENT--FILE 12: HOUSTON HOBBY 1961-1969 AVERAGE ANNUAL TEMP=20.5 C

	99.00	99.20	99.40	99.60	99.80	100.00	100.20	100.40	100.60	100.80	101.00		
101.00	1 1 1 2 2 2 2 2 2 2 2 2 1 1 1 1 0 0 0 0 0												101.00
100.90	1 1 1 2 2 2 3 3 3 3 3 2 1 1 1 1 0 0 0 0 0												100.90
100.80	1 1 2 2 2 3 3 4 4 4 4 2 1 1 1 1 0 0 0 0 0												100.80
100.70	1 1 2 2 2 3 4 4 5 5 4 3 1 1 1 1 1 0 0 0 0												100.70
100.60	1 1 2 2 3 3 4 5 6 7 6 3 2 1 1 1 1 1 0 0 0												100.60
100.50	1 1 2 2 3 4 5 7 8 10 9 4 2 1 1 1 1 1 0 0 0												100.50
100.40	1 1 2 2 3 4 6 8 12 16 13 7 3 2 1 1 1 1 1 0 0												100.40
100.30	1 1 2 2 3 4 6 10 17 29 20 8 4 2 1 1 1 1 1 0 0												100.30
100.20	1 1 2 2 3 4 6 11 22 28 10 8 5 3 2 1 1 1 1 1 0												100.20
100.10	1 1 2 2 3 4 6 12 29 21 13 7 5 3 2 1 1 1 1 1 0												100.10
100.00	1 1 1 2 2 3 6 11 13 8 16 11 5 3 2 1 1 1 1 1 0												100.00
99.90	1 1 1 2 2 3 5 8 10 13 15 8 4 2 2 1 1 1 1 1 0												99.90
99.80	1 1 1 2 2 3 4 6 7 13 11 6 3 2 1 1 1 1 1 0 0												99.80
99.70	1 1 1 1 2 2 3 3 4 7 7 4 3 2 1 1 1 1 0 0 0												99.70
99.60	1 1 1 1 2 2 2 2 3 5 4 3 2 2 1 1 1 1 0 0 0												99.60
99.50	1 1 1 1 1 2 1 1 2 3 3 3 2 2 1 1 1 1 1 0 0												99.50
99.40	1 1 1 1 1 1 1 1 2 3 3 2 2 1 1 1 1 1 0 0 0												99.40
99.30	1 1 1 1 1 1 1 1 2 2 2 2 1 1 1 1 1 1 0 0 0												99.30
99.20	1 1 1 1 1 1 1 1 1 2 2 1 1 1 1 1 1 0 0 0 0												99.20
99.10	1 1 1 1 0 1 1 1 1 1 1 1 1 1 1 1 1 0 0 0 0												99.10
99.00	0 0 0 0 0 0 0 1 1 1 1 1 1 1 1 1 1 0 0 0 0												99.00
	99.00	99.20	99.40	99.60	99.80	100.00	100.20	100.40	100.60	100.80	101.00		

011658

SECTION 1 OF 1 RUN NUMBER 1, POLLUTANT 1 (BENZENE) ,CALIBRATED CONCENTRATIONS (MULTIPLY BY 100.0) TCM-2 URBAN
SHERIDAN DISPOSAL SITE - MAXIMUM FLUX CASE - BENZENE CASE I - Pilko & Assoc.

METEOROLOGY: COMMENT--FILE 12: HOUSTON HOBBY 1961-1969 AVERAGE ANNUAL TEMP=20.5 C

	99.00	99.20	99.40	99.60	99.80	100.00	100.20	100.40	100.60	100.80	101.00	
101.00	103	113	131	153	188	218	243	250	245	231	222	204	97	75	70	65	48	33	30	27	25	101.00
100.90	113	123	138	174	205	249	288	304	301	287	282	210	118	90	83	61	42	38	34	30	27	100.90
100.80	112	129	159	187	223	272	321	368	371	356	351	246	118	109	86	58	48	43	38	33	28	100.80
100.70	110	138	169	204	249	301	376	442	477	467	433	255	148	133	96	64	56	48	41	35	30	100.70
100.60	114	144	177	212	254	348	431	546	641	654	567	315	194	136	89	75	63	53	44	37	32	100.60
100.50	117	147	184	217	276	367	502	668	835	982	862	409	231	140	108	86	69	57	47	40	34	100.50
100.40	118	147	182	226	297	395	562	801	1227	1608	1346	698	321	175	126	95	75	61	51	44	37	100.40
100.30	117	139	172	219	299	418	599	1018	1682	2919	1962	842	363	216	149	108	83	70	57	48	41	100.30
100.20	114	136	166	215	287	412	623	1132	2245	2906	1025	809	516	273	173	126	96	77	64	53	44	100.20
100.10	100	130	160	202	274	403	624	1185	2916	2078	1265	706	519	290	184	129	104	82	66	56	47	100.10
100.00	99	119	144	183	242	339	556	1123	1268	3291	5921	1148	461	281	177	127	97	78	65	54	45	100.00
99.90	95	113	138	171	224	311	469	829	1009	1309	1525	797	440	244	160	115	90	72	60	51	43	99.90
99.80	89	105	127	157	199	266	377	567	709	1254	1091	568	347	216	142	104	86	66	55	46	40	99.80
99.70	82	98	117	142	176	224	292	321	404	686	662	428	293	200	127	103	80	63	50	43	35	99.70
99.60	77	91	107	127	153	185	200	199	284	462	435	337	242	175	127	95	76	61	49	41	32	99.60
99.50	71	83	97	113	132	153	145	139	199	334	322	268	208	157	118	92	71	58	51	41	33	99.50
99.40	66	75	87	99	113	108	98	108	173	250	250	213	178	136	111	89	66	55	47	39	33	99.40
99.30	60	68	77	87	85	79	81	87	152	205	198	171	145	125	104	81	65	52	45	38	33	99.30
99.20	55	61	68	75	68	63	68	83	141	167	162	145	124	111	98	77	60	48	41	37	32	99.20
99.10	50	54	60	55	49	53	57	77	124	138	138	124	107	93	87	69	57	48	37	34	31	99.10
99.00	46	50	47	42	43	46	48	65	110	116	115	106	93	78	74	67	57	45	38	31	29	99.00
	99.00	99.20	99.40	99.60	99.80	100.00	100.20	100.40	100.60	100.80	101.00											

011659

TEXAS CLIMATOLOGICAL MODEL - VERSION-2 (URBAN)

IBM PC VERSION - PILKO AND ASSOCIATES, INC. COPYRIGHT 1986
HIGHEST PREDICTED CONCENTRATIONS FOR EACH POLLUTANT FOR EACH SCENARIO

SHERIDAN DISPOSAL SITE - MAXIMUM FLUX CASE - BENZENE CASE I - Pilko & Assoc.

RUN NUMBER	METEOROLOGY
1	COMMENT--FILE 12: HOUSTON HOBBY 1961-1969 AVERAGE ANNUAL TEMP=20.5 C

UNCALIBRATED CONCENTRATIONS IN MICROGRAMS PER CUBIC METER

RUN NUMBER	POLLUTANT 1 CALIBRATION A 1	B 1		POLLUTANT 2 CALIBRATION A 2	B 2
1	0.0000	100.0000	MULTIPLY BY 100.0	0.0000	100.0000

CALIBRATED CONC = A(I) + B(I)*CALCULATED CONC

RUN NUMBER	RECEPTOR COORDINATES X (KM)	Y (KM)	POLLUTANT 1 (BENZENE) UNCALIBRATED CONCENTRATION	CALIBRATED CONCENTRATION	RECEPTOR COORDINATES X (KM)	Y (KM)	POLLUTANT 2 ( ) UNCALIBRATED CONCENTRATION	CALIBRATED CONCENTRATION
1	99.900	100.300	29.1902	2919.0188				

011660

APPENDIX G-2

AIR MODELS USED FOR CALCULATION OF DUST EMISSION AND DISPERSION

011661

APPENDIX G-2

AIR MODELS USED FOR CALCULATION OF
DUST EMISSION AND DISPERSION

G2-1 - CALCULATION OF DUST EMISSION RATES

The wind erosion emissions from the exposed soil areas can be estimated from methods presented by Cowherd, et al 1984. By assuming an unlimited wind erosion potential from the contaminated exposed soil areas of the site a worst-case emission rate can be calculated. The mass fraction of the indicator substances found in the soil can be used to derive the emission rate of those components by simple ratioing of the total emissions. This common assumption is not always valid, but is considered adequate for screening purposes. The method proposed by Cowherd is rather involved and will only be briefly described here. The reference should be consulted for further details.

The basic emission equation for estimating the annual respirable particulates (10 micron diameter and below) for surfaces with an unlimited erosion potential is:

$$Q_{10} = 0.036\ (1-V)\ (\bar{u}/u_t)^3\ F(x)$$

where:

Q_{10} = respirable particulate emission factor, i.e. annual average PM_{10} emission rate per unit area of contaminated surface (grams per meter squared - hour)

V = fraction of contaminated surface with vegetative cover

$\bar{u}$ = mean annual wind speed (meters per second)

x = $0.886\ u_t/\bar{u}$ = dimensionless ratio

$F(x)$ = function plotted as shown in Cowherd et al. 1984

u_t = threshold value of wind speed at 7 meters (meter/second)

The vegetative cover (V) was assumed to be equal to zero for the portion of this site that might be subject to wind erosion. The mean annual wind speed for Austin, Texas was reported as 4.2 meters per second (m/s). Austin was the closest representative station for which such data was readily available. The value of

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u_t is based on the friction velocity (u*) which is a reference velocity defined by the square root of the Reynold stress divided by the density of air. The friction velocity is dependent on the size distribution of the erodible particles and can be derived indirectly by determining the mode of the particle size distribution. Since the soil analysis data did not exactly follow the procedures presented by Cowherd, a low value of 50 centimeters per second for u* was assumed. The friction velocity in conjunction with an assumed roughness height of 4 centimeters, a height corresponding to tall grasslands, can be used to derive u_t by the following formula:

$$u_t = \frac{u^*}{.4} \ln(Z/Z_0)$$

u_t = threshold value of wind speed at 7 meters (m/s)
u* = friction velocity (cm/s)
Z = 700 cm, the assumed height above the surface
Z_0 = roughness height

This formula results in a value of 6.5 m/s for u_t, if u* = 50 cm/s and Z_0 = 4 cm. Finding a value for u_t will also allow F(x) to be determined from a graphical representation in the Cowherd report. F(x) is found to be 1.1 for u_t = 6.5 m/s and u = 4.2 m/s.

Now the basic wind erosion equation can be solved as follows:

$$Q_{10} = 0.036\ (1-0)\ (4.2/6.5)^3\ 1.1 = 0.011\ \frac{g}{m^2\text{-}hr} = .43\ \frac{ton}{acre\ year}$$

The area of exposed contaminated soil was determined to be approximately 10 acres (40,469 m^2). Therefore, the total emissions of respirable particulates from this area is approximately 4.3 tons per year (0.12 g/s).

The worst-case emission rate for this area is more simply computed from the equation:

$$Q_{10} = 0.036\ (1-V)\ (u_6\text{-}hr)^3$$

where: Q_{10} max and V have the same definition as in the previous equation for Q_{10} and,

U_6-hr = expected maximum 6-hr mean wind speed during the year

u^t = annual fastest mile of wind

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The annual fastest mile recorded for Austin, as listed in Table 4.1 of Cowherd's report, is 20.2 m/s. This would result in a worst-case emissions estimate of:

$$Q_{10} = 0.036\ (1-0)(20.2-2)^3 = 217.03\ \frac{g}{m^2\text{-}hr} = 244\ \frac{g}{acre\text{-}s}$$

From the entire 10 acres, the worst-case emission rate for respirable particles is computed to be 2,440 grams per second. This is an extremely high value and should be used with caution. The assumption of unlimited erosion potential is probably not entirely valid for the site and was only chosen for screening purposes.

The emission rates for the individual indicator substances contained in the soils subject to wind erosion can now be determined. Table G2-1 shows the concentration of these indicators in the soil along with the emission rates to be used in the models.

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TABLE G2-1

Emission Rates of Indicator Chemicals in Soils Subject to Wind Erosion

Indicator Chemical	Representative Concentration (mg/kg)	Calculated Emission Rates For Metals *	
		Short Term (g/s)	Annual (ug/s)
Chromium	13	0.03	1.6
Lead	149	0.36	18
Nickel	12	0.03	1.4
Zinc	285	0.70	34
PCBs	10	0.02	1.2

* Assumes a total respirable particulate emissions rate for the exposed soils of 2440 g/s for the short term and 0.12 g/s for annual.

011665

G2-2 - DISPERSION MODELS USED FOR PREDICTION OF DUST EXPOSURE LEVEL

G2-2.1 Use of the Box Model to Predict Exposure Levels

The methods for predicting concentrations directly over an area source are neither well developed nor tested. However, Schlesinger et. al. have suggested a modified box model that appears to perform reasonably well. The equation for the concentration calculation is:

$$C_i = Qi/HWu$$

where: C_i = average concentration from component "i" within the box (grams per cubic meter)

Q = emission rate of component "i" from the source (grams per second)

H = downwind height of the box (meters)

W = width of the box (meters)

u = average windspeed through the box (meters per second)

The height of the box is determined by the trajectory of the pollutant releases occurring at the upwind edge of the source. For neutral atmospheric conditions, the height of the box at the downwind edge is a function of the length of the source and the roughness height of the area. The roughness height is a measure of the surface irregularities over which a fluid is flowing. A roughness height of 4 centimeters, corresponding to that for tall grassland, has been assumed for this site. The downwind height of the box can be derived by satisfying the following equation:

$$S = 6.25\ Z_0\ \left(\frac{H}{Z_0} * \ln \frac{H}{Z_0} - 1.58\ \frac{H}{Z_0} + 1.58\right)$$

where: S = the length of the box (meters)

H = downwind height of the box (meters)

Z_0 = roughness height (meters)

The exposed soil area of 10 acres and 201 meters side length would yield a value of 57 meters for H.

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This box model is best used for calculating short term concentrations since the relationship used to derive H is only valid for neutral conditions. However, by using an average annual wind speed for the site, the results may be used to give a very conservative upper limit for long term concentrations. The average wind speed for Austin, Texas was reported to be 4.2 meters per second (m/s) (Cowherd et. al., 1984). The worst-case wind speed generally accepted for neutral conditions is 3 m/s. Substituting the unit emission rate of 1 gram per second (g/s) along with the other parameters for the exposed soils areas into the concentration equation will yield the following concentration values:

Exposed Soil:	Short Term	$29.1 * 10^{-6}$ g/m^3
	Annual	$20.7 * 10^{-6}$ g/m^3

The short-term values should be considered for time periods of 1 to 24 hours. The above figures are typically referred to as Chi over Q values. Since they have been normalized by a unit emission rate, they can be factored by the appropriate emission rate to yield the correction concentration (Table G2-1).

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G2-2.2 Gaussian Dispersion Equation

The assumption that the concentration of air pollution existing in the plume exhibits a bivariate normal distribution at downwind distances is generally accepted and has proven useful in many air quality models. The basic concentration equation for a ground level source is:

$$C(X) = \frac{Q}{Pi*Sy*Sz*u}$$

where:

C(X) = concentration at distance x from the source (grams per cubic meter)

Q = source emission rate (grams per second)

Pi = 3.1416, the number Pi

Sy = horizontal dispersion coefficient (meters)

Sz = vertical dispersion coefficient (meters)

u = mean wind speed (meters per second)

The dispersion coefficients Sy and Sz have been determined empirically. Plots of Sy and Sz for various downwind distances as well as explanations of the dispersion equations may be found

in Turner, 1970. Those dispersion coefficients are valid for sources in rural areas and will be used in this analysis. The above equation is normally used to simulate a point source of pollution, such as a smokestack. However, area sources such as the exposed soil areas can be simulated by constructing a virtual point source upwind of the area source. The virtual point of source is located such that its plume width equals that of the area source as it passes over it. The dispersion coefficients vary with stability, i.e. the turbulent structure of the atmosphere, so the distance of the virtual point source must also vary by stability. For most sources, the plume width is considered to be equal to 4.3 Sy. Therefore, it the plume width is set equal to the area source width, then Sy would equal the area source width divided by 4.3. At the distance of the midpoint of the area source, Sy must equal 47 meters for the exposed soil area source. As a rule of thumb, concentrations near an area source modeled in this fashion are not considered to be valid. Generally, it is considered best to be one or two source widths from the area source edge before considering the concentrations. However, for screening purposes it may be useful to report concentrations at locations closer than is conventionally done.

The basic dispersion equation was executed for various conditions appropriate for screening for the short and long term averaging times. Table G2-2 depicts the various assumptions used. The multiplying factor is used to adjust the concentration to account for the longer averaging time since the equation is basically designed to give 1-hour concentrations. The equation was executed for the unit emission rate so that Chi/Q values could be developed as was performed for the Box model. Table G2-3 depicts these values adjusted for averaging time. The area sources were each centered on the pond for purposes of computing Chi/Q for the trailer location. The other Chi/Q's are stated in relation to the number of area source widths from the edge of the source. The effect of adjusting the position of any area source can now easily be investigated.

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TABLE G2-2

Gaussian Dispersion Equation Assumptions

Averaging Time	Atomospheric Stability Class	Average Wind Speed (m/s)	Multiplying Factor
1-hour	Very Stable	1.0	1.0
24-hours	Stable	2.0	0.5
Annual	Neutral	3.0	0.3

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TABLE C2-3

Normalized Concentration Estimates Derived from the Gaussian Equation

Distance from Source Center (m)	Chi/Q (times 1.0E-06 s/m3) Exposure Duration 1-hour	24-hour	Annual
(Edge of Barren Area) 0	353	69.3	22.9
200	289	52.2	15.2
400	242	41.1	11.2
600	207	33.3	8.7
(Trailer) 771	183	28.2	7.2

* Distance from the edge of the area source in increments of area source width (200 m).
Chi/Q = concentration divided by a unit emission rate.

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G2-3 - RESULTS

The emissions data were combined with the model results to obtain concentration estimates for each of the indicator substances. Table G2-1 contains a summary of the emission rates for wind erosion. Multiplying those emission rates by the Chi/Q's for the Box model discussed earlier yields the expected on-site concentrations. Table G2-4 contains the concentrations that might occur for points directly on or very near to the sources under neutral conditions. The short term concentrations computed by the Box model are valid for periods of 1 to 24 hours, although 24 hour values would be expected to be somewhat lower in reality.

The emissions data and the Chi/Q's listed in Table G2-3 from the Gaussian equation were combined to produce 1-hour, 24-hour and annual average estimates of concentrations at various downwind distances. These are shown for each averaging period in Tables G2-5, G2-6 and G2-7. Although concentrations are not usually predicted close to the source when using this method, it was felt that the numbers might be useful for a screening exercise. The short-term concentrations predicted with the Gaussian equation are very much higher than those predicted by the Box model. This is a result of using stable and persistent wind conditions as well as very low wind speeds (see Table G2-2). These conditions are doubly artificial for soils since a threshold of approximately 5 m/s is required to initiate wind erosion. Regardless of these drawbacks, this analysis was designed primarily to indicate upper limits or possible concentration values, not necessarily the most realistic numbers. It is interesting to note that the Box model results compare very favorably with the Gaussian results for neutral conditions. The Gaussian Chi/Q's for the edge of the area sources was $22.89*10^{-6}$ for the exposed soil. The Box model gave results of $20.7*10^{-6}$, which is in very good agreement with the Gaussian results.

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TABLE G2-4

On-Site Concentrations of Metals in Dust
Computed by the Box Model

Indicator Chemical	Short Term (g/m3*1.0E-06)	Annual (ug/m3*1.0E-06)
Chromium	0.92	32
Lead	10.58	370
Nickel	0.85	30
Zinc	20.24	708
PCBs	0.71	25

NOTES
Short-term concentrations are good for 1 to 24 hours.
Short Term = 29.1E-06 g-s/m3-g x Emission rate (Table E2-1)
Annual = 20.7E-06 ug-s/m3-ug x Emission rate (Table E2-1)

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TABLE G2-5

1-Hour Concentrations of Indicator Chemicals
at Varying Distances from the Source Area

Indicator Chemical	Concentrations (in ug/m3) for Dust from Unaffected Dike Soils				
	Edge	1S	2S	3S	Trailer
Chromium	11.2	9.2	7.7	6.6	5.8
Lead	128.3	105.1	88.0	75.3	66.5
Nickel	10.3	8.5	7.1	6.1	5.4
Zinc	245.5	201.0	168.3	143.9	127.3
PCBs	8.6	7.1	5.9	5.1	4.5

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TABLE G2-6

24-Hour Concentrations of Indicator Chemicals
at Varying Distances from the Source Area

Indicator Chemical	Concentrations (in ug/m3) for Dust from Unaffected Dike Soils				
	Edge	1S	2S	3S	Trailer
Chromium	2.2	1.7	1.3	1.1	0.9
Lead	25.2	19.0	14.9	12.1	10.3
Nickel	2.0	1.5	1.2	1.0	0.8
Zinc	48.2	36.3	28.6	23.2	19.6
PCBs	1.7	1.3	1.0	0.8	0.7

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TABLE G2-7

Annual Concentrations of Indicator Chemicals
at Varying Distances from the Source Area

Indicator Chemical	Concentrations (in ug/m3) for Dust from Unaffected Dike Soils				
	Edge	1S	2S	3S	Trailer
Chromium	3.57E-05	2.37E-05	1.75E-05	1.36E-05	1.12E-05
Lead	4.09E-04	2.72E-04	2.00E-04	1.56E-04	1.29E-04
Nickel	3.30E-05	2.19E-05	1.61E-05	1.25E-05	1.04E-05
Zinc	7.83E-04	5.20E-04	3.83E-04	2.98E-04	2.46E-04
PCBs	2.75E-05	1.82E-05	1.34E-05	1.04E-05	8.64E-06

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Turner, D.B., 1970. Workbook of Atmospheric Dispersion Estimates. Revised 7th Printing, January 1974. Office of Air Programs, Publication No. AP-26, U. S. Environmental Protection Agency, U. S. Government Printing Office, Washington D.C. 20402.

Cowherd, C.J., Rapid Assessment of Exposure to Particulate Emissions from Surface Contamination Sites. EPA/600/8-85/002, prepared for U. S. EPA by Midwest Research Institute, Kansas City, Missouri, February 1985.

Schlesinger J. et al., Application of an Air Model in a Risk Assessment, from proceedings of the 1987 Specialty Conference on Environment Engineering, J. D. Dietz (ed), Orlando, Florida, July 6-8, 1987. American Society of Civil Engineering.

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APPENDIX H-1

ENFIELD'S (1982) UNSATURATED FLOW MODEL (UZM)

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APPENDIX H-1

ENFIELD'S (1982) UNSATURATED FLOW MODEL (UZM)

After review of the available options for models of transport through the unsaturated zone (UZ), a time-dependent unsaturated zone model developed by EPA investigators Enfield, Carsel, Cohen, Phan and Walters was selected (Enfield et al., 1982). Method 1 from Enfield's 1982 paper was selected because it provides a unified, "two-pass" approach to estimate organic pollutant transport through soils. The model assumes no dispersion and transport is a function of the following parameters:

1) Bulk density of the soil = P = 1.6 g/cm^3;
2) Interstitial porewater velocity = Vd/ne where Vd is the average recharge rate (Darcy velocity in cm/hour) and ne is effective porosity = 0.3;
3) Water content of the soil
4) Sorption coefficients (R_p values for each constituent);
5) Degradation rates;
6) C_o, the initial concentration in mg/l (OLM leachate concentration is assumed); and
7) Solubility of the constituent (needed only if Koc is not known and has to be estimated from solubility).

The algorithm for the model is:

$$\frac{Ct}{C_o} = \exp\left(-\frac{P}{ne*p} * \frac{t}{R_p} * k_i\right) \qquad (1)$$

where

k_i = specific degradation and chemical rate constants = ln 2/half-life (days) = $0.693/t_{1/2}$
t = time (days) of travel to distance x, determined from the velocity of the pollutant
C_t = concentration at time t (in mg/l) at distance x
C_o = initial concentration (mg/l)
P = soil bulk density = 1.6 g/cm^3
p = density of water = 1.0 g/cm^3
ne = effective porosity = 0.3
R_p = retardation of the pollutant with respect to water velocity
= V_w/V_p when V_w = the Darcy velocity of water

Values for R_p and C_o for each of the constituents are given in Tables 10-11, 10-12 and 10-13 for main pond sludges, affected dike soils and sludges in the evaporation system, respectively. The R_p values are used to calculate V_p, as follows:

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$$V_p = V_w/R_p \quad (2)$$

For the clay zone $V_p = V_{pc} = V_{wc}/R_p$ where

$$V_{wc} = K_c * i_c/ne = 7.4 \times 10^{-6} \text{ cm/sec} * 1 \text{ ft/ft}/0.3 = 2.47 \times 10^{-5} \text{ cm/sec}$$

For the unsaturated portion of the aquifer,

$$V_p = V_{pa} = V_{wa}/R_p \text{ where}$$

$$V_{wa} = k_a * i_a/ne = 7.9 \times 10^{-3} \text{ cm/sec} * 1 \text{ ft/ft}/0.3 = 2.63 \times 10^{-2} \text{ cm/sec}$$

A gradient i = 1 is assumed for both zones because this assumption is necessary to solve the steady-state water flow form of the equation, which is the simplest form of the model.

Travel time (T_p) for each constituent through the unsaturated zone can be calculated for any given distance x by the following general equation:

$$T_p = X/V_p \quad (3)$$

Because there are two different strata in the unsaturated zone at the site, equation (3) must be modified as follows:

$T_p = T_{pc} + T_{pa}$ where
T_{pc} = time spent in the clay zone = x_c/V_{pc}
T_{pa} = time spent in the sand zone = x_a/V_{pa}

If xT = total travel distance = $x_c + x_a$, and
xT ≐ 20′ (the entire thickness of the unsaturated zone),

then $T_p = x_c/V_{pc} + x_a/V_{pa} = 5/V_{pc} + 15/V_{pa}$ (4)

If $xT \leq 5'$ (the thickness of the clay), then
$Tp = x_c/V_{pc} + 0/V_{pa} = x_c/V_{pc}$ (5)

If 5′<xT<20 (in other words, if the pollutant has cleared the clay and is traveling through the sand), then

$$T_p = 5/V_{pc} + (xT - 5)/V_{pa} \quad (6)$$

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Similarly, if travel time (e.g., time since end of waste disposal) is known or assumed, the distance traveled in that time can be calculated as follows:

$$\text{If } T_{pc} = x_c/V_{pc} \text{ where } x_c \leq 5, \text{ then } T_{pc} \leq /V_{pc}, \text{ and}$$
$$xT_{tpc} = T_{pc} * V_{pc} \qquad (7)$$

Note that when $T_{pc} * V_{pc} = 5$, the pollutant has cleared the clay.

If T_p = total travel time and $T_p > T_{pc}$ such that

$$T_p = T_{pc} + T_{pa}$$

$$\text{then} \quad xT_{TpT} = xT_{tpc} + (T_p - t_{pc}) * (V_{pa})$$

$$\text{and} \quad xT_{Tp} = 5 + (T_p - t_{pc}) * V_{pa} \qquad (8)$$

Note that when $xT_{TpR} > 20$ feet, the unsaturated zone model is no longer appropriate and a saturated flow model is then used to model resultant ground water concentration based on the concentration for C_t predicted from the unsaturated zone model.

Solutions to these equations are provided for each indicator chemical in Table H1-1 for main pond sludges, Table H1-2 for affected dike soils and Table H1-3 for sludges in the evaporation system. The solutions are presented in two forms:

A. <u>Total Unsaturated Pathway</u> - Values for Ct in these columns represent the predicted concentrations for each pollutant at the top of the saturated zone (i.e., after passage through Xt = 20' of unsaturated zone) at time T_p, which is the time it takes each individual pollutant to reach the saturated zone, as calculated from equation (4). For example: Benzene is predicted to reach the saturated zone in 397 days at a concentration of 0.046 mg/l (Table H1-1).

B. <u>Concentrations at assumed times</u> - Values for Ct in these columns represent concentration at T = 1 year, 10 years and 100 years at the distance xT calculated for each parameter using equation (6) (for $T_{pT} \leq T_{pc}$) and equation (8) (for $T_{pT} > T_{pc}$). For example, Benzene is predicted to travel 141 cm in one year and reach a concentration of 0.066 mg/l at that depth (Table H1-1).

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Table H1 1

Results of Unsaturated Zone Time-Dependent Model Using Leachate Values from EPA's Organic Leachate Model (OLM)
for Sludges in the Main Pond at the Sheridan Disposal Services Site

Parameter (p)	Co Leachate Concentration at t=0 (from OLM) (mg/l)	Rp Retardation Coefficient for p (unitless)	Assumed Half Life (days)	Pollutant Velocity in Clay: Vpc=Vwc/Rp, Vwc = kc*ic/ne = 2.47E-05 (cm/sec)	Pollutant Velocity in Clay: tpc=xc/Vpc, tpc=travel time in clay (xc=5'=152cm) (days)	Pollutant Velocity in Aquifer: Vpa=Vwa/Rp, Vwa = ka*ia/ne = 2.63E-02 (cm/sec)	Pollutant Velocity in Aquifer: tpa=xa/Vpa, tpa=travel time in aquifer (xa=15'=457cm) (days)	Total Unsaturated Pathway: tp=tpc+tpa, Total Unsat'd Travel Time for xt=xa+xc=20' = 610cm (days)	Ct at tp and xt=20' (Concentration Remaining in Pulse) (mg/l)	Concentrations (Ct) and Travel Distances (Xt) for tp = 1, 10 & 100 yrs: At time t = 365 days, Xt (cm)	At time t = 365 days, Ct at Xt (mg/l)	At time t = 3650 days, Xt (cm)	At time t = 3650 days, Ct at Xt (mg/l)	At time t = 36500 days, Xt (cm)	At time t = 36500 days, Ct at Xt (mg/l)	Method Detection Limit (mg/l)
Benzene	3.85	5.53	60	4.46E-06	395	6.76E-03	1	397	4.04E-02	1.41E+02	6.60E-02	1.36E+06	6.46E-10	1.49E+07	0.00E+00	5.00E-03
2,4-dimethylphenol	4.17	11.65	60	2.12E-06	832	2.26E-03	2	834	5.03E-02	6.69E+01	6.03E-01	5.52E+05	1.68E-05	6.98E+06	4.56E-04	1.50E-02
Ethylbenzene	3.32	48.46	60	5.09E-07	3465	5.43E-04	10	3475	4.00E-02	1.61E+01	2.09E+00	8.82E+03	3.21E-02	1.35E+06	2.31E-20	5.00E-03
Naphthalene	0.34	34.6	60	7.13E-07	2474	7.61E-04	7	2481	4.13E-03	2.25E+31	1.70E-03	7.25E+04	5.15E-04	2.24E+06	2.03E-79	1.50E-02
PCBs (total as Aroclor 5016)	0.04	807	129	3.06E-08	57708	3.26E-05	162	57870	5.13E-05	9.64E-01	1.95E-02	9.64E+00	3.53E-08	9.64E+01	1.19E-02	5.00E-07
Phenol	12.72	1.97	60	1.25E-05	141	1.34E-02	0	141	1.53E-01	5.95E+02	1.43E-04	4.05E+06	3.45E-09	4.28E+07	0.00E+00	1.50E-02
Tetrachloroethylene	0.55	26.49	500	9.31E-07	1894	9.94E-04	5	1900	1.43E-01	2.94E+01	2.96E-01	1.51E+05	6.45E-08	2.97E+06	1.49E-08	5.00E-03
Toluene	2.09	17.46	60	1.41E-06	1249	1.51E-03	4	1252	3.25E-02	4.46E+01	7.62E-03	3.13E+05	6.87E-06	6.59E+06	3.19E-56	5.00E-03
Trichloroethylene	0.41	7.55	900	3.27E-06	540	3.49E-03	2	541	3.04E-01	1.03E+02	3.35E-01	9.37E+05	5.60E-02	1.06E+07	9.34E-10	5.00E-03
Chromium	12.14	54	1.00E+13	4.57E-07	3861	4.88E-04	11	3872	1.21E+01	1.44E+01	1.31E+01	1.44E+02	1.21E+03	1.38E+06	1.21E+01	1.00E-02
Lead	24.92	54	1.00E+13	4.57E-07	3861	4.88E-04	11	3872	2.49E+01	1.44E+01	2.49E+01	1.44E+02	2.49E+03	1.38E+06	2.49E+01	4.00E-02
Nickel	5.35	54	1.00E+13	4.57E-07	3861	4.88E-04	11	3872	5.35E+00	1.44E+01	5.35E+00	1.44E+02	5.35E+00	1.38E+06	5.35E+00	8.00E-03
Zinc	46.62	54	1.00E+13	4.57E-07	3861	4.88E-04	11	3872	4.66E+01	1.44E+01	4.66E+01	1.44E+02	4.66E+03	1.38E+06	4.66E+01	2.00E-02

EXPLANATION OF VARIABLE NAMES AND CALCULATIONS

Co = initial concentration of leachate at the bottom of the waste (top of the unsaturated zone)

Ct = concentration left in pollutant pulse at time t at distance x from the bottom of the waste

Ct/Co = ΣEXP(-(1.6/0.3)*(tp/Rp)*(kpi))

Ct = Co*Ct/Co = Co*ΣEXP(-(1.6/0.3)*(tp/Rp)*(kpi))

tpi/2 = half life of pollutant (days); kpi = degradation constant = (ln2)/(tpi/2), where ln2 = 0.695. For this model, tpi/2 is assumed to be 10 times slower than rate for surface water

Rp = retardation coefficient for pollutant p (from table 7.9).

tpc = tpc + tpa, where tpc = time it takes for pollutant p to pass through xc = 5' of Stratum A (a clay unit underlying the waste); tpc = xc/Vpc

and tpa = time it takes for pollutant p to pass through xa = 15' of Stratum B (the shallow unconfined aquifer); tpa = xa/Vpa

tp = xa/Vpc + xa/Vpa = total time it takes for a pollutant to pass through the unsaturated zone (5' of Stratum A + 15' of unsaturated Stratum B).

Vpc = Velocity of pollutant p in the unsaturated clay zone = Vc/Rp, where Vwc = permeability of the clay (kc) times a unit gradient (ic=1) divided by effective porosity (ne=0.3).

Vpa = Velocity of pollutant p in the unsaturated portion of the unconfined aquifer = Vwa/Rp, where Vwa = permeability (ka) of the sand times a unit gradient (ia=1) divided by ne=0.3.

Table H1 2

Results of Unsaturated Zone Time Dependent Model Using Leachate Values from EPA's Organic Leachate Model (OLM) for Visibly Affected Soils in the Dikes of the Main Pond at the Sheridan Disposal Services Site

Parameter (p)	Co Leachate Conc'tion at t=0 (from OLM) (mg/l)	Rp Retardation Coefficient for p (unitless)	Assumed Half-Life (days)	Pollutant Velocity in Clay: Vpc=Vwc/Rp, Vwc = kc*ic/ne = 2.47E 05 (cm/sec)	Pollutant Velocity in Clay: Tpc=xc/Vpc, Tpc=travel time in clay (xc=5'=152cm) (days)	Pollutant Velocity in Aquifer: Vpa=Vwa/Rp, Vwa = ka*ia/ne = 2.63E 02 (cm/sec)	Pollutant Velocity in Aquifer: Tpa=xa/Vpa, Tpa=travel time in aquifer (xa=15'=457cm) (days)	Tp=Tpc+Tpa, Total Unsat'd Travel Time for x1=xa+xc= 20' = 610cm (days)	Ct at Tp and x1=20' (Conc'tion Remaining in Pulse) (mg/l)	Concentrations (Ct) and Travel Distances (Xt) for Tp = 1, 10 & 100 yrs: At time t = 365 days, Xt (cm)	Ct at Xt (mg/l)	At time t = 3650 days, Xt (cm)	Ct at Xt (mg/l)	At time t = 36500 days, Xt (cm)	Ct at Xt (mg/l)	Method Detection Limit (mg/l)
Benzene	0.29	5.53	60	4.46E-06	395	4.76E-03	1	397	3.50E 05	1.41E+02	4.97E 03	1.34E+06	6.38E 19	1.49E+07	0.00E+00	5.00E 03
2,4-dimethylphenol	0.52	11.65	60	2.12E-06	832	2.26E-03	2	834	6.27E 03	6.69E+01	7.52E 02	5.52E+05	2.09E 04	6.98E+06	5.69E 05	1.50E 02
Ethylbenzene	0.07	48.46	60	5.09E 07	3465	5.43E-04	10	3475	8.45E 04	1.61E+01	4.40E 02	8.82E+05	6.76E 04	1.55E+06	4.96E 22	5.00E 03
Naphthalene	0.04	34.6	60	7.13E 07	2476	7.61E 04	7	2481	4.83E-04	2.25E+01	2.09E 02	7.75E+04	6.02E-05	2.24E+06	2.40E 58	1.50E 02
PCBs (Total as Aroclor 1016)	0.01	807	129	3.06E-08	57708	3.26E-05	162	57870	1.26E 03	9.66E-01	9.87E-03	9.64E+00	5.75E 03	9.64E+01	2.74E 85	5.00E 02
Phenol	3.18	1.97	60	1.25E 05	141	1.34E 02	0	141	3.84E 02	3.95E+02	3.51E 05	4.85E+06	8.67E 50	4.20E+07	0.00E+00	1.50E 02
Tetrachloroethylene	ND	26.49	300	9.31E 07	1894	9.94E-04	5	1900	0.00E+00	2.94E+01	0.00E+00	1.51E+05	0.00E+00	2.97E+06	0.00E+00	5.00E 03
Toluene	0.16	17.46	60	1.41E-06	1269	1.51E 03	4	1252	1.95E 03	4.46E+04	4.49E 02	1.93E+05	4.09E 07	4.59E+06	1.90E 57	5.00E 03
Trichloroethylene	ND	7.55	900	3.27E-06	540	3.49E 01	2	541	0.00E+00	1.03E+02	0.00E+00	9.57E+05	0.00E+00	1.88E+07	0.00E+00	5.00E 03
Chromium	1.70	54	1.00E+13	4.57E-07	3861	4.88E 04	11	3872	1.70E+00	1.44E+01	1.70E+00	1.44E+02	1.70E+00	1.35E+06	1.70E+00	1.00E 02
Lead	12.67	54	1.00E+13	4.57E-07	3861	4.88E-04	11	3872	1.27E+01	1.44E+01	1.27E+01	1.44E+02	1.27E+01	1.35E+06	1.27E+01	4.00E 02
Nickel	1.67	54	1.00E+13	4.57E 07	3861	4.88E 04	11	3872	1.67E+00	1.44E+01	1.67E+00	1.44E+02	1.67E+00	1.35E+06	1.67E+00	8.00E 03
Zinc	29.04	54	1.00E+13	4.57E-07	3861	4.88E 04	11	3872	2.90E+01	1.44E+01	2.90E+01	1.44E+02	2.90E+01	1.35E+06	2.90E+01	2.00E 02

EXPLANATION OF VARIABLE NAMES AND CALCULATIONS

Co = initial concentration of leachate at the bottom of the waste (top of the unsaturated zone)

Ct = concentration left in pollutant pulse at time t at distance x from the bottom of the waste

Ct/Co = @EXP(-(1.6/0.5)*(Tp/Rp)*(kpi))

Ct = Co*Ct/Co = Co*@EXP(-(1.6/0.5)*(Tp/Rp)*(kpi))

tpi/2 = half life of pollutant (days); kpi = degradation constant = (ln2)/(tpi/2), where ln2 = 0.693. For this model, tpi/2 is assumed to be 10 times slower than rate for surface water.

Rp = retardation coefficient for pollutant p (from Table 7-9).

Tp = Tpc + Tpa, where Tpc = time it takes for pollutant p to pass through xc = 5' of Stratum A (a clay unit underlying the waste), Tpc = xc/Vpc and Tpa = time it takes for pollutant p to pass through xa = 15' of Stratum B (the shallow unconfined aquifer); Tpa = xa/Vpa

Tp = xc/Vpc + xa/Vpa = t(cm) time it takes for a pollutant to pass through the unsaturated zone (5' of Stratum A + 15' of unsaturated Stratum B).

Vpc = Velocity of pollutant p in the unsaturated clay zone = Vc/Rp, where Vwc = permeability of the clay (kc) times a unit gradient (ic=1) divided by effective porosity (ne=0.3).

Vpa = Velocity of pollutant p in the unsaturated portion of the unconfined aquifer = Vwa/Rp, where Vwa = permeability (ka) of the sand times a unit gradient (ia=1) divided by ne=0.3.

TABLE H1 3

Results of Unsaturated Zone Time Dependent Model Using Leachate Values from EPA's Organic Leachate Model (OLM) for Sludges in the Evaporation System at the Sheridan Disposal Services Site

Parameter (p)	Co Leachate Concn tion at t=0 (from OLM) (mg/l)	Rp Retardation Coeffic(ent for p (unitless)	Assumed Half Life (days)	Pollutant Velocity in Clay: Vpc=Vwc/Rp, Vwc = Kc*ic/ne = 2.47E-05 (cm/sec)	Pollutant Velocity in Clay: Tpc=xc/Vpc, Tpc=Travel time in clay (xc=5'=152cm) (days)	Pollutant Velocity in Aquifer: Vpa=Vwa/Rp, Vwa = ka*ia/ne = 2.63E-02 (cm/sec)	Pollutant Velocity in Aquifer: Tpa=xa/Vpa, Tpa=Travel time in aquifer (xa=15'=457cm) (days)	Tp=Tpc+Tpa Total Unsat'd Travel Time for xf=xa+xc= 20' = 610cm (days)	Ct at Tp and xf=20' (Concn tion Remaining in Pulse) (mg/l)	Concentrations (Ct) and Travel Distances (Xt) for Tp + 1, 10 & 100 yrs: At time t = 365 days, Xt (cm)	At time t = 365 days, Ct at Xt (mg/l)	At time t = 3650 days, Xt (cm)	At time t = 3650 days, Ct at Xt (mg/l)	At time t = 36500 days, Xt (cm)	At time t = 36500 days, Ct at Xt (mg/l)	Method Detection Limit (mg/l)
Benzene	0.44	5.53	60	4.46E-06	395	4.76E-03	1	397	5.31E-03	1.41E+02	7.95E-03	1.34E+06	9.68E-19	1.49E+07	0.0E+00	5.00E-03
Ethylbenzene	0.70	48.46	60	5.09E-07	3405	5.43E-04	10	3475	8.45E-03	1.67E+01	4.40E-01	8.82E+05	6.76E-03	1.35E+06	4.94E-21	5.00E-03
2,4-dimethylphenol	0.66	11.63	60	2.12E-06	832	2.26E-03	2	834	7.96E-03	6.69E+01	9.55E-02	5.32E+05	2.63E-09	6.98E+06	7.27E-05	1.50E-02
Naphthalene	ND	34.6	60	7.13E-07	2474	7.61E-04	7	2481	0.00E+00	2.25E+01	0.00E+00	7.75E+04	0.00E+00	2.26E+06	0.00E+00	1.50E-02
Total PCBs (as Aroclor 1016)	0.01	807	129	3.06E-08	57708	3.26E-05	162	57870	1.25E-03	9.64E-01	9.87E-03	9.64E+00	8.78E-05	9.64E+01	2.74E-03	5.00E-02
Phenol	13.48	1.97	60	1.25E-05	141	1.34E-02	0	141	1.63E-01	5.95E+02	1.49E-04	4.05E+06	3.63E-49	4.20E+07	0.00E+00	1.50E-02
Tetrachloroethylene	0.11	26.49	300	9.31E-07	1894	9.94E-04	5	1900	4.55E-02	2.94E+01	9.28E-02	1.51E+05	2.81E-02	2.07E+06	4.67E-09	5.00E-03
Toluene	0.69	17.46	60	1.41E-06	1249	1.51E-03	4	1252	8.33E-03	4.46E+01	1.90E-01	3.13E+05	1.76E-06	4.59E+06	8.18E-57	5.60E-03
Trichloroethylene	ND	7.55	900	3.27E-06	540	3.49E-03	2	541	0.00E+00	1.03E+02	0.00E+00	9.37E+05	0.00E+00	1.05E+07	0.00E+00	5.00E-03
Chromium	5.46	54	1.00E+13	4.57E-07	3261	4.88E-04	11	3272	5.46E+00	1.44E+01	5.46E+00	1.44E+02	5.46E+00	1.35E+06	5.46E+00	1.00E-02
Lead	13.50	54	1.00E+13	4.57E-07	3261	4.88E-04	11	3272	1.35E+01	1.44E+01	1.35E+01	1.44E+02	1.35E+01	1.35E+06	1.35E+01	4.00E-02
Nickel	3.21	54	1.00E+13	4.57E-07	3261	4.88E-04	11	3272	3.21E+00	1.44E+01	3.21E+00	1.44E+02	3.21E+00	1.35E+06	3.21E+00	8.00E-03
Zinc	56.01	54	1.00E+13	4.57E-07	3261	4.88E-04	11	3272	5.60E+01	1.44E+01	5.60E+01	1.44E+02	5.60E+01	1.35E+06	5.60E+01	2.00E-02

EXPLANATION OF VARIABLE NAMES AND CALCULATIONS

Co = initial concentration of leachate at the bottom of the waste (top of the unsaturated zone)

Ct = concentration left in pollutant pulse at time t at distance x from the bottom of the waste

(t/Co = 2EXP(-(t.6/0.3)*(Tp/Rp)*(kpt))

Ct = Co*Ct/Co = Co*2EXP(-(t.6/0.3)*(Tp/Rp)*(kpt))

tp1/2 = half life of pollutant (days); kpt = degradation constant = (ln2)/(tp1/2), where ln2 = 0.693. For this model, tp1/2 is assumed to be 10 times slower than rate for surface water.

Rp = retardation coefficient for pollutant p (from Table 7-9).

Tp = Tpc + Tpa, where Tpc = time it takes for pollutant p to pass through xc = 5' of Stratum A (a clay unit underlying the waste); Tpc = xc/Vpc and Tpa = time it takes for pollutant p to pass through xa = 15' of Stratum B (the shallow unconfined aquifer); Tpa = xa/Vpa

Tp = xc/Vpc + xa/Vpa = total time it takes for a pollutant to pass through the unsaturated zone (5' of Stratum A + 15' of unsaturated Stratum B).

Vpc = velocity of pollutant p in the unsaturated clay zone = Vwc/Rp, where Vwc = permeability of the clay (kc) times a unit gradient (ic=1) divided by effective porosity (ne=0.3).

Vpa = velocity of pollutant p in the unsaturated portion of the unconfined aquifer = Vwa/Rp, where Vwa = permeability (ka) of the sand times a unit gradient (ia=1) divided by ne=0.3

APPENDIX H-2

AQUIFER DILUTION: THE VHS MODEL

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APPENDIX H-2

AQUIFER DILUTION: THE VHS MODEL

The model evaluated for unsaturated zone transport is an alternative boundary analysis presented by Domenico and Palciauska (1982) to predict ground water concentrations based on geometrical spreading of the contaminant stream in the aquifer with continuous recharge. This model is the basis for the VHS model in FR 50(38): 7897-7900. The model does not require a detailed hydrogeological and geochemical data base (e.g., redox potential, temperature), which is not available for the site, and is considered very conservative. The input concentration to the model presented below are the "worst-case" concentrations (based on a clay thickness of only 5 feet) for each disposal compartment (see Tables 10-9 through 10-11) predicted from OLM, with and without Enfield's unsaturated zone model. For this application, it is assumed that the aquifer begins at 15 feet below the bottom of the clay underlying the sludges or affected soils in each of the disposal compartments.

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The model is formulated as a boundary-value problem that approximates the spreading of a contaminant plume in the horizontal and vertical directions perpendicular to the prevailing ground water flow path and results in an equilibrium dilution for the receptor location specified. The model is conservative in that no allowance for degradation is made and accounts only for transverse (not longitudinal) dispersion.

The algorithm for the contaminant velocity (Domenico and Palciauskas, 1982) is:

$$Vc = \frac{Vwc}{(1 + (dd/n)*Kd)} = 0.000485 \text{ cm/sec} = 0.419 \text{ m/day} \qquad (1)$$

where:

Vc = Contaminant velocity

Vwc = vertical water velocity in aquifer = k*i/ne

= permeability * unit gradient/effective porosity

= (7.9E-03 cm/sec)/0.3 = 0.0263 cm/sec = 22.75 m/day

dd/n = ratio of dry density of soil to the porosity

= 4-10 g/cm3 for most geologic materials

= 1.6 g/cm3/0.3 = 5.33

Kd = distribution coefficient = 10 ml/g (Table 7-9)

= 10 cm3/g

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The algorithm for mixing in the aquifer due to geometrical spreading is:

$$\frac{Cy}{Cl} = \mathrm{erf}\left|\frac{Z}{2(D*Y)^{0.5}}\right| * \mathrm{erf}\left|\frac{X}{4(D*Y)^{0.5}}\right|$$

where:

Cl = leachate concentration (calculated using Enfield's UZM)

Cy = concentration in aquifer at distance Y from source

D = dispersivity = 0.10*Y (Pickens and Grisak, 1981)

Y = distance from source to exposure point

X = site width perpendicular to flow direction
= 625 feet (190.5 m)

Z = aquifer penetration depth = Y*(Vc/Vgw) = depth to which the plume can reach in distance Y from the source

Vgw = groundwater velocity = k*i/ne (for aquifer), where:

k = lab permeability = 7.9E-03cm/sec

i = horizontal gradient = 0.0031 m/m

ne = effective porosity (n) = 0.3

Vc = contaminant velocity from equation (1) above

erf = error function (see inset, Table 10-15)

The aquifer penetration depth (Z) is calculated for the purpose of determining if the plume will be fully mixed in the aquifer by the time the receptor location (Y) is reached. For all three disposal compartments, Z (272 m to 633 m) computed from the Y-distances for each compartment (45.7-106.7 m) is much greater than the saturated thickness of the aquifer (35 feet = 10.7 m). Conceptually, this means that the plume would hit the bottom of the aquifer and "bounce" long before reaching its theoretical maximum depth of penetration, thus mixing itself in the relatively narrow saturated zone. For this reason, the Z entered in the equations becomes the actual thickness of the aquifer, rather than the theoretical limit.

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TABLE H2-4

Calculations for VMS model

CONTAMINANT VELOCITY CALCULATION

```
          VMC                (7 96E-03 CM/SEC * (M/M)/0 3)
VC = ---------------  = ---------------------------------  = 4 85E-04 CM/SEC = 4 19E-01 M/DAY
     (I * (DD/DI)*GE)      (6(1)(1 0 G/CM3)/0 3)*10
```

PENETRATION DEPTH SIZE AND RECEPTOR DISTANCE EVA

```
                    100 7 M * 4 19E-01 M/DAY          4 47E+01 M2/DAY
Z = V * (VC/VGW) = ------------------------------ = ------------------ = 0 33E+02 M
                   (0 63 M/DAY * 0 0331 M/M)/0 3      7 06E-02 M/DAY

                    45 7 M * 4 19E-01 M/DAY          1 91E+01 M2/DAY
Z = V * (VC/VGW) = ------------------------------ = ------------------ = 2 71E+02 M
                   (0 63 M/DAY * 0 0331 M/M)/0 3      7 06E-02 M/DAY

                    75 M * 4 19E-01 M/DAY            3 14E+01 M2/DAY
Z = V * (VC/VGW) = ------------------------------ = ------------------ = 4 45E+02 M
                   (0 63 M/DAY * 0 0331 M/M)/0 3      7 06E-02 M/DAY
```

Saturated aquifer thickness = 35 feet = 10 668 M
Therefore the aquifer is well mixed long before 1 15 (668)m Use Z = 10 7 M

CALCULATION OF DILUTION FACTOR VMS MODEL

Cy = CI * ERF [Z/(2*SQRT(D*Y))] * ERF [H/(4*SQRT(D*Y))]
where Cy = concentration at edge of waste area
CI = leachate concentration calculated from OLM model
H = distance across the main pond perpendicular to aquifer flow
D = 0 (*)
Dilution factor at the aquifer at Y 0 is then Cy/CI (Domenico and Palciauskas 1982)
Cy/CI = ERF [Z/(2*SQRT(D*Y))] * ERF [H/(4*SQRT(D*Y))]

CALCULATION OF Cy/CI FOR MAIN POND

For Y = 100 M (edge of disposal area) H = 190 5 m
= ERF [10 7/(2*(MSQRT(0 1*Y/V)))] * ERF [190 5/(4*(MSQRT(0 1*Y/V)))]
= ERF [A] * ERF [B] where A = 5 98E-01 (unitless)
and B = 4 71E+00 (unitless)
Value of ERF [A] = ERF [0 598] = ^0 60
Value of ERF [B] = ERF [1 671] = ^0 99

For Y = 140 M (Brazos River) H = 190 5 m
= ERF [10 7/(2*(MSQRT(0 1*Y/V)))] * ERF [190 5/(4*(MSQRT(0 1*Y/V)))]
= ERF [A] * ERF [B] where A = 2 10E-01 (unitless)
and B = 3 36E+00
Value of ERF [A] = ERF [0 235] = ^0 230
Value of ERF [B] = ERF [1 00] = ^0 87

Therefore C/CI = dilution factor at Y = 100 M H = 190 5 m 0 37
Therefore C/CI = dilution factor at Y = 140 M H = 190 5 m 0 62

CALCULATION OF Cy/CI FOR DIKES

For Y = 45 7 m (edge of disposal area) H = 304 8 m
= ERF [10 7/(2*(MSQRT(0 1*Y/V)))] * ERF [305/(4*(MSQRT(0 1*Y/V)))]
= ERF [A] * ERF [B] where A = 3 70E-01 (unitless)
and B = 5 28E+00 (unitless)
Value of ERF [A] = ERF [0 37] = ^0 40
Value of ERF [B] = ERF [1 28] = ^1

For Y = 100 m (Brazos River) H = 304 8 m
= ERF [10 7/(2*(MSQRT(0 1*Y/V)))] * ERF [305/(4*(MSQRT(0 1*Y/V)))]
= ERF [A] * ERF [B] where A = 6 96E-01 (unitless)
and B = 2 41E+00
Value of ERF [A] = ERF [0 169] = ^0 19
Value of ERF [B] = ERF [2 41] = ^0 999

Therefore C/CI = dilution factor at Y = 45 7 m H = 305 m 0 4
Therefore C/CI = dilution factor at Y = 100 m H = 305 m 0 19

CALCULATION OF Cy/CI FOR EVAPORATION SYSTEM

For Y = 75 m (edge of disposal area) H = 61 m
= ERF [10 7/(2*(MSQRT(0 1*Y/V)))] * ERF [61/(4*(MSQRT(0 1*Y/V)))]
= ERF [A] * ERF [B] where A = 2 26E-01 (unitless)
and B = 6 43E-01 (unitless)
Value of ERF [A] = ERF [0 226] = ^0 25
Value of ERF [B] = ERF [0 643] = ^0 64

For Y = 215 m (Brazos River) H = 61 m
= ERF [10 7/(2*(MSQRT(0 1*Y/V)))] * ERF [61/(4*(MSQRT(0 1*Y/V)))]
= ERF [A] * ERF [B] where A = 7 87E-02 (unitless)
and B = 2 24E-01
Value of ERF [A] = ERF [0 0786] = ^0 09
Value of ERF [B] = ERF [0 224] = ^0 25

Therefore C/CI = dilution factor at Y = 75 m H = 61 m 0 16
Therefore C/CI = dilution factor at Y = 215 m H = 61 m 0 02

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APPENDIX H-3

Ground Water Model WMPLUME

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APPENDIX H-3

Ground Water Model WMPLUME

A computer model based on the two-dimensional steady state dispersion equation developed by Wilson and Miller (Journal of Hydraulics Division, ASCE, 1978, pp. 503-513) was used to estimate the "worst case" seepage concentrations to surface water bodies where receptors may be located. The potential exposure concentrations at the receptor points can then be calculated by dividing the seepage rates by the stream flow rate, or alternatively, by calculating the total load from the aquifer per day and dividing by variable stream flow volumes.

The dispersion program, called WMPLUME, is approved by the International Ground Water Modeling Center. WMPLUME calculates the concentration of a solute at any x,y location in an aquifer with given uniform horizontal flow in the x-direction. The program assumes a relatively thin aquifer allowing instantaneous vertical mixing, and that the source of the solute has a constant release rate and is fully penetrating. The source is assumed to be small in comparison to the area of the contaminant plume and does not influence the regional ground water flow field. These are very conservative assumptions in comparison with the actual conditions at the site. Consequently, the predicted seepage rates are much greater than what would actually occur.

The steady-state solution developed by Wilson and Miller for the solute concentration (C), in mg/l (ppm), is calculated at any x,y location in an aquifer by:

$C = \bar{C}_1 e^{-\lambda t}$ where λ is a decay factor and

$$\bar{C}_1 = \frac{f_2 \exp(x/B) \; K_o(r/B)}{2\pi \; n_e \; (D_x D_y)^{1/2}}$$ where

$f_2 = Q_o C_o$ for a continuous injection of mass per unit length

$r = [(x^2 + (D_x/D_y)\, Y^2)]^{1/2}$ where r is the weighted distance from the source to the observation point,

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$B = 2D_x/V$ where B is the mixing scale, equivalent to the Hantush leakage factor

$D_x = a_x \bar{V}$,

$D_y = a_y \bar{V}$,

$u = r^2R_d/4D_xt$, and

$W(u,r/B)$ is Hantush' well function; $K_o(r/B) = W(u,r/B)/2$ for steady state conditions.

The variable symbols require definition of the following input variables as defined below:

1. C_o = the average concentration of the constituent parameter (in mg/l) as measured at the source area

2. a_x = longitudinal dispersivity

3. a_y = transverse dispersivity

4. $\bar{V}$ = seepage velocity

   $\bar{V} = K_c i/n_e$, where K_c = permeability of the boundary clay

   i_c = hydraulic gradient = unity

5. n_e = effective porosity

6. m = aquifer thickness

7. Q_o = volumetric injection rate
   $Q_o = K_a iA$, where
   K_a = horizontal hydraulic conductivity of the aquifer
   i = hydraulic gradient
   A = area of the receptor point plane through which the constituent plume passes.

8. R_d = retardation coefficient ($R_d \geq 1$);
   calculated by first calculating K_d in ml/g (the distribution coefficient), where

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$K_d(_i) = (6.3 \times 10^{-1})(f_{oc})(K_{ow})_{(i)}$, where

K_{ow} = octanol/water partition coefficient

i = solute index

f_{oc} = fraction of organic carbon in sediments (g organic carbon per g dry sediments)

Once K_d is calculated, refer to published K_d/R_d scales (pg. 50 of Practical Aspects of Ground Water Modeling, Walton, 1984) to line up the calculated K_d with a corresponding R_d

Alternatively, use the following formula:

$R_d = 1 + [(\rho / n_e) K_d]$, where

ρ = bulk soil density (usually 1.5 to 1.6 g/cm^3)

n_e = effective porosity

9. λ = biodegradation decay parameter

$= \frac{\ln 2}{t_{1/2}}$ where $t_{1/2}$ is the constituent half life

10. x,y = Cartesian coordinates

11. t = time (days) duration of source and duration of migration and dispersion

In order for the analytical solution to WMPLUME to be statistically correct, certain boundary conditions relating to the point source and the distance to the receptor must be met. Two different criteria are applied. The first is the approximation which allows the Hantush well function [W(u,r/B)] to be approximated using Laplace's method for large values of r/B:

$$W(u,r/B) \cong (\pi B/2r)^{1/2} * \exp(-r/B) * \mathrm{erfc}\,[((-r/B)+2u)/2u^{1/2}]$$

.....(Equation 8 from Wilson and Miller)

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This equation is reasonably accurate (within 10%) for r/B >1 and very accurate (within 1%) for r/B >10. This means that the further the receptor is from the source, the more accurate is this approximation (Wilson and Miller, 1978), as long as B remains constant.

This second criterion that needs to be met relates the distance from the receptor to the source to the length of a square source area (L) which, at a certain distance r, can be modeled as a point source. This relationship is defined in Wilson and Miller (1978) in their Equation 16:

$$r/B \geq 4\gamma/N\ (L/B)^2(1 + D_x/D_y) \quad \text{. . . . . (Equation 16 from Wilson and Miller)}$$

where r = the distance from source to receptor parallel to ground water flow

L = the length of side of source area perpendicular to ground water flow

N = the percent error allowed

$\gamma = 1 + (2B\lambda/V)$

$B = 2\ \frac{Dx}{V}$

$D_x = a_x V$, where a_x = longitudinal dispersivity

$D_y = a_y V$, where a_y = transverse dispersivity

At the Sheridan Site, the following values were substituted into Equation 16:

N = 5% (error allowed)

$\gamma = 1$ (λ = degradation = 0 for WMPLUME model)

$a_x = 50$ m
$a_y = 5$ m

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$$\frac{D_x}{D_y} = 10$$

$$B = 100m$$

Results of the mathematical substitution into Equation 16 yield:

$$r = 44L^2/500$$

$$\text{or } L = (500r/44)^{1/2}$$

At the Sheridan Site, a minimum distance r was measured from the receptor to the northern edge of the main pond. This value determined the size (length L) of the source area nearest the receptor. As the distance from the receptor to the source increases, the size (length L) of the source area representing that portion of the main pond increases, as does the load associated with that area.

To meet the requirements of Wilson and Miller's Equation 16 (5% error) the main pond at SDS was divided into 34 separate source areas, which cumulatively represent the entire load of waste in the main pond. Thirty-four was the minimum number of areas that fill the main pond while still solving Equation 16. The main pond could be divided into larger number of areas, thereby decreasing the error. Coversely, the pond could be divided into fewer areas or point sources, but not without either moving the receptor away from the pond or increasing the error. Each of these areas is modeled as a point source, the loading rate of which is proportional to the size of the area in comparison to the total load of the main pond.

The summation of concentrations from each point source at a particular receptor location is justified because the partial differential equation describing transport through the saturated porous media is linear and is (see Wilson and Miller, 1978):

$$Rd \frac{\partial C}{\partial t} = D_x \frac{\partial^2 C}{\partial x^2} + D_y \frac{\partial^2 C}{\partial y^2} + D_z \frac{\partial^2 C}{\partial z^2} - \frac{V \partial C}{x} - \lambda RdC \quad \ldots (1)$$

In this equation, t, x, and y are independent variables (remember z need not be considered because the concentration throughout the z-direction in the aquifer is assumed to be constant, therefore dz/dC = 0), while C (concentration) is the dependent variable. The variables R_d, D_x, D_y, D_z, V and are constant with respect to the independent variables.

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The conditions necessary for a differential equation to be linear include:

1) the dependent variable (C) and its various derivatives occur to the first degree only

2) that no products of the dependent variable and/or any of its derivatives are present

3) that no transcendental functions of the dependent variable and/or its derivatives occur.

These three points are paraphrased from Introduction to Ordinary Differential Equations (Ross, Shepley, 1974, Xerox College Publishing, Massachusetts, p. 3). Similar definitions could be found in other texts on differential equations. Equation 1 meets the above criteria; hence, the equation is linear. The fact that the equation for C listed on page H3-1 does not appear to be linear is immaterial because this equation is a solution to the linear partial differential equation which describes solute transport. Since the differential equation is linear, the principal of superposition can be applied allowing the summation of concentrations from different point sources.

The actual input values for the above variables are summarized for the final set of model runs with WMPLUME in Tables H3-1 and H3-2. Table H3-3 lists the coordinates of each of the 34 point source areas. Abbreviated copies of each model run with resulting seepage concentrations follow as Attachment 1. In addition, resultant seepage concentrations for the indicator parameters are plotted for the modeled concentration nodes in Figures H3-1 through H3-14 in this appendix. Attachment 2 contains a copy of the original source code for WMPLUME with a brief explanation of the model parameters by the author of WMPLUME, Milovan S. Beljin.

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TABLE H3-1

SUMMARY OF WMPLUME MODEL INPUT PARAMETERS
Sheridan Disposal Services Site

Input Parameter	Case 1	Case 2	Case
C_o (mg/l)		SEE TABLE H3-2	
Q_o (m^3/day)		SEE TABLE H3-2	
ax (meters)	50	50	50
ay (meters)	5	5	5
V_a (meter/day)	2.12×10^{-2}	2.12×10^{-2}	2.12×10^{-2}
K_a (cm/sec)	7.9×10^{-3}	7.9×10^{-3}	7.9×10^{-3}
i_a (m/m)	.0031	.0031	.0031
n_e (unitless)	.3	.3	.3
m_a (meters)	10	10	10
λ $(days)^{-1}$	0	0	0
Rd (unitless)		SEE TABLE H3-2	
t_{source} (days)	365	3650	36500
$t_{dispersion}$ (days)	365	3650	36500

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NOTES

1) To calculate source loading rate, multiply $C_o \times Q_o$ for each constituent.

2) $Q_o = k_c i_c A$, where $k_c = k_{clay} = 7.4 \times 10^{-6}$ cm/sec, $i_c = 1$, and A = area of each source cell as outlined in Table H3-2.

3) $V_a = k_a i_a$, where k and i are values for the aquifers as outlined above.

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TABLE H3-2

SUMMARY OF WMPLUME MODEL INPUT LOADING RATES

Sheridan Disposal Services Site

			Areas 1-6	Areas 7-10	Areas 11-16	Areas 17-25	Areas 26-28	Areas 29-34
		Area (sq.m)	523	929	1452	2090	2845	3716
		Qo (cu.m/day)	3.34	5.93	9.28	13.4	18.2	23.7
Indicator Parameters	Rp	Co (mg/l)	LOADING RATES (kg/d)					
Benzene	5.53	3.85	0.0129	0.0229	0.0357	0.0514	0.0699	0.0914
2,4-Dimethylphenol	11.63	4.8	0.016	0.028	0.045	0.064	0.087	0.114
Ethylbenzene	48.46	3.32	0.011	0.0197	0.031	0.0443	0.0604	0.0788
Naphthalene	34.6	0.34	0.0011	0.0020	0.0032	0.0045	0.0062	0.0081
PCBs (Total as Arochlor 1016)	807	0.04	0.00013	0.00024	0.00037	0.00053	0.00073	0.00095
Phenol	1.97	19.75	0.066	0.117	0.183	0.264	0.359	0.469
Tetrachloroethylene	26.49	0.35	0.0012	0.0021	0.0032	0.0047	0.0064	0.0083
Toluene	17.46	3.75	0.013	0.022	0.035	0.050	0.068	0.089
Trichloroethylene	7.55	0.41	0.0014	0.0024	0.0038	0.0055	0.0075	0.0097
Chromium	54	9.33	0.0312	0.0554	0.0866	0.125	0.170	0.222
Lead	54	18.76	0.0634	0.112	0.176	0.253	0.345	0.450
Nickel	54	5.51	0.0184	0.0327	0.0511	0.074	0.100	0.1308
Zinc	54	126.58	0.423	0.7514	1.174	1.69	2.30	3.006

NOTES:

1) Co is the initial concentration of leachate at the bottom of the waste (top of unsaturated zone).

2) Loading Rate (f) = Co * Qo; in kg/d.

3) Qo = k * i * A; (in cu.m/day) where
   k = k(clay) = 7.4 x 10E-06 cm/sec, i = 1, and
   A = area of each source cell as defined above.

4) Rp = Retardation coefficient for pollutant p.

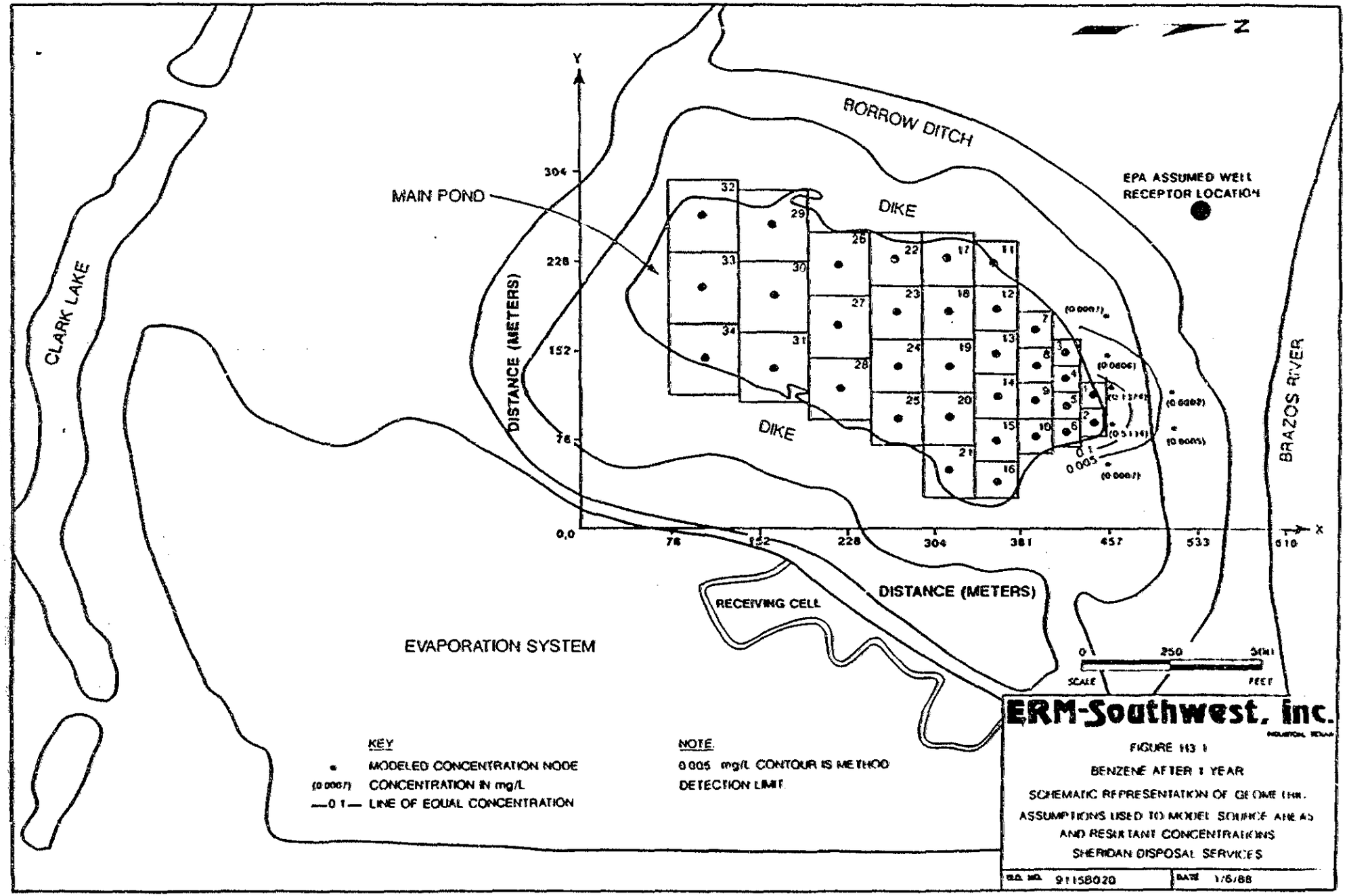
TABLE H3-3

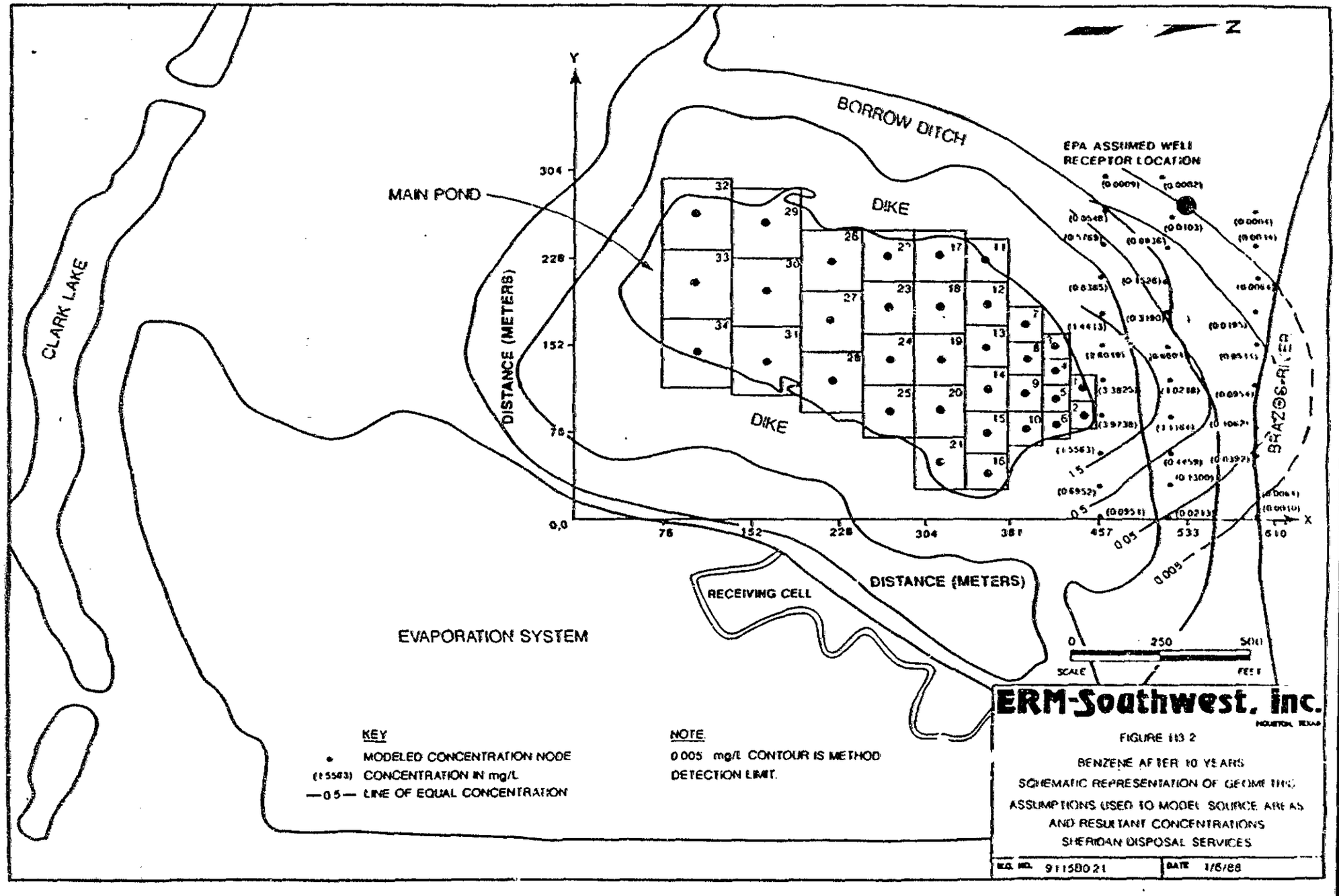
Coordinates of Source Input Nodes for WMPLUME Model

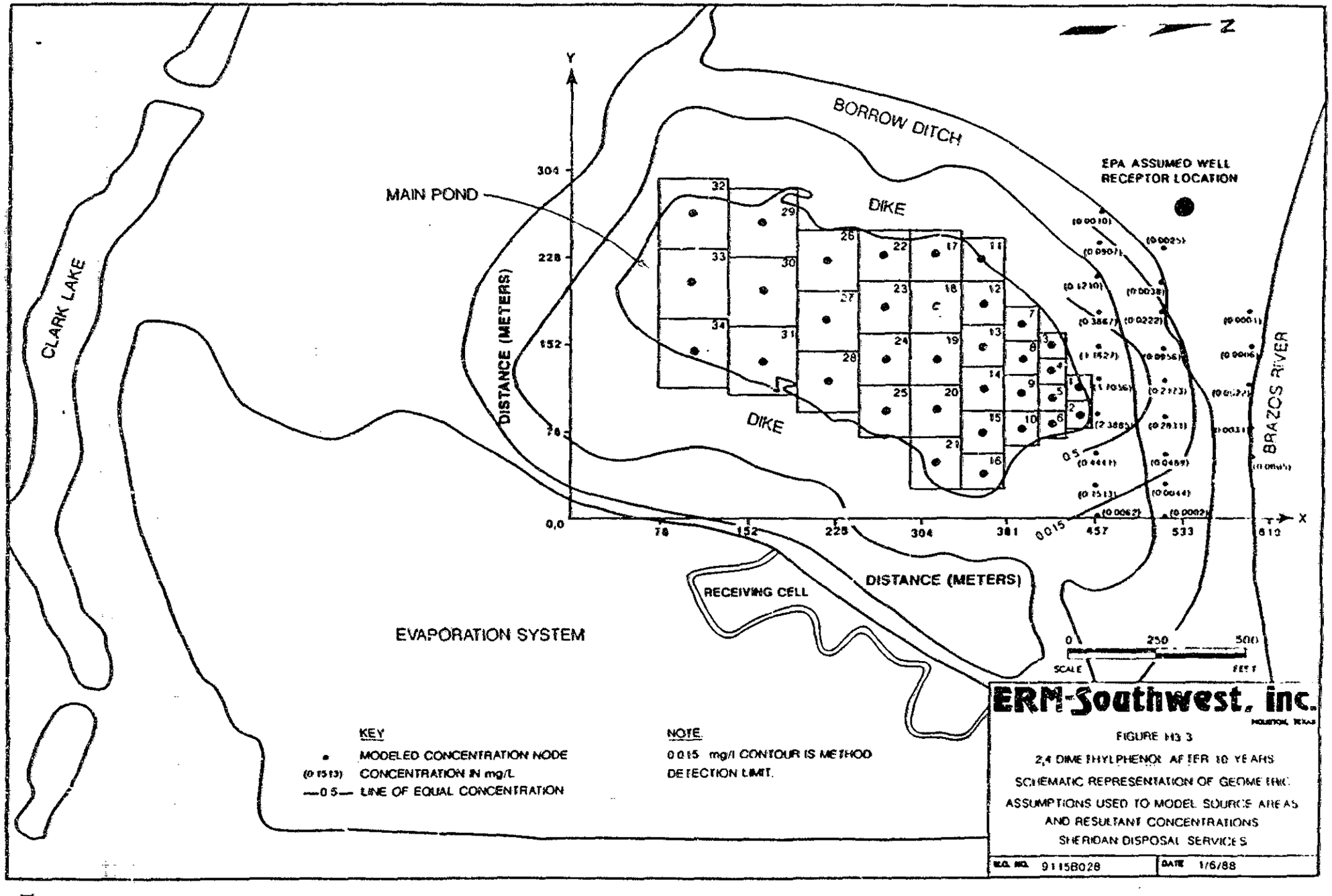
Sheridan Disposal Services Site

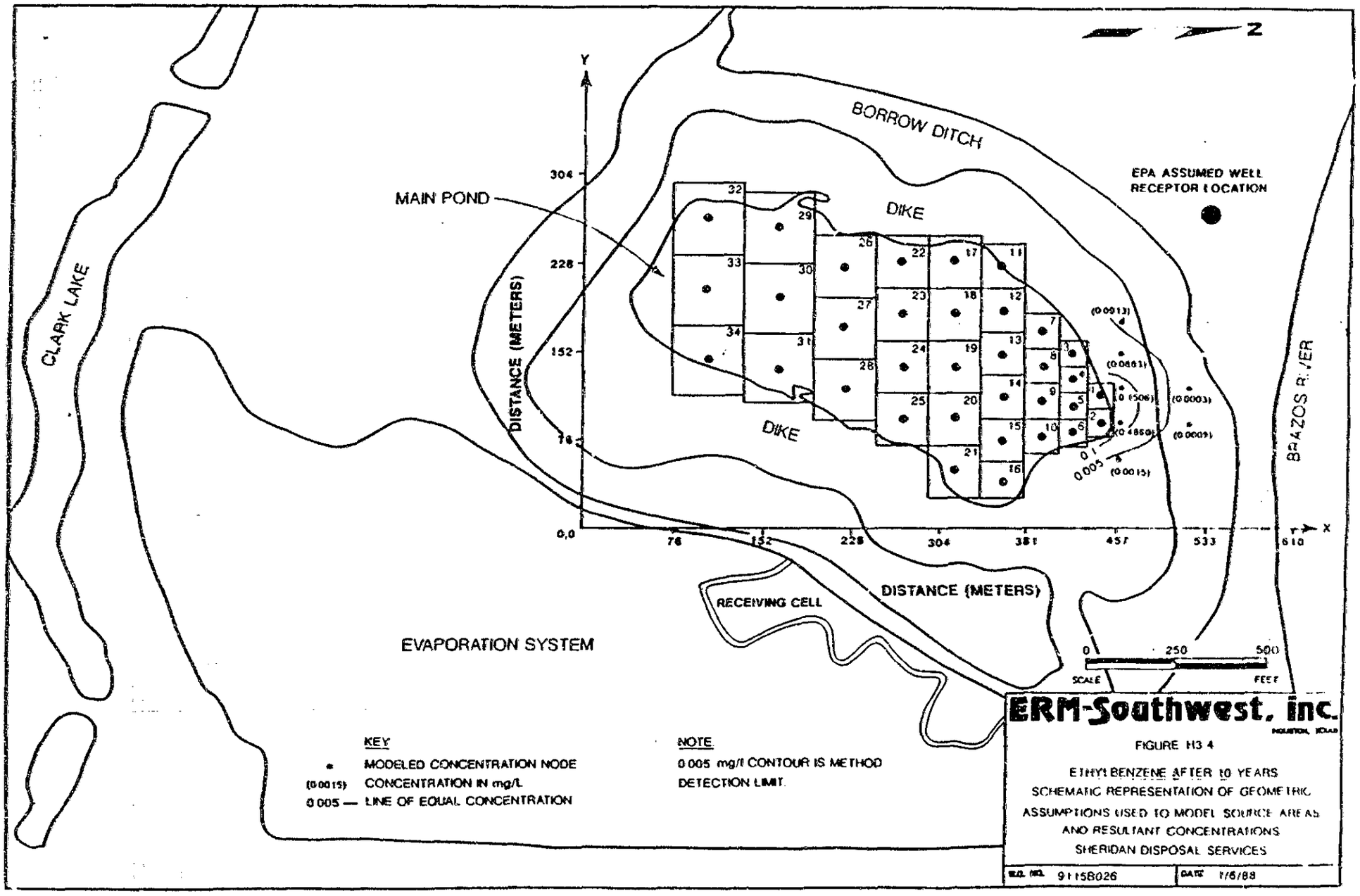
Source Area	Coordinates	Source Area	Coordinates
1	(445,110)	18	(320,182)
2	(445,87)	19	(320,137)
3	(423,148)	20	(320,91)
4	(423,126)	21	(320,46)
5	(423,103)	22	(274,229)
6	(423,80)	23	(274,183)
7	(396,16	24	(274,137)
8	(396,137)	25	(274,91)
9	(396,107)	26	(225,225)
10	(396,76)	27	(225,171)
11	(362,225)	28	(225,118)
12	(362,187)	29	(168,259)
13	(362,148)	30	(168,198)
14	(362,110)	31	(168,137)
15	(362,72)	32	(107,267)
16	(362,34)	33	(107,206)
17	(320,229)	34	(107,145)

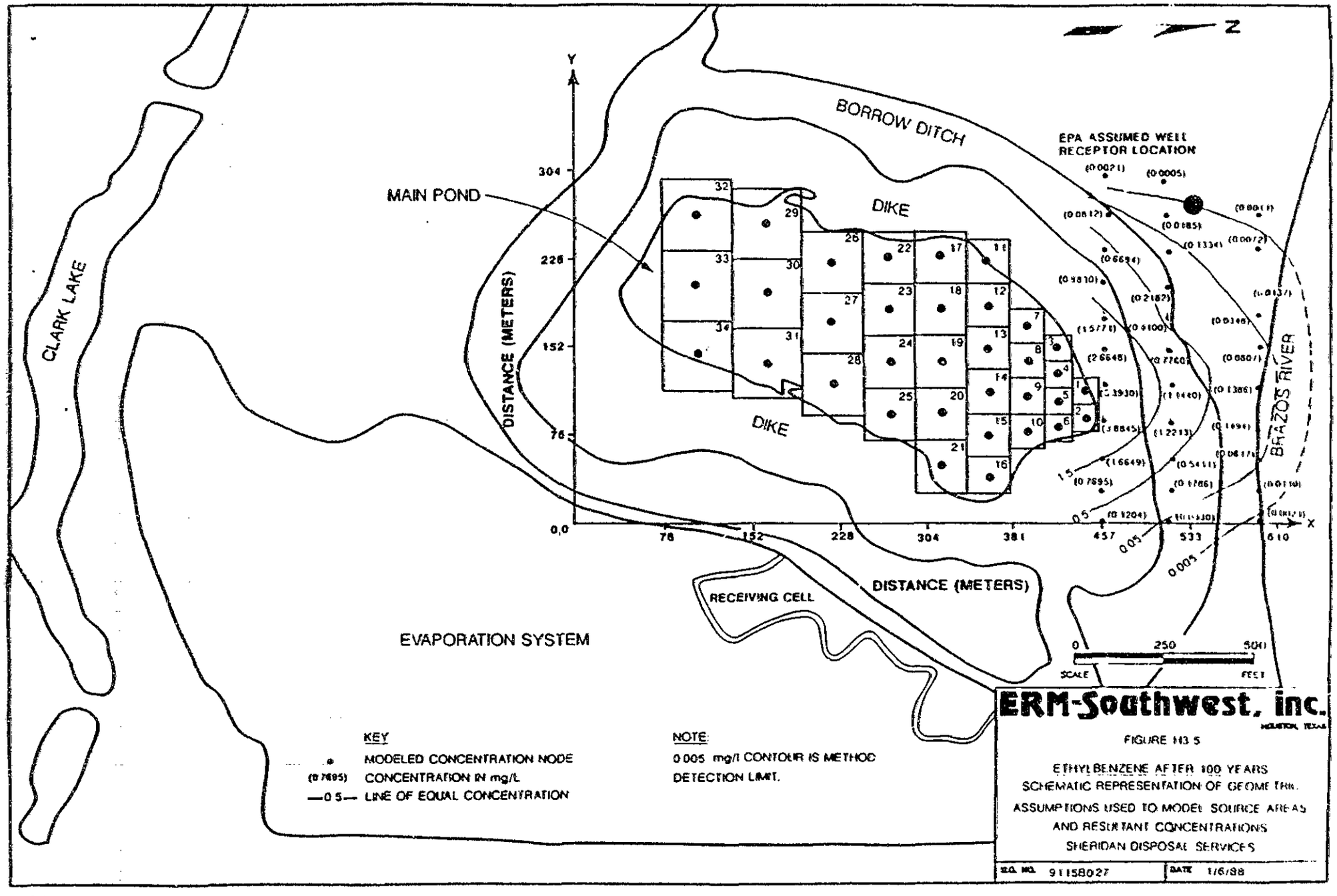
011697

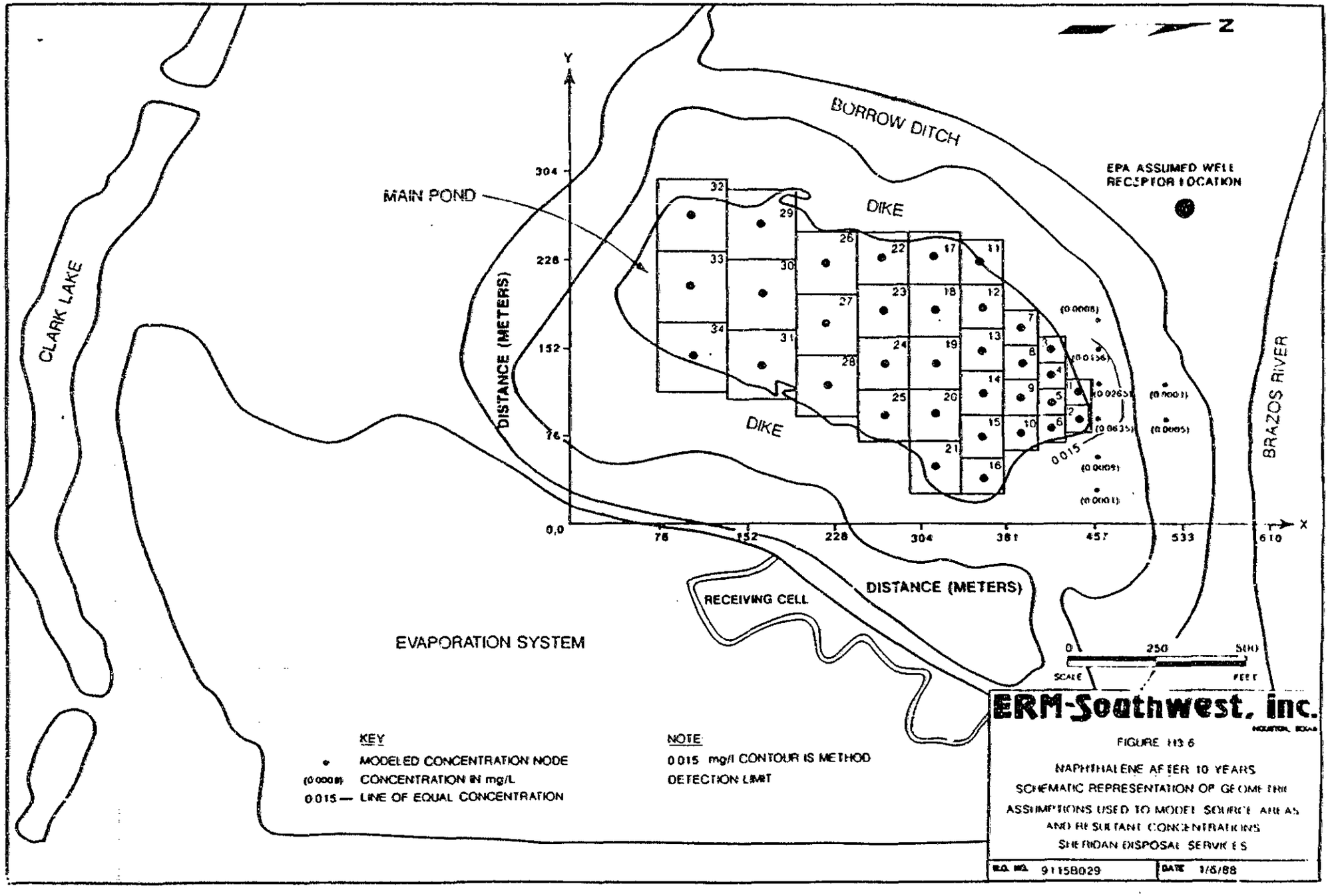

N
BORROW DITCH
EPA ASSUMED WELL RECEPTOR LOCATION
MAIN POND
DIKE
DIKE
CLARK LAKE
BRAZOS RIVER
DISTANCE (METERS)
DISTANCE (METERS)
Y
X
0,0
76
152
228
304
381
457
533
610
RECEIVING CELL
EVAPORATION SYSTEM
0.1
0.005
SCALE
FEET
KEY
MODELED CONCENTRATION NODE
(0.0007) CONCENTRATION IN mg/L
—0.1— LINE OF EQUAL CONCENTRATION
NOTE:
0.005 mg/L CONTOUR IS METHOD DETECTION LIMIT
ERM-Southwest, Inc.
FIGURE H3-1
BENZENE AFTER 1 YEAR
SCHEMATIC REPRESENTATION OF GEOMETRY, ASSUMPTIONS USED TO MODEL SOURCE AREAS AND RESULTANT CONCENTRATIONS
SHERIDAN DISPOSAL SERVICES
91158020
1/6/88

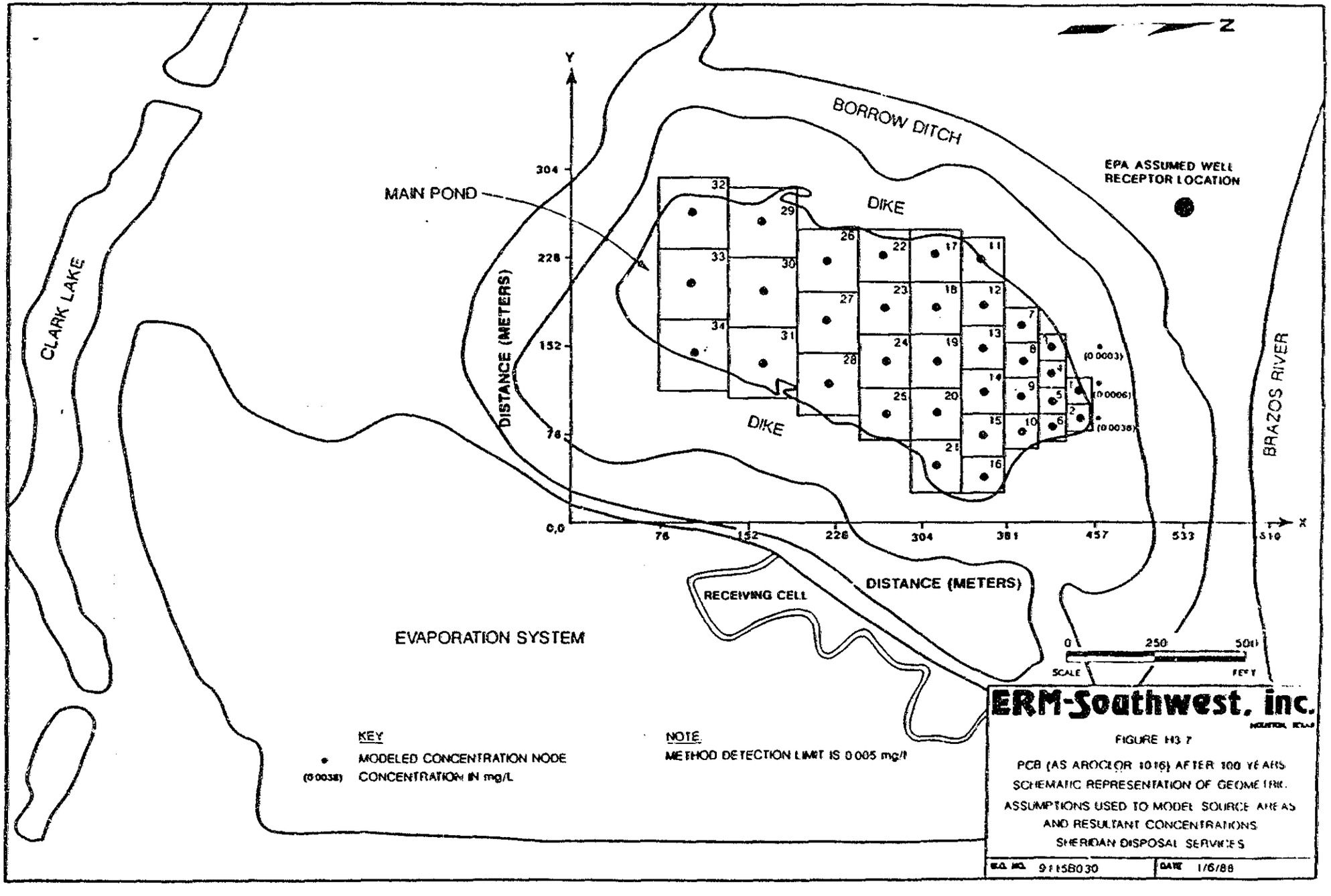

N
BORROW DITCH
EPA ASSUMED WELL RECEPTOR LOCATION
MAIN POND
DIKE
DIKE
CLARK LAKE
DISTANCE (METERS)
DISTANCE (METERS)
Y
X
0,0
76
152
228
304
381
457
533
610
RECEIVING CELL
EVAPORATION SYSTEM
BRAZOS RIVER
1.5
0.5
0.05
0.005
0
250
500
SCALE
FEET
KEY
MODELED CONCENTRATION NODE
(1.5563) CONCENTRATION IN mg/L
—0.5— LINE OF EQUAL CONCENTRATION
NOTE
0.005 mg/L CONTOUR IS METHOD DETECTION LIMIT.
ERM-Southwest, inc.
HOUSTON, TEXAS
FIGURE H3 2
BENZENE AFTER 10 YEARS
SCHEMATIC REPRESENTATION OF GEOMETRIC ASSUMPTIONS USED TO MODEL SOURCE AREAS AND RESULTANT CONCENTRATIONS
SHERIDAN DISPOSAL SERVICES
W.O. NO. 91158021
DATE 1/6/88

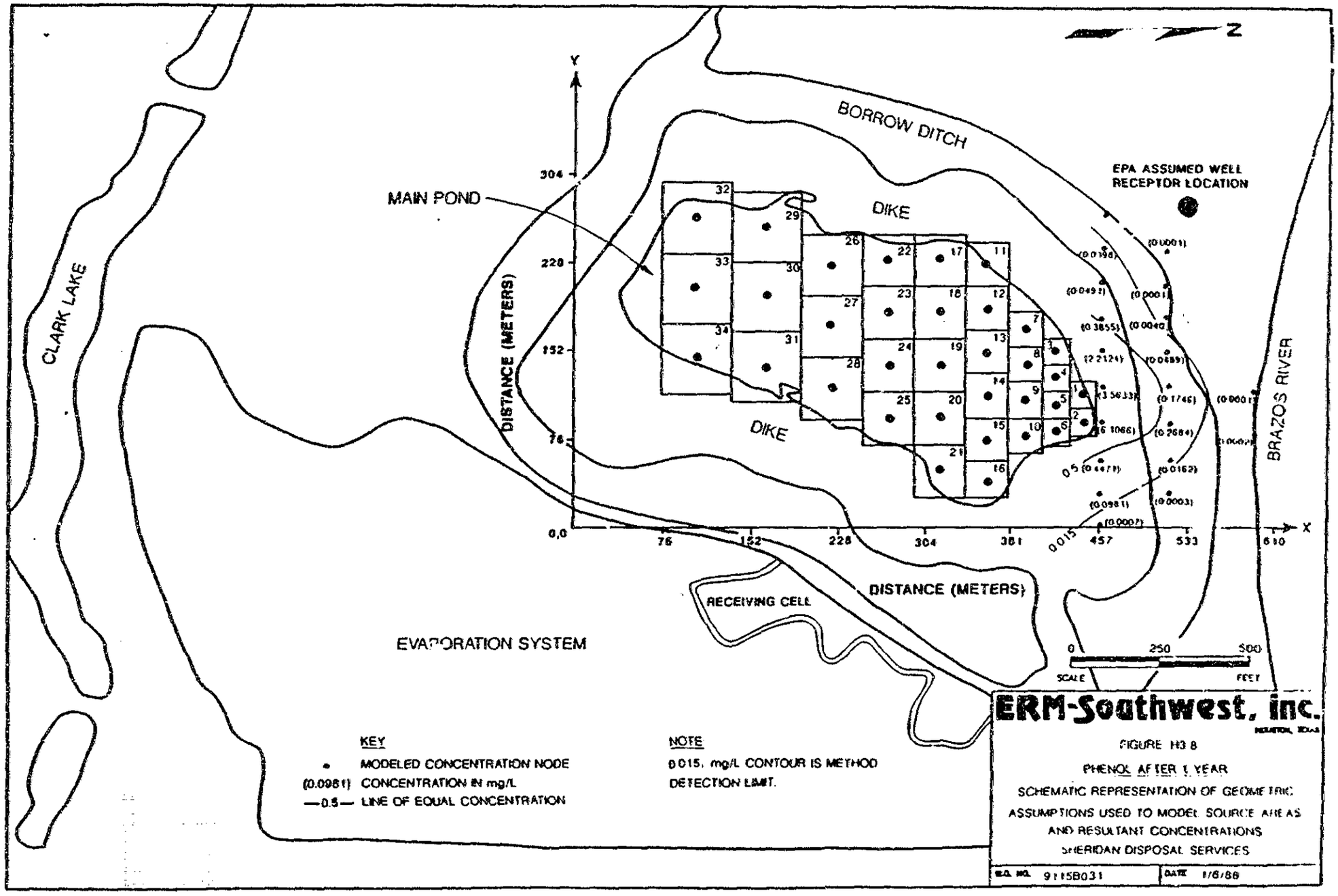

BORROW DITCH
EPA ASSUMED WELL RECEPTOR LOCATION
MAIN POND
DIKE
DIKE
CLARK LAKE
BRAZOS RIVER
DISTANCE (METERS)
DISTANCE (METERS)
RECEIVING CELL
EVAPORATION SYSTEM
Y
X
0,0
78
152
228
304
381
457
533
610
0.5
0.015
SCALE
FEET
KEY
MODELED CONCENTRATION NODE
(0.1513) CONCENTRATION IN mg/L
—0.5— LINE OF EQUAL CONCENTRATION
NOTE:
0.015 mg/l CONTOUR IS METHOD DETECTION LIMIT.
ERM-Southwest, inc.
HOUSTON, TEXAS
FIGURE H3 3
2,4 DIMETHYLPHENOL AFTER 10 YEARS
SCHEMATIC REPRESENTATION OF GEOMETRIC ASSUMPTIONS USED TO MODEL SOURCE AREAS AND RESULTANT CONCENTRATIONS
SHERIDAN DISPOSAL SERVICES
9115B028
1/6/88

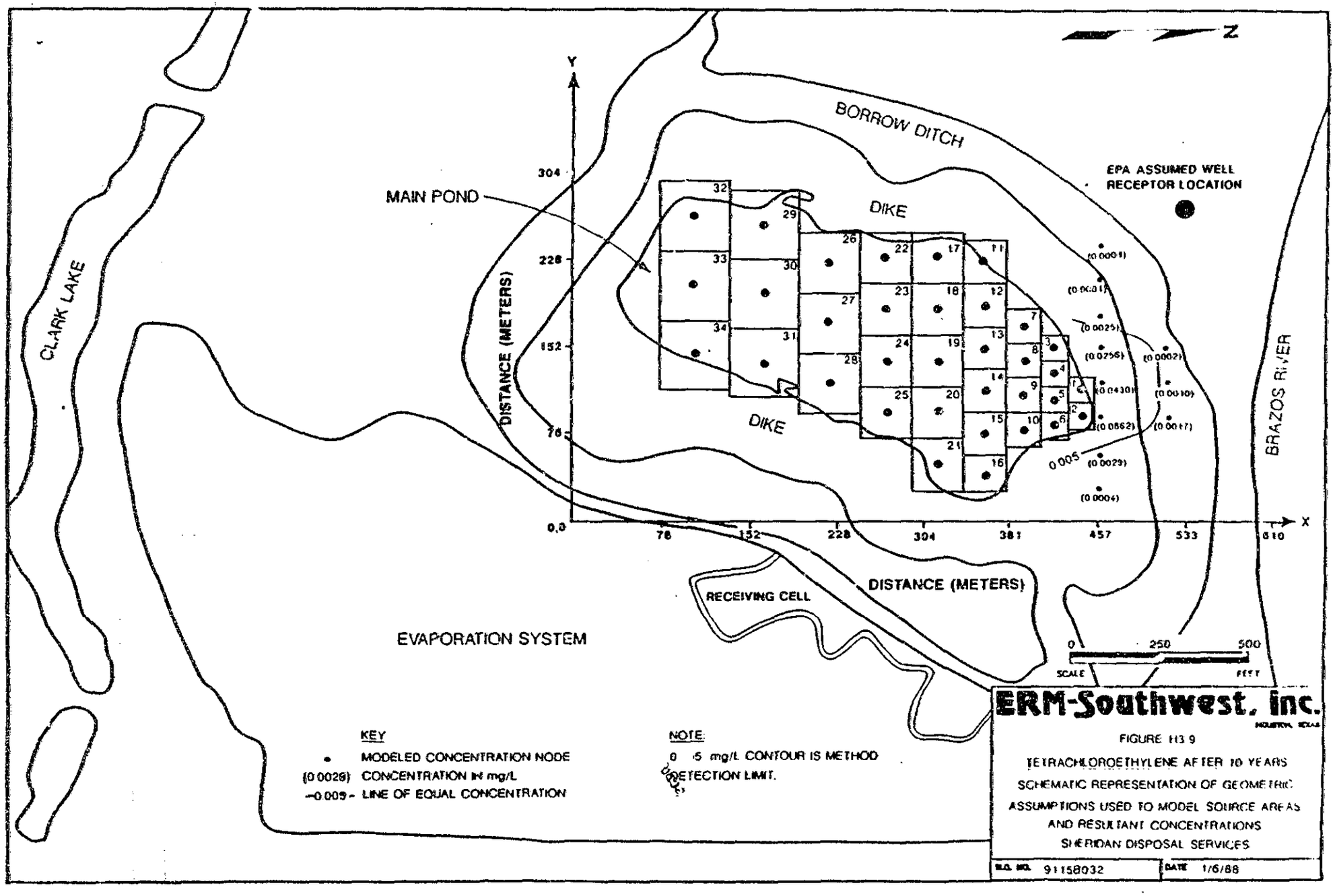

N
BORROW DITCH
EPA ASSUMED WELL RECEPTOR LOCATION
MAIN POND
DIKE
DIKE
CLARK LAKE
BRAZOS RIVER
DISTANCE (METERS)
DISTANCE (METERS)
Y
X
0,0
76
152
228
304
381
457
533
610
RECEIVING CELL
EVAPORATION SYSTEM
(0.0913)
(0.0881)
(0.0003)
(0.0009)
(0.0015)
0.005
0
250
500
SCALE
FEET
KEY
MODELED CONCENTRATION NODE
(0.0015) CONCENTRATION IN mg/L
0.005 — LINE OF EQUAL CONCENTRATION
NOTE
0.005 mg/l CONTOUR IS METHOD DETECTION LIMIT.
ERM-Southwest, inc.
HOUSTON, TEXAS
FIGURE H3 4
ETHYLBENZENE AFTER 10 YEARS
SCHEMATIC REPRESENTATION OF GEOMETRIC ASSUMPTIONS USED TO MODEL SOURCE AREAS AND RESULTANT CONCENTRATIONS
SHERIDAN DISPOSAL SERVICES
W.O. NO. 91158026
DATE 1/6/88

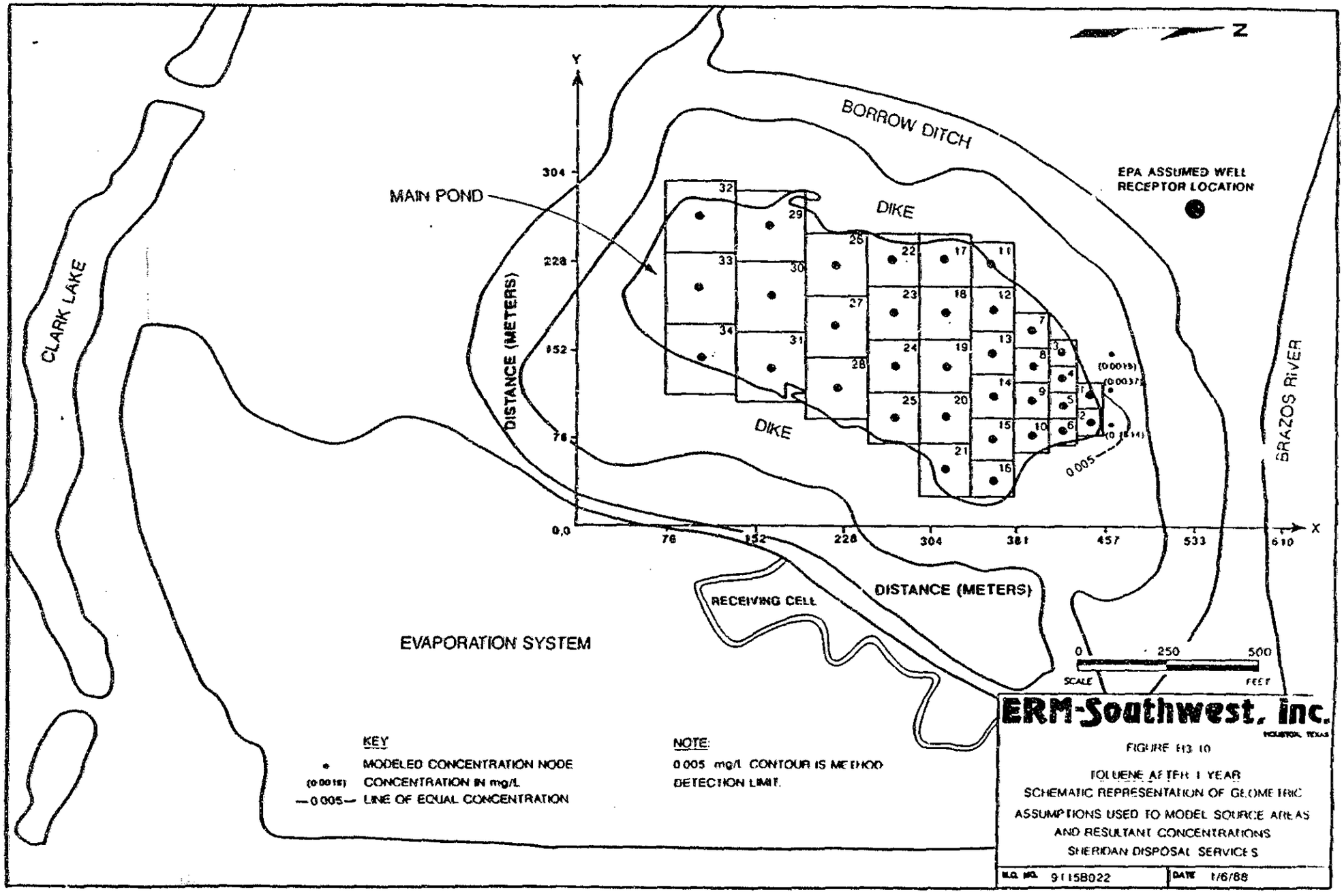

N
BORROW DITCH
EPA ASSUMED WELL RECEPTOR LOCATION
MAIN POND
DIKE
DIKE
CLARK LAKE
BRAZOS RIVER
DISTANCE (METERS)
DISTANCE (METERS)
RECEIVING CELL
EVAPORATION SYSTEM
Y
X
0,0
76
152
228
304
381
457
533
610
0.5
0.05
0.005
0
250
500
SCALE
FEET
KEY
MODELED CONCENTRATION NODE
(0.7695) CONCENTRATION IN mg/L
—0.5— LINE OF EQUAL CONCENTRATION
NOTE:
0.005 mg/l CONTOUR IS METHOD DETECTION LIMIT.
ERM-Southwest, inc.
HOUSTON, TEXAS
FIGURE H3.5
ETHYLBENZENE AFTER 100 YEARS
SCHEMATIC REPRESENTATION OF GEOMETRIC
ASSUMPTIONS USED TO MODEL SOURCE AREAS
AND RESULTANT CONCENTRATIONS
SHERIDAN DISPOSAL SERVICES
P.O. NO. 91158027
DATE 1/6/88

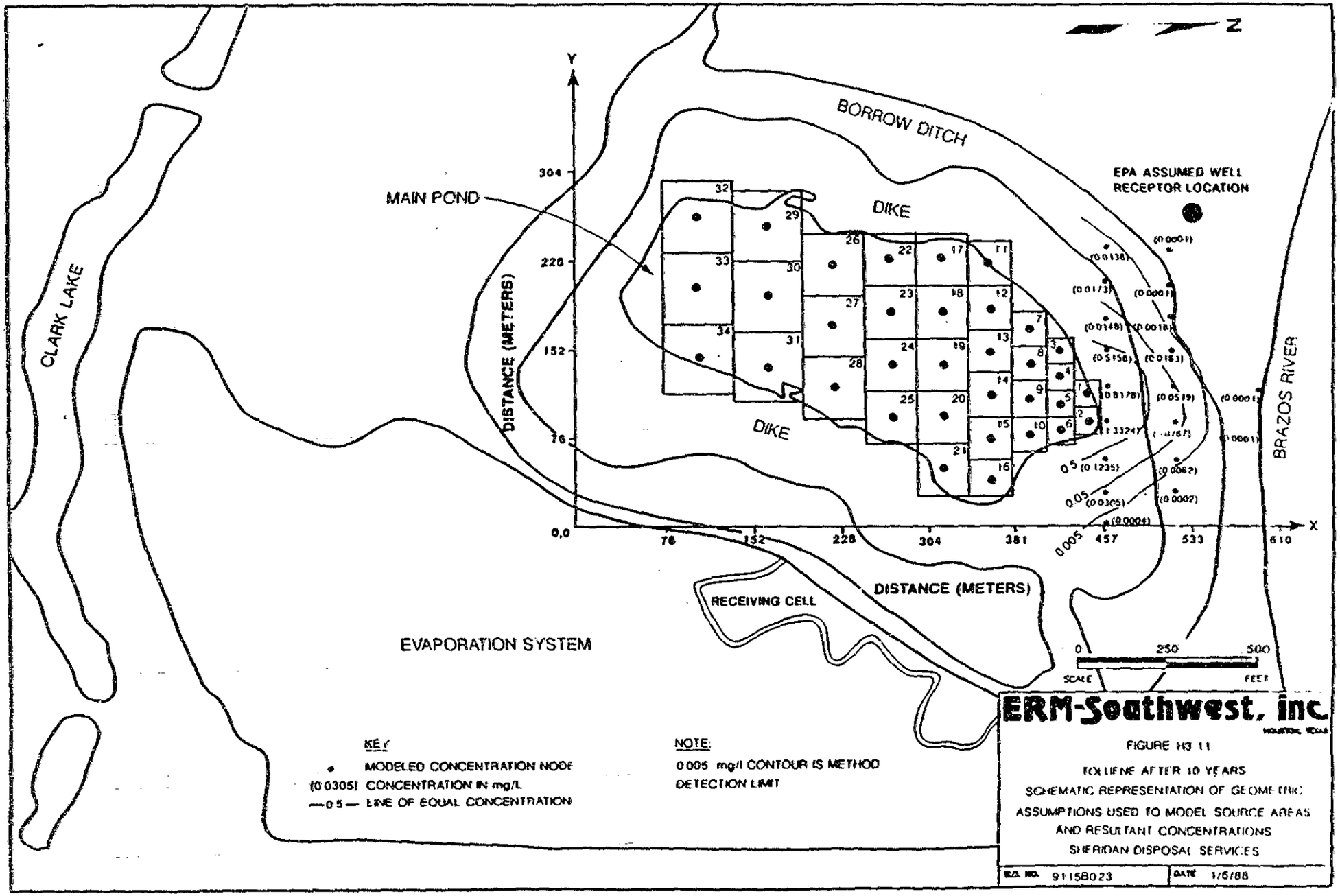

N
BORROW DITCH
EPA ASSUMED WELL RECEPTOR LOCATION
MAIN POND
DIKE
DIKE
CLARK LAKE
BRAZOS RIVER
DISTANCE (METERS)
DISTANCE (METERS)
RECEIVING CELL
EVAPORATION SYSTEM
Y
X
0,0
76
152
228
304
381
457
533
610
0.015
(0.0008)
(0.0156)
(0.0265)
(0.0635)
(0.0001)
(0.0005)
(0.0109)
(0.0001)
0
250
500
SCALE
FEET
KEY
MODELED CONCENTRATION NODE
(0.0008) CONCENTRATION IN mg/L
0.015 — LINE OF EQUAL CONCENTRATION
NOTE:
0.015 mg/l CONTOUR IS METHOD DETECTION LIMIT
ERM-Southwest, inc.
HOUSTON, TEXAS
FIGURE H3.6
NAPHTHALENE AFTER 10 YEARS
SCHEMATIC REPRESENTATION OF GEOMETRIC ASSUMPTIONS USED TO MODEL SOURCE AREAS AND RESULTANT CONCENTRATIONS
SHERIDAN DISPOSAL SERVICES
P.O. NO. 91158029
DATE 1/6/88

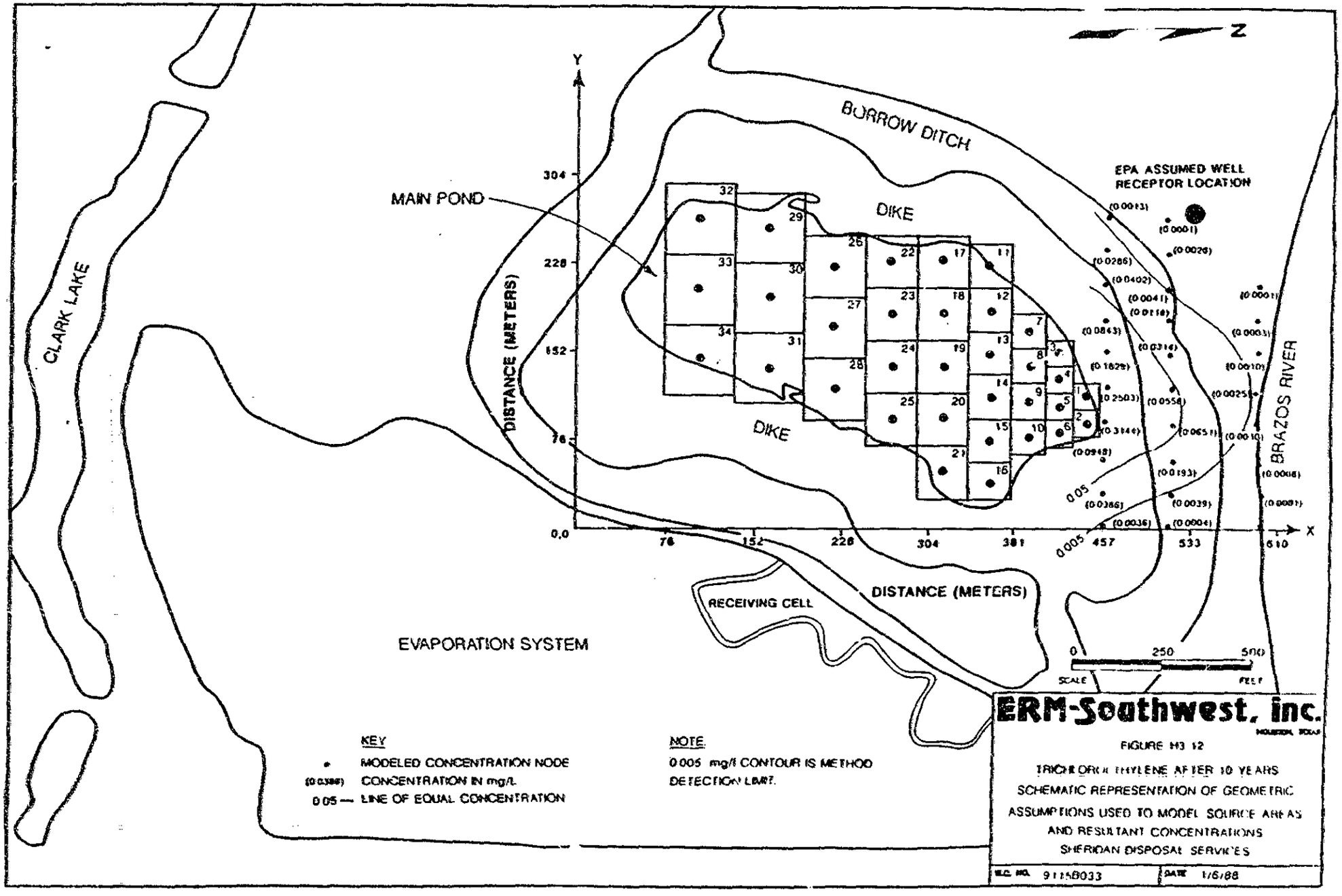

N
Y
X
BORROW DITCH
EPA ASSUMED WELL RECEPTOR LOCATION
MAIN POND
DIKE
DIKE
CLARK LAKE
BRAZOS RIVER
DISTANCE (METERS)
DISTANCE (METERS)
RECEIVING CELL
EVAPORATION SYSTEM
0,0
76
152
228
304
381
457
533
510
(0.0003)
(0.0006)
(0.0038)
0
250
500
SCALE
FEET
KEY
MODELED CONCENTRATION NODE
(0.0038) CONCENTRATION IN mg/L
NOTE
METHOD DETECTION LIMIT IS 0.005 mg/l
ERM-Southwest, inc.
FIGURE H3.7
PCB (AS AROCLOR 1016) AFTER 100 YEARS
SCHEMATIC REPRESENTATION OF GEOMETRIC
ASSUMPTIONS USED TO MODEL SOURCE AREAS
AND RESULTANT CONCENTRATIONS
SHERIDAN DISPOSAL SERVICES
E.O. NO. 9115B030
DATE 1/6/88

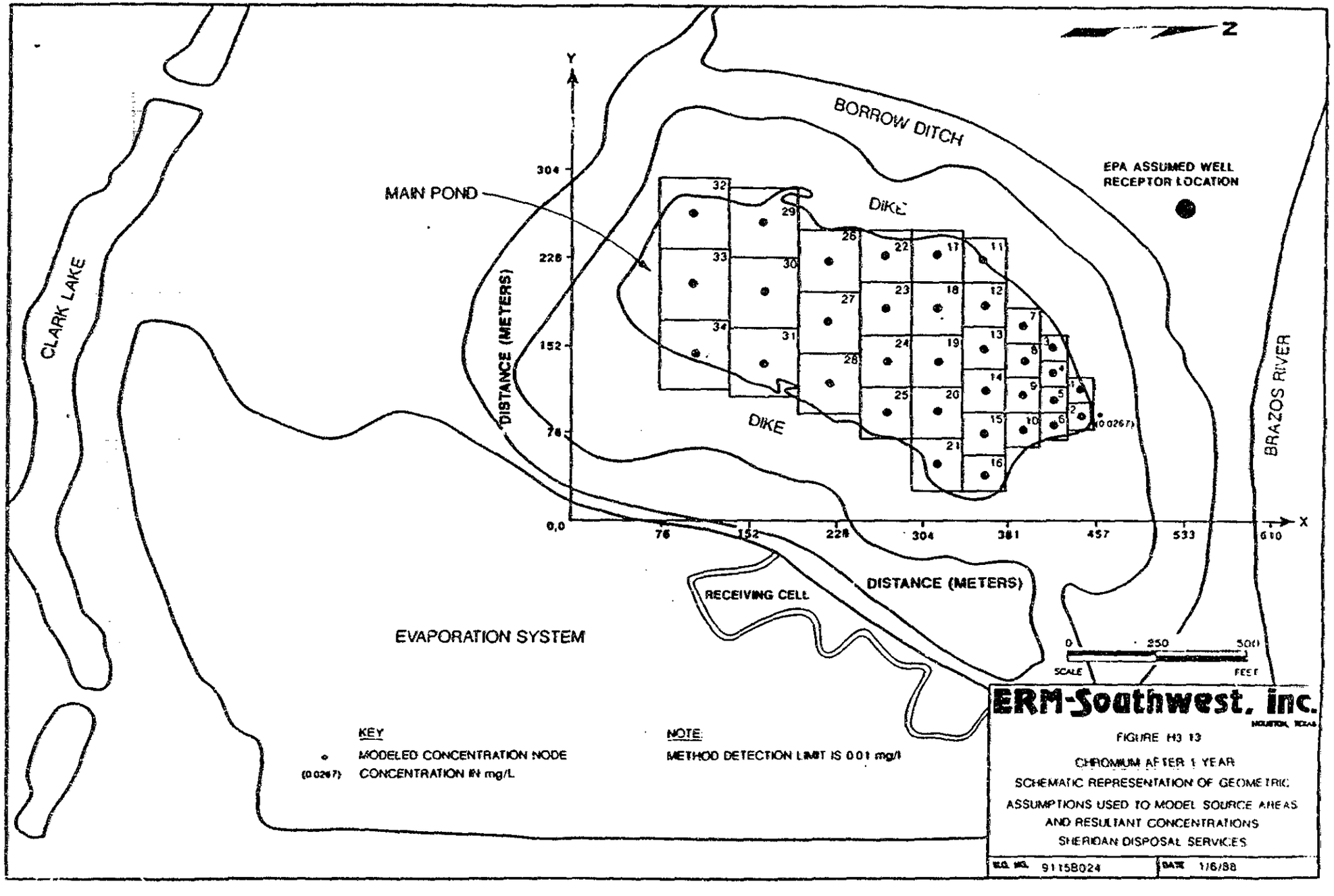

N
BORROW DITCH
EPA ASSUMED WELL RECEPTOR LOCATION
MAIN POND
DIKE
DIKE
CLARK LAKE
BRAZOS RIVER
DISTANCE (METERS)
DISTANCE (METERS)
Y
X
0,0
76
152
228
304
381
457
533
610
RECEIVING CELL
EVAPORATION SYSTEM
0
250
500
SCALE
FEET
KEY
MODELED CONCENTRATION NODE
(0.0981) CONCENTRATION IN mg/L
—0.5— LINE OF EQUAL CONCENTRATION
NOTE
0.015 mg/L CONTOUR IS METHOD DETECTION LIMIT.
ERM-Southwest, inc.
FIGURE H3 8
PHENOL AFTER 1 YEAR
SCHEMATIC REPRESENTATION OF GEOMETRIC ASSUMPTIONS USED TO MODEL SOURCE AREAS AND RESULTANT CONCENTRATIONS
SHERIDAN DISPOSAL SERVICES
DATE 1/6/88

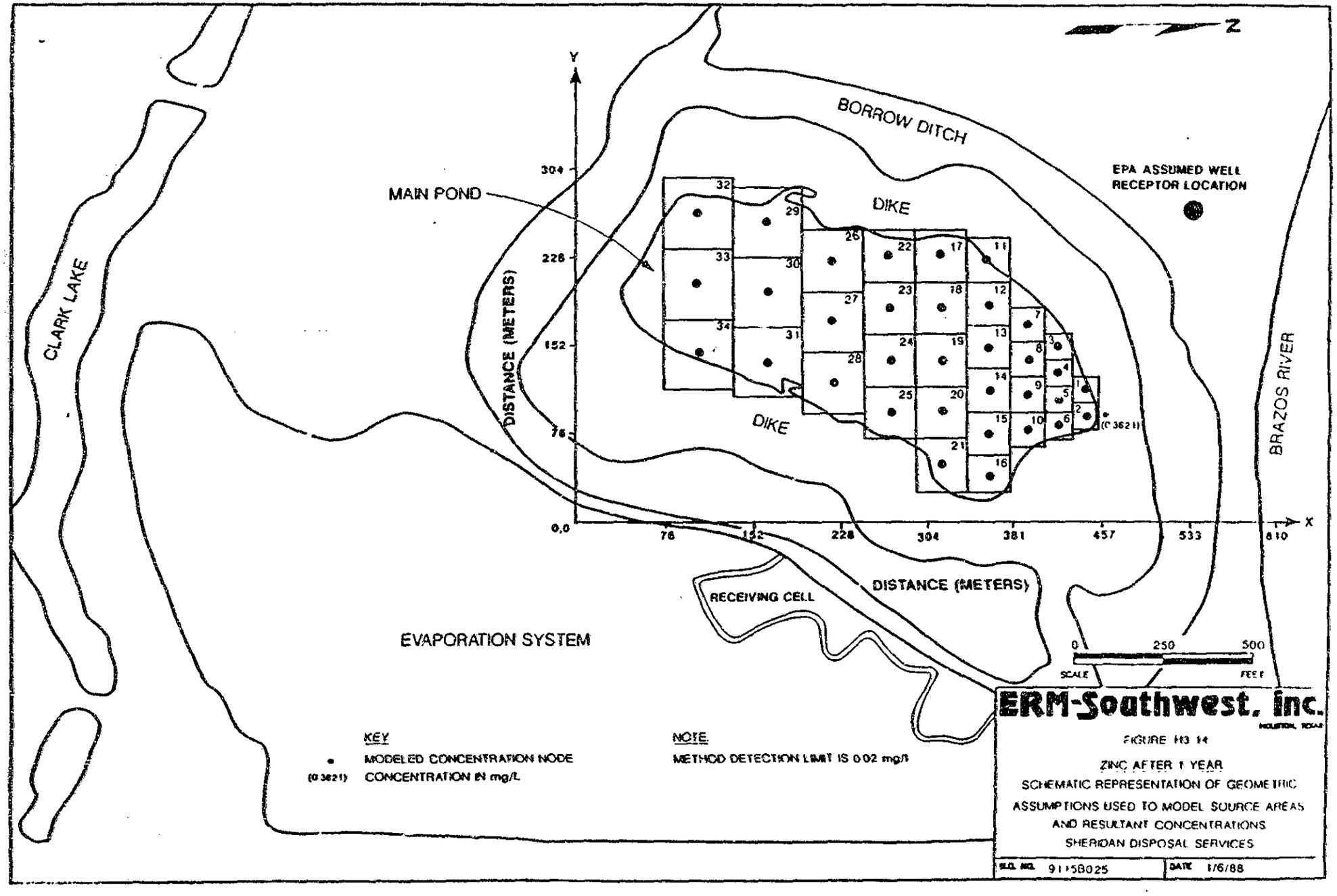

N
Y
X
BORROW DITCH
DIKE
DIKE
MAIN POND
EPA ASSUMED WELL RECEPTOR LOCATION
CLARK LAKE
BRAZOS RIVER
DISTANCE (METERS)
DISTANCE (METERS)
RECEIVING CELL
EVAPORATION SYSTEM
0.005
0
250
500
SCALE
FEET
KEY
MODELED CONCENTRATION NODE
(0.0028) CONCENTRATION IN mg/L
0.005 LINE OF EQUAL CONCENTRATION
NOTE:
0.5 mg/L CONTOUR IS METHOD DETECTION LIMIT.
ERM-Southwest, Inc.
FIGURE H3.9
TETRACHLOROETHYLENE AFTER 10 YEARS
SCHEMATIC REPRESENTATION OF GEOMETRIC ASSUMPTIONS USED TO MODEL SOURCE AREAS AND RESULTANT CONCENTRATIONS
SHERIDAN DISPOSAL SERVICES
91158032
1/6/88


N
BORROW DITCH
EPA ASSUMED WELL RECEPTOR LOCATION
MAIN POND
DIKE
DIKE
CLARK LAKE
BRAZOS RIVER
DISTANCE (METERS)
DISTANCE (METERS)
Y
X
0,0
76
152
228
304
381
457
533
610
0.005
RECEIVING CELL
EVAPORATION SYSTEM
0
250
500
SCALE
FEET
KEY
MODELED CONCENTRATION NODE
(0.0018) CONCENTRATION IN mg/L
—0.005— LINE OF EQUAL CONCENTRATION
NOTE:
0.005 mg/L CONTOUR IS METHOD DETECTION LIMIT.
ERM-Southwest, Inc.
HOUSTON, TEXAS
FIGURE H3-10
TOLUENE AFTER 1 YEAR
SCHEMATIC REPRESENTATION OF GEOMETRIC ASSUMPTIONS USED TO MODEL SOURCE AREAS AND RESULTANT CONCENTRATIONS
SHERIDAN DISPOSAL SERVICES
JOB NO. 9115B022
DATE 1/6/88


N
BORROW DITCH
EPA ASSUMED WELL RECEPTOR LOCATION
MAIN POND
DIKE
DIKE
CLARK LAKE
BRAZOS RIVER
DISTANCE (METERS)
DISTANCE (METERS)
Y
X
0,0
76
152
228
304
381
457
533
610
RECEIVING CELL
EVAPORATION SYSTEM
0 250 500
SCALE FEET
KEY
MODELED CONCENTRATION NODE
(0.0305) CONCENTRATION IN mg/L
—0.5— LINE OF EQUAL CONCENTRATION
NOTE:
0.005 mg/l CONTOUR IS METHOD DETECTION LIMIT
ERM-Southwest, inc.
FIGURE H3 11
TOLUENE AFTER 10 YEARS
SCHEMATIC REPRESENTATION OF GEOMETRIC ASSUMPTIONS USED TO MODEL SOURCE AREAS AND RESULTANT CONCENTRATIONS
SHERIDAN DISPOSAL SERVICES
91158023
1/6/88


N
BORROW DITCH
EPA ASSUMED WELL RECEPTOR LOCATION
MAIN POND
DIKE
DIKE
CLARK LAKE
BRAZOS RIVER
DISTANCE (METERS)
DISTANCE (METERS)
Y
X
0,0
76
152
228
304
381
457
533
610
RECEIVING CELL
EVAPORATION SYSTEM
0.05
0.005
0
250
500
SCALE
FEET
KEY
MODELED CONCENTRATION NODE
CONCENTRATION IN mg/L
0.05 — LINE OF EQUAL CONCENTRATION
NOTE
0.005 mg/l CONTOUR IS METHOD DETECTION LIMIT.
ERM-Southwest, inc.
FIGURE H3 12
TRICHLOROETHYLENE AFTER 10 YEARS
SCHEMATIC REPRESENTATION OF GEOMETRIC ASSUMPTIONS USED TO MODEL SOURCE AREAS AND RESULTANT CONCENTRATIONS
SHERIDAN DISPOSAL SERVICES
91158033
1/6/88


N
BORROW DITCH
EPA ASSUMED WELL RECEPTOR LOCATION
MAIN POND
DIKE
DIKE
CLARK LAKE
BRAZOS RIVER
DISTANCE (METERS)
DISTANCE (METERS)
Y
X
0,0
76
152
228
304
381
457
533
610
RECEIVING CELL
EVAPORATION SYSTEM
(0.0267)
0
250
500
SCALE
FEET
KEY
MODELED CONCENTRATION NODE
(0.0267) CONCENTRATION IN mg/L
NOTE:
METHOD DETECTION LIMIT IS 0.01 mg/l
ERM-Southwest, inc.
HOUSTON, TEXAS
FIGURE H3 13
CHROMIUM AFTER 1 YEAR
SCHEMATIC REPRESENTATION OF GEOMETRIC
ASSUMPTIONS USED TO MODEL SOURCE AREAS
AND RESULTANT CONCENTRATIONS
SHERIDAN DISPOSAL SERVICES
91158024
1/6/88


N
Y
X
BORROW DITCH
DIKE
DIKE
MAIN POND
EPA ASSUMED WELL RECEPTOR LOCATION
CLARK LAKE
BRAZOS RIVER
DISTANCE (METERS)
DISTANCE (METERS)
RECEIVING CELL
EVAPORATION SYSTEM
0,0
76
152
228
304
381
457
533
610
0
250
500
SCALE
FEET
KEY
MODELED CONCENTRATION NODE
(0.3621) CONCENTRATION IN mg/L
NOTE
METHOD DETECTION LIMIT IS 0.02 mg/l
ERM-Southwest, inc.
HOUSTON, TEXAS
FIGURE H3-14
ZINC AFTER 1 YEAR
SCHEMATIC REPRESENTATION OF GEOMETRIC
ASSUMPTIONS USED TO MODEL SOURCE AREAS
AND RESULTANT CONCENTRATIONS
SHERIDAN DISPOSAL SERVICES
91158025
1/6/88

ATTACHMENT 1

WMPLUME Model Results

011712

```
*****************************************
*                                       *
*   SOLUTE TRANSPORT FROM POINT SOURCES *
*   IN TWO-DIMENSIONAL UNIFORM FLOW     *
*                                       *
*   MODEL: WMPLUME  (REV 2-27 87)       *
*       CODE USED WAS WMPLUMED          *
*****************************************
```

USER: sps

LOCATION: Sheridan: benzene, 1 year

DATE: 1/6/88

INPUT DATA:

DARCY VELOCITY.....:	0.02 m/d
EFFECTIVE POROSITY.....:	.3
AQUIFER THICKNESS.....:	10.00 m
LONGITUDINAL DISPERSIVITY.....:	50.00 m
LATERAL DISPERSIVITY.....:	5.00 m
RETARDATION FACTOR.....:	5.53
DECAY CONSTANT (lambda).....:	0 1/d
NUMBER OF POINT SOURCES.....:	34

SOURCE DATA:

SOURCE NO. 1

X-COORDINATE OF THE SOURCE.....:	445.00 m
Y-COORDINATE OF THE SOURCE.....:	110.00 m
THE SOURCE STRENGTH.....:	.0129 kg/d
ELAPSED TIME OF THE SOURCE ACTIVITY...:	365.00 d

SOURCE NO. 2

X-COORDINATE OF THE SOURCE.....:	445.00 m
Y-COORDINATE OF THE SOURCE.....:	57.00 m
THE SOURCE STRENGTH.....:	.0129 kg/d
ELAPSED TIME OF THE SOURCE ACTIVITY...:	365.00 d

011713

Benzene, 1 year

	460.00 m	480.00 m	500.00 m	520.00 m	540.00 m
0.00 m	0.0000	0.0000	0.0000	0.0000	0.0000
30.00 m	0.0000	0.0000	0.0000	0.0000	0.0000
60.00 m	0.0007	0.0001	0.0000	0.0000	0.0000
90.00 m	0.5134	0.0940	0.0097	0.0005	0.0000
120.00 m	0.1374	0.0295	0.0031	0.0002	0.0000
150.00 m	0.0806	0.0075	0.0003	0.0000	0.0000
180.00 m	0.0007	0.0000	0.0000	0.0000	0.0000
210.00 m	0.0000	0.0000	0.0000	0.0000	0.0000
240.00 m	0.0000	0.0000	0.0000	0.0000	0.0000
270.00 m	0.0000	0.0000	0.0000	0.0000	0.0000
300.00 m	0.0000	0.0000	0.0000	0.0000	0.0000
330.00 m	0.0000	0.0000	0.0000	0.0000	0.0000
360.00 m	0.0000	0.0000	0.0000	0.0000	0.0000
390.00 m	0.0000	0.0000	0.0000	0.0000	0.0000
420.00 m	0.0000	0.0000	0.0000	0.0000	0.0000
450.00 m	0.0000	0.0000	0.0000	0.0000	0.0000
480.00 m	0.0000	0.0000	0.0000	0.0000	0.0000
510.00 m	0.0000	0.0000	0.0000	0.0000	0.0000
540.00 m	0.0000	0.0000	0.0000	0.0000	0.0000
570.00 m	0.0000	0.0000	0.0000	0.0000	0.0000

	560.00 m	580.00 m	600.00 m	620.00 m
0.00 m	0.0000	0.0000	0.0000	0.0000
30.00 m	0.0000	0.0000	0.0000	0.0000
60.00 m	0.0000	0.0000	0.0000	0.0000
90.00 m	0.0000	0.0000	0.0000	0.0000
120.00 m	0.0000	0.0000	0.0000	0.0000
150.00 m	0.0000	0.0000	0.0000	0.0000
180.00 m	0.0000	0.0000	0.0000	0.0000
210.00 m	0.0000	0.0000	0.0000	0.0000
240.00 m	0.0000	0.0000	0.0000	0.0000
270.00 m	0.0000	0.0000	0.0000	0.0000
300.00 m	0.0000	0.0000	0.0000	0.0000
330.00 m	0.0000	0.0000	0.0000	0.0000
360.00 m	0.0000	0.0000	0.0000	0.0000
390.00 m	0.0000	0.0000	0.0000	0.0000
420.00 m	0.0000	0.0000	0.0000	0.0000
450.00 m	0.0000	0.0000	0.0000	0.0000
480.00 m	0.0000	0.0000	0.0000	0.0000
510.00 m	0.0000	0.0000	0.0000	0.0000
540.00 m	0.0000	0.0000	0.0000	0.0000
570.00 m	0.0000	0.0000	0.0000	0.0000

011714

```
*****************************************
*                                       *
*   SOLUTE TRANSPORT FROM POINT SOURCES *
*   IN TWO-DIMENSIONAL UNIFORM FLOW     *
*                                       *
*   MODEL: WMPLUME  (REV 2-23 87)       *
*       CODE USED WAS WMPLUMOD          *
*****************************************
```

USER: sps

LOCATION: Sheridan: benzene, 10 years

DATE: 1/6/88

INPUT DATA:

```
DARCY VELOCITY.........................:    0.02 m/d
EFFECTIVE POROSITY.....................:     .3
AQUIFER THICKNESS......................:   10.00 m
LONGITUDINAL DISPERSIVITY..............:   50.00 m
LATERAL DISPERSIVITY...................:    5.00 m
RETARDATION FACTOR.....................:    5.53
DECAY CONSTANT (lambda)................:    0     1/d
NUMBER OF POINT SOURCES................:   34
```

SOURCE DATA:

SOURCE NO. 1

```
X-COORDINATE OF THE SOURCE............:  445.00 m
Y-COORDINATE OF THE SOURCE............:  110.00 m
THE SOURCE STRENGTH...................:    .0129  kg/d
ELAPSED TIME OF THE SOURCE ACTIVITY...: 3650.00 d
```

SOURCE NO. 2

```
X-COORDINATE OF THE SOURCE............:  445.00 m
Y-COORDINATE OF THE SOURCE............:   97.00 m
THE SOURCE STRENGTH...................:    .0129  kg/d
ELAPSED TIME OF THE SOURCE ACTIVITY...: 3650.00 d
```

011715

****** ********** RESULTS **********

******* y-direction CONCENTRATION in mg/l (ppm) benzene, 10 years

y \ x

		460.00 m	480.00 m	500.00 m	520.00 m	540.00 m
0.00	m	0.0951	0.0627	0.0380	0.0213	0.0110
30.00	m	0.6952	0.4188	0.2397	0.1300	0.0667
60.00	m	1.5563	1.0814	0.7130	0.4459	0.2647
90.00	m	3.9738	2.6738	1.7626	1.1164	0.6739
120.00	m	3.3825	2.4018	1.6076	1.0218	0.6161
150.00	m	2.6019	1.7137	1.0884	0.6601	0.3800
180.00	m	1.4413	0.9161	0.5548	0.3190	0.1736
210.00	m	0.8385	0.5052	0.2866	0.1528	0.0765
240.00	m	0.5769	0.3337	0.1822	0.0936	0.0451
270.00	m	0.0548	0.0336	0.0192	0.0103	0.0051
300.00	m	0.0009	0.0005	0.0003	0.0002	0.0001
330.00	m	0.0000	0.0000	0.0000	0.0000	0.0000
360.00	m	0.0000	0.0000	0.0000	0.0000	0.0000
390.00	m	0.0000	0.0000	0.0000	0.0000	0.0000
420.00	m	0.0000	0.0000	0.0000	0.0000	0.0000
450.00	m	0.0000	0.0000	0.0000	0.0000	0.0000
480.00	m	0.0000	0.0000	0.0000	0.0000	0.0000
510.00	m	0.0000	0.0000	0.0000	0.0000	0.0000
540.00	m	0.0000	0.0000	0.0000	0.0000	0.0000
570.00	m	0.0000	0.0000	0.0000	0.0000	0.0000

		560.00 m	580.00 m	600.00 m	620.00 m
0.00	m	0.0053	0.0023	0.0010	0.0004
30.00	m	0.0323	0.0148	0.0064	0.0026
60.00	m	0.1482	0.0785	0.0392	0.0184
90.00	m	0.3858	0.2086	0.1062	0.0507
120.00	m	0.3513	0.1988	0.0954	0.0452
150.00	m	0.2069	0.1061	0.0511	0.0231
180.00	m	0.0891	0.0431	0.0195	0.0083
210.00	m	0.0358	0.0157	0.0064	0.0025
240.00	m	0.0203	0.0086	0.0034	0.0012
270.00	m	0.0024	0.0010	0.0004	0.0001
300.00	m	0.0000	0.0000	0.0000	0.0000
330.00	m	0.0000	0.0000	0.0000	0.0000
360.00	m	0.0000	0.0000	0.0000	0.0000
390.00	m	0.0000	0.0000	0.0000	0.0000
420.00	m	0.0000	0.0000	0.0000	0.0000
450.00	m	0.0000	0.0000	0.0000	0.0000
480.00	m	0.0000	0.0000	0.0000	0.0000
510.00	m	0.0000	0.0000	0.0000	0.0000
540.00	m	0.0000	0.0000	0.0000	0.0000
570.00	m	0.0000	0.0000	0.0000	0.0000

```
*********************************************
*                                           *
*   SOLUTE TRANSPORT FROM POINT SOURCES     *
*   IN TWO-DIMENSIONAL UNIFORM FLOW         *
*                                           *
*   MODEL: WMPLUME  (REV 2-23 87)           *
*       CODE USED WAS WMPL2MOD              *
*********************************************
```

USER: sjr

LOCATION: Sheridan; benzene, 20 years

DATE: 1/13/88

INPUT DATA:

```
DARCY VELOCITY.........................:    0.02 m/d
EFFECTIVE POROSITY.....................:     .3
AQUIFER THICKNESS......................:   10.00 m
LONGITUDINAL DISPERSIVITY..............:   50.00 m
LATERAL DISPERSIVITY...................:   50.00 m
RETARDATION FACTOR.....................:    5.53
DECAY CONSTANT (lambda)................:    0     1/d
NUMBER OF POINT SOURCES................:   34
```

SOURCE DATA:

SOURCE NO. 1

```
X-COORDINATE OF THE SOURCE.............:  445.00 m
Y-COORDINATE OF THE SOURCE.............:  110.00 m
THE SOURCE STRENGTH....................:    .0129  kg/d
ELAPSED TIME OF THE SOURCE ACTIVITY...: 7300.00 d
```

SOURCE NO. 2

```
X-COORDINATE OF THE SOURCE.............:  445.00 m
Y-COORDINATE OF THE SOURCE.............:   87.00 m
THE SOURCE STRENGTH....................:    .0129  kg/d
ELAPSED TIME OF THE SOURCE ACTIVITY...: 7300.00 d
```

011717

********** RESULTS **********

+------ X-direction CONCENTRATION in mg/l (ppm) benzene, 20 years
!
v Y

		460.00 m	480.00 m	500.00 m	520.00 m	540.00 m
0.00	m	1.7717	1.4792	1.1990	0.9433	0.7204
30.00	m	2.7599	2.2638	1.8020	1.3940	1.0491
60.00	m	4.0062	3.1842	2.4667	1.8685	1.3836
90.00	m	5.2886	3.9800	2.9995	2.2330	1.6334
120.00	m	5.5323	4.2038	3.1681	2.3531	1.7163
150.00	m	4.9694	3.8663	2.9509	2.2069	1.6154
180.00	m	4.1328	3.2473	2.4980	1.8793	1.3813
210.00	m	3.2179	2.5365	1.9571	1.4761	1.0871
240.00	m	2.3514	1.8525	1.4293	1.0780	0.7938
270.00	m	1.5958	1.2594	0.9721	0.7330	0.5392
300.00	m	0.9998	0.7928	0.6135	0.4630	0.3405
330.00	m	0.5786	0.4614	0.3584	0.2711	0.1995
360.00	m	0.3099	0.2483	0.1936	0.1468	0.1082
390.00	m	0.1538	0.1236	0.0967	0.0735	0.0543
420.00	m	0.0707	0.0569	0.0446	0.0340	0.0251
450.00	m	0.0301	0.0242	0.0190	0.0145	0.0107
480.00	m	0.0118	0.0095	0.0075	0.0057	0.0042
510.00	m	0.0043	0.0034	0.0027	0.0021	0.0015
540.00	m	0.0014	0.0012	0.0009	0.0007	0.0005
570.00	m	0.0004	0.0004	0.0003	0.0002	0.0002

		560.00 m	580.00 m	600.00 m	620.00 m
0.00	m	0.5341	0.3845	0.2686	0.1821
30.00	m	0.7682	0.5473	0.3791	0.2551
60.00	m	1.0004	0.7055	0.4847	0.3240
90.00	m	1.1703	0.8193	0.5596	0.3723
120.00	m	1.2259	0.8558	0.5829	0.3867
150.00	m	1.1557	0.8072	0.5496	0.3644
180.00	m	0.9908	0.6930	0.4721	0.3130
210.00	m	0.7808	0.5464	0.3722	0.2466
240.00	m	0.5699	0.3985	0.2711	0.1793
270.00	m	0.3866	0.2698	0.1832	0.1208
300.00	m	0.2438	0.1698	0.1150	0.0756
330.00	m	0.1428	0.0993	0.0671	0.0440
360.00	m	0.0775	0.0538	0.0363	0.0237
390.00	m	0.0359	0.0270	0.0182	0.0119
420.00	m	0.0180	0.0125	0.0084	0.0055
450.00	m	0.0077	0.0054	0.0036	0.0023
480.00	m	0.0030	0.0021	0.0014	0.0009
510.00	m	0.0011	0.0008	0.0005	0.0003
540.00	m	0.0004	0.0003	0.0002	0.0001
570.00	m	0.0001	0.0001	0.0001	0.0000

```
*********************************************
*                                           *
*   SOLUTE TRANSPORT FROM POINT SOURCES     *
*   IN TWO-DIMENSIONAL UNIFORM FLOW         *
*                                           *
*   MODEL: WMPLUME  (REV 2-23 87)           *
*       CODE USED WAS WMPL2MOD              *
*********************************************
```

USER: sjr

LOCATION: Sheridan; benzene, 50 years

DATE: 1/13/88

INPUT DATA:

```
DARCY VELOCITY........................:    0.02 m/d
EFFECTIVE POROSITY....................:     .3
AQUIFER THICKNESS.....................:   10.00 m
LONGITUDINAL DISPERSIVITY.............:   50.00 m
LATERAL DISPERSIVITY..................:   50.00 m
RETARDATION FACTOR....................:    5.53
DECAY CONSTANT (lambda)...............:    0     1/d
NUMBER OF POINT SOURCES...............:   34
```

SOURCE DATA:

SOURCE NO. 1

```
X-COORDINATE OF THE SOURCE............:  445.00 m
Y-COORDINATE OF THE SOURCE............:  110.00 m
THE SOURCE STRENGTH...................:    .0129  kg/d
ELAPSED TIME OF THE SOURCE ACTIVITY...:18250.00 d
```

SOURCE NO. 2

```
X-COORDINATE OF THE SOURCE............:  445.00 m
Y-COORDINATE OF THE SOURCE............:   97.00 m
THE SOURCE STRENGTH...................:    .0129  kg/d
ELAPSED TIME OF THE SOURCE ACTIVITY...:18250.00 d
```

011719

+++++++++++++++++++++++++++++++++++ RESULTS +++++++++++++++++++++++++++++++++++

+-------> X-direction CONCENTRATION in mg/l (ppm) benzene, 50 years

:

v Y

		460.00 m	480.00 m	500.00 m	520.00 m	540.00 m
0.00	m	5.5479	5.2021	4.8150	4.4026	3.9796
30.00	m	7.4584	6.8670	6.2475	5.6249	5.0165
60.00	m	9.6030	8.6265	7.6896	6.8128	5.9984
90.00	m	11.6632	10.1202	8.8556	7.7492	6.7600
120.00	m	12.3943	10.7921	9.4266	8.2256	7.1542
150.00	m	11.9928	10.6005	9.3310	8.1753	7.1252
180.00	m	11.0073	9.8235	8.7119	7.6761	6.7181
210.00	m	9.6558	8.6788	7.7454	6.8616	6.0328
240.00	m	8.1213	7.3427	6.5895	5.8674	5.1820
270.00	m	6.5449	5.9572	5.3774	4.8128	4.2700
300.00	m	5.0646	4.6433	4.2171	3.7943	3.3820
330.00	m	3.7778	3.4868	3.1853	2.8808	2.5794
360.00	m	2.7251	2.5292	2.3224	2.1102	1.8974
390.00	m	1.9047	1.7756	1.6374	1.4937	1.3400
420.00	m	1.2912	1.2079	1.1176	1.0228	0.9259
450.00	m	0.8494	0.7967	0.7391	0.6782	0.6154
480.00	m	0.5421	0.5096	0.4737	0.4355	0.3960
510.00	m	0.3357	0.3161	0.2943	0.2710	0.2468
540.00	m	0.2016	0.1901	0.1772	0.1633	0.1489
570.00	m	0.1174	0.1108	0.1034	0.0954	0.0870

		560.00 m	580.00 m	600.00 m	620.00 m
0.00	m	3.5581	3.1476	2.7553	2.3869
30.00	m	4.4333	3.8826	3.3694	2.8969
60.00	m	5.2458	4.5544	3.9233	3.3517
90.00	m	5.8684	5.0638	4.3395	3.6906
120.00	m	6.1927	5.3291	4.5552	3.8649
150.00	m	6.1736	5.3142	4.5419	3.8520
180.00	m	5.8385	5.0367	4.3114	3.6605
210.00	m	5.2627	4.5539	3.9078	3.3243
240.00	m	4.5384	3.9406	3.3913	2.8920
270.00	m	3.7547	3.2717	2.8243	2.4150
300.00	m	2.9861	2.6113	2.2614	1.9390
330.00	m	2.2866	2.0067	1.7432	1.4989
360.00	m	1.6883	1.4866	1.2954	1.1168
390.00	m	1.2035	1.0630	0.9298	0.8027
420.00	m	0.8291	0.7342	0.6431	0.5571
450.00	m	0.5524	0.4903	0.4304	0.3735
480.00	m	0.3561	0.3167	0.2785	0.2421
510.00	m	0.2222	0.1979	0.1743	0.1517
540.00	m	0.1343	0.1197	0.1055	0.0919
570.00	m	0.0785	0.0700	0.0618	0.0539

```
*********************************************
*                                           *
*   SOLUTE TRANSPORT FROM POINT SOURCES     *
*   IN TWO-DIMENSIONAL UNIFORM FLOW         *
*                                           *
*   MODEL: WMPLUME  (REV 2-23 87)           *
*       CODE USED WAS WMPL2MOD              *
*********************************************
```

USER: sjr

LOCATION: Sheridan; 2,4 dimethylphenol, 1 year

DATE: 1/13/88

INPUT DATA:

DARCY VELOCITY.....:	0.02	m/d
EFFECTIVE POROSITY.....:	.3	
AQUIFER THICKNESS.....:	10.00	m
LONGITUDINAL DISPERSIVITY.....:	50.00	m
LATERAL DISPERSIVITY.....:	5.00	m
RETARDATION FACTOR.....:	11.63	
DECAY CONSTANT (lambda).....:	0	1/d
NUMBER OF POINT SOURCES.....:	34	

SOURCE DATA:

SOURCE NO. 1

X-COORDINATE OF THE SOURCE.....:	445.00	m
Y-COORDINATE OF THE SOURCE.....:	110.00	m
THE SOURCE STRENGTH.....:	.016	kg/d
ELAPSED TIME OF THE SOURCE ACTIVITY...:	365.00	d

SOURCE NO. 2

X-COORDINATE OF THE SOURCE.....:	445.00	m
Y-COORDINATE OF THE SOURCE.....:	87.00	m
THE SOURCE STRENGTH.....:	.016	kg/d
ELAPSED TIME OF THE SOURCE ACTIVITY...:	365.00	d

011721

********** RESULTS **********

-------> X-direction CONCENTRATION in mg/l (ppm) 2,4 dimethylphenol, 1 year

v Y

		460.00 m	480.00 m	500.00 m	520.00 m	540.00 m
0.00	m	0.0000	0.0000	0.0000	0.0000	0.0000
30.00	m	0.0000	0.0000	0.0000	0.0000	0.0000
60.00	m	0.0000	0.0000	0.0000	0.0000	0.0000
90.00	m	0.3278	0.0174	0.0002	0.0000	0.0000
120.00	m	0.0241	0.0016	0.0000	0.0000	0.0000
150.00	m	0.0137	0.0001	0.0000	0.0000	0.0000
180.00	m	0.0000	0.0000	0.0000	0.0000	0.0000
210.00	m	0.0000	0.0000	0.0000	0.0000	0.0000
240.00	m	0.0000	0.0000	0.0000	0.0000	0.0000
270.00	m	0.0000	0.0000	0.0000	0.0000	0.0000
300.00	m	0.0000	0.0000	0.0000	0.0000	0.0000
330.00	m	0.0000	0.0000	0.0000	0.0000	0.0000
360.00	m	0.0000	0.0000	0.0000	0.0000	0.0000
390.00	m	0.0000	0.0000	0.0000	0.0000	0.0000
420.00	m	0.0000	0.0000	0.0000	0.0000	0.0000
450.00	m	0.0000	0.0000	0.0000	0.0000	0.0000
480.00	m	0.0000	0.0000	0.0000	0.0000	0.0000
510.00	m	0.0000	0.0000	0.0000	0.0000	0.0000
540.00	m	0.0000	0.0000	0.0000	0.0000	0.0000
570.00	m	0.0000	0.0000	0.0000	0.0000	0.0000

		560.00 m	580.00 m	600.00 m	620.00 m
0.00	m	0.0000	0.0000	0.0000	0.0000
30.00	m	0.0000	0.0000	0.0000	0.0000
60.00	m	0.0000	0.0000	0.0000	0.0000
90.00	m	0.0000	0.0000	0.0000	0.0000
120.00	m	0.0000	0.0000	0.0000	0.0000
150.00	m	0.0000	0.0000	0.0000	0.0000
180.00	m	0.0000	0.0000	0.0000	0.0000
210.00	m	0.0000	0.0000	0.0000	0.0000
240.00	m	0.0000	0.0000	0.0000	0.0000
270.00	m	0.0000	0.0000	0.0000	0.0000
300.00	m	0.0000	0.0000	0.0000	0.0000
330.00	m	0.0000	0.0000	0.0000	0.0000
360.00	m	0.0000	0.0000	0.0000	0.0000
390.00	m	0.0000	0.0000	0.0000	0.0000
420.00	m	0.0000	0.0000	0.0000	0.0000
450.00	m	0.0000	0.0000	0.0000	0.0000
480.00	m	0.0000	0.0000	0.0000	0.0000
510.00	m	0.0000	0.0000	0.0000	0.0000
540.00	m	0.0000	0.0000	0.0000	0.0000
570.00	m	0.0000	0.0000	0.0000	0.0000

011722

```
*****************************************
*                                       *
*   SOLUTE TRANSPORT FROM POINT SOURCES *
*   IN TWO-DIMENSIONAL UNIFORM FLOW     *
*                                       *
*   MODEL: WMPLUME  (REV 2-23 87)       *
*       CODE USED WAS WMPLIMOD          *
*****************************************
```

USER: sjr

LOCATION: Sheridan; 2,4 dimethylphenol, 10 years

DATE: 1/13/88

INPUT DATA:

```
DARCY VELOCITY.........................:    0.02 m/d
EFFECTIVE POROSITY.....................:     .3
AQUIFER THICKNESS......................:   10.00 m
LONGITUDINAL DISPERSIVITY..............:   50.00 m
LATERAL DISPERSIVITY...................:    5.00 m
RETARDATION FACTOR.....................:   11.63
DECAY CONSTANT (lambda)................:    0     1/d
NUMBER OF POINT SOURCES................:   34
```

011723

SOURCE DATA:

SOURCE NO. 1

```
X-COORDINATE OF THE SOURCE.............:  445.00 m
Y-COORDINATE OF THE SOURCE.............:  110.00 m
THE SOURCE STRENGTH....................:    .016  kg/d
ELAPSED TIME OF THE SOURCE ACTIVITY...: 3650.00 d
```

SOURCE NO. 2

```
X-COORDINATE OF THE SOURCE.............:  445.00 m
Y-COORDINATE OF THE SOURCE.............:   87.00 m
THE SOURCE STRENGTH....................:    .016  kg/d
ELAPSED TIME OF THE SOURCE ACTIVITY...: 3650.00 d
```

********** RESULTS **********

+-------> X-direction CONCENTRATION in mg/l (ppm) 2,4 dimethylpenol, 10 years
:
v Y

	460.00 m	480.00 m	500.00 m	520.00 m	540.00 m
0.00 m	0.0062	0.0025	0.0008	0.0002	0.0001
30.00 m	0.1513	0.0535	0.0144	0.0044	0.0010
60.00 m	0.4441	0.2360	0.1135	0.0489	0.0187
90.00 m	2.3885	1.2716	0.6319	0.2831	0.1124
120.00 m	1.7036	0.9782	0.4906	0.2173	0.0847
150.00 m	1.1627	0.5607	0.2454	0.0956	0.0327
180.00 m	0.3867	0.1681	0.0650	0.0222	0.0067
210.00 m	0.1210	0.0444	0.0140	0.0038	0.0009
240.00 m	0.0907	0.0319	0.0097	0.0025	0.0006
270.00 m	0.0010	0.0004	0.0001	0.0000	0.0000
300.00 m	0.0000	0.0000	0.0000	0.0000	0.0000
330.00 m	0.0000	0.0000	0.0000	0.0000	0.0000
360.00 m	0.0000	0.0000	0.0000	0.0000	0.0000
390.00 m	0.0000	0.0000	0.0000	0.0000	0.0000
420.00 m	0.0000	0.0000	0.0000	0.0000	0.0000
450.00 m	0.0000	0.0000	0.0000	0.0000	0.0000
480.00 m	0.0000	0.0000	0.0000	0.0000	0.0000
510.00 m	0.0000	0.0000	0.0000	0.0000	0.0000
540.00 m	0.0000	0.0000	0.0000	0.0000	0.0000
570.00 m	0.0000	0.0000	0.0000	0.0000	0.0000

	560.00 m	580.00 m	600.00 m	620.00 m
0.00 m	0.0000	0.0000	0.0000	0.0000
30.00 m	0.0002	0.0000	0.0000	0.0000
60.00 m	0.0063	0.0019	0.0005	0.0001
90.00 m	0.0391	0.0118	0.0031	0.0007
120.00 m	0.0289	0.0086	0.0022	0.0005
150.00 m	0.0098	0.0025	0.0006	0.0001
180.00 m	0.0017	0.0004	0.0001	0.0000
210.00 m	0.0002	0.0000	0.0000	0.0000
240.00 m	0.0001	0.0000	0.0000	0.0000
270.00 m	0.0000	0.0000	0.0000	0.0000
300.00 m	0.0000	0.0000	0.0000	0.0000
330.00 m	0.0000	0.0000	0.0000	0.0000
360.00 m	0.0000	0.0000	0.0000	0.0000
390.00 m	0.0000	0.0000	0.0000	0.0000
420.00 m	0.0000	0.0000	0.0000	0.0000
450.00 m	0.0000	0.0000	0.0000	0.0000
480.00 m	0.0000	0.0000	0.0000	0.0000
510.00 m	0.0000	0.0000	0.0000	0.0000
540.00 m	0.0000	0.0000	0.0000	0.0000
570.00 m	0.0000	0.0000	0.0000	0.0000

```
*********************************************
*                                           *
*   SOLUTE TRANSPORT FROM POINT SOURCES     *
*   IN TWO-DIMENSIONAL UNIFORM FLOW         *
*                                           *
*   MODEL: WMPLUME  (REV 2-23 87)           *
*       CODE USED WAS WMPL2MOD              *
*********************************************
```

USER: sjr

LOCATION: Sheridan; 2,4 dimethylphenol, 20 years

DATE: 1/13/88

INPUT DATA:

```
DARCY VELOCITY........................:    0.02 m/d
EFFECTIVE POROSITY....................:     .3
AQUIFER THICKNESS.....................:   10.00 m
LONGITUDINAL DISPERSIVITY.............:   50.00 m
LATERAL DISPERSIVITY..................:    5.00 m
RETARDATION FACTOR....................:   11.63
DECAY CONSTANT (lambda)...............:    0     1/d
NUMBER OF POINT SOURCES...............:   34
```

SOURCE DATA:

SOURCE NO. 1

```
X-COORDINATE OF THE SOURCE............:  445.00 m
Y-COORDINATE OF THE SOURCE............:  110.00 m
THE SOURCE STRENGTH...................:    .016  kg/d
ELAPSED TIME OF THE SOURCE ACTIVITY...: 7300.00 d
```

SOURCE NO. 2

```
X-COORDINATE OF THE SOURCE............:  445.00 m
Y-COORDINATE OF THE SOURCE............:   87.00 m
THE SOURCE STRENGTH...................:    .016  kg/d
ELAPSED TIME OF THE SOURCE ACTIVITY...: 7300.00 d
```

011725

********** RESULTS **********

+-------> X-direction CONCENTRATION in mg/l (ppm) 2,4 dimethylphenol, 20 years
|
v Y

		460.00 m	480.00 m	500.00 m	520.00 m	540.00 m
0.00	m	0.1027	0.0661	0.0390	0.0212	0.0106
30.00	m	0.7916	0.4644	0.2579	0.1352	0.0668
60.00	m	1.7767	1.2154	0.7872	0.4824	0.2795
90.00	m	4.6871	3.1117	2.0203	1.2571	0.7432
120.00	m	3.9501	2.7713	1.8265	1.1396	0.6723
150.00	m	3.0163	1.9534	1.2169	0.7217	0.4051
180.00	m	1.6336	1.0178	0.6025	0.3375	0.1783
210.00	m	0.9324	0.5489	0.3029	0.1565	0.0756
240.00	m	0.6443	0.3640	0.1933	0.0962	0.0447
270.00	m	0.0553	0.0331	0.0185	0.0096	0.0046
300.00	m	0.0007	0.0004	0.0002	0.0001	0.0001
330.00	m	0.0000	0.0000	0.0000	0.0000	0.0000
360.00	m	0.0000	0.0000	0.0000	0.0000	0.0000
390.00	m	0.0000	0.0000	0.0000	0.0000	0.0000
420.00	m	0.0000	0.0000	0.0000	0.0000	0.0000
450.00	m	0.0000	0.0000	0.0000	0.0000	0.0000
480.00	m	0.0000	0.0000	0.0000	0.0000	0.0000
510.00	m	0.0000	0.0000	0.0000	0.0000	0.0000
540.00	m	0.0000	0.0000	0.0000	0.0000	0.0000
570.00	m	0.0000	0.0000	0.0000	0.0000	0.0000

011726

		560.00 m	580.00 m	600.00 m	620.00 m
0.00	m	0.0048	0.0021	0.0008	0.0003
30.00	m	0.0311	0.0136	0.0056	0.0022
60.00	m	0.1527	0.0786	0.0380	0.0172
90.00	m	0.4153	0.2184	0.1077	0.0497
120.00	m	0.3738	0.1952	0.0955	0.0436
150.00	m	0.2142	0.1063	0.0494	0.0214
180.00	m	0.0886	0.0413	0.0180	0.0073
210.00	m	0.0341	0.0143	0.0056	0.0020
240.00	m	0.0194	0.0078	0.0029	0.0010
270.00	m	0.0020	0.0008	0.0003	0.0001
300.00	m	0.0000	0.0000	0.0000	0.0000
330.00	m	0.0000	0.0000	0.0000	0.0000
360.00	m	0.0000	0.0000	0.0000	0.0000
390.00	m	0.0000	0.0000	0.0000	0.0000
420.00	m	0.0000	0.0000	0.0000	0.0000
450.00	m	0.0000	0.0000	0.0000	0.0000
480.00	m	0.0000	0.0000	0.0000	0.0000
510.00	m	0.0000	0.0000	0.0000	0.0000
540.00	m	0.0000	0.0000	0.0000	0.0000
570.00	m	0.0000	0.0000	0.0000	0.0000

```
*****************************************************
*                                                   *
*   SOLUTE TRANSPORT FROM POINT SOURCES             *
*   IN TWO-DIMENSIONAL UNIFORM FLOW                 *
*                                                   *
*   MODEL: WMPLUME (REV. 2-23-87)                   *
*       CODE USED WAS WMPLOMOD                      *
*****************************************************
```

USER: dew

LOCATION: Sheridan, ethylbenzene 10 years

DATE: 1/7/88

INPUT DATA:

DARCY VELOCITY.....:	0.02	m/d
EFFECTIVE POROSITY.....:	.3	
AQUIFER THICKNESS.....:	10.00	m
LONGITUDINAL DISPERSIVITY.....:	50.00	m
LATERAL DISPERSIVITY.....:	5.00	m
RETARDATION FACTOR.....:	48.45	
DECAY CONSTANT (lambda).....:	0	1/d
NUMBER OF POINT SOURCES.....:	34	

SOURCE DATA:

SOURCE NO. 1

X-COORDINATE OF THE SOURCE.....:	445.00	m
Y-COORDINATE OF THE SOURCE.....:	110.00	m
THE SOURCE STRENGTH.....:	.011	kg/d
ELAPSED TIME OF THE SOURCE ACTIVITY...:	3650.00	d

SOURCE NO. 2

X-COORDINATE OF THE SOURCE.....:	445.00	m
Y-COORDINATE OF THE SOURCE.....:	87.00	m
THE SOURCE STRENGTH.....:	.011	kg/d
ELAPSED TIME OF THE SOURCE ACTIVITY...:	3650.00	d

011727

ethylbenzene, 10 years

		[illegible] m	[illegible] m	[illegible] m	[illegible] m	[illegible] m
[illegible]	m	[illegible]	[illegible]	0.0000	[illegible]	[illegible]
30.00	m	[illegible]	[illegible]	0.0000	[illegible]	0.0000
60.00	m	0.0015	[illegible]	0.0000	[illegible]	0.0000
90.00	m	0.4860	[illegible]	[illegible]	[illegible]	0.0000
120.00	m	0.1505	[illegible]	0.0050	[illegible]	0.0000
150.00	m	0.0365	[illegible]	[illegible]	[illegible]	0.0000
180.00	m	[illegible]	[illegible]	0.0000	[illegible]	0.0000
210.00	m	0.0000	0.0000	0.0000	[illegible]	0.0000
240.00	m	0.0000	0.0000	0.0000	0.0000	0.0000
270.00	m	0.0000	[illegible]	0.0000	0.0000	0.0000
300.00	m	0.0000	0.0000	0.0000	0.0000	0.0000
330.00	m	0.0000	0.0000	0.0000	0.0000	0.0000
360.00	m	0.0000	0.0000	0.0000	[illegible]	[illegible]
390.00	m	[illegible]	0.0000	0.0000	0.0000	0.0000
420.00	m	0.0000	0.0000	0.0000	0.0000	0.0000
450.00	m	[illegible]	0.0000	0.0000	0.0000	0.0000
480.00	m	0.0000	0.0000	0.0000	0.0000	0.0000
510.00	m	0.0000	0.0000	0.0000	0.0000	0.0000
540.00	m	0.0000	0.0000	0.0000	0.0000	0.0000
570.00	m	0.0000	0.0000	0.0000	0.0000	0.0000

		560.00 m	580.00 m	600.00 m	620.00 m	640.00 m
[illegible]	m	0.0000	0.0000	0.0000	0.0000	0.0000
30.00	m	[illegible]	0.0000	0.0000	0.0000	0.0000
60.00	m	0.0000	0.0000	0.0000	0.0000	0.0000
90.00	m	0.0000	0.0000	0.0000	0.0000	0.0000
120.00	m	0.0000	0.0000	0.0000	0.0000	0.0000
150.00	m	0.0000	0.0000	0.0000	0.0000	0.0000
180.00	m	0.0000	0.0000	0.0000	0.0000	0.0000
210.00	m	0.0000	0.0000	0.0000	0.0000	0.0000
240.00	m	0.0000	0.0000	0.0000	0.0000	0.0000
270.00	m	0.0000	0.0000	0.0000	0.0000	0.0000
300.00	m	0.0000	0.0000	0.0000	0.0000	0.0000
330.00	m	0.0000	0.0000	0.0000	0.0000	0.0000
360.00	m	0.0000	0.0000	0.0000	0.0000	0.0000
390.00	m	0.0000	0.0000	0.0000	0.0000	0.0000
420.00	m	0.0000	0.0000	0.0000	0.0000	0.0000
450.00	m	0.0000	0.0000	0.0000	0.0000	0.0000
480.00	m	0.0000	0.0000	0.0000	0.0000	0.0000
510.00	m	0.0000	0.0000	0.0000	0.0000	0.0000
540.00	m	0.0000	0.0000	0.0000	0.0000	0.0000
570.00	m	0.0000	0.0000	0.0000	0.0000	0.0000

		660.00 m	680.00 m
[illegible]	m	0.0000	0.0000
30.00	m	0.0000	0.0000
60.00	m	0.0000	0.0000
90.00	m	0.0000	0.0000
120.00	m	0.0000	0.0000
150.00	m	0.0000	0.0000
180.00	m	0.0000	0.0000
210.00	m	0.0000	0.0000
240.00	m	0.0000	0.0000
270.00	m	0.0000	0.0000
300.00	m	0.0000	0.0000
330.00	m	0.0000	0.0000
360.00	m	0.0000	0.0000
390.00	m	0.0000	0.0000
420.00	m	0.0000	0.0000
450.00	m	0.0000	0.0000
480.00	m	0.0000	0.0000
510.00	m	0.0000	0.0000
540.00	m	0.0000	0.0000
570.00	m	0.0000	0.0000

011728

```
*****************************************************
*                                                   *
*   SOLUTE TRANSPORT FROM POINT SOURCES             *
*   IN TWO-DIMENSIONAL UNIFORM FLO                  *
*                                                   *
*   MODEL: WMPLUME  (RE. 2-22 87)                   *
*       CODE USED WAS WMPLSMCI                      *
*****************************************************
```

USER: dew

LOCATION: Sheridan, ethylbenzene, 100 years

DATE: 1/7/88

INPUT DATA:

DARCY VELOCITY.....:	0.02	m/d
EFFECTIVE POROSITY.....:	.3	
AQUIFER THICKNESS.....:	10.00	m
LONGITUDINAL DISPERSIVITY.....:	50.00	m
LATERAL DISPERSIVITY.....:	5.00	m
RETARDATION FACTOR.....:	46.46	
DECAY CONSTANT (lamoda).....:	0	1/d
NUMBER OF POINT SOURCES.....:	34	

SOURCE DATA:

SOURCE NO. 1

X-COORDINATE OF THE SOURCE.....:	445.00	m
Y-COORDINATE OF THE SOURCE.....:	110.00	m
THE SOURCE STRENGTH.....:	.011	kg/d
ELAPSED TIME OF THE SOURCE ACTIVITY...:	36500.00	d

SOURCE NO. 2

X-COORDINATE OF THE SOURCE.....:	445.00	m
Y-COORDINATE OF THE SOURCE.....:	87.00	m
THE SOURCE STRENGTH.....:	.011	kg/d
ELAPSED TIME OF THE SOURCE ACTIVITY...:	36500.00	d

011729

ethylbenzene, 100 years

		[illegible] m	[illegible] m	[illegible] m	[illegible] m	[illegible] m
[illegible]	m	[illegible]	[illegible]	[illegible]	[illegible]	0.0186
[illegible]	m	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	m	1.6649	[illegible]	[illegible]	0.5411	[illegible]
[illegible]	m	3.8845	[illegible]	[illegible]	[illegible]	0.7757
[illegible]	m	[illegible]	[illegible]	[illegible]	1.1440	0.7269
150.00	m	2.6649	1.5261	[illegible]	0.7760	0.4747
[illegible]	m	1.5771	1.0501	[illegible]	0.4100	0.2390
210.00	m	0.9830	0.6268	[illegible]	[illegible]	0.1188
240.00	m	[illegible]	0.4110	[illegible]	0.1334	0.0702
270.00	m	0.0812	0.0526	0.0321	0.0185	0.0100
[illegible]	m	[illegible]	[illegible]	0.0008	0.0005	0.0003
[illegible]	m	0.0000	[illegible]	0.0000	0.0000	0.0000
[illegible]	m	0.0000	[illegible]	0.0000	0.0000	0.0000
[illegible]	m	0.0000	[illegible]	[illegible]	0.0000	0.0000
420.00	m	[illegible]	0.0000	[illegible]	0.0000	0.0000
450.00	m	0.0000	0.0000	0.0000	0.0000	0.0000
480.00	m	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
510.00	m	0.0000	0.0000	0.0000	0.0000	0.0000
[illegible]	m	0.0000	0.0000	0.0000	0.0000	0.0000
570.00	m	0.0000	0.0000	0.0000	0.0000	0.0000

		560.00 m	580.00 m	600.00 m	620.00 m	640.00 m
[illegible]	m	0.0098	0.0049	0.0023	0.0010	0.0004
[illegible]	m	0.0533	0.0270	0.0130	0.0060	0.0026
60.00	m	0.2019	0.1145	0.0617	0.0316	0.0153
90.00	m	0.4705	0.2720	0.1494	0.0777	0.0382
120.00	m	0.4403	0.2537	0.1386	0.0717	0.0350
150.00	m	0.2768	0.1535	0.0807	0.0401	0.0188
180.00	m	0.1725	0.0697	0.0348	0.0164	0.0073
210.00	m	0.0612	0.0298	0.0137	0.0059	0.0024
240.00	m	0.0349	0.0164	0.0072	0.0030	0.0012
[illegible]	m	0.0051	0.0024	0.0011	0.0005	0.0002
[illegible]	m	0.0001	0.0001	0.0000	0.0000	0.0000
[illegible]	m	0.0000	0.0000	0.0000	0.0000	0.0000
360.00	m	0.0000	0.0000	0.0000	0.0000	0.0000
[illegible]	m	0.0000	0.0000	0.0000	0.0000	0.0000
[illegible]	m	0.0000	0.0000	0.0000	0.0000	0.0000
[illegible]	m	0.0000	0.0000	0.0000	0.0000	0.0000
[illegible]	m	0.0000	0.0000	0.0000	0.0000	0.0000
[illegible]	m	0.0000	0.0000	0.0000	0.0000	0.0000
540.00	m	0.0000	0.0000	[illegible]	0.0000	0.0000
[illegible]	m	0.0000	0.0000	0.0000	0.0000	0.0000

		660.00 m	[illegible] m
[illegible]	m	0.0001	0.0001
[illegible]	m	0.0011	0.0004
[illegible]	m	0.0070	0.0030
[illegible]	m	0.0177	[illegible]
[illegible]	m	0.0181	0.0070
[illegible]	m	0.0083	0.0035
[illegible]	m	0.0031	0.0012
[illegible]	m	0.0009	0.0003
240.00	m	0.0004	0.0001
270.00	m	0.0001	0.0000
300.00	m	0.0000	0.0000
[illegible]	m	0.0000	0.0000
[illegible]	m	0.0000	0.0000
[illegible]	m	0.0000	0.0000
[illegible]	m	[illegible]	[illegible]
[illegible]	m	[illegible]	[illegible]

011730

```
*****************************************************
*                                                   *
*   SOLUTE TRANSPORT FROM POINT SOURCES             *
*   IN TWO-DIMENSIONAL UNIFORM FLOW                 *
*                                                   *
*   MODEL: WMPLUME  (REV 0-22 87)                   *
*       CODE USED WAS WMPLUMOD                      *
*****************************************************
```

LEEF: epa

LOCATION: Sherican: naphthalene, 10 years

DATE: 1/7/88

INPUT DATA:

```
DARCY VELOCITY.........................:    0.02 m/d
EFFECTIVE POROSITY.....................:     .3
AQUIFER THICKNESS......................:   10.00 m
LONGITUDINAL DISPERSIVITY..............:   50.00 m
LATERAL DISPERSIVITY...................:    5.00 m
RETARDATION FACTOR.....................:   34.60
DECAY CONSTANT (lamoda)................:    0     1/d
NUMBER OF POINT SOURCES................:   34
```

SOURCE DATA:

SOURCE NO. 1

```
X-COORDINATE OF THE SOURCE.............:  445.00 m
Y-COORDINATE OF THE SOURCE.............:  110.00 m
THE SOURCE STRENGTH....................:    .0011  kg/d
ELAPSED TIME OF THE SOURCE ACTIVITY...: 3650.00 d
```

SOURCE NO. 2

```
X-COORDINATE OF THE SOURCE.............:  445.00 m
Y-COORDINATE OF THE SOURCE.............:   87.00 m
THE SOURCE STRENGTH....................:    .0011  kg/d
ELAPSED TIME OF THE SOURCE ACTIVITY...: 3650.00 d
```

011731

naphthalene, 10 years

	460.00 m	480.00 m	500.00 m	520.00 m	540.00 m
0.00 m	0.0000	0.0000	0.0000	0.0000	0.0000
30.00 m	0.0001	0.0000	0.0000	0.0000	0.0000
60.00 m	0.0009	0.0002	0.0000	0.0000	0.0000
90.00 m	0.0073	0.0152	0.0038	0.0005	0.0000
120.00 m	0.0255	0.0088	0.0019	0.0003	0.0000
150.00 m	0.0156	0.0031	0.0004	0.0000	0.0000
180.00 m	0.0009	0.0001	0.0000	0.0000	0.0000
210.00 m	0.0000	0.0000	0.0000	0.0000	0.0000
240.00 m	0.0000	0.0000	0.0000	0.0000	0.0000
270.00 m	0.0000	0.0000	0.0000	0.0000	0.0000
300.00 m	0.0000	0.0000	0.0000	0.0000	0.0000
330.00 m	0.0000	0.0000	0.0000	0.0000	0.0000
360.00 m	0.0000	0.0000	0.0000	0.0000	0.0000
390.00 m	0.0000	0.0000	0.0000	0.0000	0.0000
420.00 m	0.0000	0.0000	0.0000	0.0000	0.0000
450.00 m	0.0000	0.0000	0.0000	0.0000	0.0000
480.00 m	0.0000	0.0000	0.0000	0.0000	0.0000
510.00 m	0.0000	0.0000	0.0000	0.0000	0.0000
540.00 m	0.0000	0.0000	0.0000	0.0000	0.0000
570.00 m	0.0000	0.0000	0.0000	0.0000	0.0000

	560.00 m	580.00 m	600.00 m	620.00 m
0.00 m	0.0000	0.0000	0.0000	0.0000
30.00 m	0.0000	0.0000	0.0000	0.0000
60.00 m	0.0000	0.0000	0.0000	0.0000
90.00 m	0.0000	0.0000	0.0000	0.0000
120.00 m	0.0000	0.0000	0.0000	0.0000
150.00 m	0.0000	0.0000	0.0000	0.0000
180.00 m	0.0000	0.0000	0.0000	0.0000
210.00 m	0.0000	0.0000	0.0000	0.0000
240.00 m	0.0000	0.0000	0.0000	0.0000
270.00 m	0.0000	0.0000	0.0000	0.0000
300.00 m	0.0000	0.0000	0.0000	0.0000
330.00 m	0.0000	0.0000	0.0000	0.0000
360.00 m	0.0000	0.0000	0.0000	0.0000
390.00 m	0.0000	0.0000	0.0000	0.0000
420.00 m	0.0000	0.0000	0.0000	0.0000
450.00 m	0.0000	0.0000	0.0000	0.0000
480.00 m	0.0000	0.0000	0.0000	0.0000
510.00 m	0.0000	0.0000	0.0000	0.0000
540.00 m	0.0000	0.0000	0.0000	0.0000
570.00 m	0.0000	0.0000	0.0000	0.0000

011732

```
*****************************************************
*                                                   *
*   SOLUTE TRANSPORT FROM POINT SOURCES             *
*   IN TWO-DIMENSIONAL UNIFORM FLOW                 *
*                                                   *
*   MODEL: WMFLONE  (REV 2-23-87)                   *
*        CODE USED WAS WMFLIMOD                     *
*****************************************************
```

USER: sos

LOCATION: Sheridan: naphthalene, 100 years

DATE: 1/7/88

INPUT DATA:

```
DARCY VELOCITY.........................:    0.02 m/d
EFFECTIVE POROSITY.....................:     .3
AQUIFER THICKNESS......................:   10.00 m
LONGITUDINAL DISPERSIVITY..............:   50.00 m
LATERAL DISPERSIVITY...................:    5.00 m
RETARDATION FACTOR.....................:   34.60
DECAY CONSTANT (lambda)................:    0     1/d
NUMBER OF POINT SOURCES................:   34
```

SOURCE DATA:

SOURCE NO. 1

```
X-COORDINATE OF THE SOURCE.............:  445.00 m
Y-COORDINATE OF THE SOURCE.............:  110.00 m
THE SOURCE STRENGTH....................:    .0011  kg/d
ELAPSED TIME OF THE SOURCE ACTIVITY....:36500.00 d
```

SOURCE NO. 2

```
X-COORDINATE OF THE SOURCE.............:  445.00 m
Y-COORDINATE OF THE SOURCE.............:   87.00 m
THE SOURCE STRENGTH....................:    .0011  kg/d
ELAPSED TIME OF THE SOURCE ACTIVITY....:36500.00 d
```

011733

RESULTS

[illegible] CONCENTRATION in mg/l [illegible] naphthalene, 100 years

	460.00 m	480.00 m	500.00 m	520.00 m	540.00 m
0.00 m	0.0324	0.0223	0.0167	0.0118	0.0080
30.00 m	0.1371	0.1005	0.0718	0.0497	0.0333
60.00 m	0.2791	0.2185	0.1652	0.1207	0.0852
90.00 m	0.5490	0.4116	0.3059	0.2224	0.1574
120.00 m	0.5095	0.3971	0.2991	0.2188	0.1554
150.00 m	0.4209	0.3145	0.2305	0.1647	0.1144
180.00 m	0.2856	0.2101	0.1504	0.1045	0.0703
210.00 m	0.2023	0.1450	0.1005	0.0677	0.0435
240.00 m	0.1360	0.0945	0.0637	0.0415	0.0261
270.00 m	0.0273	0.0197	0.0137	0.0092	0.0059
300.00 m	0.0021	0.0014	0.0010	0.0006	0.0004
330.00 m	0.0001	0.0000	0.0000	0.0000	0.0000
360.00 m	0.0000	0.0000	0.0000	0.0000	0.0000
390.00 m	0.0000	0.0000	0.0000	0.0000	0.0000
420.00 m	0.0000	0.0000	0.0000	0.0000	0.0000
450.00 m	0.0000	0.0000	0.0000	0.0000	0.0000
480.00 m	0.0000	0.0000	0.0000	0.0000	0.0000
510.00 m	0.0000	0.0000	0.0000	0.0000	0.0000
540.00 m	0.0000	0.0000	0.0000	0.0000	0.0000
570.00 m	0.0000	0.0000	0.0000	0.0000	0.0000

011734

	560.00 m	580.00 m	600.00 m	620.00 m
0.00 m	0.0052	0.0032	0.0019	0.0011
30.00 m	0.0216	0.0135	0.0081	0.0047
60.00 m	0.0581	0.0383	0.0243	0.0149
90.00 m	0.1081	0.0719	0.0462	0.0287
120.00 m	0.1069	0.0711	0.0457	0.0283
150.00 m	0.0769	0.0500	0.0314	0.0190
180.00 m	0.0458	0.0288	0.0174	0.0102
210.00 m	0.0271	0.0163	0.0094	0.0052
240.00 m	0.0159	0.0093	0.0052	0.0028
270.00 m	0.0037	0.0022	0.0012	0.0007
300.00 m	0.0003	0.0002	0.0001	0.0000
330.00 m	0.0000	0.0000	0.0000	0.0000
360.00 m	0.0000	0.0000	0.0000	0.0000
390.00 m	0.0000	0.0000	0.0000	0.0000
420.00 m	0.0000	0.0000	0.0000	0.0000
450.00 m	0.0000	0.0000	0.0000	0.0000
480.00 m	0.0000	0.0000	0.0000	0.0000
510.00 m	0.0000	0.0000	0.0000	0.0000
540.00 m	0.0000	0.0000	0.0000	0.0000
570.00 m	0.0000	0.0000	0.0000	0.0000

```
*****************************************************
*                                                   *
*   SOLUTE TRANSPORT FROM POINT SOURCES             *
*   IN TWO-DIMENSIONAL UNIFORM FLOW                 *
*                                                   *
*   MODEL: WMPLUME  (REV 0-22 87)                   *
*        CODE USED WAS WMPLUMOD                     *
*****************************************************
```

USER: sos

LOCATION: Sheridan: FCB, 10 years

DATE: 1/5/88

INPUT DATA:

```
DARCY VELOCITY.........................:    0.02 m/d
EFFECTIVE POROSITY.....................:     .3
AQUIFER THICKNESS......................:   10.00 m
LONGITUDINAL DISPERSIVITY..............:   50.00 m
LATERAL DISPERSIVITY...................:    5.00 m
RETARDATION FACTOR.....................:  607.00
DECAY CONSTANT (lamoda)................:    0     1/d
NUMBER OF POINT SOURCES................:   34
```

SOURCE DATA:

SOURCE NO. 1

```
X-COORDINATE OF THE SOURCE.............:  445.00 m
Y-COORDINATE OF THE SOURCE.............:  110.00 m
THE SOURCE STRENGTH....................:    .00013  kg/d
ELAPSED TIME OF THE SOURCE ACTIVITY....: 3650.00 d
```

SOURCE NO. 2

```
X-COORDINATE OF THE SOURCE.............:  445.00 m
Y-COORDINATE OF THE SOURCE.............:   57.00 m
THE SOURCE STRENGTH....................:    .00013  kg/d
ELAPSED TIME OF THE SOURCE ACTIVITY....: 3650.00 d
```

011735

[illegible] CONCENTRATION in mg/l (ppm) PCB, 10 years

	460.00 m	480.00 m	500.00 m	520.00 m	540.00 m
0.00 m	0.0000	0.0000	0.0000	0.0000	0.0000
30.00 m	0.0000	0.0000	0.0000	0.0000	0.0000
60.00 m	0.0000	0.0000	0.0000	0.0000	0.0000
90.00 m	0.0000	0.0000	0.0000	0.0000	0.0000
120.00 m	0.0000	0.0000	0.0000	0.0000	0.0000
150.00 m	0.0000	0.0000	0.0000	0.0000	0.0000
180.00 m	0.0000	0.0000	0.0000	0.0000	0.0000
210.00 m	0.0000	0.0000	0.0000	0.0000	0.0000
240.00 m	0.0000	0.0000	0.0000	0.0000	0.0000
270.00 m	0.0000	0.0000	0.0000	0.0000	0.0000
300.00 m	0.0000	0.0000	0.0000	0.0000	0.0000
330.00 m	0.0000	0.0000	0.0000	0.0000	0.0000
360.00 m	0.0000	0.0000	0.0000	0.0000	0.0000
390.00 m	0.0000	0.0000	0.0000	0.0000	0.0000
420.00 m	0.0000	0.0000	0.0000	0.0000	0.0000
450.00 m	0.0000	0.0000	0.0000	0.0000	0.0000
480.00 m	0.0000	0.0000	0.0000	0.0000	0.0000
510.00 m	0.0000	0.0000	0.0000	0.0000	0.0000
540.00 m	0.0000	0.0000	0.0000	0.0000	0.0000
570.00 m	0.0000	0.0000	0.0000	0.0000	0.0000

011736

	560.00 m	580.00 m	600.00 m	620.00 m
0.00 m	0.0000	0.0000	0.0000	0.0000
30.00 m	0.0000	0.0000	0.0000	0.0000
60.00 m	0.0000	0.0000	0.0000	0.0000
90.00 m	0.0000	0.0000	0.0000	0.0000
120.00 m	0.0000	0.0000	0.0000	0.0000
150.00 m	0.0000	0.0000	0.0000	0.0000
180.00 m	0.0000	0.0000	0.0000	0.0000
210.00 m	0.0000	0.0000	0.0000	0.0000
240.00 m	0.0000	0.0000	0.0000	0.0000
270.00 m	0.0000	0.0000	0.0000	0.0000
300.00 m	0.0000	0.0000	0.0000	0.0000
330.00 m	0.0000	0.0000	0.0000	0.0000
360.00 m	0.0000	0.0000	0.0000	0.0000
390.00 m	0.0000	0.0000	0.0000	0.0000
420.00 m	0.0000	0.0000	0.0000	0.0000
450.00 m	0.0000	0.0000	0.0000	0.0000
480.00 m	0.0000	0.0000	0.0000	0.0000
510.00 m	0.0000	0.0000	0.0000	0.0000
540.00 m	0.0000	0.0000	0.0000	0.0000
570.00 m	0.0000	0.0000	0.0000	0.0000

```
*****************************************************
*                                                   *
*   SOLUTE TRANSPORT FROM POINT SOURCES             *
*   IN TWO-DIMENSIONAL UNIFORM FLOW                 *
*                                                   *
*   MODEL: WMPLUME  (RE  2-22 87)                   *
*       CODE USED WAS WMPLUMOD                      *
*****************************************************
```

USER: sps

LOCATION: Sheridan: PCB 100 years

DATE: 1/6/88

INPUT DATA:

DARCY VELOCITY.....:	0.02	m/d
EFFECTIVE POROSITY.....:	.3	
AQUIFER THICKNESS.....:	10.00	m
LONGITUDINAL DISPERSIVITY.....:	50.00	m
LATERAL DISPERSIVITY.....:	5.00	m
RETARDATION FACTOR.....:	507.00	
DECAY CONSTANT (lambda).....:	0	1/d
NUMBER OF POINT SOURCES.....:	34	

SOURCE DATA:

SOURCE NO. 1

X-COORDINATE OF THE SOURCE.....:	445.00	m
Y-COORDINATE OF THE SOURCE.....:	110.00	m
THE SOURCE STRENGTH.....:	.00013	kg/d
ELAPSED TIME OF THE SOURCE ACTIVITY...:	36500.00	d

SOURCE NO. 2

X-COORDINATE OF THE SOURCE.....:	445.00	m
Y-COORDINATE OF THE SOURCE.....:	87.00	m
THE SOURCE STRENGTH.....:	.00013	kg/d
ELAPSED TIME OF THE SOURCE ACTIVITY...:	36500.00	d

011737

---------- RESULTS ----------

-------- Projection CONCENTRATION in mg/l PCB, 100 years

	460.00 m	480.00 m	500.00 m	520.00 m	540.00 m
0.00 m	0.0000	0.0000	0.0000	0.0000	0.0000
30.00 m	0.0000	0.0000	0.0000	0.0000	0.0000
60.00 m	0.0000	0.0000	0.0000	0.0000	0.0000
90.00 m	0.0038	0.0004	0.0000	0.0000	0.0000
120.00 m	0.0006	0.0001	0.0000	0.0000	0.0000
150.00 m	0.0003	0.0000	0.0000	0.0000	0.0000
180.00 m	0.0000	0.0000	0.0000	0.0000	0.0000
210.00 m	0.0000	0.0000	0.0000	0.0000	0.0000
240.00 m	0.0000	0.0000	0.0000	0.0000	0.0000
270.00 m	0.0000	0.0000	0.0000	0.0000	0.0000
300.00 m	0.0000	0.0000	0.0000	0.0000	0.0000
330.00 m	0.0000	0.0000	0.0000	0.0000	0.0000
360.00 m	0.0000	0.0000	0.0000	0.0000	0.0000
390.00 m	0.0000	0.0000	0.0000	0.0000	0.0000
420.00 m	0.0000	0.0000	0.0000	0.0000	0.0000
450.00 m	0.0000	0.0000	0.0000	0.0000	0.0000
480.00 m	0.0000	0.0000	0.0000	0.0000	0.0000
510.00 m	0.0000	0.0000	0.0000	0.0000	0.0000
540.00 m	0.0000	0.0000	0.0000	0.0000	0.0000
570.00 m	0.0000	0.0000	0.0000	0.0000	0.0000

	560.00 m	580.00 m	600.00 m	620.00 m
0.00 m	0.0000	0.0000	0.0000	0.0000
30.00 m	0.0000	0.0000	0.0000	0.0000
60.00 m	0.0000	0.0000	0.0000	0.0000
90.00 m	0.0000	0.0000	0.0000	0.0000
120.00 m	0.0000	0.0000	0.0000	0.0000
150.00 m	0.0000	0.0000	0.0000	0.0000
180.00 m	0.0000	0.0000	0.0000	0.0000
210.00 m	0.0000	0.0000	0.0000	0.0000
240.00 m	0.0000	0.0000	0.0000	0.0000
270.00 m	0.0000	0.0000	0.0000	0.0000
300.00 m	0.0000	0.0000	0.0000	0.0000
330.00 m	0.0000	0.0000	0.0000	0.0000
360.00 m	0.0000	0.0000	0.0000	0.0000
390.00 m	0.0000	0.0000	0.0000	0.0000
420.00 m	0.0000	0.0000	0.0000	0.0000
450.00 m	0.0000	0.0000	0.0000	0.0000
480.00 m	0.0000	0.0000	0.0000	0.0000
510.00 m	0.0000	0.0000	0.0000	0.0000
540.00 m	0.0000	0.0000	0.0000	0.0000
570.00 m	0.0000	0.0000	0.0000	0.0000

```
*****************************************************
*                                                   *
*   SOLUTE TRANSPORT FROM POINT SOURCES             *
*   IN TWO-DIMENSIONAL UNIFORM FLOW                 *
*                                                   *
*   MODEL: WMPLUME  (REV 0-22 ST                    *
*       CODE USED WAS WMPLUMOD                      *
*****************************************************
```

USER: sps

LOCATION: Sheridan: phenol, 1 year

DATE: 1/6/88

INPUT DATA:

DARCY VELOCITY.....:	0.02	m/d
EFFECTIVE POROSITY.....:	.3	
AQUIFER THICKNESS.....:	10.00	m
LONGITUDINAL DISPERSIVITY.....:	50.00	m
LATERAL DISPERSIVITY.....:	5.00	m
RETARDATION FACTOR.....:	1.97	
DECAY CONSTANT (lambda).....:	0	1/d
NUMBER OF POINT SOURCES.....:	34	

011739

SOURCE DATA:

SOURCE NO. 1

X-COORDINATE OF THE SOURCE.....:	445.00	m
Y-COORDINATE OF THE SOURCE.....:	110.00	m
THE SOURCE STRENGTH.....:	.066	kg/d
ELAPSED TIME OF THE SOURCE ACTIVITY...:	365.00	d

SOURCE NO. 2

X-COORDINATE OF THE SOURCE.....:	445.00	m
Y-COORDINATE OF THE SOURCE.....:	87.00	m
THE SOURCE STRENGTH.....:	.066	kg/d
ELAPSED TIME OF THE SOURCE ACTIVITY...:	365.00	d

[illegible] CONCENTRATION in mg/l (ppm) prenol, 1 year

		460.00 m	480.00 m	500.00 m	520.00 m	540.00 m
0.00	m	0.0007	0.0001	0.0000	0.0000	0.0000
30.00	m	0.0981	0.0176	0.0024	0.0003	0.0000
60.00	m	0.4471	0.1757	0.0589	0.0162	0.0036
90.00	m	6.1066	2.5480	0.9145	0.2684	0.0626
120.00	m	3.5633	1.6497	0.6016	0.1746	0.0400
150.00	m	2.2124	0.7595	0.2155	0.0489	0.0087
180.00	m	0.3855	0.1061	0.0232	0.0040	0.0005
210.00	m	0.0491	0.0092	0.0013	0.0001	0.0000
240.00	m	0.0398	0.0073	0.0010	0.0001	0.0000
270.00	m	0.0000	0.0000	0.0000	0.0000	0.0000
300.00	m	0.0000	0.0000	0.0000	0.0000	0.0000
330.00	m	0.0000	0.0000	0.0000	0.0000	0.0000
360.00	m	0.0000	0.0000	0.0000	0.0000	0.0000
390.00	m	0.0000	0.0000	0.0000	0.0000	0.0000
420.00	m	0.0000	0.0000	0.0000	0.0000	0.0000
450.00	m	0.0000	0.0000	0.0000	0.0000	0.0000
480.00	m	0.0000	0.0000	0.0000	0.0000	0.0000
510.00	m	0.0000	0.0000	0.0000	0.0000	0.0000
540.00	m	0.0000	0.0000	0.0000	0.0000	0.0000
570.00	m	0.0000	0.0000	0.0000	0.0000	0.0000

		560.00 m	580.00 m	600.00 m	620.00 m
0.00	m	0.0000	0.0000	0.0000	0.0000
30.00	m	0.0000	0.0000	0.0000	0.0000
60.00	m	0.0006	0.0001	0.0000	0.0000
90.00	m	0.0114	0.0016	0.0002	0.0000
120.00	m	0.0072	0.0010	0.0001	0.0000
150.00	m	0.0012	0.0001	0.0000	0.0000
180.00	m	0.0001	0.0000	0.0000	0.0000
210.00	m	0.0000	0.0000	0.0000	0.0000
240.00	m	0.0000	0.0000	0.0000	0.0000
270.00	m	0.0000	0.0000	0.0000	0.0000
300.00	m	0.0000	0.0000	0.0000	0.0000
330.00	m	0.0000	0.0000	0.0000	0.0000
360.00	m	0.0000	0.0000	0.0000	0.0000
390.00	m	0.0000	0.0000	0.0000	0.0000
420.00	m	0.0000	0.0000	0.0000	0.0000
450.00	m	0.0000	0.0000	0.0000	0.0000
480.00	m	0.0000	0.0000	0.0000	0.0000
510.00	m	0.0000	0.0000	0.0000	0.0000
540.00	m	0.0000	0.0000	0.0000	0.0000
570.00	m	0.0000	0.0000	0.0000	0.0000

```
*****************************************
*                                       *
*   SOLUTE TRANSPORT FROM POINT SOURCES *
*   IN TWO-DIMENSIONAL UNIFORM FLOW     *
*                                       *
*   MODEL: WMPLUME  (REV 2-23 87)       *
*       CODE USED WAS WMPLUMOD          *
*****************************************
```

USER: sps

LOCATION: Sheridan: phenol, 10 years

DATE: 1/6/88

011741

INPUT DATA:

DARCY VELOCITY.....	0.02	m/d
EFFECTIVE POROSITY.....	.3	
AQUIFER THICKNESS.....	10.00	m
LONGITUDINAL DISPERSIVITY.....	50.00	m
LATERAL DISPERSIVITY.....	5.00	m
RETARDATION FACTOR.....	1.97	
DECAY CONSTANT (lamda).....	0	1/d
NUMBER OF POINT SOURCES.....	34	

SOURCE DATA:

SOURCE NO. 1

X-COORDINATE OF THE SOURCE.....	445.00	m
Y-COORDINATE OF THE SOURCE.....	110.00	m
THE SOURCE STRENGTH.....	.066	kg/d
ELAPSED TIME OF THE SOURCE ACTIVITY...:	3650.00	d

SOURCE NO. 2

X-COORDINATE OF THE SOURCE.....	[illegible]	m
Y-COORDINATE OF THE SOURCE.....	[illegible]	m
THE SOURCE STRENGTH.....	[illegible]	[illegible]
ELAPSED TIME OF THE SOURCE ACTIVITY...:	[illegible]	d

********** RESULTS **********

+------- X-direction CONCENTRATION in mg/l (ppm) phenol, 10 years

	460.00 m	480.00 m	500.00 m	520.00 m	540.00 m
0.00 m	4.6746	4.2190	3.6962	3.1507	2.6169
30.00 m	16.4447	14.0125	11.7973	9.7351	7.9[illegible]
60.00 m	31.9856	27.8753	23.8041	19.9358	16.3807
90.00 m	55.1425	45.8046	38.0300	31.2630	25.7831
120.00 m	56.1143	47.7549	39.9260	32.8997	26.7122
150.00 m	50.3358	41.8914	34.5761	28.1960	22.6723
180.00 m	39.7396	32.9489	26.9533	21.7274	17.2410
210.00 m	31.4679	25.7427	20.7258	16.4172	12.7869
240.00 m	21.7378	17.4202	13.7676	10.7194	8.2135
270.00 m	7.5800	6.4157	5.1349	4.0376	3.1177
300.00 m	1.8185	1.4392	1.1263	0.8707	0.6640
330.00 m	0.2820	0.2135	0.1597	0.1182	0.0866
360.00 m	0.0269	0.0198	0.0143	0.0101	0.0071
390.00 m	0.0015	0.0011	0.0007	0.0005	0.0004
420.00 m	0.0000	0.0000	0.0000	0.0000	0.0000
450.00 m	0.0000	0.0000	0.0000	0.0000	0.0000
480.00 m	0.0000	0.0000	0.0000	0.0000	0.0000
510.00 m	0.0000	0.0000	0.0000	0.0000	0.0000
540.00 m	0.0000	0.0000	0.0000	0.0000	0.0000
570.00 m	0.0000	0.0000	0.0000	0.0000	0.0000

	560.00 m	580.00 m	600.00 m	620.00 m
0.00 m	2.1197	1.6752	1.2921	0.9727
30.00 m	6.3895	5.0179	3.8617	2.9106
60.00 m	13.2056	10.4427	8.0975	6.1545
90.00 m	20.2765	15.9496	12.3323	9.3642
120.00 m	21.3514	16.7853	12.9569	9.8354
150.00 m	17.9514	13.9800	10.6731	8.0375
180.00 m	13.4545	10.3171	7.7879	5.7383
210.00 m	9.7863	7.3545	5.4232	3.9214
240.00 m	6.1873	4.5777	3.3233	2.3655
270.00 m	2.3613	1.7559	1.2766	0.9099
300.00 m	0.4989	0.3687	0.2677	0.1907
330.00 m	0.0627	0.0449	0.0318	0.0222
360.00 m	0.0049	0.0034	0.0023	0.0015
390.00 m	0.0002	0.0002	0.0001	0.0001
420.00 m	0.0000	0.0000	0.0000	0.0000
450.00 m	0.0000	0.0000	0.0000	0.0000
480.00 m	0.0000	0.0000	0.0000	0.0000
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

```
*****************************************
*                                       *
*   SOLUTE TRANSPORT FROM POINT SOURCES *
*   IN TWO-DIMENSIONAL UNIFORM FLOW     *
*                                       *
*   MODEL: WMPLUME  (REV 2-23 87)       *
*       CODE USED WAS WMPL2MOD          *
*****************************************
```

USER: sjr

LOCATION: Sheridan; phenol, 20 years

DATE: 1/13/88

INPUT DATA:

DARCY VELOCITY.....:	0.02 m/d
EFFECTIVE POROSITY.....:	.3
AQUIFER THICKNESS.....:	10.00 m
LONGITUDINAL DISPERSIVITY.....:	50.00 m
LATERAL DISPERSIVITY.....:	5.00 m
RETARDATION FACTOR.....:	1.97
DECAY CONSTANT (lambda).....:	0 1/d
NUMBER OF POINT SOURCES.....:	34

SOURCE DATA:

SOURCE NO. 1

X-COORDINATE OF THE SOURCE.....:	445.00 m
Y-COORDINATE OF THE SOURCE.....:	110.00 m
THE SOURCE STRENGTH.....:	.066 kg/d
ELAPSED TIME OF THE SOURCE ACTIVITY...:	7300.00 d

SOURCE NO. 2

X-COORDINATE OF THE SOURCE.....:	445.00 m
Y-COORDINATE OF THE SOURCE.....:	87.00 m
THE SOURCE STRENGTH.....:	.066 kg/d
ELAPSED TIME OF THE SOURCE ACTIVITY...:	7300.00 d

011743

********** RESULTS **********

------- X-direction CONCENTRATION in mg/l (ppm) phenol, 20 years

Y		460.00 m	480.00 m	500.00 m	520.00 m	540.00 m
0.00	m	11.2526	11.1889	10.9503	10.5681	10.0697
30.00	m	31.3554	29.6085	27.8630	26.0748	24.2334
60.00	m	58.7905	55.5602	51.9950	48.2319	44.3702
90.00	m	95.8747	86.9519	79.1962	71.9735	65.1289
120.00	m	107.6329	99.1401	90.6216	82.3598	74.4124
150.00	m	106.9716	97.6522	88.9064	80.5552	72.5644
180.00	m	95.4231	87.2718	79.3549	71.6993	64.3443
210.00	m	81.2302	73.8318	66.6569	59.7725	53.2268
240.00	m	60.4873	54.4495	48.7451	43.3758	38.3474
270.00	m	32.3593	29.5272	26.7034	23.9371	21.2696
300.00	m	13.8070	12.6070	11.4120	10.2397	9.1060
330.00	m	4.6784	4.2696	3.8585	3.4534	3.0614
360.00	m	1.2142	1.1112	1.0053	0.8992	0.7955
390.00	m	0.2371	0.2179	0.1976	0.1770	0.1566
420.00	m	0.0345	0.0318	0.0290	0.0260	0.0230
450.00	m	0.0037	0.0034	0.0031	0.0028	0.0025
480.00	m	0.0003	0.0003	0.0002	0.0002	0.0002
510.00	m	0.0000	0.0000	0.0000	0.0000	0.0000
540.00	m	0.0000	0.0000	0.0000	0.0000	0.0000
570.00	m	0.0000	0.0000	0.0000	0.0000	0.0000

		560.00 m	580.00 m	600.00 m	620.00 m
0.00	m	9.4800	8.8217	8.1160	7.3830
30.00	m	22.3468	20.4341	18.5194	16.6293
60.00	m	40.4857	36.6397	32.8834	29.2610
90.00	m	58.6184	52.4350	46.5877	41.0922
120.00	m	66.8091	59.5799	52.7557	46.3645
150.00	m	64.9449	57.7230	50.9290	44.5907
180.00	m	57.3333	50.7077	44.5030	38.7467
210.00	m	47.0575	41.2935	35.9563	31.0593
240.00	m	33.6673	29.3426	25.3781	21.7746
270.00	m	18.7342	16.3564	14.1543	12.1394
300.00	m	8.0250	7.0079	6.0635	5.1977
330.00	m	2.6881	2.3381	2.0144	1.7192
360.00	m	0.6962	0.6030	0.5168	0.4385
390.00	m	0.1368	0.1182	0.1009	0.0852
420.00	m	0.0201	0.0173	0.0148	0.0124
450.00	m	0.0022	0.0019	0.0016	0.0013
480.00	m	0.0002	0.0001	0.0001	0.0001
510.00	m	0.0000	0.0000	0.0000	0.0000
540.00	m	0.0000	0.0000	0.0000	0.0000
570.00	m	0.0000	0.0000	0.0000	0.0000

```
*****************************************************
*                                                   *
*   SOLUTE TRANSPORT FROM POINT SOURCES             *
*   IN TWO-DIMENSIONAL UNIFORM FLOW                 *
*                                                   *
*   MODEL: WMPLUME  (REV 1-27 87                    *
*       CODE USED WAS WMPL2MOD                      *
*****************************************************
```

USER: sps

LOCATION: Sheridan: tetrachloroethylene, 10 years

DATE: 1/7/88

INPUT DATA:

DARCY VELOCITY.....:	0.02	m/d
EFFECTIVE POROSITY.....:	.3	
AQUIFER THICKNESS.....:	10.00	m
LONGITUDINAL DISPERSIVITY.....:	50.00	m
LATERAL DISPERSIVITY.....:	5.00	m
RETARDATION FACTOR.....:	25.49	
DECAY CONSTANT (lambda).....:	0	1/d
NUMBER OF POINT SOURCES.....:	34	

SOURCE DATA:

SOURCE NO. 1

X-COORDINATE OF THE SOURCE.....:	445.00	m
Y-COORDINATE OF THE SOURCE.....:	110.00	m
THE SOURCE STRENGTH.....:	.0012	kg/d
ELAPSED TIME OF THE SOURCE ACTIVITY...:	3650.00	d

SOURCE NO. 2

X-COORDINATE OF THE SOURCE.....:	445.00	m
Y-COORDINATE OF THE SOURCE.....:	87.00	m
THE SOURCE STRENGTH.....:	.0012	kg/d
ELAPSED TIME OF THE SOURCE ACTIVITY...:	3650.00	d

011745

Tetrachloroethylene
10 years

[illegible]	m	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	m	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	m	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	m	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	m	0.0427	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	m	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	m	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	m	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
240.00	m	0.0001	0.0000	0.0000	0.0000	0.0000
[illegible]	m	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	m	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	m	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	m	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	m	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	m	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	m	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	m	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	m	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	m	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	m	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

[illegible]	m	0.0000	0.0000	0.0000	0.0000	0.0000
[illegible]	m	[illegible]	0.0000	0.0000	0.0000	0.0000
[illegible]	m	0.0000	0.0000	0.0000	0.0000	0.0000
[illegible]	m	0.0000	0.0000	0.0000	0.0000	0.0000
120.00	m	0.0000	0.0000	0.0000	0.0000	0.0000
[illegible]	m	0.0000	0.0000	0.0000	0.0000	0.0000
[illegible]	m	0.0000	0.0000	0.0000	0.0000	0.0000
[illegible]	m	0.0000	0.0000	0.0000	0.0000	0.0000
[illegible]	m	0.0000	0.0000	0.0000	0.0000	0.0000
[illegible]	m	0.0000	0.0000	0.0000	0.0000	0.0000
[illegible]	m	0.0000	0.0000	0.0000	0.0000	0.0000
[illegible]	m	0.0000	0.0000	0.0000	0.0000	0.0000
[illegible]	m	0.0000	0.0000	0.0000	0.0000	0.0000
[illegible]	m	0.0000	0.0000	0.0000	0.0000	0.0000
[illegible]	m	0.0000	0.0000	0.0000	0.0000	0.0000
[illegible]	m	0.0000	0.0000	0.0000	0.0000	0.0000
[illegible]	m	0.0000	0.0000	0.0000	0.0000	0.0000
[illegible]	m	0.0000	0.0000	0.0000	0.0000	0.0000

[illegible]	m	[illegible]	[illegible]
[illegible]	m	[illegible]	[illegible]
[illegible]	m	[illegible]	[illegible]
[illegible]	m	[illegible]	[illegible]
120.0	m	[illegible]	0.0000
[illegible]	m	[illegible]	0.0000
[illegible]	m	[illegible]	[illegible]
[illegible]	m	[illegible]	[illegible]
240.0	m	0.0000	0.0000
[illegible]	m	[illegible]	0.0000
[illegible]	m	0.0000	0.0000
[illegible]	m	[illegible]	0.0000
[illegible]	m	[illegible]	0.0000
[illegible]	m	[illegible]	[illegible]
[illegible]	m	[illegible]	[illegible]
[illegible]	m	[illegible]	[illegible]
[illegible]	m	[illegible]	[illegible]
[illegible]	m	[illegible]	[illegible]

011746

```
*********************************************
*                                           *
*   SOLUTE TRANSPORT FROM POINT SOURCES     *
*   IN TWO-DIMENSIONAL UNIFORM FLOW         *
*                                           *
*   MODEL: WMPLUME  (REV 2-23 87)           *
*       CODE USED WAS WMPL2MOD              *
*********************************************
```

USER: sjr

LOCATION: Sheridan; tetrachloroethylene, 20 years

DATE: 1/13/98

INPUT DATA:

DARCY VELOCITY.....	0.02	m/d
EFFECTIVE POROSITY.....	.3	
AQUIFER THICKNESS.....	10.00	m
LONGITUDINAL DISPERSIVITY.....	50.00	m
LATERAL DISPERSIVITY.....	5.00	m
RETARDATION FACTOR.....	26.49	
DECAY CONSTANT (lambda).....	0	1/d
NUMBER OF POINT SOURCES.....	34	

SOURCE DATA:

SOURCE NO. 1

X-COORDINATE OF THE SOURCE.....	445.00	m
Y-COORDINATE OF THE SOURCE.....	110.00	m
THE SOURCE STRENGTH.....	.0012	kg/d
ELAPSED TIME OF THE SOURCE ACTIVITY...:	7300.00	d

SOURCE NO. 2

X-COORDINATE OF THE SOURCE.....	445.00	m
Y-COORDINATE OF THE SOURCE.....	87.00	m
THE SOURCE STRENGTH.....	.0012	kg/d
ELAPSED TIME OF THE SOURCE ACTIVITY...:	7300.00	d

011747

++++++++++++++++++++++++++++++++ RESULTS ++++++++++++++++++++++++++++++++

+------- X-direction CONCENTRATION in mg/l (ppm) tetrachloroethylene, 20 years
|
v Y

		460.00 m	480.00 m	500.00 m	520.00 m	540.00 m
0.00	m	0.0002	0.0001	0.0000	0.0000	0.0000
30.00	m	0.0073	0.0022	0.0006	0.0001	0.0000
60.00	m	0.0241	0.0121	0.0054	0.0021	0.0007
90.00	m	0.1584	0.0800	0.0372	0.0153	0.0055
120.00	m	0.1082	0.0593	0.0278	0.0113	0.0040
150.00	m	0.0719	0.0323	0.0129	0.0045	0.0014
180.00	m	0.0208	0.0082	0.0029	0.0009	0.0002
210.00	m	0.0053	0.0017	0.0005	0.0001	0.0000
240.00	m	0.0040	0.0012	0.0003	0.0001	0.0000
270.00	m	0.0000	0.0000	0.0000	0.0000	0.0000
300.00	m	0.0000	0.0000	0.0000	0.0000	0.0000
330.00	m	0.0000	0.0000	0.0000	0.0000	0.0000
360.00	m	0.0000	0.0000	0.0000	0.0000	0.0000
390.00	m	0.0000	0.0000	0.0000	0.0000	0.0000
420.00	m	0.0000	0.0000	0.0000	0.0000	0.0000
450.00	m	0.0000	0.0000	0.0000	0.0000	0.0000
480.00	m	0.0000	0.0000	0.0000	0.0000	0.0000
510.00	m	0.0000	0.0000	0.0000	0.0000	0.0000
540.00	m	0.0000	0.0000	0.0000	0.0000	0.0000
570.00	m	0.0000	0.0000	0.0000	0.0000	0.0000

		560.00 m	580.00 m	600.00 m	620.00 m
0.00	m	0.0000	0.0000	0.0000	0.0000
30.00	m	0.0000	0.0000	0.0000	0.0000
60.00	m	0.0002	0.0001	0.0000	0.0000
90.00	m	0.0017	0.0004	0.0001	0.0000
120.00	m	0.0012	0.0003	0.0001	0.0000
150.00	m	0.0003	0.0001	0.0000	0.0000
180.00	m	0.0000	0.0000	0.0000	0.0000
210.00	m	0.0000	0.0000	0.0000	0.0000
240.00	m	0.0000	0.0000	0.0000	0.0000
270.00	m	0.0000	0.0000	0.0000	0.0000
300.00	m	0.0000	0.0000	0.0000	0.0000
330.00	m	0.0000	0.0000	0.0000	0.0000
360.00	m	0.0000	0.0000	0.0000	0.0000
390.00	m	0.0000	0.0000	0.0000	0.0000
420.00	m	0.0000	0.0000	0.0000	0.0000
450.00	m	0.0000	0.0000	0.0000	0.0000
480.00	m	0.0000	0.0000	0.0000	0.0000
510.00	m	0.0000	0.0000	0.0000	0.0000
540.00	m	0.0000	0.0000	0.0000	0.0000
570.00	m	0.0000	0.0000	0.0000	0.0000

```
*****************************************
*                                       *
*   SOLUTE TRANSPORT FROM POINT SOURCES *
*   IN TWO-DIMENSIONAL UNIFORM FLOW     *
*                                       *
*   MODEL: WMPLUME  (REV 2-23 87)       *
*       CODE USED WAS WMPL2MOD          *
*****************************************
```

USER: sjr

LOCATION: Sheridan; tetrachloroethylene, 50 years

DATE: 1/13/88

INPUT DATA:

DARCY VELOCITY.....:	0.02	m/d
EFFECTIVE POROSITY.....:	.3	
AQUIFER THICKNESS.....:	10.00	m
LONGITUDINAL DISPERSIVITY.....:	50.00	m
LATERAL DISPERSIVITY.....:	5.00	m
RETARDATION FACTOR.....:	26.49	
DECAY CONSTANT (lambda).....:	0	1/d
NUMBER OF POINT SOURCES.....:	34	

SOURCE DATA:

SOURCE NO. 1

X-COORDINATE OF THE SOURCE.....:	445.00	m
Y-COORDINATE OF THE SOURCE.....:	110.00	m
THE SOURCE STRENGTH.....:	.0012	kg/d
ELAPSED TIME OF THE SOURCE ACTIVITY...:	18250.00	d

SOURCE NO. 2

X-COORDINATE OF THE SOURCE.....:	445.00	m
Y-COORDINATE OF THE SOURCE.....:	87.00	m
THE SOURCE STRENGTH.....:	.0012	kg/d
ELAPSED TIME OF THE SOURCE ACTIVITY...:	18250.00	d

011749

---------- RESULTS ----------

------- X-direction CONCENTRATION in mg/l (ppm) Tetrachloroethylene, 50 years

!

v Y

		460.00 m	480.00 m	500.00 m	520.00 m	540.00 m
0.00	m	0.0097	0.0065	0.0040	0.0023	0.0012
30.00	m	0.0680	0.0419	0.0246	0.0137	0.0072
60.00	m	0.1525	0.1075	0.0720	0.0458	0.0277
90.00	m	0.3820	0.2600	0.1737	0.1117	0.0687
120.00	m	0.3272	0.2349	0.1594	0.1029	0.0632
150.00	m	0.2524	0.1686	0.1088	0.0673	0.0396
180.00	m	0.1416	0.0915	0.0565	0.0332	0.0185
210.00	m	0.0837	0.0514	0.0298	0.0163	0.0084
240.00	m	0.0575	0.0339	0.0189	0.0100	0.0049
270.00	m	0.0060	0.0037	0.0022	0.0012	0.0006
300.00	m	0.0001	0.0001	0.0000	0.0000	0.0000
330.00	m	0.0000	0.0000	0.0000	0.0000	0.0000
360.00	m	0.0000	0.0000	0.0000	0.0000	0.0000
390.00	m	0.0000	0.0000	0.0000	0.0000	0.0000
420.00	m	0.0000	0.0000	0.0000	0.0000	0.0000
450.00	m	0.0000	0.0000	0.0000	0.0000	0.0000
480.00	m	0.0000	0.0000	0.0000	0.0000	0.0000
510.00	m	0.0000	0.0000	0.0000	0.0000	0.0000
540.00	m	0.0000	0.0000	0.0000	0.0000	0.0000
570.00	m	0.0000	0.0000	0.0000	0.0000	0.0000

		560.00 m	580.00 m	600.00 m	620.00 m
0.00	m	0.0006	0.0003	0.0001	0.0000
30.00	m	0.0036	0.0017	0.0008	0.0003
60.00	m	0.0159	0.0086	0.0044	0.0021
90.00	m	0.0401	0.0222	0.0116	0.0057
120.00	m	0.0368	0.0203	0.0105	0.0051
150.00	m	0.0221	0.0116	0.0058	0.0027
180.00	m	0.0098	0.0049	0.0023	0.0010
210.00	m	0.0041	0.0018	0.0008	0.0003
240.00	m	0.0023	0.0010	0.0004	0.0002
270.00	m	0.0003	0.0001	0.0001	0.0000
300.00	m	0.0000	0.0000	0.0000	0.0000
330.00	m	0.0000	0.0000	0.0000	0.0000
360.00	m	0.0000	0.0000	0.0000	0.0000
390.00	m	0.0000	0.0000	0.0000	0.0000
420.00	m	0.0000	0.0000	0.0000	0.0000
450.00	m	0.0000	0.0000	0.0000	0.0000
480.00	m	0.0000	0.0000	0.0000	0.0000
510.00	m	0.0000	0.0000	0.0000	0.0000
540.00	m	0.0000	0.0000	0.0000	0.0000
570.00	m	0.0000	0.0000	0.0000	0.0000

```
*****************************************
*                                       *
*   SOLUTE TRANSPORT FROM POINT SOURCES *
*   IN TWO-DIMENSIONAL UNIFORM FLOW     *
*                                       *
*   MODEL: WMPLUME  (REV 2-23 87)       *
*       CODE USED WAS WMPLUMCD          *
*****************************************
```

USER: sos

LOCATION: Sheridan: toluene, 1 year

DATE: 1/6/88

INPUT DATA:

DARCY VELOCITY.....:	0.02 m/d
EFFECTIVE POROSITY.....:	.3
AQUIFER THICKNESS.....:	10.00 m
LONGITUDINAL DISPERSIVITY.....:	50.00 m
LATERAL DISPERSIVITY.....:	5.00 m
RETARDATION FACTOR.....:	17.46
DECAY CONSTANT (lambda).....:	0 1/d
NUMBER OF POINT SOURCES.....:	34

SOURCE DATA:

SOURCE NO. 1

X-COORDINATE OF THE SOURCE.....:	445.00 m
Y-COORDINATE OF THE SOURCE.....:	110.00 m
THE SOURCE STRENGTH.....:	.013 kg/d
ELAPSED TIME OF THE SOURCE ACTIVITY...:	365.00 d

SOURCE NO. 2

X-COORDINATE OF THE SOURCE.....:	445.00 m
Y-COORDINATE OF THE SOURCE.....:	87.00 m
THE SOURCE STRENGTH.....:	.013 kg/d
ELAPSED TIME OF THE SOURCE ACTIVITY...:	365.00 d

011751

---------- RESULTS ----------

------- Perspective CONCENTRATION in mg/l (ppm) toluene, 1 year

	460.00 m	480.00 m	500.00 m	520.00 m	540.00 m
0.00 m	0.0000	0.0000	0.0000	0.0000	0.0000
30.00 m	0.0000	0.0000	0.0000	0.0000	0.0000
60.00 m	0.0000	0.0000	0.0000	0.0000	0.0000
90.00 m	0.1614	0.0027	0.0000	0.0000	0.0000
120.00 m	0.0037	0.0001	0.0000	0.0000	0.0000
150.00 m	0.0019	0.0000	0.0000	0.0000	0.0000
180.00 m	0.0000	0.0000	0.0000	0.0000	0.0000
210.00 m	0.0000	0.0000	0.0000	0.0000	0.0000
240.00 m	0.0000	0.0000	0.0000	0.0000	0.0000
270.00 m	0.0000	0.0000	0.0000	0.0000	0.0000
300.00 m	0.0000	0.0000	0.0000	0.0000	0.0000
330.00 m	0.0000	0.0000	0.0000	0.0000	0.0000
360.00 m	0.0000	0.0000	0.0000	0.0000	0.0000
390.00 m	0.0000	0.0000	0.0000	0.0000	0.0000
420.00 m	0.0000	0.0000	0.0000	0.0000	0.0000
450.00 m	0.0000	0.0000	0.0000	0.0000	0.0000
480.00 m	0.0000	0.0000	0.0000	0.0000	0.0000
510.00 m	0.0000	0.0000	0.0000	0.0000	0.0000
540.00 m	0.0000	0.0000	0.0000	0.0000	0.0000
570.00 m	0.0000	0.0000	0.0000	0.0000	0.0000

	560.00 m	580.00 m	600.00 m	620.00 m
0.00 m	0.0000	0.0000	0.0000	0.0000
30.00 m	0.0000	0.0000	0.0000	0.0000
60.00 m	0.0000	0.0000	0.0000	0.0000
90.00 m	0.0000	0.0000	0.0000	0.0000
120.00 m	0.0000	0.0000	0.0000	0.0000
150.00 m	0.0000	0.0000	0.0000	0.0000
180.00 m	0.0000	0.0000	0.0000	0.0000
210.00 m	0.0000	0.0000	0.0000	0.0000
240.00 m	0.0000	0.0000	0.0000	0.0000
270.00 m	0.0000	0.0000	0.0000	0.0000
300.00 m	0.0000	0.0000	0.0000	0.0000
330.00 m	0.0000	0.0000	0.0000	0.0000
360.00 m	0.0000	0.0000	0.0000	0.0000
390.00 m	0.0000	0.0000	0.0000	0.0000
420.00 m	0.0000	0.0000	0.0000	0.0000
450.00 m	0.0000	0.0000	0.0000	0.0000
480.00 m	0.0000	0.0000	0.0000	0.0000
510.00 m	0.0000	0.0000	0.0000	0.0000
540.00 m	0.0000	0.0000	0.0000	0.0000
570.00 m	0.0000	0.0000	0.0000	0.0000

```
*****************************************
*                                       *
*   SOLUTE TRANSPORT FROM POINT SOURCES *
*   IN TWO-DIMENSIONAL UNIFORM FLOW     *
*                                       *
*   MODEL: WMPLUME  (REV 2-23 87)       *
*       CODE USED WAS WMPLUMCD          *
*****************************************
```

USER: sns

LOCATION: Sheridan: toluene, 10 years

DATE: 1/6/88

INPUT DATA:

DARCY VELOCITY.....:	0.02	m/d
EFFECTIVE POROSITY.....:	.3	
AQUIFER THICKNESS.....:	10.00	m
LONGITUDINAL DISPERSIVITY.....:	50.00	m
LATERAL DISPERSIVITY.....:	5.00	m
RETARDATION FACTOR.....:	17.46	
DECAY CONSTANT (lambda).....:	0	1/d
NUMBER OF POINT SOURCES.....:	34	

SOURCE DATA:

SOURCE NO. 1

X-COORDINATE OF THE SOURCE.....:	445.00	m
Y-COORDINATE OF THE SOURCE.....:	110.00	m
THE SOURCE STRENGTH.....:	.013	kg/d
ELAPSED TIME OF THE SOURCE ACTIVITY...:	3650.00	d

SOURCE NO. 2

X-COORDINATE OF THE SOURCE.....:	445.00	m
Y-COORDINATE OF THE SOURCE.....:	87.00	m
THE SOURCE STRENGTH.....:	.013	kg/d
ELAPSED TIME OF THE SOURCE ACTIVITY...:	3650.00	d

011753

[illegible] CONCENTRATION in mg/l [illegible] toluene, 10 years

		450.00 m	480.00 m	500.00 m	520.00 m	540.00 m
0.00	m	0.0004	0.0001	0.0000	0.0000	0.0000
30.00	m	0.0315	0.0066	0.0011	0.0002	0.0000
60.00	m	0.1233	0.0532	0.0197	0.0062	0.0016
90.00	m	1.7724	0.5930	0.2335	0.0767	0.0207
120.00	m	0.5178	0.4012	0.1595	0.0519	0.0138
150.00	m	0.5158	0.1939	0.0619	0.0163	0.0035
180.00	m	0.1042	0.0327	0.0084	0.0018	0.0003
210.00	m	0.0173	0.0039	0.0007	0.0001	0.0000
240.00	m	0.0138	0.0030	0.0005	0.0001	0.0000
270.00	m	0.0000	0.0000	0.0000	0.0000	0.0000
300.00	m	0.0000	0.0000	0.0000	0.0000	0.0000
330.00	m	0.0000	0.0000	0.0000	0.0000	0.0000
360.00	m	0.0000	0.0000	0.0000	0.0000	0.0000
390.00	m	0.0000	0.0000	0.0000	0.0000	0.0000
420.00	m	0.0000	0.0000	0.0000	0.0000	0.0000
450.00	m	0.0000	0.0000	0.0000	0.0000	0.0000
480.00	m	0.0000	0.0000	0.0000	0.0000	0.0000
510.00	m	0.0000	0.0000	0.0000	0.0000	0.0000
540.00	m	0.0000	0.0000	0.0000	0.0000	0.0000
570.00	m	0.0000	0.0000	0.0000	0.0000	0.0000

		560.00 m	580.00 m	600.00 m	620.00 m
0.00	m	0.0000	0.0000	0.0000	0.0000
30.00	m	0.0000	0.0000	0.0000	0.0000
60.00	m	0.0003	0.0001	0.0000	0.0000
90.00	m	0.0045	0.0008	0.0001	0.0000
120.00	m	0.0029	0.0005	0.0001	0.0000
150.00	m	0.0006	0.0001	0.0000	0.0000
180.00	m	0.0000	0.0000	0.0000	0.0000
210.00	m	0.0000	0.0000	0.0000	0.0000
240.00	m	0.0000	0.0000	0.0000	0.0000
270.00	m	0.0000	0.0000	0.0000	0.0000
300.00	m	0.0000	0.0000	0.0000	0.0000
330.00	m	0.0000	0.0000	0.0000	0.0000
360.00	m	0.0000	0.0000	0.0000	0.0000
390.00	m	0.0000	0.0000	0.0000	0.0000
420.00	m	0.0000	0.0000	0.0000	0.0000
450.00	m	0.0000	0.0000	0.0000	0.0000
480.00	m	0.0000	0.0000	0.0000	0.0000
510.00	m	0.0000	0.0000	0.0000	0.0000
540.00	m	0.0000	0.0000	0.0000	0.0000
570.00	m	0.0000	0.0000	0.0000	0.0000

011754

```
*****************************************
*                                       *
*   SOLUTE TRANSPORT FROM POINT SOURCES *
*   IN TWO-DIMENSIONAL UNIFORM FLOW     *
*                                       *
*   MODEL: WMPLUME  (REV 2-23 87)       *
*       CODE USED WAS WMPLUMOD          *
*****************************************
```

USER: sos

LOCATION: Sheridan: toluene, 100 years

DATE: 1/6/88

INPUT DATA:

```
DARCY VELOCITY.........................:    0.02 m/d
EFFECTIVE POROSITY.....................:     .3
AQUIFER THICKNESS......................:   10.00 m
LONGITUDINAL DISPERSIVITY..............:   50.00 m
LATERAL DISPERSIVITY...................:    5.00 m
RETARDATION FACTOR.....................:   17.46
DECAY CONSTANT (lambda)................:    0     1/d
NUMBER OF POINT SOURCES................:   34
```

SOURCE DATA:

SOURCE NO. 1

```
X-COORDINATE OF THE SOURCE.............:  445.00 m
Y-COORDINATE OF THE SOURCE.............:  110.00 m
THE SOURCE STRENGTH....................:    .013  kg/d
ELAPSED TIME OF THE SOURCE ACTIVITY....:36500.00 d
```

SOURCE NO. 2

```
X-COORDINATE OF THE SOURCE.............:  445.00 m
Y-COORDINATE OF THE SOURCE.............:   87.00 m
THE SOURCE STRENGTH....................:    .013  kg/d
ELAPSED TIME OF THE SOURCE ACTIVITY....:36500.00 d
```

011755

[illegible] CONCENTRATION in mg/l [illegible] Toluene, 100 years

		460.00 m	480.00 m	500.00 m	520.00 m	540.00 m
0.00	m	1.0679	0.9852	0.9852	0.7763	0.6654
30.00	m	3.5278	3.1138	2.6897	2.2935	1.9277
60.00	m	6.6970	6.1221	5.3369	4.5776	3.8546
90.00	m	11.7684	9.9317	8.4244	7.0748	5.8784
120.00	m	12.1798	10.5350	8.9727	7.5477	6.2[illegible]
150.00	m	11.1031	9.4163	7.9320	6.6177	5.4435
180.00	m	8.9577	7.5889	6.3480	5.2433	4.2725
210.00	m	7.2137	6.0316	4.9747	4.0464	3.2441
240.00	m	5.0474	4.1391	3.3572	2.6937	2.1244
270.00	m	2.0030	1.6671	1.3667	1.1032	0.8766
300.00	m	0.5390	0.4368	0.3533	0.2811	0.2[illegible]
330.00	m	0.1012	0.0798	0.0621	0.0475	0.0364
360.00	m	0.0122	0.0094	0.0072	0.0054	0.00[illegible]
390.00	m	0.0009	0.0007	0.0005	0.0004	0.00[illegible]
420.00	m	0.0000	0.0000	0.0000	0.0000	0.00[illegible]
450.00	m	0.0000	0.0000	0.0000	0.0000	0.00[illegible]
480.00	m	0.0000	0.0000	0.0000	0.0000	0.0000
510.00	m	0.0000	0.0000	0.0000	0.0000	0.0000
540.00	m	0.0000	0.0000	0.0000	0.0000	0.0000
570.00	m	0.0000	0.0000	0.0000	0.0000	0.0000

		560.00 m	580.00 m	600.00 m	620.00 m
0.00	m	0.5379	0.4578	0.3678	0.2892
30.00	m	1.5947	1.2971	1.0366	0.5135
60.00	m	3.1952	2.6044	2.0869	1.6433
90.00	m	4.8199	3.8993	3.1084	2.4396
120.00	m	5.1379	4.1512	3.3041	2.5889
150.00	m	4.4298	3.5505	2.8037	2.1792
180.00	m	3.4319	2.7156	2.1152	1.6210
210.00	m	2.5628	1.9952	1.5254	1.1480
240.00	m	1.6545	1.2690	0.9578	0.7110
270.00	m	0.6853	0.5269	0.3961	0.2956
300.00	m	0.1712	0.1309	0.0985	0.0739
330.00	m	0.0274	0.0204	0.0150	0.0109
360.00	m	0.0029	0.0021	0.0015	0.[illegible]
390.00	m	0.0002	0.0001	0.0001	0.0001
420.00	m	0.0000	0.0000	0.0000	0.0000
450.00	m	0.0000	0.0000	0.0000	0.0000
480.00	m	0.0000	0.0000	0.0000	0.0000
510.00	m	0.0000	0.0000	0.0000	0.0000
540.00	m	0.0000	0.0000	0.0000	0.0000
570.00	m	0.0000	0.0000	0.0000	0.0000

```
*****************************************
*                                       *
*   SOLUTE TRANSPORT FROM POINT SOURCES *
*   IN TWO-DIMENSIONAL UNIFORM FLOW     *
*                                       *
*   MODEL: WMPLUME  (REV 2-23 87)       *
*       CODE USED WAS WMPLOMOD          *
*****************************************
```

USER: sjr

LOCATION: Sheridan; trichloroethylene 1 year

DATE: 1/13/88

INPUT DATA:

DARCY VELOCITY.....:	0.02 m/d
EFFECTIVE POROSITY.....:	.3
AQUIFER THICKNESS.....:	10.00 m
LONGITUDINAL DISPERSIVITY.....:	50.00 m
LATERAL DISPERSIVITY.....:	5.00 m
RETARDATION FACTOR.....:	7.55
DECAY CONSTANT (lambda).....:	0 1/d
NUMBER OF POINT SOURCES.....:	34

011757

SOURCE DATA:

SOURCE NO. 1

X-COORDINATE OF THE SOURCE.....:	445.00 m
Y-COORDINATE OF THE SOURCE.....:	110.00 m
THE SOURCE STRENGTH.....:	.0014 kg/d
ELAPSED TIME OF THE SOURCE ACTIVITY...:	365.00 d

SOURCE NO. 2

X-COORDINATE OF THE SOURCE.....:	445.00 m
Y-COORDINATE OF THE SOURCE.....:	97.00 m
THE SOURCE STRENGTH.....:	.0014 kg/d
ELAPSED TIME OF THE SOURCE ACTIVITY...:	365.00 d

CONCENTRATION in mg/l (ppm) trichloroethylene; 1 year

	460.00 m	480.00 m	500.00 m	520.00 m	540.00 m
0.00 m	0.0000	0.0000	0.0000	0.0000	0.0000
30.00 m	0.0000	0.0000	0.0000	0.0000	0.0000
60.00 m	0.0000	0.0000	0.0000	0.0000	0.0000
90.00 m	0.0472	0.0052	0.0003	0.0000	0.0000
120.00 m	0.0075	0.0011	0.0001	0.0000	0.0000
150.00 m	0.0044	0.0002	0.0000	0.0000	0.0000
180.00 m	0.0000	0.0000	0.0000	0.0000	0.0000
210.00 m	0.0000	0.0000	0.0000	0.0000	0.0000
240.00 m	0.0000	0.0000	0.0000	0.0000	0.0000
270.00 m	0.0000	0.0000	0.0000	0.0000	0.0000
300.00 m	0.0000	0.0000	0.0000	0.0000	0.0000
330.00 m	0.0000	0.0000	0.0000	0.0000	0.0000
360.00 m	0.0000	0.0000	0.0000	0.0000	0.0000
390.00 m	0.0000	0.0000	0.0000	0.0000	0.0000
420.00 m	0.0000	0.0000	0.0000	0.0000	0.0000
450.00 m	0.0000	0.0000	0.0000	0.0000	0.0000
480.00 m	0.0000	0.0000	0.0000	0.0000	0.0000
510.00 m	0.0000	0.0000	0.0000	0.0000	0.0000
540.00 m	0.0000	0.0000	0.0000	0.0000	0.0000
570.00 m	0.0000	0.0000	0.0000	0.0000	0.0000

	560.00 m	580.00 m	600.00 m	620.00 m
0.00 m	0.0000	0.0000	0.0000	0.0000
30.00 m	0.0000	0.0000	0.0000	0.0000
60.00 m	0.0000	0.0000	0.0000	0.0000
90.00 m	0.0000	0.0000	0.0000	0.0000
120.00 m	0.0000	0.0000	0.0000	0.0000
150.00 m	0.0000	0.0000	0.0000	0.0000
180.00 m	0.0000	0.0000	0.0000	0.0000
210.00 m	0.0000	0.0000	0.0000	0.0000
240.00 m	0.0000	0.0000	0.0000	0.0000
270.00 m	0.0000	0.0000	0.0000	0.0000
300.00 m	0.0000	0.0000	0.0000	0.0000
330.00 m	0.0000	0.0000	0.0000	0.0000
360.00 m	0.0000	0.0000	0.0000	0.0000
390.00 m	0.0000	0.0000	0.0000	0.0000
420.00 m	0.0000	0.0000	0.0000	0.0000
450.00 m	0.0000	0.0000	0.0000	0.0000
480.00 m	0.0000	0.0000	0.0000	0.0000
510.00 m	0.0000	0.0000	0.0000	0.0000
540.00 m	0.0000	0.0000	0.0000	0.0000
570.00 m	0.0000	0.0000	0.0000	0.0000

011758

```
*****************************************************
*                                                   *
*   SOLUTE TRANSPORT FROM POINT SOURCES             *
*   IN TWO-DIMENSIONAL UNIFORM FLOW                 *
*                                                   *
*   MODEL: WMFLOWE  (REV 2-23 87)                   *
*        CODE USED WAS WMFLOWCD                     *
*****************************************************
```

USER: sos

LOCATION: Sheridan: trichloroethylene 10 years

DATE: 1/7/88

INPUT DATA:

```
DARCY VELOCITY.........................:    0.02 m/d
EFFECTIVE POROSITY.....................:     .3
AQUIFER THICKNESS......................:   10.00 m
LONGITUDINAL DISPERSIVITY..............:   50.00 m
LATERAL DISPERSIVITY...................:    5.00 m
RETARDATION FACTOR.....................:    7.55
DECAY CONSTANT (lambda)................:    0     1/d
NUMBER OF POINT SOURCES................:   21
```

SOURCE DATA:

SOURCE NO. 1

```
X-COORDINATE OF THE SOURCE.............:  447.00 m
Y-COORDINATE OF THE SOURCE.............:  110.00 m
THE SOURCE STRENGTH....................:    .0014  kg/d
ELAPSED TIME OF THE SOURCE ACTIVITY...: 3650.00 d
```

SOURCE NO. 2

```
X-COORDINATE OF THE SOURCE.............:  447.00 m
Y-COORDINATE OF THE SOURCE.............:   87.00 m
THE SOURCE STRENGTH....................:    .0014  kg/d
ELAPSED TIME OF THE SOURCE ACTIVITY...: 3650.00 d
```

011759

Trichloroethylene; 10 year

		460.00 m	480.00 m	500.00 m	520.00 m	540.00 m
0.00	m	0.0076	0.0023	0.0010	0.0004	0.0002
30.00	m	0.0226	0.0194	0.0090	0.0039	0.0015
60.00	m	0.0948	0.0598	0.0352	0.0193	0.0099
90.00	m	0.3144	0.1941	0.1158	0.0651	0.0341
120.00	m	0.3[illegible]	0.1646	0.0995	0.0588	0.0291
150.00	m	0.1229	0.1079	0.0602	0.0314	0.0157
180.00	m	0.0343	0.0470	0.0244	0.0118	0.0052
210.00	m	0.0402	0.0205	0.0096	0.0041	0.0015
240.00	m	0.0235	0.0139	0.0057	0.0026	0.0010
270.00	m	0.0013	0.0007	0.0003	0.0001	0.0001
300.00	m	0.0000	0.0000	0.0000	0.0000	0.0000
330.00	m	0.0000	0.0000	0.0000	0.0000	0.0000
360.00	m	0.0000	0.0000	0.0000	0.0000	0.0000
390.00	m	0.0000	0.0000	0.0000	0.0000	0.0000
420.00	m	0.0000	0.0000	0.0000	0.0000	0.0000
450.00	m	0.0000	0.0000	0.0000	0.0000	0.0000
480.00	m	0.0000	0.0000	0.0000	0.0000	0.0000
510.00	m	0.0000	0.0000	0.0000	0.0000	0.0000
540.00	m	0.0000	0.0000	0.0000	0.0000	0.0000
570.00	m	0.0000	0.0000	0.0000	0.0000	0.0000

		560.00 m	580.00 m	600.00 m	620.00 m
0.00	m	0.0001	0.0000	0.0000	0.0000
30.00	m	0.0005	0.0002	0.0001	0.0000
60.00	m	0.0047	0.0020	0.0008	0.0003
90.00	m	0.0165	0.0073	0.0030	0.0011
120.00	m	0.0139	0.0061	0.0025	0.0009
150.00	m	0.0068	0.0028	0.0010	0.0004
180.00	m	0.0022	0.0008	0.0003	0.0001
210.00	m	0.0006	0.0002	0.0001	0.0000
240.00	m	0.0003	0.0001	0.0000	0.0000
270.00	m	0.0000	0.0000	0.0000	0.0000
300.00	m	0.0000	0.0000	0.0000	0.0000
330.00	m	0.0000	0.0000	0.0000	0.0000
360.00	m	0.0000	0.0000	0.0000	0.0000
390.00	m	0.0000	0.0000	0.0000	0.0000
420.00	m	0.0000	0.0000	0.0000	0.0000
450.00	m	0.0000	0.0000	0.0000	0.0000
480.00	m	0.0000	0.0000	0.0000	0.0000
510.00	m	0.0000	0.0000	0.0000	0.0000
540.00	m	0.0000	0.0000	0.0000	0.0000
570.00	m	0.0000	0.0000	0.0000	0.0000

```
*****************************************
*                                       *
*   SOLUTE TRANSPORT FROM POINT SOURCES *
*   IN TWO-DIMENSIONAL UNIFORM FLOW     *
*                                       *
*   MODEL: WMPLUME  (REV 2-23 87)       *
*       CODE USED WAS WMPLOMOD          *
*****************************************
```

USER: sjr

LOCATION: Sheridan; trichloroethylene, 20 years

DATE: 1/13/88

INPUT DATA:

DARCY VELOCITY.....	0.02	m/d
EFFECTIVE POROSITY.....	.3	
AQUIFER THICKNESS.....	10.00	m
LONGITUDINAL DISPERSIVITY.....	50.00	m
LATERAL DISPERSIVITY.....	5.00	m
RETARDATION FACTOR.....	7.55	
DECAY CONSTANT (lambda).....	0	1/d
NUMBER OF POINT SOURCES.....	34	

SOURCE DATA:

SOURCE NO. 1

X-COORDINATE OF THE SOURCE.....	445.00	m
Y-COORDINATE OF THE SOURCE.....	110.00	m
THE SOURCE STRENGTH.....	.0014	kg/d
ELAPSED TIME OF THE SOURCE ACTIVITY...:	7300.00	d

SOURCE NO. 2

X-COORDINATE OF THE SOURCE.....	445.00	m
Y-COORDINATE OF THE SOURCE.....	87.00	m
THE SOURCE STRENGTH.....	.0014	kg/d
ELAPSED TIME OF THE SOURCE ACTIVITY...:	7300.00	d

011761

RESULTS

x-direction

CONCENTRATION in mg/l (ppm) trichloroethylene, 20 years

Y

	460.00 m	480.00 m	500.00 m	520.00 m	540.00 m
0.00 m	0.0279	0.0213	0.0154	0.0105	0.0068
30.00 m	0.1440	0.1025	0.0707	0.0472	0.0304
60.00 m	0.3000	0.2307	0.1708	0.1219	0.0838
90.00 m	0.6217	0.4576	0.3337	0.2374	0.1640
120.00 m	0.5660	0.4349	0.3217	0.2304	0.1596
150.00 m	0.4582	0.3355	0.2405	0.1677	0.1132
180.00 m	0.2981	0.2143	0.1494	0.1008	0.0657
210.00 m	0.2052	0.1430	0.0961	0.0621	0.0386
240.00 m	0.1383	0.0933	0.0608	0.0382	0.0230
270.00 m	0.0246	0.0174	0.0119	0.0076	0.0047
300.00 m	0.0015	0.0010	0.0007	0.0004	0.0003
330.00 m	0.0000	0.0000	0.0000	0.0000	0.0000
360.00 m	0.0000	0.0000	0.0000	0.0000	0.0000
390.00 m	0.0000	0.0000	0.0000	0.0000	0.0000
420.00 m	0.0000	0.0000	0.0000	0.0000	0.0000
450.00 m	0.0000	0.0000	0.0000	0.0000	0.0000
480.00 m	0.0000	0.0000	0.0000	0.0000	0.0000
510.00 m	0.0000	0.0000	0.0000	0.0000	0.0000
540.00 m	0.0000	0.0000	0.0000	0.0000	0.0000
570.00 m	0.0000	0.0000	0.0000	0.0000	0.0000

	560.00 m	580.00 m	600.00 m	620.00 m
0.00 m	0.0042	0.0025	0.0014	0.0007
30.00 m	0.0189	0.0112	0.0064	0.0035
60.00 m	0.0555	0.0353	0.0216	0.0127
90.00 m	0.1096	0.0706	0.0439	0.0262
120.00 m	0.1068	0.0688	0.0427	0.0254
150.00 m	0.0738	0.0463	0.0280	0.0162
180.00 m	0.0412	0.0249	0.0144	0.0080
210.00 m	0.0230	0.0132	0.0072	0.0038
240.00 m	0.0134	0.0074	0.0039	0.0020
270.00 m	0.0028	0.0016	0.0008	0.0004
300.00 m	0.0002	0.0001	0.0000	0.0000
330.00 m	0.0000	0.0000	0.0000	0.0000
360.00 m	0.0000	0.0000	0.0000	0.0000
390.00 m	0.0000	0.0000	0.0000	0.0000
420.00 m	0.0000	0.0000	0.0000	0.0000
450.00 m	0.0000	0.0000	0.0000	0.0000
480.00 m	0.0000	0.0000	0.0000	0.0000
510.00 m	0.0000	0.0000	0.0000	0.0000
540.00 m	0.0000	0.0000	0.0000	0.0000
570.00 m	0.0000	0.0000	0.0000	0.0000

```
*                                                    *
*   SOLUTE TRANSPORT FROM POINT SOURCES              *
*   IN TWO-DIMENSIONAL UNIFORM FLOW                  *
*                                                    *
*   MODEL: WMPLUME  (RE. 2-[illegible])                  *
*       CODE USED WAS WMPLUMCD                       *
*****************************************************
```

USER: sps

LOCATION: Sheridan chromium, 1 year

DATE: 1/6/88

INPUT DATA:

DARCY VELOCITY.....:	0.02 m/d
EFFECTIVE POROSITY.....:	.3
AQUIFER THICKNESS.....:	10.00 m
LONGITUDINAL DISPERSIVITY.....:	50.00 m
LATERAL DISPERSIVITY.....:	5.00 m
RETARDATION FACTOR.....:	54.00
DECAY CONSTANT (lambda.....:	0 1/d
NUMBER OF POINT SOURCES.....:	34

SOURCE DATA:

SOURCE NO. 1

X-COORDINATE OF THE SOURCE.....:	445.00 m
Y-COORDINATE OF THE SOURCE.....:	110.00 m
THE SOURCE STRENGTH.....:	.0312 kg/d
ELAPSED TIME OF THE SOURCE ACTIVITY...:	365.00 d

SOURCE NO. 2

X-COORDINATE OF THE SOURCE.....:	445.00 m
Y-COORDINATE OF THE SOURCE.....:	87.00 m
THE SOURCE STRENGTH.....:	.0312 kg/d
ELAPSED TIME OF THE SOURCE ACTIVITY...:	365.00 d

011763

[illegible] 2D 2E [illegible] Serum cm, 1year

		[illegible] m	420.00 m	[illegible] m	520.00 m	540.00 m
[illegible]	m	[illegible]	0.0000	0.0000	0.0000	0.0000
[illegible]	m	[illegible]	[illegible]	[illegible]	[illegible]	0.0000
[illegible]	m	[illegible]	[illegible]	[illegible]	[illegible]	0.0000
[illegible]	m	[illegible]	0.0000	0.0000	0.0000	0.0000
120.00	m	0.0000	0.0000	0.0000	0.0000	0.0000
150.00	m	0.0000	0.0000	0.0000	0.0000	0.0000
180.00	m	[illegible]	0.0000	0.0000	0.0000	0.0000
210.00	m	[illegible]	0.0000	0.0000	0.0000	0.0000
240.00	m	0.0000	0.0000	0.0000	0.0000	0.0000
270.00	m	[illegible]	0.0000	0.0000	0.0000	0.0000
300.00	m	0.0000	0.0000	0.0000	0.0000	0.0000
330.00	m	0.0000	0.0000	0.0000	0.0000	0.0000
360.00	m	0.0000	0.0000	0.0000	0.0000	0.0000
390.00	m	0.0000	0.0000	0.0000	0.0000	0.0000
420.00	m	0.0000	0.0000	0.0000	0.0000	0.0000
450.00	m	0.0000	0.0000	0.0000	0.0000	0.0000
480.00	m	0.0000	0.0000	0.0000	0.0000	0.0000
510.00	m	0.0000	0.0000	0.0000	0.0000	0.0000
540.00	m	0.0000	0.0000	0.0000	0.0000	0.0000
570.00	m	0.0000	0.0000	0.0000	0.0000	0.0000

		560.00 m	580.00 m	600.00 m	620.00 m	640.00 m
[illegible]	m	0.0000	0.0000	0.0000	0.0000	0.0000
[illegible]	m	[illegible]	0.0000	0.0000	0.0000	0.0000
60.00	m	0.0000	0.0000	0.0000	0.0000	0.0000
90.00	m	0.0000	0.0000	0.0000	0.0000	0.0000
120.00	m	0.0000	0.0000	0.0000	0.0000	0.0000
150.00	m	0.0000	0.0000	0.0000	0.0000	0.0000
180.00	m	0.0000	0.0000	0.0000	0.0000	0.0000
210.00	m	0.0000	0.0000	0.0000	0.0000	0.0000
240.00	m	0.0000	0.0000	0.0000	0.0000	0.0000
270.00	m	0.0000	0.0000	0.0000	0.0000	0.0000
300.00	m	0.0000	0.0000	0.0000	0.0000	0.0000
330.00	m	0.0000	0.0000	0.0000	0.0000	0.0000
360.00	m	0.0000	0.0000	0.0000	0.0000	0.0000
390.00	m	0.0000	0.0000	0.0000	0.0000	0.0000
420.00	m	0.0000	0.0000	0.0000	0.0000	0.0000
450.00	m	0.0000	0.0000	0.0000	0.0000	0.0000
480.00	m	0.0000	0.0000	0.0000	0.0000	0.0000
510.00	m	0.0000	0.0000	0.0000	0.0000	0.0000
540.00	m	0.0000	0.0000	0.0000	0.0000	0.0000
570.00	m	0.0000	0.0000	0.0000	0.0000	0.0000

		660.00 m	680.00 m
0.00	m	0.0000	0.0000
[illegible]	m	0.0000	0.0000
[illegible]	m	0.0000	0.0000
[illegible]	m	0.0000	0.0000
120.00	m	0.0000	0.0000
150.00	m	0.0000	0.0000
[illegible]	m	0.0000	0.0000
[illegible]	m	0.0000	0.0000
[illegible]	m	0.0000	0.0000
[illegible]	m	0.0000	0.0000
[illegible]	m	0.0000	0.0000
330.00	m	0.0000	0.0000
360.00	m	0.0000	0.0000
390.00	m	0.0000	0.0000
420.00	m	0.0000	0.0000
[illegible]	m	[illegible]	0.0000
[illegible]	m	[illegible]	0.0000
[illegible]	m	[illegible]	0.0000
[illegible]	m	[illegible]	[illegible]

011764

```
*****************************************
*                                       *
*   SOLUTE TRANSPORT FROM POINT SOURCES *
*   IN TWO-DIMENSIONAL UNIFORM FLOW     *
*                                       *
*   MODEL: WMPLUME  (REV 2-23 87)       *
*       CODE USED WAS WMPL2MOD          *
*****************************************
```

USER: sps

LOCATION: Sheridan chromium, 10 years

DATE: 1/6/88

INPUT DATA:

```
DARCY VELOCITY.........................:    0.02 m/d
EFFECTIVE POROSITY.....................:     .3
AQUIFER THICKNESS......................:   10.00 m
LONGITUDINAL DISPERSIVITY..............:   50.00 m
LATERAL DISPERSIVITY...................:    5.00 m
RETARDATION FACTOR.....................:   54.00
DECAY CONSTANT (lambda)................:    0     1/d
NUMBER OF POINT SOURCES................:   34
```

SOURCE DATA:

SOURCE NO. 1

```
X-COORDINATE OF THE SOURCE.............:  445.00 m
Y-COORDINATE OF THE SOURCE.............:  110.00 m
THE SOURCE STRENGTH....................:    .0312  kg/d
ELAPSED TIME OF THE SOURCE ACTIVITY....: 7650.00 d
```

SOURCE NO. 2

```
X-COORDINATE OF THE SOURCE.............:  445.00 m
Y-COORDINATE OF THE SOURCE.............:   87.00 m
THE SOURCE STRENGTH....................:    .0312  kg/d
ELAPSED TIME OF THE SOURCE ACTIVITY....: 7650.00 d
```

011765

********** RESULTS **********

X-direction CONCENTRATION in mg/l (ppm) Chromium, 10 years

	460.00 m	480.00 m	500.00 m	520.00 m	540.00 m
0.00 m	0.0000	0.0000	0.0000	0.0000	0.0000
30.00 m	0.0000	0.0000	0.0000	0.0000	0.0000
60.00 m	0.0021	0.0002	0.0000	0.0000	0.0000
90.00 m	1.2655	0.2281	0.0248	0.0013	0.0000
120.00 m	0.2482	0.0767	0.0085	0.0005	0.0000
150.00 m	0.2043	0.0198	0.0010	0.0000	0.0000
180.00 m	0.0019	0.0001	0.0000	0.0000	0.0000
210.00 m	0.0000	0.0000	0.0000	0.0000	0.0000
240.00 m	0.0000	0.0000	0.0000	0.0000	0.0000
270.00 m	0.0000	0.0000	0.0000	0.0000	0.0000
300.00 m	0.0000	0.0000	0.0000	0.0000	0.0000
330.00 m	0.0000	0.0000	0.0000	0.0000	0.0000
360.00 m	0.0000	0.0000	0.0000	0.0000	0.0000
390.00 m	0.0000	0.0000	0.0000	0.0000	0.0000
420.00 m	0.0000	0.0000	0.0000	0.0000	0.0000
450.00 m	0.0000	0.0000	0.0000	0.0000	0.0000
480.00 m	0.0000	0.0000	0.0000	0.0000	0.0000
510.00 m	0.0000	0.0000	0.0000	0.0000	0.0000
540.00 m	0.0000	0.0000	0.0000	0.0000	0.0000
570.00 m	0.0000	0.0000	0.0000	0.0000	0.0000

	560.00 m	580.00 m	600.00 m	620.00 m	640.00 m
0.00 m	0.0000	0.0000	0.0000	0.0000	0.0000
30.00 m	0.0000	0.0000	0.0000	0.0000	0.0000
60.00 m	0.0000	0.0000	0.0000	0.0000	0.0000
90.00 m	0.0000	0.0000	0.0000	0.0000	0.0000
120.00 m	0.0000	0.0000	0.0000	0.0000	0.0000
150.00 m	0.0000	0.0000	0.0000	0.0000	0.0000
180.00 m	0.0000	0.0000	0.0000	0.0000	0.0000
210.00 m	0.0000	0.0000	0.0000	0.0000	0.0000
240.00 m	0.0000	0.0000	0.0000	0.0000	0.0000
270.00 m	0.0000	0.0000	0.0000	0.0000	0.0000
300.00 m	0.0000	0.0000	0.0000	0.0000	0.0000
330.00 m	0.0000	0.0000	0.0000	0.0000	0.0000
360.00 m	0.0000	0.0000	0.0000	0.0000	0.0000
390.00 m	0.0000	0.0000	0.0000	0.0000	0.0000
420.00 m	0.0000	0.0000	0.0000	0.0000	0.0000
450.00 m	0.0000	0.0000	0.0000	0.0000	0.0000
480.00 m	0.0000	0.0000	0.0000	0.0000	0.0000
510.00 m	0.0000	0.0000	0.0000	0.0000	0.0000
540.00 m	0.0000	0.0000	0.0000	0.0000	0.0000
570.00 m	0.0000	0.0000	0.0000	0.0000	0.0000

	660.00 m	680.00 m
0.00 m	0.0000	0.0000
30.00 m	0.0000	0.0000
60.00 m	0.0000	0.0000
90.00 m	0.0000	0.0000
120.00 m	0.0000	0.0000
150.00 m	0.0000	0.0000
180.00 m	0.0000	0.0000
210.00 m	0.0000	0.0000
240.00 m	0.0000	0.0000
270.00 m	0.0000	0.0000
300.00 m	0.0000	0.0000
330.00 m	0.0000	0.0000
360.00 m	0.0000	0.0000
390.00 m	0.0000	0.0000
420.00 m	0.0000	0.0000
450.00 m	0.0000	0.0000
480.00 m	0.0000	0.0000
510.00 m	0.0000	0.0000
540.00 m	0.0000	0.0000
570.00 m	0.0000	0.0000

011766

```
*****************************************
*                                       *
*   SOLUTE TRANSPORT FROM POINT SOURCES *
*   IN TWO-DIMENSIONAL UNIFORM FLOW     *
*                                       *
*   MODEL: WMPLUME  (REV 2-23 87)       *
*       CODE USED WAS WMPL2MOD          *
*****************************************
```

USER: sps

LOCATION: Sheridan: lead , 10 years

DATE: 1/6/85

INPUT DATA.

DARCY VELOCITY.....	0.02	m/d
EFFECTIVE POROSITY.....	.3	
AQUIFER THICKNESS.....	10.00	m
LONGITUDINAL DISPERSIVITY.....	50.00	m
LATERAL DISPERSIVITY.....	5.00	m
RETARDATION FACTOR.....	54.00	
DECAY CONSTANT (lamda).....	0	1/d
NUMBER OF POINT SOURCES.....	74	

SOURCE DATA:

SOURCE NO. 1

X-COORDINATE OF THE SOURCE.....	445.00	m
Y-COORDINATE OF THE SOURCE.....	110.00	m
THE SOURCE STRENGTH.....	.0674	kg/d
ELAPSED TIME OF THE SOURCE ACTIVITY...	3650.00	d

SOURCE NO. 2

X-COORDINATE OF THE SOURCE.....	445.00	m
Y-COORDINATE OF THE SOURCE.....	67.00	m
THE SOURCE STRENGTH.....	.0674	kg/d
ELAPSED TIME OF THE SOURCE ACTIVITY...	3650.00	d

011766-001

RESULTS

x-direction CONCENTRATION in mg/l (ppm) lead, 10 years

		460.00 m	480.00 m	500.00 m	520.00 m	540.00 m
0.00	m	0.0000	0.0000	0.0000	0.0000	0.0000
30.00	m	0.0001	0.0000	0.0000	0.0000	0.0000
60.00	m	0.0042	0.0005	0.0000	0.0000	0.0000
90.00	m	2.5715	0.4839	0.0503	0.0026	0.0001
120.00	m	0.7075	0.1559	0.0172	0.0009	0.0000
150.00	m	0.4151	0.0403	0.0020	0.0000	0.0000
180.00	m	0.0038	0.0002	0.0000	0.0000	0.0000
210.00	m	0.0000	0.0000	0.0000	0.0000	0.0000
240.00	m	0.0000	0.0000	0.0000	0.0000	0.0000
270.00	m	0.0000	0.0000	0.0000	0.0000	0.0000
300.00	m	0.0000	0.0000	0.0000	0.0000	0.0000
330.00	m	0.0000	0.0000	0.0000	0.0000	0.0000
360.00	m	0.0000	0.0000	0.0000	0.0000	0.0000
390.00	m	0.0000	0.0000	0.0000	0.0000	0.0000
420.00	m	0.0000	0.0000	0.0000	0.0000	0.0000
450.00	m	0.0000	0.0000	0.0000	0.0000	0.0000
480.00	m	0.0000	0.0000	0.0000	0.0000	0.0000
510.00	m	0.0000	0.0000	0.0000	0.0000	0.0000
540.00	m	0.0000	0.0000	0.0000	0.0000	0.0000
570.00	m	0.0000	0.0000	0.0000	0.0000	0.0000

011767

		560.00 m	580.00 m	600.00 m	620.00 m
0.00	m	0.0000	0.0000	0.0000	0.0000
30.00	m	0.0000	0.0000	0.0000	0.0000
60.00	m	0.0000	0.0000	0.0000	0.0000
90.00	m	0.0000	0.0000	0.0000	0.0000
120.00	m	0.0000	0.0000	0.0000	0.0000
150.00	m	0.0000	0.0000	0.0000	0.0000
180.00	m	0.0000	0.0000	0.0000	0.0000
210.00	m	0.0000	0.0000	0.0000	0.0000
240.00	m	0.0000	0.0000	0.0000	0.0000
270.00	m	0.0000	0.0000	0.0000	0.0000
300.00	m	0.0000	0.0000	0.0000	0.0000
330.00	m	0.0000	0.0000	0.0000	0.0000
360.00	m	0.0000	0.0000	0.0000	0.0000
390.00	m	0.0000	0.0000	0.0000	0.0000
420.00	m	0.0000	0.0000	0.0000	0.0000
450.00	m	0.0000	0.0000	0.0000	0.0000
480.00	m	0.0000	0.0000	0.0000	0.0000
510.00	m	0.0000	0.0000	0.0000	0.0000
540.00	m	0.0000	0.0000	0.0000	0.0000
570.00	m	0.0000	0.0000	0.0000	0.0000

```
*****************************************
*                                       *
*   SOLUTE TRANSPORT FROM POINT SOURCES *
*   IN TWO-DIMENSIONAL UNIFORM FLOW     *
*                                       *
*   MODEL: WMPLUME  (REV 2-23 87)       *
*       CODE USED WAS WMPLIMOD          *
*****************************************
```

USER: sjr

LOCATION: Sheridan; lead , 30 years

DATE: 1/13/88

INPUT DATA:

```
DARCY VELOCITY.........................:    0.02 m/d
EFFECTIVE POROSITY.....................:     .3
AQUIFER THICKNESS......................:   10.00 m
LONGITUDINAL DISPERSIVITY..............:   50.00 m
LATERAL DISPERSIVITY...................:    5.00 m
RETARDATION FACTOR.....................:   54.00
DECAY CONSTANT (lambda)................:    0     1/d
NUMBER OF POINT SOURCES................:   34
```

SOURCE DATA:

SOURCE NO. 1

```
X-COORDINATE OF THE SOURCE............:  445.00 m
Y-COORDINATE OF THE SOURCE............:  110.00 m
THE SOURCE STRENGTH...................:    .0634  kg/d
ELAPSED TIME OF THE SOURCE ACTIVITY...:10950.00 d
```

SOURCE NO. 2

```
X-COORDINATE OF THE SOURCE............:  445.00 m
Y-COORDINATE OF THE SOURCE............:   27.00 m
THE SOURCE STRENGTH...................:    .0634  kg/d
ELAPSED TIME OF THE SOURCE ACTIVITY...:10950.00 d
```

011768

+-------> X-direction CONCENTRATION in mg/l (ppm) lead, 30 years
:
v Y

		460.00 m	480.00 m	500.00 m	520.00 m	540.00 m
0.00	m	0.0014	0.0003	0.0001	0.0000	0.0000
30.00	m	0.1364	0.0283	0.0046	0.0006	0.0001
60.00	m	0.5637	0.2369	0.0852	0.0257	0.0064
90.00	m	6.3497	2.7798	1.0660	0.3416	0.0891
120.00	m	3.8587	1.8630	0.7242	0.2292	0.0586
150.00	m	2.4323	0.8931	0.2768	0.0702	0.0143
180.00	m	0.4857	0.1470	0.0363	0.0072	0.0012
210.00	m	0.0750	0.0163	0.0027	0.0004	0.0000
240.00	m	0.0599	0.0126	0.0021	0.0003	0.0000
270.00	m	0.0001	0.0000	0.0000	0.0000	0.0000
300.00	m	0.0000	0.0000	0.0000	0.0000	0.0000
330.00	m	0.0000	0.0000	0.0000	0.0000	0.0000
360.00	m	0.0000	0.0000	0.0000	0.0000	0.0000
390.00	m	0.0000	0.0000	0.0000	0.0000	0.0000
420.00	m	0.0000	0.0000	0.0000	0.0000	0.0000
450.00	m	0.0000	0.0000	0.0000	0.0000	0.0000
480.00	m	0.0000	0.0000	0.0000	0.0000	0.0000
510.00	m	0.0000	0.0000	0.0000	0.0000	0.0000
540.00	m	0.0000	0.0000	0.0000	0.0000	0.0000
570.00	m	0.0000	0.0000	0.0000	0.0000	0.0000

		560.00 m	580.00 m	600.00 m	620.00 m
0.00	m	0.0000	0.0000	0.0000	0.0000
30.00	m	0.0000	0.0000	0.0000	0.0000
60.00	m	0.0013	0.0002	0.0000	0.0000
90.00	m	0.0186	0.0031	0.0004	0.0000
120.00	m	0.0120	0.0019	0.0002	0.0000
150.00	m	0.0023	0.0003	0.0000	0.0000
180.00	m	0.0002	0.0000	0.0000	0.0000
210.00	m	0.0000	0.0000	0.0000	0.0000
240.00	m	0.0000	0.0000	0.0000	0.0000
270.00	m	0.0000	0.0000	0.0000	0.0000
300.00	m	0.0000	0.0000	0.0000	0.0000
330.00	m	0.0000	0.0000	0.0000	0.0000
360.00	m	0.0000	0.0000	0.0000	0.0000
390.00	m	0.0000	0.0000	0.0000	0.0000
420.00	m	0.0000	0.0000	0.0000	0.0000
450.00	m	0.0000	0.0000	0.0000	0.0000
480.00	m	0.0000	0.0000	0.0000	0.0000
510.00	m	0.0000	0.0000	0.0000	0.0000
540.00	m	0.0000	0.0000	0.0000	0.0000
570.00	m	0.0000	0.0000	0.0000	0.0000

0011769

```
*********************************************
*                                           *
*   SOLUTE TRANSPORT FROM POINT SOURCES     *
*   IN TWO-DIMENSIONAL UNIFORM FLOW         *
*                                           *
*   MODEL: WMPLUME  (REV 2-23 87)           *
*        CODE USED WAS WMPL2MOD             *
*********************************************
```

USER: sds

LOCATION: Sheridan: nickel, 10 years

DATE: 1/6/88

011770

INPUT DATA:

DARCY VELOCITY.....:	0.02	m/d
EFFECTIVE POROSITY.....:	.3	
AQUIFER THICKNESS.....:	10.00	m
LONGITUDINAL DISPERSIVITY.....:	50.00	m
LATERAL DISPERSIVITY.....:	5.00	m
RETARDATION FACTOR.....:	54.00	
DECAY CONSTANT (lambda).....:	0	1/d
NUMBER OF POINT SOURCES.....:	34	

SOURCE DATA:

SOURCE NO. 1

X-COORDINATE OF THE SOURCE.....:	445.00	m
Y-COORDINATE OF THE SOURCE.....:	110.00	m
THE SOURCE STRENGTH.....:	.0184	kg/d
ELAPSED TIME OF THE SOURCE ACTIVITY...:	3650.00	d

SOURCE NO. 2

X-COORDINATE OF THE SOURCE.....:	445.00	m
Y-COORDINATE OF THE SOURCE.....:	87.00	m
THE SOURCE STRENGTH.....:	.0184	kg/d
ELAPSED TIME OF THE SOURCE ACTIVITY...:	3650.00	d

[illegible] Nickel, 10 years

	450.00 m	480.00 m	500.00 m	520.00 m	540.00 m
0.00 m	0.0000	0.0000	0.0000	0.0000	0.0000
30.00 m	0.0000	0.0000	0.0000	0.0000	0.0000
60.00 m	0.0012	0.0001	0.0000	0.0000	0.0000
90.00 m	0.7463	0.1404	0.0146	0.0003	0.0000
120.00 m	0.2053	0.0452	0.0050	0.0003	0.0000
150.00 m	0.1205	0.0117	0.0006	0.0000	0.0000
180.00 m	0.0011	0.0000	0.0000	0.0000	0.0000
210.00 m	0.0000	0.0000	0.0000	0.0000	0.0000
240.00 m	0.0000	0.0000	0.0000	0.0000	0.0000
270.00 m	0.0000	0.0000	0.0000	0.0000	0.0000
300.00 m	0.0000	0.0000	0.0000	0.0000	0.0000
330.00 m	0.0000	0.0000	0.0000	0.0000	0.0000
360.00 m	0.0000	0.0000	0.0000	0.0000	0.0000
390.00 m	0.0000	0.0000	0.0000	0.0000	0.0000
420.00 m	0.0000	0.0000	0.0000	0.0000	0.0000
450.00 m	0.0000	0.0000	0.0000	0.0000	0.0000
480.00 m	0.0000	0.0000	0.0000	0.0000	0.0000
510.00 m	0.0000	0.0000	0.0000	0.0000	0.0000
540.00 m	0.0000	0.0000	0.0000	0.0000	0.0000
570.00 m	0.0000	0.0000	0.0000	0.0000	0.0000

	560.00 m	580.00 m	600.00 m	620.00 m
0.00 m	0.0000	0.0000	0.0000	0.0000
30.00 m	0.0000	0.0000	0.0000	0.0000
60.00 m	0.0000	0.0000	0.0000	0.0000
90.00 m	0.0000	0.0000	0.0000	0.0000
120.00 m	0.0000	0.0000	0.0000	0.0000
150.00 m	0.0000	0.0000	0.0000	0.0000
180.00 m	0.0000	0.0000	0.0000	0.0000
210.00 m	0.0000	0.0000	0.0000	0.0000
240.00 m	0.0000	0.0000	0.0000	0.0000
270.00 m	0.0000	0.0000	0.0000	0.0000
300.00 m	0.0000	0.0000	0.0000	0.0000
330.00 m	0.0000	0.0000	0.0000	0.0000
360.00 m	0.0000	0.0000	0.0000	0.0000
390.00 m	0.0000	0.0000	0.0000	0.0000
420.00 m	0.0000	0.0000	0.0000	0.0000
450.00 m	0.0000	0.0000	0.0000	0.0000
480.00 m	0.0000	0.0000	0.0000	0.0000
510.00 m	0.0000	0.0000	0.0000	0.0000
540.00 m	0.0000	0.0000	0.0000	0.0000
570.00 m	0.0000	0.0000	0.0000	0.0000

011771

```
*****************************************************
*                                                   *
*   SOLUTE TRANSPORT FROM POINT SOURCES             *
*   IN TWO-DIMENSIONAL UNIFORM FLOW                 *
*                                                   *
*   MODEL: WMPLUME  (REV 2-20 ST)                   *
*       CODE USED WAS WMPLUMCE                      *
*****************************************************
```

USER: sps

LOCATION: Sheridan: zinc , 1 year

DATE: 1/7/88

INPUT DATA:

.0212

DARCY VELOCITY.....:	0.02	m/d
EFFECTIVE POROSITY.....:	.3	
AQUIFER THICKNESS.....:	10.00	m
LONGITUDINAL DISPERSIVITY.....:	50.00	m
LATERAL DISPERSIVITY.....:	5.00	m
RETARDATION FACTOR.....:	54.00	
DECAY CONSTANT (lambda).....:	0	1/d
NUMBER OF POINT SOURCES.....:	34	

011772

SOURCE DATA:

SOURCE NO. 1

X-COORDINATE OF THE SOURCE.....:	445.00	m
Y-COORDINATE OF THE SOURCE.....:	110.00	m
THE SOURCE STRENGTH.....:	.423	kg/d
ELAPSED TIME OF THE SOURCE ACTIVITY...:	365.00	d

SOURCE NO. 2

X-COORDINATE OF THE SOURCE.....:	445.00	m
Y-COORDINATE OF THE SOURCE.....:	87.00	m
THE SOURCE STRENGTH.....:	.423	kg/d
ELAPSED TIME OF THE SOURCE ACTIVITY...:	365.00	d

********** RESULTS **********

-------- x-direction CONCENTRATION in mg/l (ppm) zinc, 1 year

	460.00 m	480.00 m	500.00 m	520.00 m	540.00 m
1.00 m	0.0000	0.0000	0.0000	0.0000	0.0000
30.00 m	0.0000	0.0000	0.0000	0.0000	0.0000
60.00 m	0.0000	0.0000	0.0000	0.0000	0.0000
90.00 m	0.3621	0.0000	0.0000	0.0000	0.0000
120.00 m	0.0000	0.0000	0.0000	0.0000	0.0000
150.00 m	0.0000	0.0000	0.0000	0.0000	0.0000
180.00 m	0.0000	0.0000	0.0000	0.0000	0.0000
210.00 m	0.0000	0.0000	0.0000	0.0000	0.0000
240.00 m	0.0000	0.0000	0.0000	0.0000	0.0000
270.00 m	0.0000	0.0000	0.0000	0.0000	0.0000
300.00 m	0.0000	0.0000	0.0000	0.0000	0.0000
330.00 m	0.0000	0.0000	0.0000	0.0000	0.0000
360.00 m	0.0000	0.0000	0.0000	0.0000	0.0000
390.00 m	0.0000	0.0000	0.0000	0.0000	0.0000
420.00 m	0.0000	0.0000	0.0000	0.0000	0.0000
450.00 m	0.0000	0.0000	0.0000	0.0000	0.0000
480.00 m	0.0000	0.0000	0.0000	0.0000	0.0000
510.00 m	0.0000	0.0000	0.0000	0.0000	0.0000
540.00 m	0.0000	0.0000	0.0000	0.0000	0.0000
570.00 m	0.0000	0.0000	0.0000	0.0000	0.0000

	560.00 m	580.00 m	600.00 m	620.00 m
1.00 m	0.0000	0.0000	0.0000	0.0000
30.00 m	0.0000	0.0000	0.0000	0.0000
60.00 m	0.0000	0.0000	0.0000	0.0000
90.00 m	0.0000	0.0000	0.0000	0.0000
120.00 m	0.0000	0.0000	0.0000	0.0000
150.00 m	0.0000	0.0000	0.0000	0.0000
180.00 m	0.0000	0.0000	0.0000	0.0000
210.00 m	0.0000	0.0000	0.0000	0.0000
240.00 m	0.0000	0.0000	0.0000	0.0000
270.00 m	0.0000	0.0000	0.0000	0.0000
300.00 m	0.0000	0.0000	0.0000	0.0000
330.00 m	0.0000	0.0000	0.0000	0.0000
360.00 m	0.0000	0.0000	0.0000	0.0000
390.00 m	0.0000	0.0000	0.0000	0.0000
420.00 m	0.0000	0.0000	0.0000	0.0000
450.00 m	0.0000	0.0000	0.0000	0.0000
480.00 m	0.0000	0.0000	0.0000	0.0000
510.00 m	0.0000	0.0000	0.0000	0.0000
540.00 m	0.0000	0.0000	0.0000	0.0000
570.00 m	0.0000	0.0000	0.0000	0.0000

011773

```
*****************************************
*                                       *
*   SOLUTE TRANSPORT FROM POINT SOURCES *
*   IN TWO-DIMENSIONAL UNIFORM FLOW     *
*                                       *
*   MODEL: WMPLUME  (REV 2-23 87)       *
*       CODE USED WAS WMPL2MOD          *
*****************************************
```

USER: sps

LOCATION: Sheridan: zinc, 10 years

DATE: 1/6/88

INPUT DATA:

DARCY VELOCITY.....:	0.02	m/d
EFFECTIVE POROSITY.....:	.3	
AQUIFER THICKNESS.....:	10.00	m
LONGITUDINAL DISPERSIVITY.....:	50.00	m
LATERAL DISPERSIVITY.....:	5.00	m
RETARDATION FACTOR.....:	54.00	
DECAY CONSTANT (lamoda).....:	0	1/d
NUMBER OF POINT SOURCES.....:	34	

SOURCE DATA:

SOURCE NO. 1

X-COORDINATE OF THE SOURCE.....:	445.00	m
Y-COORDINATE OF THE SOURCE.....:	110.00	m
THE SOURCE STRENGTH.....:	.423	kg/d
ELAPSED TIME OF THE SOURCE ACTIVITY...:	3650.00	d

SOURCE NO. 2

X-COORDINATE OF THE SOURCE.....:	445.00	m
Y-COORDINATE OF THE SOURCE.....:	87.00	m
THE SOURCE STRENGTH.....:	.423	kg/d
ELAPSED TIME OF THE SOURCE ACTIVITY...:	3650.00	d

011774

********** RESULTS **********

------- 1-direction CONCENTRATION in mg/l (ppm) Zinc, 10 years

		460.00 m	480.00 m	500.00 m	520.00 m	540.00 m
0.00	m	0.0000	0.0000	0.0000	0.0000	0.0000
30.00	m	0.0006	0.0000	0.0000	0.0000	0.0000
60.00	m	0.0281	0.0000	0.0002	0.0000	0.0000
90.00	m	17.1567	0.2284	0.2758	0.0175	0.0004
120.00	m	4.7202	1.0400	0.1150	0.0062	0.0002
150.00	m	2.7700	0.2691	0.0131	0.0007	0.0000
180.00	m	0.0256	0.0010	0.0000	0.0000	0.0000
210.00	m	0.0001	0.0000	0.0000	0.0000	0.0000
240.00	m	0.0001	0.0000	0.0000	0.0000	0.0000
270.00	m	0.0000	0.0000	0.0000	0.0000	0.0000
300.00	m	0.0000	0.0000	0.0000	0.0000	0.0000
330.00	m	0.0000	0.0000	0.0000	0.0000	0.0000
360.00	m	0.0000	0.0000	0.0000	0.0000	0.0000
390.00	m	0.0000	0.0000	0.0000	0.0000	0.0000
420.00	m	0.0000	0.0000	0.0000	0.0000	0.0000
450.00	m	0.0000	0.0000	0.0000	0.0000	0.0000
480.00	m	0.0000	0.0000	0.0000	0.0000	0.0000
510.00	m	0.0000	0.0000	0.0000	0.0000	0.0000
540.00	m	0.0000	0.0000	0.0000	0.0000	0.0000
570.00	m	0.0000	0.0000	0.0000	0.0000	0.0000

		560.00 m	580.00 m	600.00 m	620.00 m	640.00 m
0.00	m	0.0000	0.0000	0.0000	0.0000	0.0000
30.00	m	0.0000	0.0000	0.0000	0.0000	0.0000
60.00	m	0.0000	0.0000	0.0000	0.0000	0.0000
90.00	m	0.0000	0.0000	0.0000	0.0000	0.0000
120.00	m	0.0000	0.0000	0.0000	0.0000	0.0000
150.00	m	0.0000	0.0000	0.0000	0.0000	0.0000
180.00	m	0.0000	0.0000	0.0000	0.0000	0.0000
210.00	m	0.0000	0.0000	0.0000	0.0000	0.0000
240.00	m	0.0000	0.0000	0.0000	0.0000	0.0000
270.00	m	0.0000	0.0000	0.0000	0.0000	0.0000
300.00	m	0.0000	0.0000	0.0000	0.0000	0.0000
330.00	m	0.0000	0.0000	0.0000	0.0000	0.0000
360.00	m	0.0000	0.0000	0.0000	0.0000	0.0000
390.00	m	0.0000	0.0000	0.0000	0.0000	0.0000
420.00	m	0.0000	0.0000	0.0000	0.0000	0.0000
450.00	m	0.0000	0.0000	0.0000	0.0000	0.0000
480.00	m	0.0000	0.0000	0.0000	0.0000	0.0000
510.00	m	0.0000	0.0000	0.0000	0.0000	0.0000
540.00	m	0.0000	0.0000	0.0000	0.0000	0.0000
570.00	m	0.0000	0.0000	0.0000	0.0000	0.0000

		660.00 m	680.00 m
0.00	m	0.0000	0.0000
30.00	m	0.0000	0.0000
60.00	m	0.0000	0.0000
90.00	m	0.0000	0.0000
120.00	m	0.0000	0.0000
150.00	m	0.0000	0.0000
180.00	m	0.0000	0.0000
210.00	m	0.0000	0.0000
240.00	m	0.0000	0.0000
270.00	m	0.0000	0.0000
300.00	m	0.0000	0.0000
330.00	m	0.0000	0.0000
360.00	m	0.0000	0.0000
390.00	m	0.0000	0.0000
420.00	m	0.0000	0.0000
450.00	m	0.0000	0.0000
480.00	m	0.0000	0.0000
510.00	m	0.0000	0.0000
540.00	m	0.0000	0.0000
570.00	m	0.0000	0.0000

011775

ATTACHMENT 2

011776

PROGRAMS IN "SOLUTE" PACKAGE

No.	Name	Description
1.	ONED1	One-dimensional solute transport in a semi-infinite column, constant concentrations as the inlet boundary condition.
2.	ONED3	One-dimensional solute transport in a semi-infinite column, specified mass flux as the inlet boundary condition. Retardation and decay options included.
3.	WMPLUME	Two-dimensional transport of a plume from continuous multiple point sources in a uniform groundwater flow field. Includes options for retardation and decay.
4.	SLUG	Two-dimensional transport of a slug from an instantaneous point source in a uniform groundwater flow field.
5.	RADIAL	Solute transport in a plane radial flow. This program calculates the concentration distribution along the radial coordinate from a recharge well.
6.	LTIRD	Same as RADIAL, but based on improved solution of solute transport equation in radial coordinates.
7.	PLUME3D	Three-dimensional solute transport of a plume from continuous multiple point sources in a uniform groundwater flow field. Decay option included.
8.	SLUG3D	Three-dimensional trasnport of a slug from an instantaneous point source in a uniform groundwater flow field. Decay option included.
9.	UNITS	This program converts ten most frequently used units in hydrogeology from English units to metric units and vice versa.
10.	ERFC	A subroutine to calculate the values of error function and complimentary error function for the given argument x.

0117777

PROGRAM IDENTIFICATION

1.1	Program Title:	Analytical Model for Transport of a Solute Plume from Point Sources in a Uniform Two-Dimensional Groundwater Flow Field
1.2	Program Code Name:	WMPLUME.BAS
1.3	Program Writer:	Milovan S. Beljin
1.4	Program Organization:	International Ground Water Modeling Center Holcomb Research Institute, Butler University Indianapolis, Indiana 46208, Tel: 317/283-9458
1.5	Date:	January 1985
1.6	Version:	IBM-PC 1.0
1.7	Source Language:	Microsoft BASIC
1.8	Memory Requirements:	64k
1.9	Availability:	WMPLUME.BAS is a non-proprietary code. It is distributed at cost by IGWMC. A copy of the program on 5¼" diskette is available
2.0	Abstract:	A program to calculate the concentration distribution of a plume from point sources in two-dimensional regional flow. It includes options for retardation and decay
2.1	Comments:	WMPLUME.BAS is based on Wilson and Miller (1978) equation

011778

TRANSPORT FROM A POINT SOURCE IN A UNIFORM TWO-DIMENSIONAL FLOW FIELD

If the pollutant is continuously injected from a point source into an aquifer, a plume develops downstream of the source and spreads out to the sides and below. When the aquifer is relatively thin, vertical mixing occurs, and the concentration becomes uniform throughout the depth of the aquifer. In that case, the plume is two-dimensional. The governing equation and initial and boundary conditions for this problem are

$$D_{xx} \frac{\partial^2 C}{\partial x^2} + D_{yy} \frac{\partial^2 C}{\partial y^2} - \bar{v} \frac{\partial C}{\partial x} - \lambda RC + \frac{Q_c}{n} = R \frac{\partial C}{\partial t} \tag{5.1}$$

$$c\ (x,\ y,\ 0) = 0$$

$$Q_c(x,\ y,\ t) = QC_0\delta(x,\ y)$$

$$C\ (\pm\infty,\ \pm\infty,\ t) = 0$$

where

$Q_c[M/L^3T]$	the mass injection rate of solute per unit volume of aquifer;
$Q[L^3/T/L]$	the volumetric injection rate of fluid per unit aquifer thickness;
$C_0[M/L^3]$	concentration of the injected fluid;
$\delta(x,\ y)\ [L^{-2}]$	the Dirac delta function.

The analytical solution of the problem is given in the form (Wilson and Miller 1978)

$$C(x,\ y,\ t) = \frac{QC_o \exp\left(\frac{x}{B}\right)}{4\pi n(D_{xx}D_{yy})^{\frac{1}{2}}} W(u,\ {}^{r}/_{B}) \tag{5.2}$$

where

$$B = \frac{2D_{xx}}{\bar{v}}$$

011779

$$r = [(x^2 + \frac{D_{xx}}{D_{yy}} y^2)\gamma]^{\frac{1}{2}}$$

$$\gamma = 1 + \frac{2B\lambda R}{\bar{v}}$$

$$u = \frac{r^2 R}{4\gamma D_{xx} t}$$

$$W(u, {}^{r}/_{B}) = \int_u^{\infty} \frac{1}{\theta} \exp [- (\theta + \frac{r^2}{4B^2\theta})] \, d\theta.$$

$W(u, {}^{r}/_{B})$ corresponds to the Hantush well function for the problem of transient flow to a well in an infinite leaky aquifer. For many pollution problems, ${}^{r}/_{B}$ is large, and the tabulated values are insufficient. Willson and Miller (1978) give an approximation:

$$W(u, {}^{r}/_{B}) \cong (\frac{\pi B}{2r})^{\frac{1}{2}} \exp (- \frac{r}{B}) \operatorname{erfc} (- \frac{\frac{r}{B} - 2u}{2u^{\frac{1}{2}}}). \tag{5.3}$$

This approximation for $W(u, {}^{r}/_{B})$ is reasonably accurate (within 10%) for ${}^{r}/_{B} > 1$ and accurate (within 1%) for ${}^{r}/_{B} > 10$ (Wilson and Miller 1978). A minimum distance downstream from the source should be calculated before the approximation is applied.

In practice the described problem corresponds to that involving the movement of the solute continuously injected into an aquifer from a recharge well (Figure 3).

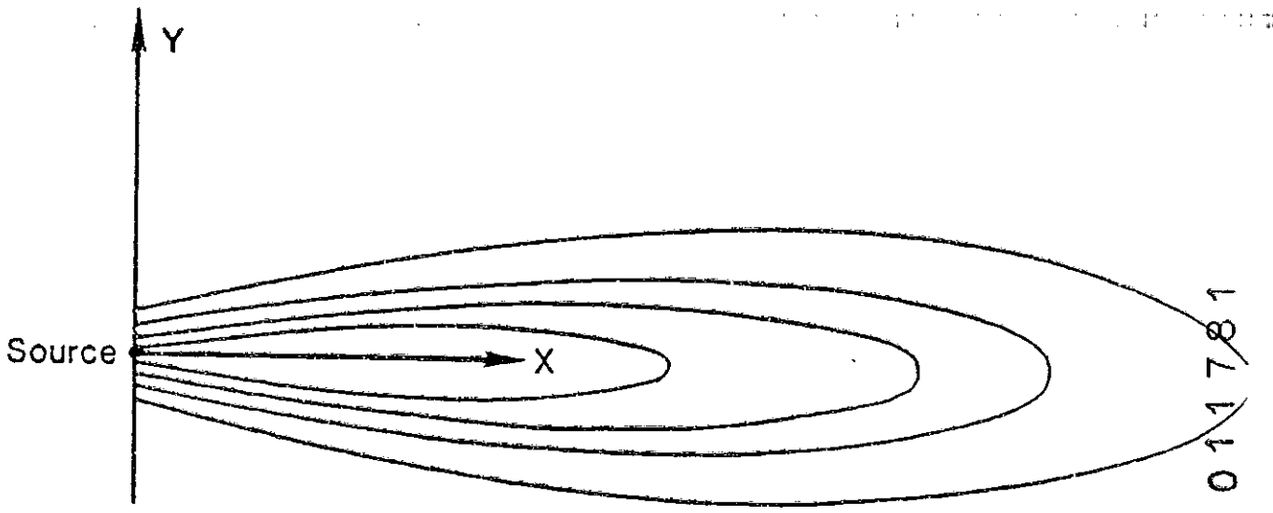
As time approaches infinity, $t \to \infty$, and $u \to 0$, a balance occurs between the rate at which pollution disperses and the rate of injection

$$C(x, y, t) = \frac{QC_o \exp (\frac{x}{B})}{2\pi n(D_{xx}D_{yy})^{\frac{1}{2}}} K_o(\frac{r}{B}) \tag{5.4}$$

where K_o is the modified Bessel function of the second kind zeroth order.

011780

Figure 3.



ASSUMPTIONS:

- uniformly porous confined aquifer,
- the aquifer is homogeneous, isotropic, infinite in areal extent, and constant in thickness,
- a fully penetraing solute injection well,
- recharge rates are negligible in relation to uniform regional flow rate,
- pollutants are distributed instantaneously to the entire aquifer thickness beneath the point source,
- injection is continuous and constant.

5.3. PROGRAM LISTING

```
10  REM  ***********************************************************
15  REM  *                                                         *
20  REM  *                 program:  "WMPLUME.BAS"                 *
25  REM  *                 version:   IBM-PC 1.0 - January,1985    *
30  REM  *                                                         *
35  REM  *                      by:  MILOVAN S. BELJIN             *
40  REM  *                                                         *
45  REM  *            HOLCOMB RESEARCH INSTITUTE - IGWMC           *
50  REM  *            INDIANAPOLIS, INDIANA 46208                  *
55  REM  *                                                         *
60  REM  *  THIS PROGRAM CALCULATES THE CONCENTRATION DISTRIBUTION  *
65  REM  *  FOR DISPLACEMENT OF SOLUTE IN A HOMOGENEOUS, CONFINED   *
70  REM  *  AQUIFER WITH UNIFORM REGIONAL FLOW AND MULTIPLE, FULLY  *
75  REM  *  PENETRATING SOLUTE INJECTION WELLS (POINT SOURCES).     *
80  REM  *  BASED ON WILSON AND MILLER EQUATION (1978).            *
85  REM  *                                                         *
90  REM  ***********************************************************
95  REM
100 DIM X(41),Y(21),C(21,41),Q(10),CW(10),TW(10)
105 SCREEN 0,0,0: WIDTH 80: COLOR 2,0,0: KEY OFF: CLS
110 LOCATE 3,18: PRINT "WMPLUME.BAS has several options: "
115 LOCATE 7,15: PRINT "1. INTERACTIVE"
120 LOCATE 8,15: PRINT "   For preliminary analysis."
125 LOCATE 10,15:PRINT "2. INTERACTIVE & PRINTER"
130 LOCATE 11,15:PRINT "   If you need a hard copy of input data"
135 LOCATE 12,15:PRINT "   and results."
140 LOCATE 14,15:PRINT "3. EXIT TO MAIN MENU"
145 LOCATE 20,22: INPUT "YOUR CHOICE  ":CH1%
150 IF CH1%=1 THEN A$="SCRN:"
155 IF CH1%=2 THEN A$="LPT1:"
160 IF CH1%=3 THEN RUN "MENU.BAS"
165 OPEN A$ FOR OUTPUT AS #1
170 REM ***************************************************************
175 REM                      ... ENTERING INPUT DATA ...
180 CLS: REM ---------------------------------------------------------
185 LOCATE 10,10
190 INPUT "WHAT UNITS :   <1> METRIC  or  <2> ENGLISH  ":CH2%
195 IF CH2%=2 GOTO 205
200 UN1$=" kg/d": UN2$=" m ": UN4$=" d": UN5$="   1/d": UN6$=" m/d" :GOTO 210
205 UN1$=" lb/d": UN2$=" ft": UN4$=" d": UN5$="   1/d": UN6$=" ft/d
210 CLS: REM ---------------------------------------------------------
215 PRINT TAB(9)"TRANSPORT FROM A POINT SOURCE IN TWO-DIMENSIONAL UNIFORM FLOW
220 PRINT TAB(9) STRING$(61,"*"): PRINT : PRINT : PRINT
225 IF CH1%=1 GOTO 250
230 LINE INPUT "  USER:       ";US$
235 LINE INPUT "  LOCATION:   ";L$
240 LINE INPUT "  DATE:       ";D$
245 PRINT :PRINT
250 REM
255 INPUT "  DARCY VELOCITY.......................[m/d ] or [ft/d]:";V
260 INPUT "  EFFECTIVE POROSITY...................................  :";N
265 INPUT "  AQUIFER THICKNESS....................................  :";M
270 INPUT "  LONGITUDINAL DISPERSIVITY.............[m ] or [ft]  :";AL
275 INPUT "  LATERAL DISPERSIVITY..................[m ] or [ft]  :";AT
280 INPUT "  RETARDATION FACTOR...................................  :";R
285 INPUT "  DECAY CONSTANT (lambda)......................[1/d]  :";LM
290 INPUT "  NUMBER OF POINT SOURCES.....................[max 10]  :";NW
295 LOCATE 24,9
300 INPUT "DO YOU WANT TO CHANGE THE DATA: <RETURN> NO; <1> YES ";CH3%
```

```
305 IF CH3%=1 GOTO 210
310 FOR Z=1 TO NW
315 CLS
320 PRINT TAB(9)"TRANSPORT FROM A POINT SOURCE IN TWO-DIMENSIONAL UNIFORM FLOW
325 PRINT TAB(9) STRING$(61,"*"): PRINT
330 PRINT TAB(25) "ENTER POINT SOURCE DATA": PRINT: PRINT
335 PRINT "  SOURCE NO.";Z
340 PRINT "  ------------"
345 PRINT
350 INPUT "  X-COORDINATE  OF THE SOURCE.............(m) or (ft)  :";XW(Z)
355 INPUT "  Y-COORDINATE  OF THE SOURCE.............(m) or (ft)  :";YW(Z)
360 INPUT "  THE SOURCE STRENGTH.................(kg/d) or (lb/d):";CC(Z)
365 INPUT "  ELAPSED TIME OF THE SOURCE ACTIVITY.............(d) :";TW(Z)
370 LOCATE 24,9
375 INPUT "DO YOU WANT TO CHANGE THE DATA: <RETURN> NO; <1> YES ";CH3%
380 IF CH3%=1 THEN GOTO 315
385 NEXT Z
390 CLS
395 PRINT TAB(9)"TRANSPORT FROM A POINT SOURCE IN TWO-DIMENSIONAL UNIFORM FLOW
400 PRINT TAB(9) STRING$(61,"*"):    PRINT : PRINT
405 PRINT TAB(28) "ENTER GRID DATA": PRINT : PRINT
410 V=V/N: DX=AL*V: DY=AT*V: DXDY=DX*DY: DD=DX/DY: PI=3.1415926535#
415 DOWN=4*PI*N*SQR(DXDY): B=2*DX/V: GMA=1+2*B+LM*R/V: GMAD=4*GMA*DX
420 XMIN=4*B/SQR(GMA)
425 PRINT "  NOTE:";
430 PRINT "  the error will be within 7% if you chose x-coordinate"
435 PRINT TAB(10)"of the grid origin to be";:PRINT XMIN; PRINT UN2$;
440 PRINT " from the nearest source."
445 PRINT :PRINT
450 REM
455 INPUT "  X-COORDINATE OF THE GRID ORIGIN........(m ) or (ft)  :";X0
460 INPUT "  Y-COORDINATE OF THE GRID ORIGIN........(m ) or (ft)  :";Y0
465 INPUT "  DISTANCE INCREMENT DELX................(m ) or (ft)  :";DELX
470 INPUT "  DISTANCE INCREMENT DELY................(m ) or (ft)  :";DELY
475 INPUT "  NUMBER OF NODES IN X-DIRECTION.........( max 40   )  :";NC
480 INPUT "  NUMBER OF NODES IN Y-DIRECTION.........( max 20   )  :";NR
485 LOCATE 24,9
490 INPUT "DO YOU WANT TO CHANGE THE DATA: <RETURN> NO; <1> YES ";CH3%
495 IF CH3%=1 GOTO 390
500 CLS: REM ------------------------------------------------------------------
505 PRINT TAB(9)"TRANSPORT FROM A POINT SOURCE IN TWO-DIMENSIONAL UNIFORM FLOW
510 PRINT TAB(9) STRING$(61,"*"):    PRINT : PRINT
515 IF CH1%=1 GOTO 820
520 LPRINT TAB(12) "*********************************************
525 LPRINT TAB(12) "*                                           *
530 LPRINT TAB(12) "*   SOLUTE TRANSPORT FROM POINT SOURCES     *
535 LPRINT TAB(12) "*   IN TWO-DIMENSIONAL UNIFORM FLOW         *
540 LPRINT TAB(12) "*                                           *
545 LPRINT TAB(12) "*   MODEL: WMPLUME                          *
550 LPRINT TAB(12) "*                                           *
555 LPRINT TAB(12) "*********************************************
560 LPRINT: LPRINT
565 LPRINT TAB(12)"USER:      ";US$
570 LPRINT TAB(12)"-----"
575 LPRINT TAB(12)"LOCATION: ";L$
580 LPRINT TAB(12)"--------- "
585 LPRINT TAB(12)"DATE:      ";D$
590 LPRINT TAB(12)"-----"
595 LPRINT : LPRINT
600 LPRINT TAB(28)"INPUT DATA:":    PRINT #1,: PRINT #1,
```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```
605 LPRINT TAB(12)USING"DARCY VELOCITY.......................:#####.##";V*N;
610 LPRINT UN6$
615 LPRINT TAB(12)      "EFFECTIVE POROSITY...................:    ";N
620 LPRINT TAB(12)USING"AQUIFER THICKNESS....................:#####.##";M;
625 LPRINT UN2$
630 LPRINT TAB(12)USING"LONGITUDINAL DISPERSIVITY............:#####.##";AL;
635 LPRINT UN2$
640 LPRINT TAB(12)USING"LATERAL DISPERSIVITY.................:#####.##";AT;
645 LPRINT UN2$
650 LPRINT TAB(12)USING"RETARDATION FACTOR...................:#####.##";R
655 LPRINT TAB(12)      "DECAY CONSTANT (lambda)..............:    ";LM;
660 LPRINT UN5$
665 LPRINT TAB(12)USING"NUMBER OF POINT SOURCES..............:   ##   ";NW
670 LPRINT : LPRINT
675 LPRINT TAB(26)"SOURCE DATA:"
680 FOR Z=1 TO NW
685 LPRINT: LPRINT
690 LPRINT TAB(12)"SOURCE NO.";Z
695 LPRINT TAB(12)"------------"
700 LPRINT
705 LPRINT TAB(12)USING"X-COORDINATE OF THE SOURCE...........:#####.##";XW(Z);
710 LPRINT UN2$
715 LPRINT TAB(12)USING"Y-COORDINATE OF THE SOURCE...........:#####.##";YW(Z);
720 LPRINT UN2$
725 LPRINT TAB(12)USING"THE SOURCE STRENGTH..................:#####.##";QC(Z);
730 LPRINT UN1$
735 LPRINT TAB(12)USING"ELAPSED TIME OF THE SOURCE ACTIVITY...:#####.##";TW(Z);
740 LPRINT UN4$
745 IF Z=2 THEN PRINT #1,CHR$(12);
750 NEXT Z
755 LPRINT : LPRINT
760 LPRINT TAB(29)"GRID DATA:"
765 LPRINT : LPRINT
770 LPRINT TAB(12)USING"X-COORDINATE OF THE GRID ORIGIN......:#####.##";XO;
775 LPRINT UN2$
780 LPRINT TAB(12)USING"Y-COORDINATE OF THE GRID ORIGIN......:#####.##";YO;
785 LPRINT UN2$
790 LPRINT TAB(12)USING"DISTANCE INCREMENT DELX..............:#####.##";DELX;
795 LPRINT UN2$
800 LPRINT TAB(12)USING"DISTANCE INCREMENT DELY..............:#####.##";DELY;
805 LPRINT UN2$
810 LPRINT TAB(12)USING"NUMBER OF NODES IN X-DIRECTION.......:   ##   ";NC
815 LPRINT TAB(12)USING"NUMBER OF NODES IN Y-DIRECTION.......:   ##   ";NR
820 REM ***********************************************************************
825 REM                          ... THE MAIN PROGRAM ...
830 REM -----------------------------------------------------------------------
835 LOCATE 10,24: PRINT "... PLEASE WAIT FOR A MOMENT ..."
840 REM
845 A1=.0705230784#: A2=.0422820123#: A3=.0092705272#
850 A4=1.520143E-04: A5=2.765672E-04: A6=4.306208E-05
855 X(1)=XO: Y(1)=YO
860 FOR I=1 TO NR
865     FOR J=1 TO NC
870         FOR Z=1 TO NW
875             IF CHZ%=1 THEN QCO=QC(Z)*1000/M ELSE QCO=QC(Z)*16018.3635#/M
880             X=X(J)-XW(Z)
885             IF X<0 THEN GOTO 925
890             Y=ABS(Y(I)-YW(Z))
895             IF (X=0) AND (Y=0) THEN C(I,J)=-1: GOTO 920
                ELSE RR=(X*X+Y*Y+DD)*GMA: RR=SQR(RR)
900             U=(RR*RR*R)/(GMAD*TW(Z))
```

```
905             RB=RR/B
910             GOSUB 1150
915             CW(Z)=QCO*EXP(X/B)/DOWN*WURB
920             C(I,J)=C(I,J)+CW(Z)
925         NEXT Z
930         LOCATE 13,20
935         PRINT "NOW PROCESSING ROW: ";I;:PRINT "  AND COLUMN: ";J
940         X(J+1)=X(J)+DELX
945     NEXT J
950     Y(I+1)=Y(I)+DELY
955 NEXT I
960 REM ***********************************************************************
965 REM                          ... FORMATTING THE OUTPUT ...
970 CLS: REM ----------------------------------------------------------------
975 H=FIX(NC/5): P=H+1
980 R=NC-H*5: IF R=0 THEN P=H
985 PRINT #1,CHR$(12);
990 PRINT #1,STRING$(35,"*");" RESULTS ";STRING$(35,"*")
995 PRINT #1,
1000 PRINT #1,"+-------> X-direction      CONCENTRATION in mg/l (ppm)"
1005 PRINT #1,"!": PRINT #1,"v Y"
1010 FOR S=1 TO P
1015     PRINT #1,: PRINT #1,: PRINT #1,
1020     IF S=P AND R>0 THEN L5=R ELSE L5=5
1025     PRINT #1,TAB(13) "";
1030     FOR K=1 TO L5
1035         F=F+1
1040         PRINT #1,USING " ######.##";X(F);: PRINT #1,UN2$;
1045     NEXT K
1050     PRINT #1,: PRINT #1,
1055     FOR I=1 TO NR
1060         J=(S-1)*5
1065         PRINT #1,USING "####.## ";Y(I);: PRINT #1,UN2$;
1070         FOR L=1 TO L5
1075             J=J+1
1080             PRINT #1,USING " #######.####";C(I,J);
1085         NEXT L
1090         PRINT #1,""
1095     NEXT I
1100     IF CH1%=2 GOTO 1130
1105 REM ----------------------------------------------------------------
1110 LOCATE 24,23,0: COLOR 16,7,0
1115 PRINT "Press Space Bar to Continue...";:COLOR 2,0,0
1120 MT$=INKEY$:IF MT$="" THEN 1120 ELSE IF MT$=" " THEN GOTO 1125 ELSE 1120
1125 CLS: REM ----------------------------------------------------------------
1130 NEXT S
1135 CLS: PRINT #1,CHR$(12);
1140 CLOSE #1
1145 CLEAR: GOTO 100
1150 REM ********************** SUBROUTINE WURB ****************************
1155 ARG1=(PI*B)/(2*RR)
1160 ARG2=-RB
1165 ARG3=(-RB+2*U)/(2*SQR(U))
1170 REM ----------------------- ERFC FUNCTION ------------------------------
1175     G=ABS(ARG3):G2=G*G:G3=G2*G:G4=G3*G:G5=G4*G:G6=G5*G
1180     ERFC=1/(1+A1*G+A2*G2+A3*G3+A4*G4+A5*G5+A6*G6)^16
1185     IF ARG3<0 THEN ERFC=2-ERFC
1190 REM ----------------------------------------------------------------
1195 WURB=SQR(ARG1)*EXP(ARG2)*ERFC
1200 RETURN
```

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