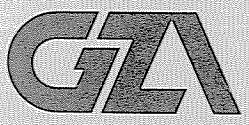
GZA
GeoEnvironmental
of New York

Engineers and
Scientists



CHEM-TROL SITE REMEDIAL INVESTIGATION REPORT HAMBURG, NEW YORK

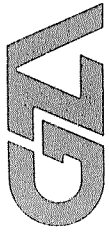
VOLUME II OF II

CHEM-TROL SITE REMEDIAL INVESTIGATION REPORT HAMBURG, NEW YORK
VOLUME II OF II

PREPARED FOR:
SCA Services, Inc.
East Rochester, New York

PREPARED BY:
GZA GeoEnvironmental of New York
Buffalo, New York

November 1994
File: 5945



APPENDIX E

HYDRAULIC CONDUCTIVITY TEST RESULTS

CHEM-TROL
Remedial Investigation\Feasibility Study
Hamburg, NY

File: R5945

SUMMARY OF PRESSURE TEST RESULTS

Packer Pressure Test Hydraulic Conductivity Calculation							
Well	Test Interval	Pg (psi)	Q (cfs)	H (ft)	K (ft/s)	K (cm/sec)	Remarks
MW-7R	13.3 - 15.6	15	0.0069	38.01	3.73E-05	1.14E-03	
	22.6 - 36.2	6	0.0165	11.54	1.03E-04	3.14E-03	
MW-8R	7 - 9.3	5	0.0031	16.30	4.38E-05	1.33E-03	
	12.7 - 19.3	8.5	0.0181	19.54	1.07E-04	3.28E-03	
MW-9R	15.6 - 23.4	18	0.0042	46.82	8.04E-06	2.45E-04	
MW-10R	8.1 - 10.6	5	0.0400				Could not maintain constant pressure
	13.1 - 20.9	16	0.0058	36.97	1.39E-05	4.25E-04	
MW-11R	17.3 - 23.6	15	0.0126	43.97	3.05E-05	9.30E-04	

K = Hydraulic Conductivity = Q/(Cs*r*H)
Q = Flow Rate (GPM)
Cs = Conductivity Coefficient
r = Well radius (ft)
H = Head (ft)

Note: (1) Head = (Distance from pressure gauge to water level) + (Applied pressure) - (Total frictional head loss)

Referance: U.S. Department of the Interior. Water and Power Resources Service. 1981. "Ground Water Manual," A Water Resources Technical Publication. John Wiley & Sons.

CHEM – TROL
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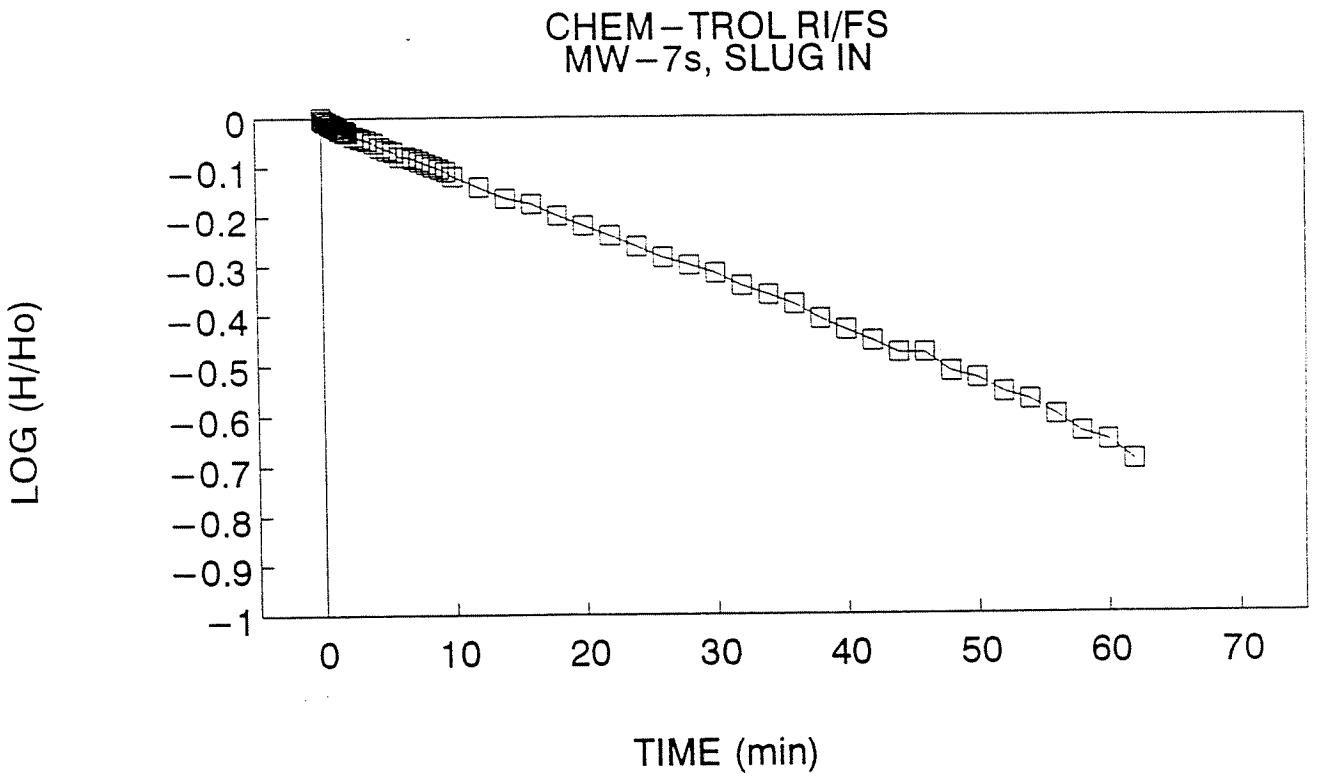
Hamburg, New York
HYDRAULIC CONDUCIVITY ESTIMATION

WELL ID	MW–7s	STATIC WATER LEVEL	4.61 FT
RISER DIA.	0.17 FT		
ZONE DIA.	0.67 FT		
TEST LENGTH	6 FT		
M	1		
SLUG	IN		

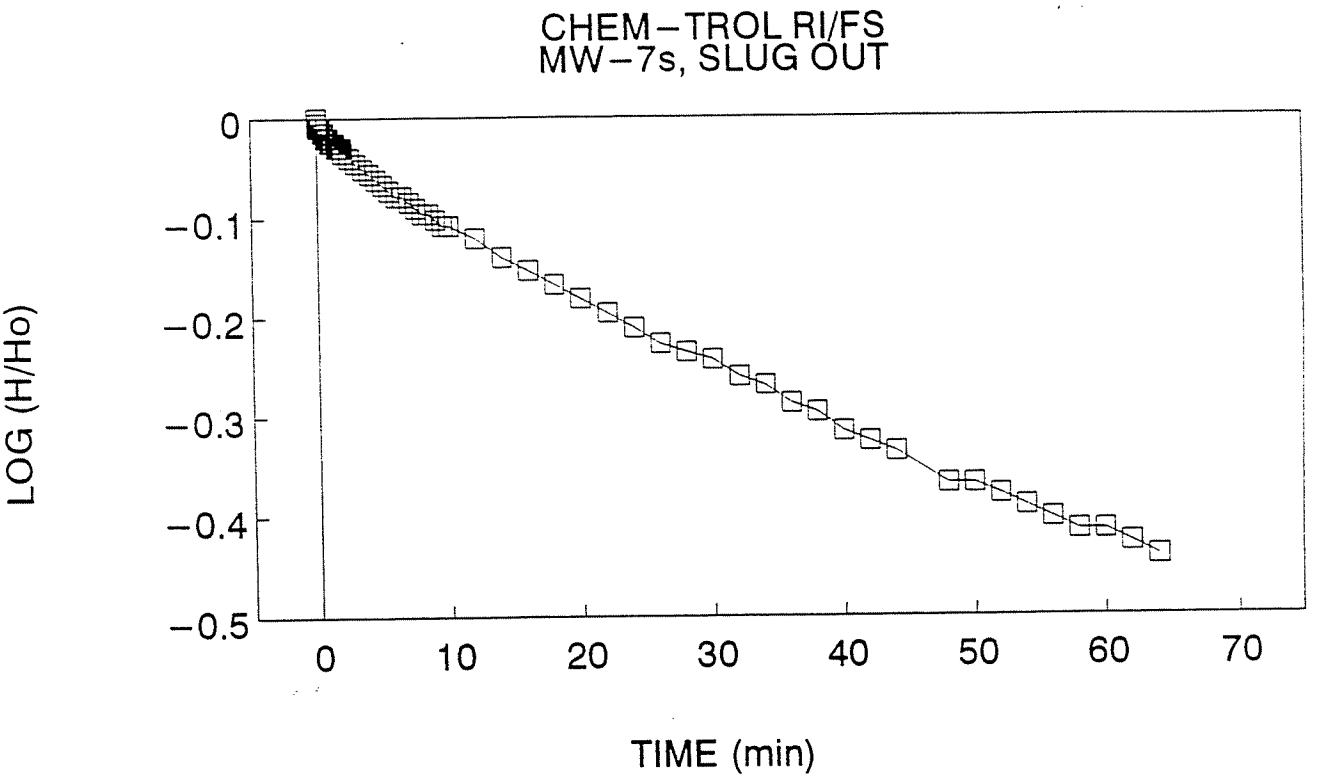


T1=	0.72	H1=	−1.05
T2=	53.97	H2=	−0.29

Kh= 5.0E−05 FT/MIN
Kh= 2.5E−05 CM/S

CHEM – TROL
REMEDIAL INVESTIGATION / FEASIBILITY STUDY
Hamburg, New York
HYDRAULIC CONDUCIVITY ESTIMATION

WELL ID	MW–7s	STATIC WATER LEVEL	4.61 FT
RISER DIA.	0.17 FT		
ZONE DIA.	0.67 FT		
TEST LENGTH	6 FT		
M	1		
SLUG	OUT		

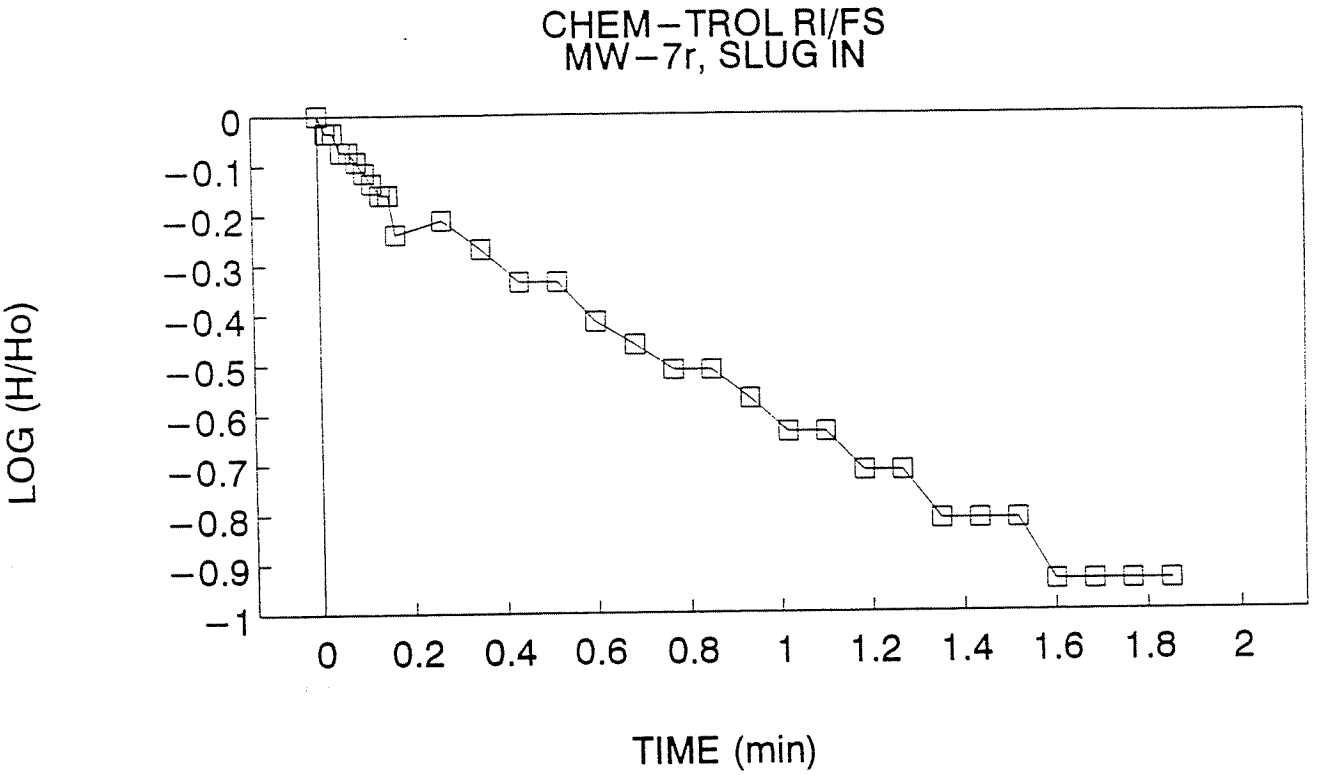


T1=	0.39	H1=	0.88
T2=	57.97	H2=	0.35

Kh= 3.3E–05 FT/MIN
Kh= 1.7E–05 CM/S

CHEM – TROL
REMEDIAL INVESTIGATION / FEASIBILITY STUDY
Hamburg, New York
HYDRAULIC CONDUCIVITY ESTIMATION

WELL ID	MW–7R	STATIC WATER LEVEL	4.4 FT
RISER DIA.	0.35 FT		
ZONE DIA.	0.25 FT		
TEST LENGTH	20.2 FT		
M	10		
SLUG	IN		

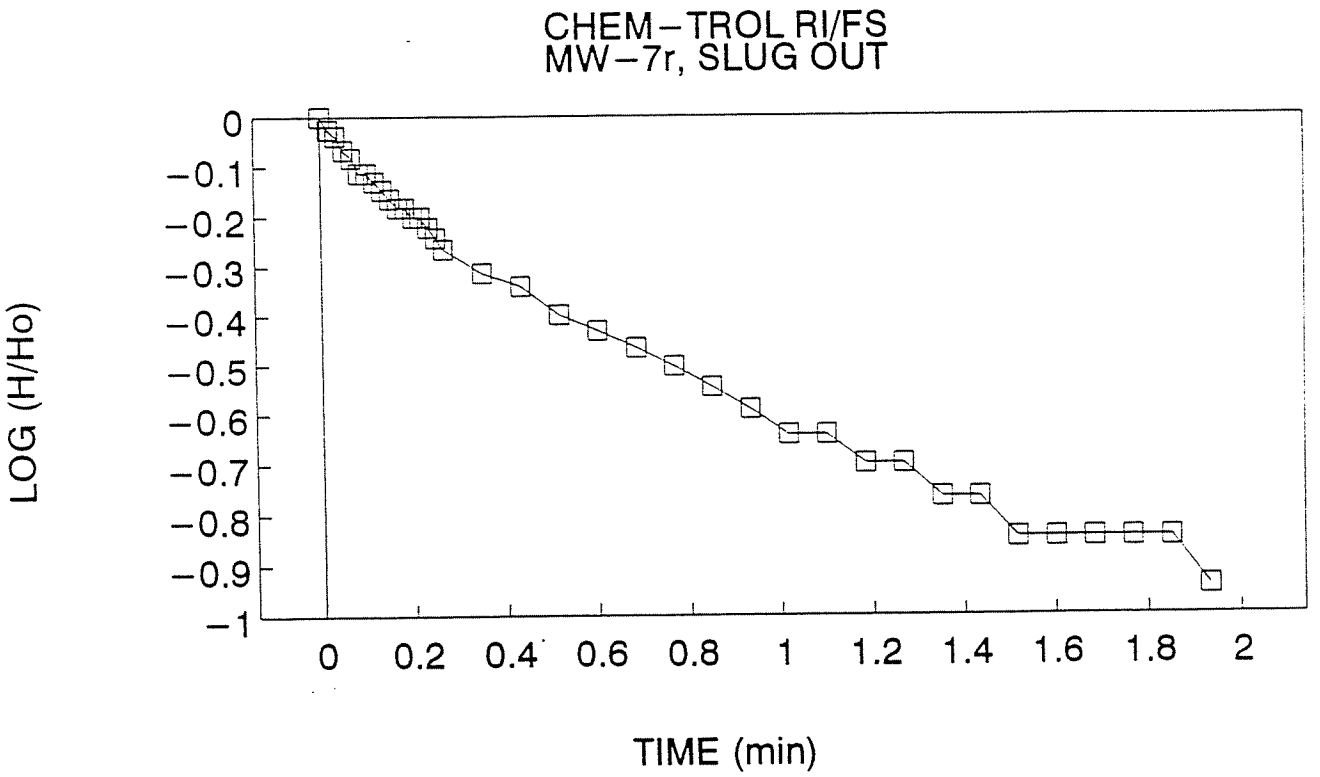


T1=	0.13	H1=	–0.18
T2=	1.52	H2=	–0.04

Kh= 6.8E–03 FT/MIN
Kh= 3.5E–03 CM/S

CHEM – TROL
REMEDIAL INVESTIGATION / FEASIBILITY STUDY
Hamburg, New York
HYDRAULIC CONDUCIVITY ESTIMATION

WELL ID	MW–7R	STATIC WATER LEVEL	4.4 FT
RISER DIA.	0.35 FT		
ZONE DIA.	0.25 FT		
TEST LENGTH	20.2 FT		
M	10		
SLUG	OUT		

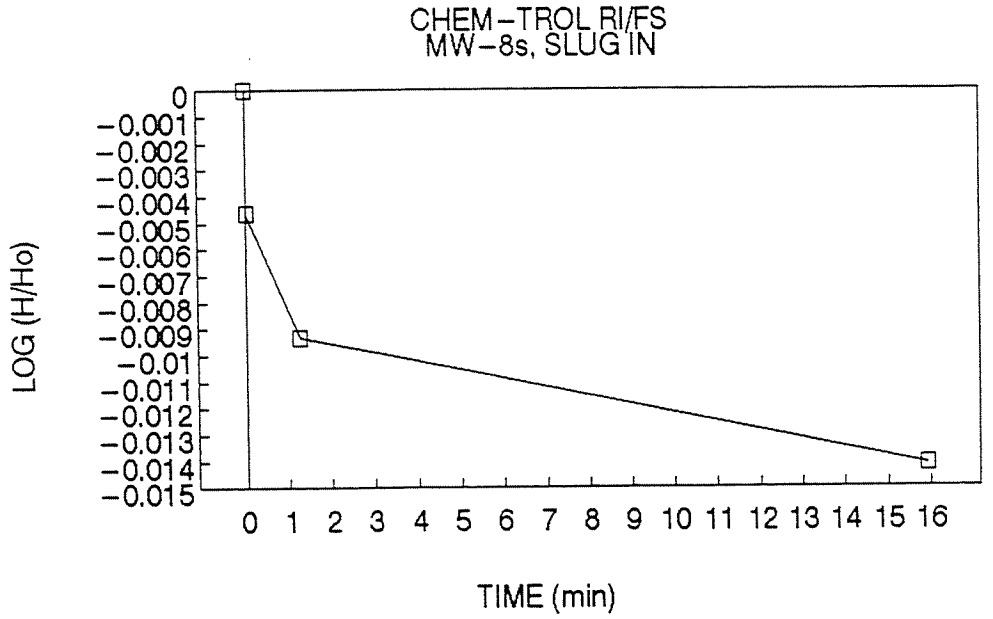


T1=	0.13	H1=	0.25
T2=	1.18	H2=	0.07

Kh= 7.6E–03 FT/MIN
Kh= 3.9E–03 CM/S

CHEM – TROL
REMEDIAL INVESTIGATION / FEASIBILITY STUDY
Hamburg, New York
HYDRAULIC CONDUCIVITY ESTIMATION

WELL ID	MW – 8s	STATIC WATER LEVEL	5.84 FT
RISER DIA.	0.17 FT		
ZONE DIA.	0.67 FT		
TEST LENGTH	1 FT		
M	1		
SLUG	IN		



T1 =	1.27	H1 =	−0.92
T2 =	15.93	H2 =	−0.91

Kh = 4.7E – 06 FT/MIN
Kh = 2.4E – 06 CM/S

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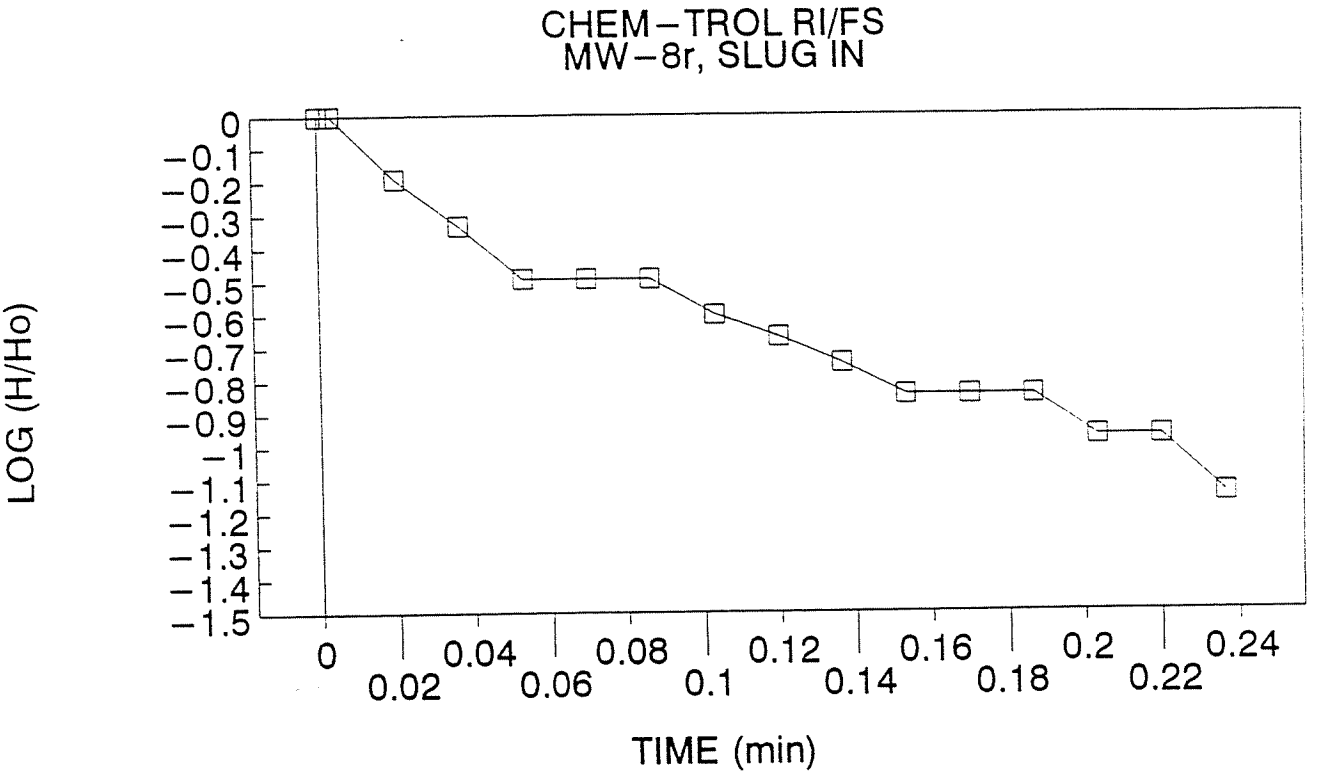
Hamburg, New York
HYDRAULIC CONDUCIVITY ESTIMATION

WELL ID	MW–8R	STATIC WATER LEVEL	5.54 FT
RISER DIA.	0.35 FT		
ZONE DIA.	0.25 FT		
TEST LENGTH	9.5 FT		
M	10		
SLUG	IN		

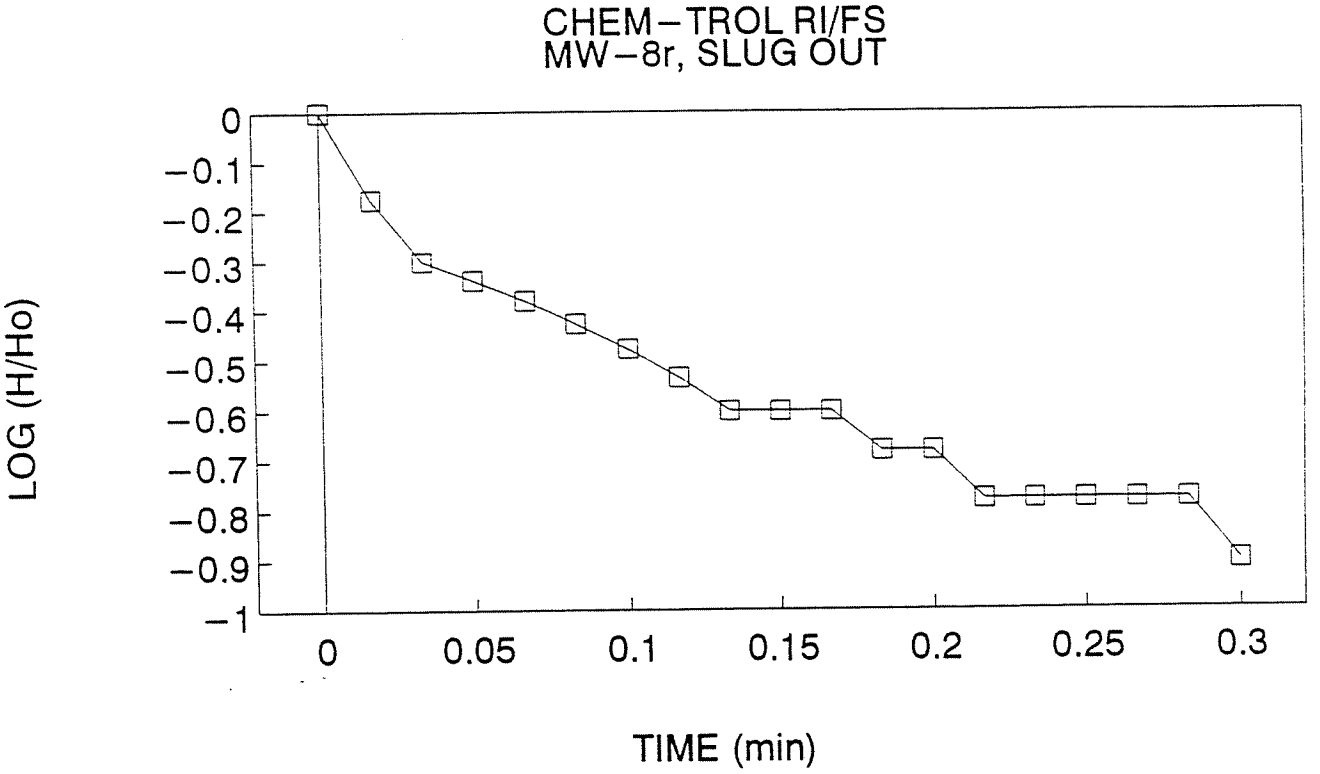


T1=	0.02	H1=	–0.18
T2=	0.15	H2=	–0.04

Kh= 1.4E–01 FT/MIN
Kh= 6.9E–02 CM/S

CHEM – TROL
REMEDIAL INVESTIGATION / FEASIBILITY STUDY
Hamburg, New York
HYDRAULIC CONDUCIVITY ESTIMATION

WELL ID	MW–8R	STATIC WATER LEVEL	5.54 FT
RISER DIA.	0.35 FT		
ZONE DIA.	0.25 FT		
TEST LENGTH	9.5 FT		
M	10		
SLUG	OUT		

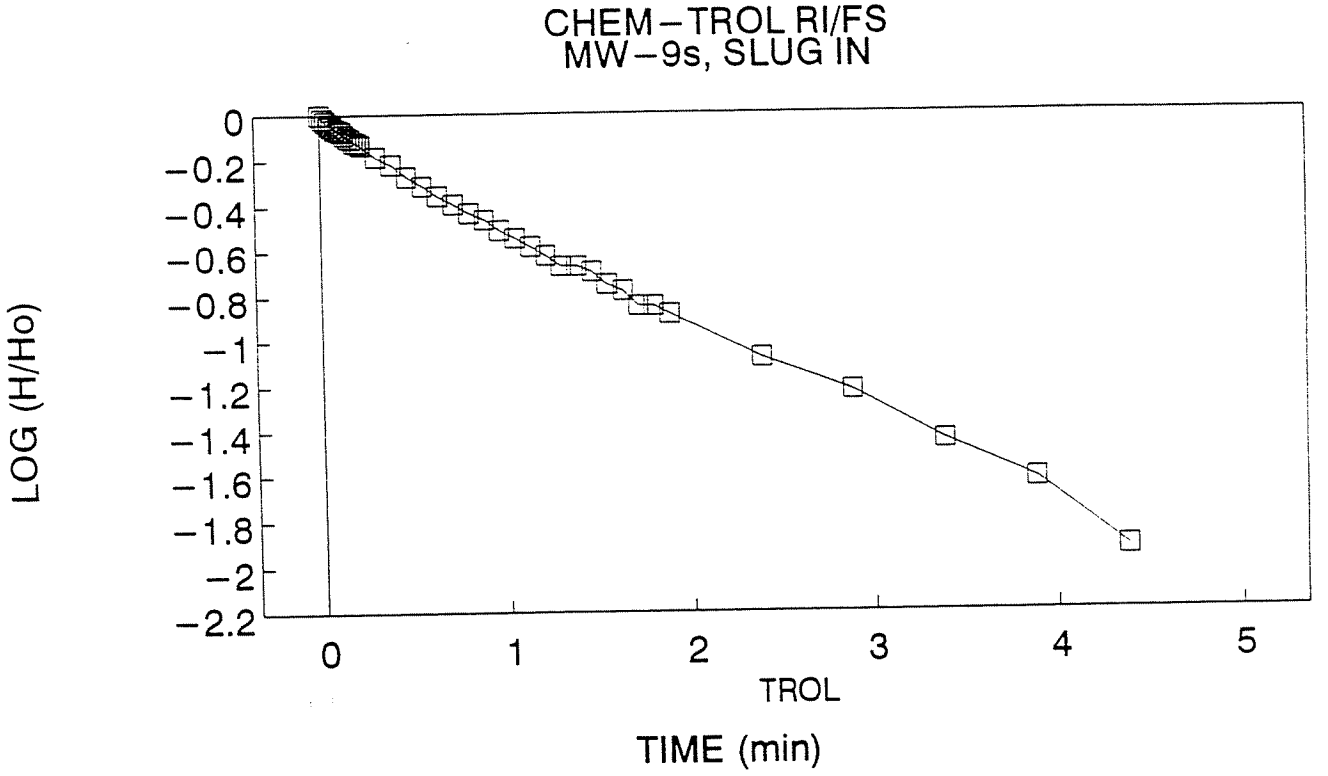


T1=	0.05	H1=	0.11
T2=	0.10	H2=	0.08

Kh= 7.7E–02 FT/MIN
Kh= 3.9E–02 CM/S

CHEM – TROL
REMEDIAL INVESTIGATION / FEASIBILITY STUDY
Hamburg, New York
HYDRAULIC CONDUCIVITY ESTIMATION

WELL ID	MW–9s	STATIC WATER LEVEL	6.04 FT
RISER DIA.	0.17 FT		
ZONE DIA.	0.67 FT		
TEST LENGTH	4.3 FT		
M	1		
SLUG	IN		

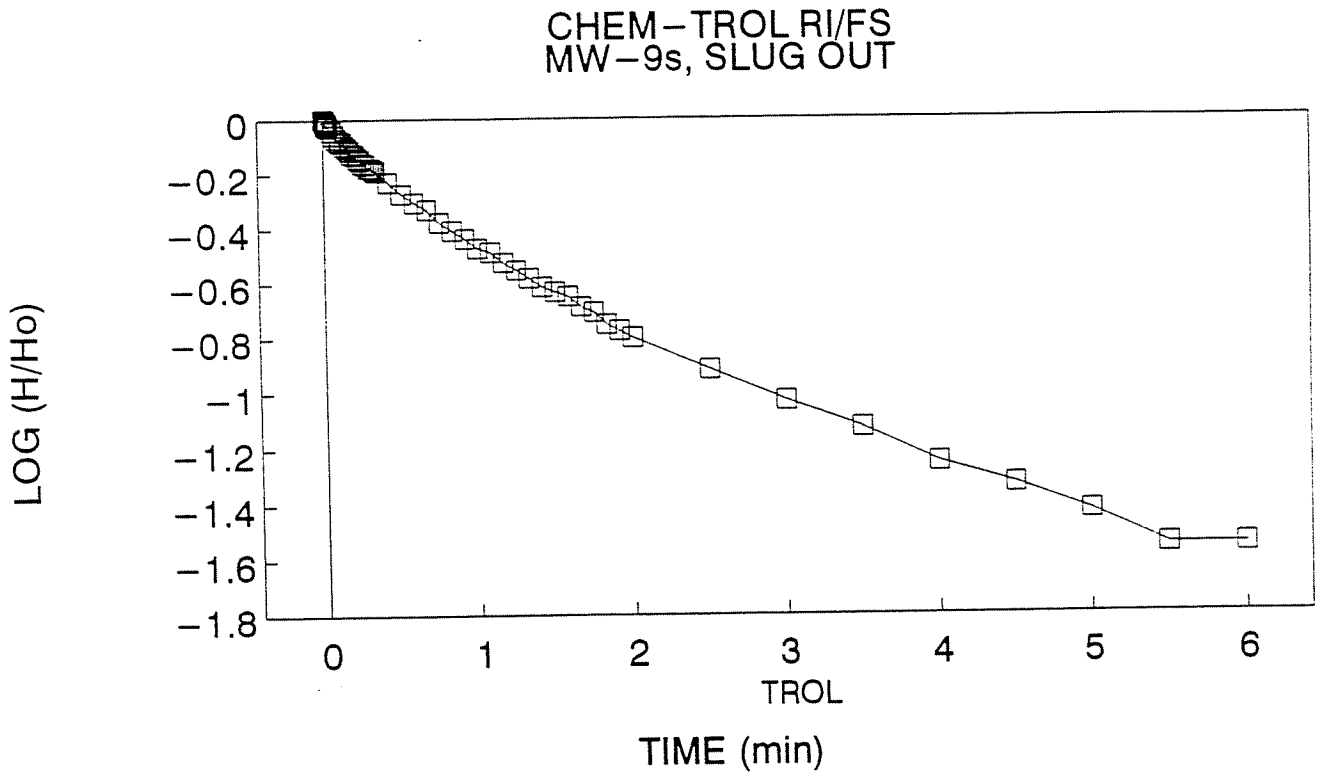


T1=	0.08	H1=	−0.73
T2=	3.38	H2=	−0.03

Kh= 2.5E−03 FT/MIN
Kh= 1.3E−03 CM/S

CHEM – TROL
REMEDIAL INVESTIGATION / FEASIBILITY STUDY
Hamburg, New York
HYDRAULIC CONDUCIVITY ESTIMATION

WELL ID	MW–9s	STATIC WATER LEVEL	6.04 FT
RISER DIA.	0.17 FT		
ZONE DIA.	0.67 FT		
TEST LENGTH	4.3 FT		
M	1		
SLUG	OUT		



T1=	0.05	H1=	0.97
T2=	2.50	H2=	0.13

Kh= 2.2E–03 FT/MIN
Kh= 1.1E–03 CM/S

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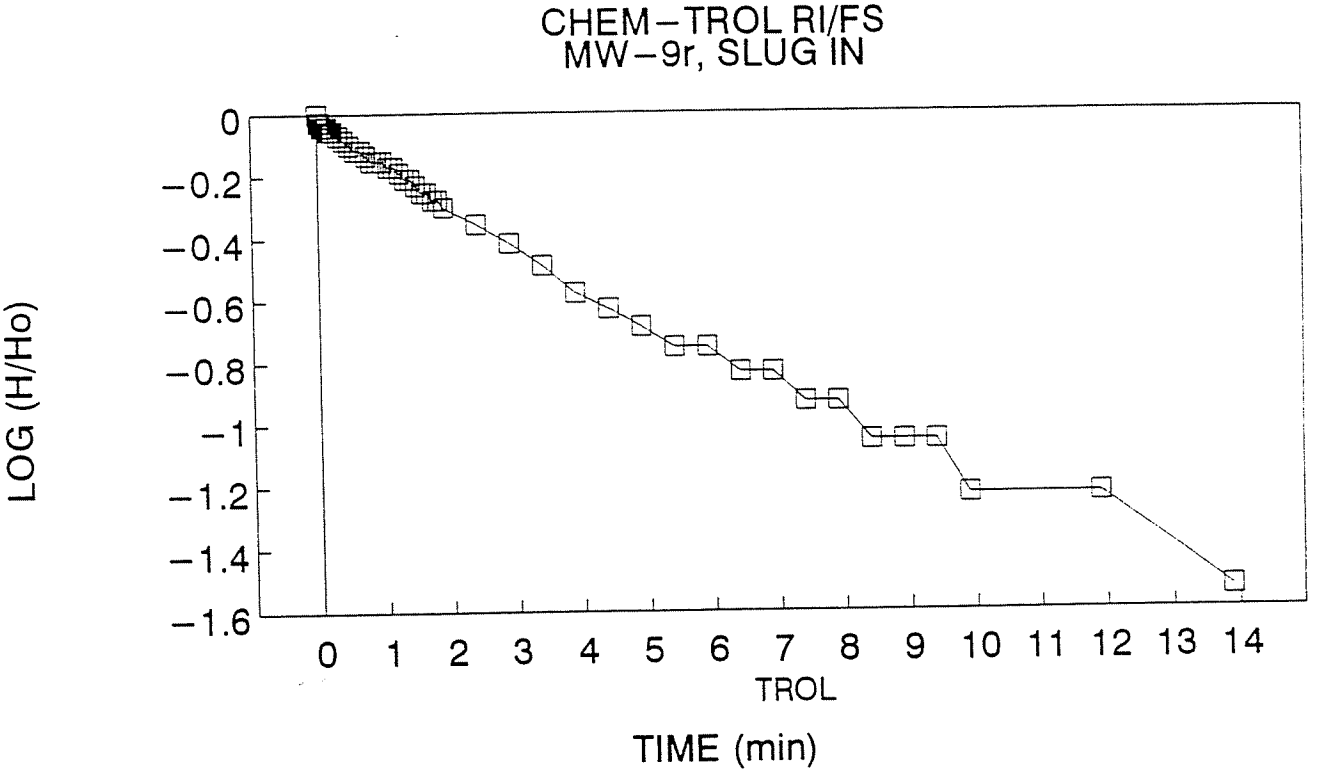
Hamburg, New York
HYDRAULIC CONDUCIVITY ESTIMATION

WELL ID	MW–9R	STATIC WATER LEVEL	7.53 FT
RISER DIA.	0.35 FT		
ZONE DIA.	0.25 FT		
TEST LENGTH	10.4 FT		
M	10		
SLUG	IN		

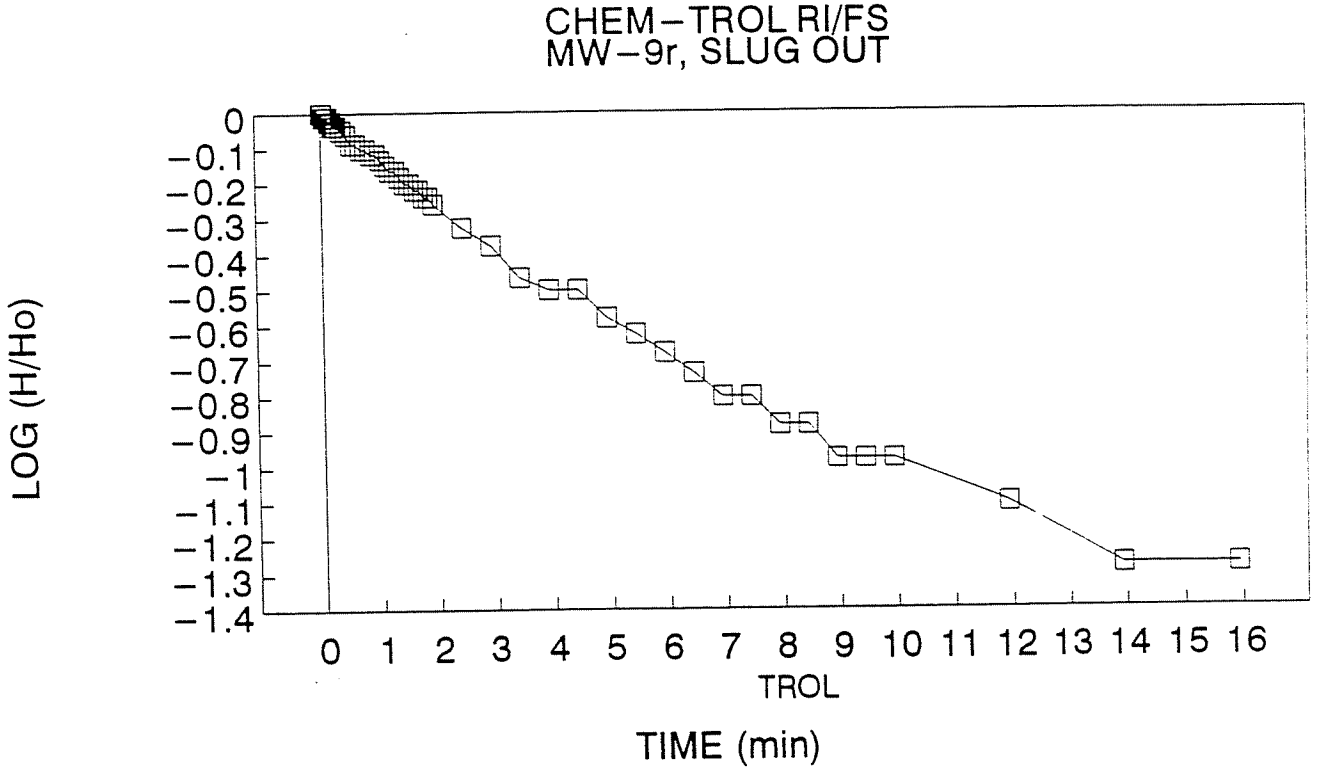


T1=	0.07	H1=	−0.31
T2=	6.40	H2=	−0.05

Kh=	3.2E−03 FT/MIN
Kh=	1.6E−03 CM/S

CHEM – TROL
REMEDIAL INVESTIGATION / FEASIBILITY STUDY
Hamburg, New York
HYDRAULIC CONDUCIVITY ESTIMATION

WELL ID	MW–9R	STATIC WATER LEVEL	7.53 FT
RISER DIA.	0.35 FT		
ZONE DIA.	0.25 FT		
TEST LENGTH	10.4 FT		
M	10		
SLUG	OUT		

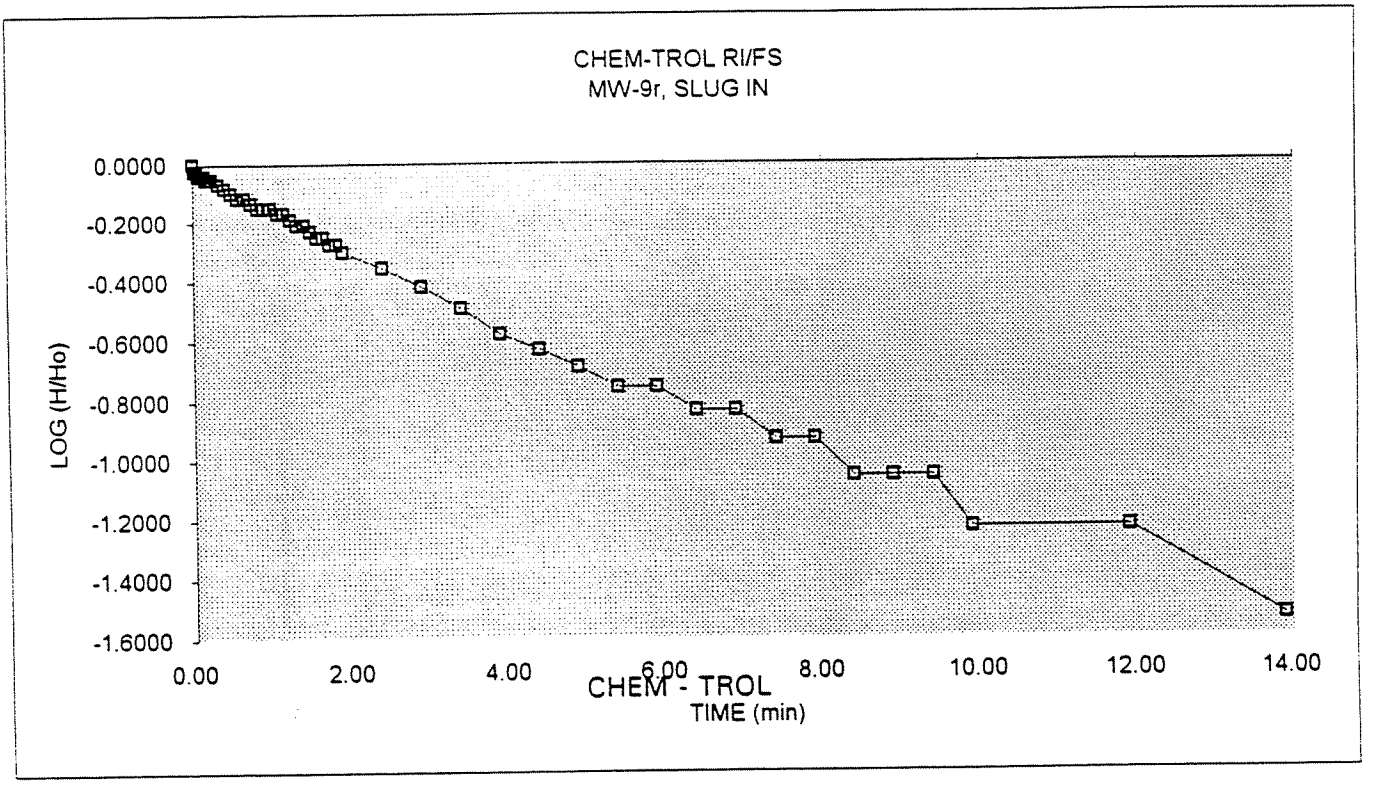


T1=	0.20	H1=	0.35
T2=	11.93	H2=	0.03

Kh= 2.3E–03 FT/MIN
Kh= 1.2E–03 CM/S

CHEM - TROL
REMEDIAL INVESTIGATION / FEASIBILITY STUDY
Hamburg, New York
HYDRAULIC CONDUCIVITY ESTIMATION

WELL ID	MW-9R	STATIC WATER LEVEL	7.53 FT
RISER DIA.	0.35	FT	
ZONE DIA.	0.25	FT	
TEST LENGTH	10.4	FT	
M	10		
SLUG	IN		

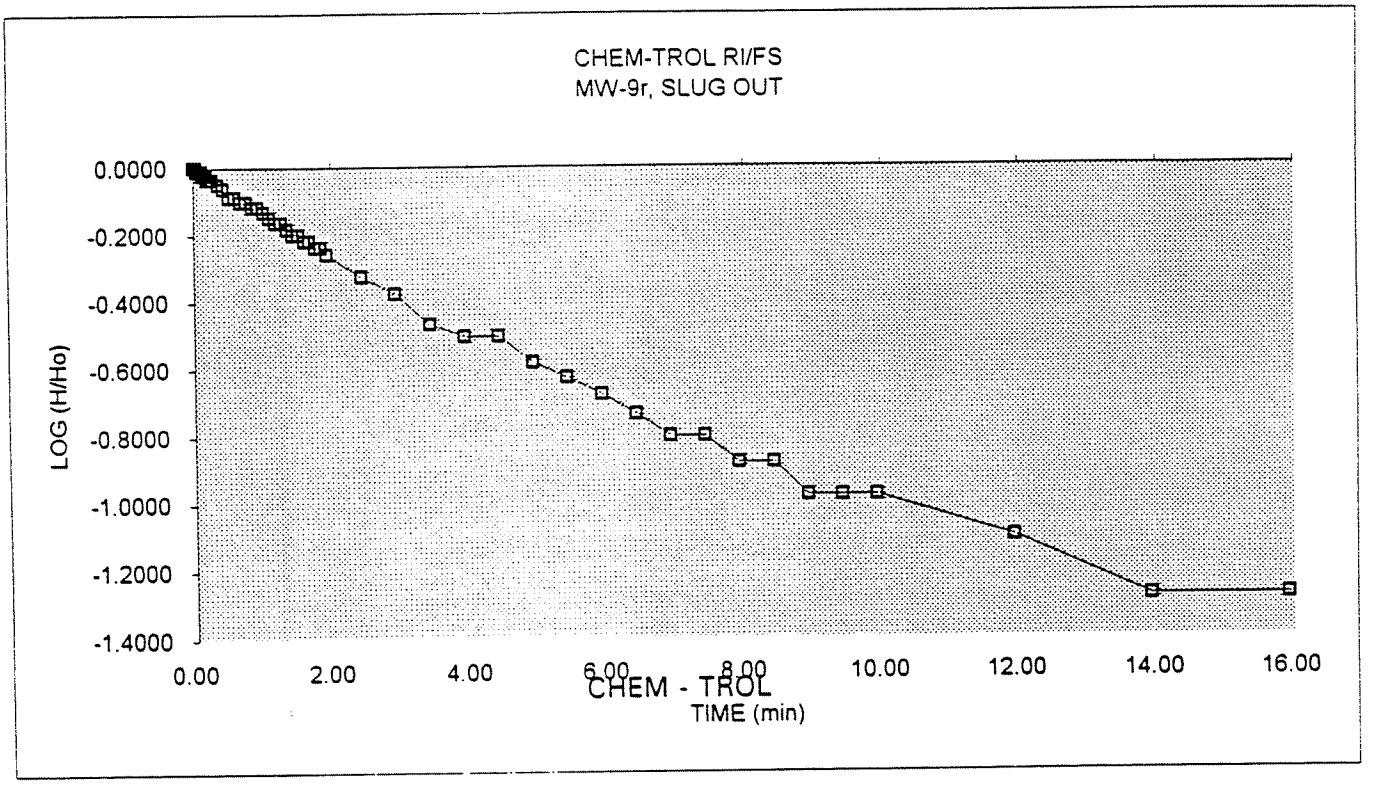


T1 =	0.07	H1 =	-0.31
T2 =	6.40	H2 =	-0.05

Kh =	3.2E-03	FT/MIN
Kh =	1.6E-03	CM/S

CHEM - TROL
REMEDIAL INVESTIGATION / FEASIBILITY STUDY
Hamburg, New York
HYDRAULIC CONDUCIVITY ESTIMATION

WELL ID	MW-9R	STATIC WATER LEVEL	7.53 FT
RISER DIA.	0.35	FT	
ZONE DIA.	0.25	FT	
TEST LENGTH	10.4	FT	
M	10		
SLUG	OUT		

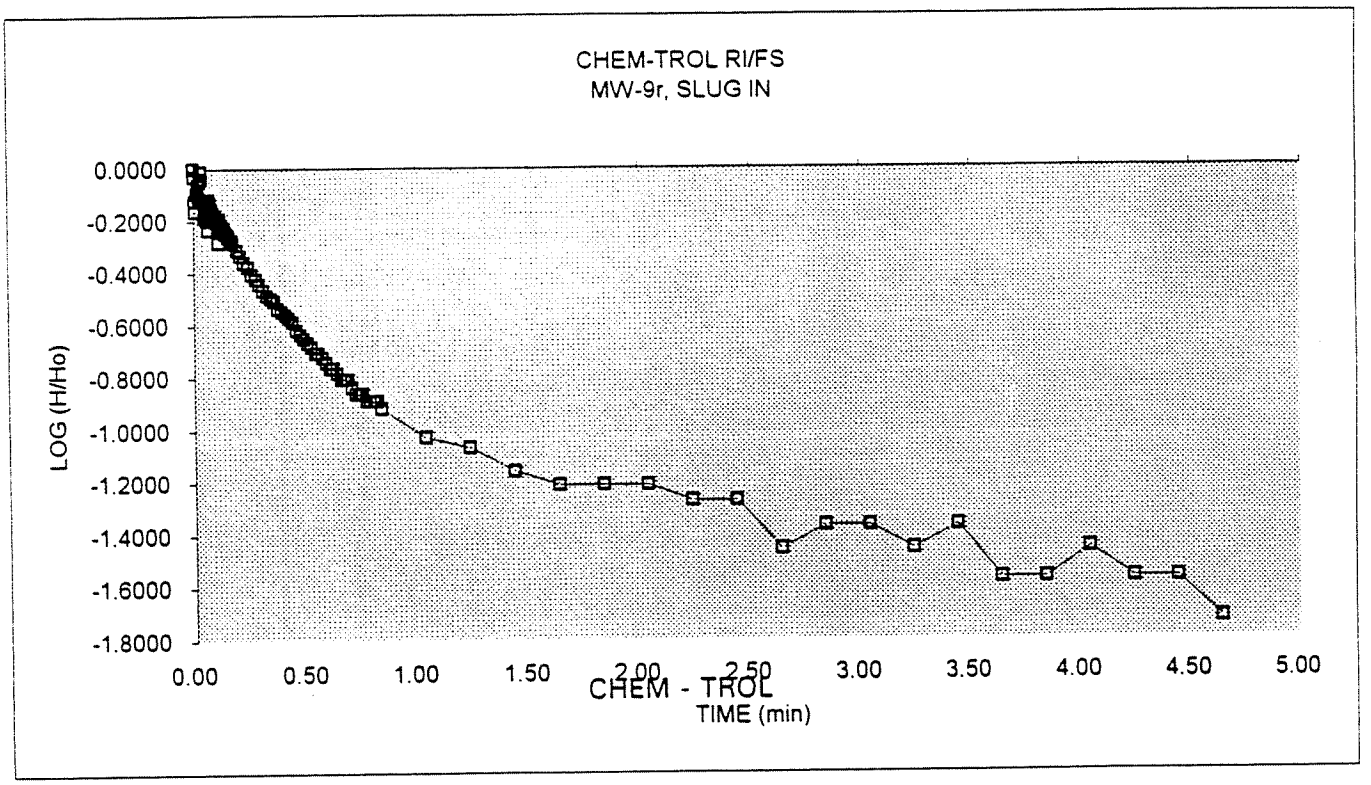


T1 =	0.20	H1 =	0.35
T2 =	11.93	H2 =	0.03

Kh =	2.3E-03	FT/MIN
Kh =	1.2E-03	CM/S

CHEM - TROL
REMEDIAL INVESTIGATION / FEASIBILITY STUDY
Hamburg, New York
HYDRAULIC CONDUCIVITY ESTIMATION
May (94)

WELL ID	MW-9R	STATIC WATER LEVEL	8.23 FT
RISER DIA.	0.31	FT	
ZONE DIA.	0.25	FT	
TEST LENGTH	15.4	FT	
M	10		
SLUG	IN		

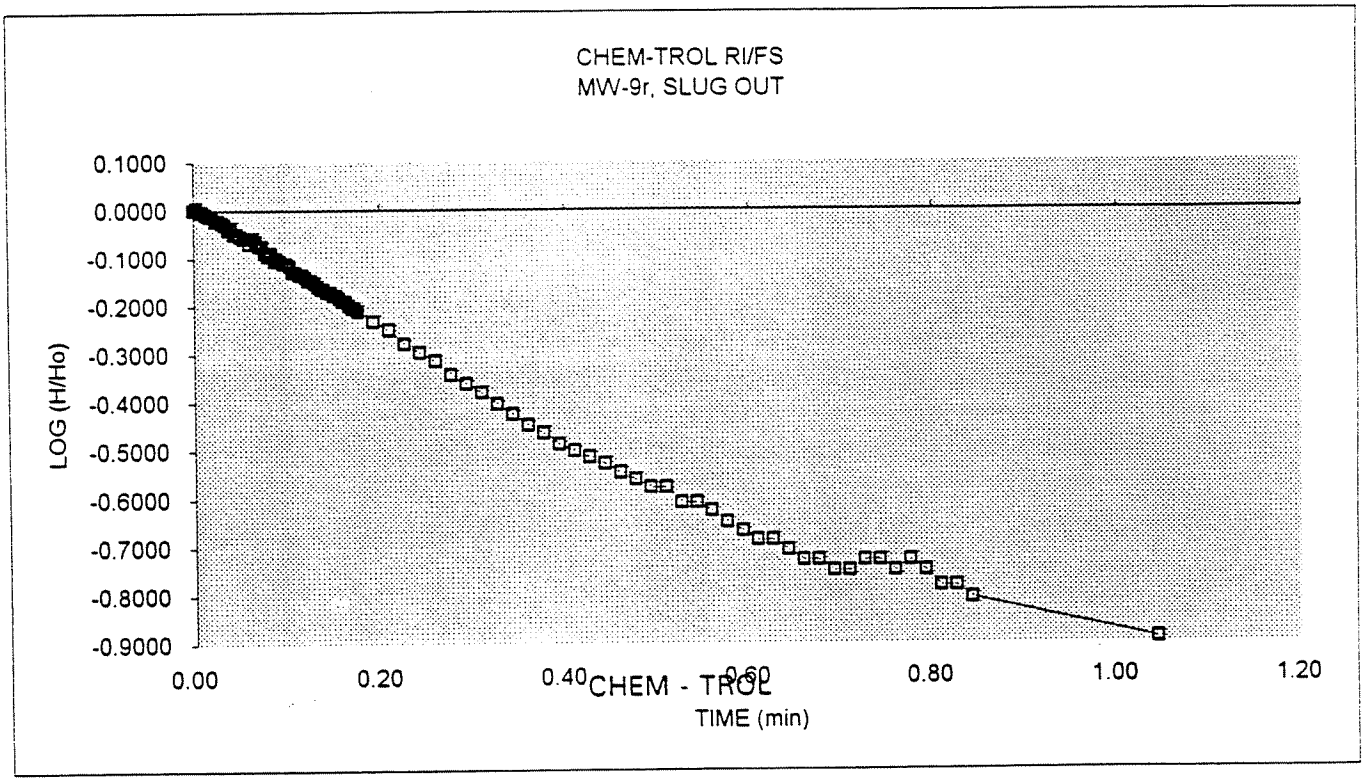


T1 =	0.83	H1 =	-0.05
T2 =	4.00	H2 =	-0.01

Kh =	3.1E-03	FT/MIN
Kh =	1.6E-03	CM/S

CHEM - TROL
REMEDIAL INVESTIGATION / FEASIBILITY STUDY
Hamburg, New York
HYDRAULIC CONDUCIVITY ESTIMATION
May (94)

WELL ID	MW-9R	STATIC WATER LEVEL	8.23 FT
RISER DIA.	0.31	FT	
ZONE DIA.	0.25	FT	
TEST LENGTH	15.4	FT	
M	10		
SLUG	OUT		

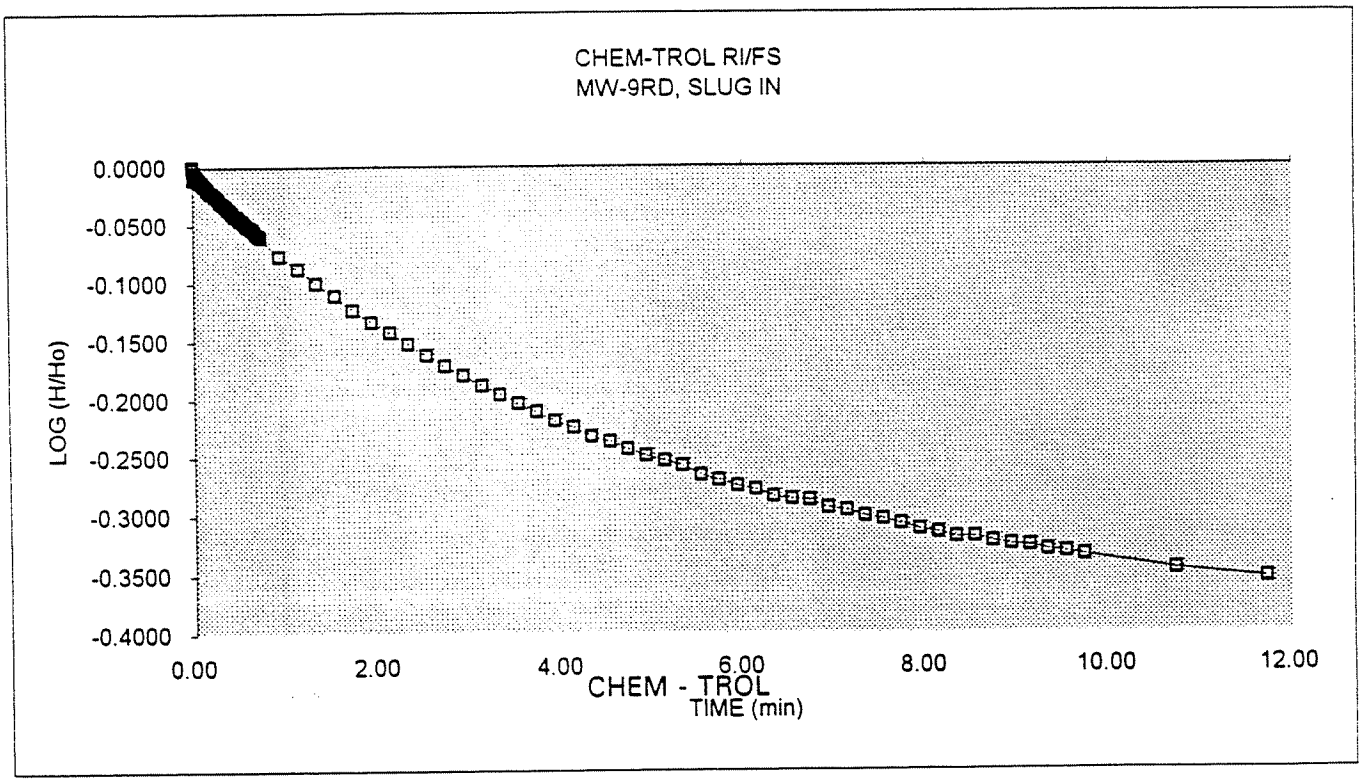


T1 =	0.21	H1 =	0.18
T2 =	0.51	H2 =	0.08

Kh =	1.7E-02	FT/MIN
Kh =	8.5E-03	CM/S

CHEM - TROL
REMEDIAL INVESTIGATION / FEASIBILITY STUDY
Hamburg, New York
HYDRAULIC CONDUCIVITY ESTIMATION

WELL ID	MW-9RD	STATIC WATER LEVEL	4.8 FT
RISER DIA.	0.13	FT	
ZONE DIA.	0.13	FT	
TEST LENGTH	25	FT	
M	10		
SLUG	IN		

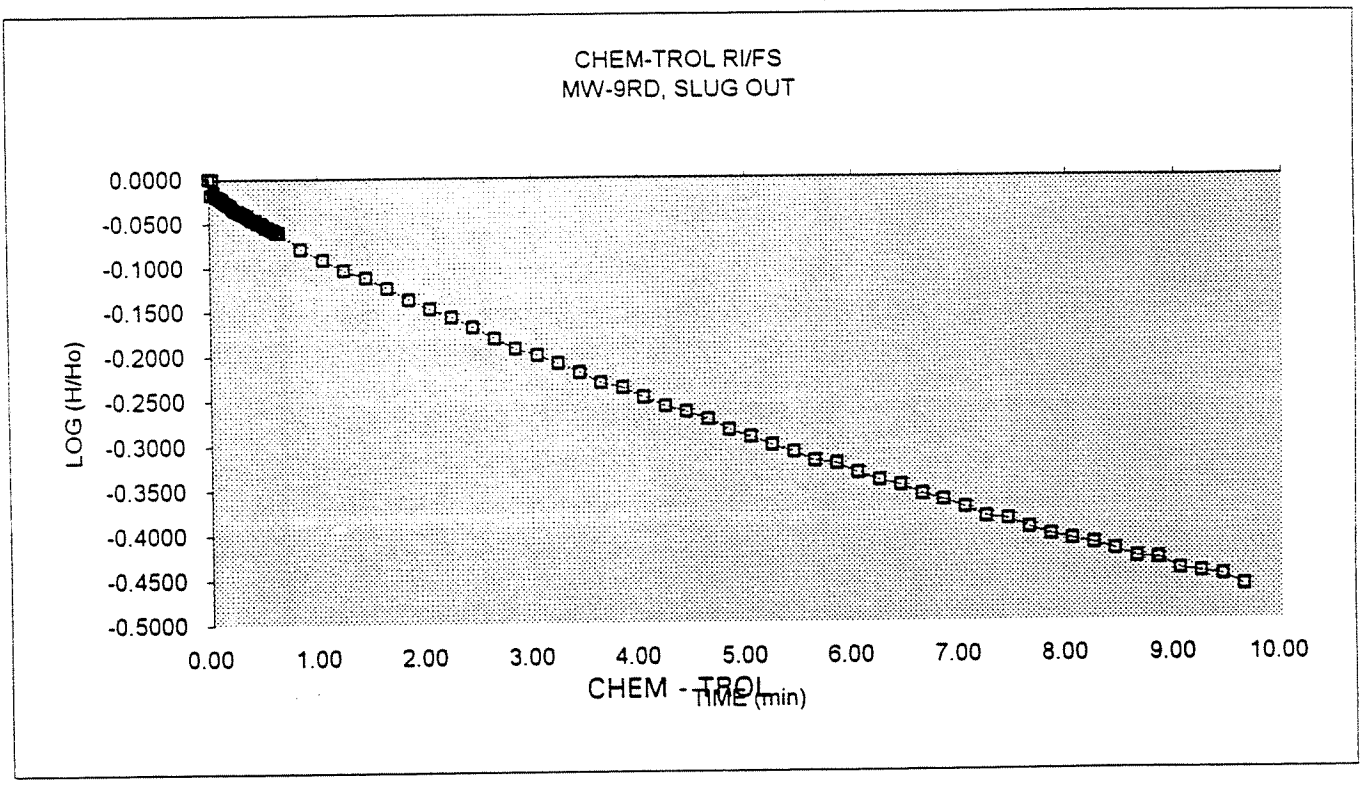


T1 =	5.34	H1 =	-1.23
T2 =	10.74	H2 =	-1.00

Kh =	2.7E-05	FT/MIN
Kh =	1.4E-05	CM/S

CHEM - TROL
REMEDIAL INVESTIGATION / FEASIBILITY STUDY
Hamburg, New York
HYDRAULIC CONDUCIVITY ESTIMATION

WELL ID	MW-9RD	STATIC WATER LEVEL	4.8 FT
RISER DIA.	0.13	FT	
ZONE DIA.	0.13	FT	
TEST LENGTH	25	FT	
M	10		
SLUG	OUT		

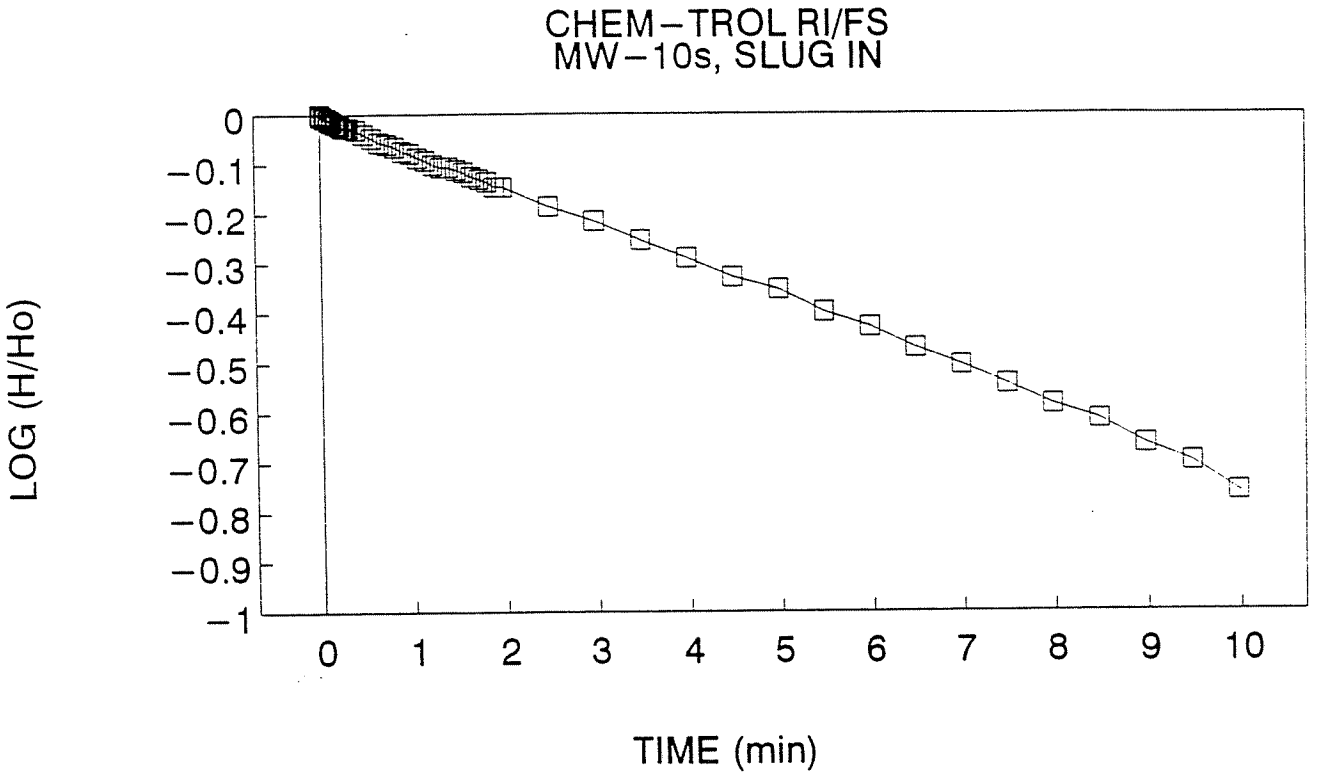


T1 =	4.25	H1 =	1.19
T2 =	9.25	H2 =	0.77

Kh =	6.1E-05	FT/MIN
Kh =	3.1E-05	CM/S

CHEM – TROL
REMEDIAL INVESTIGATION / FEASIBILITY STUDY
Hamburg, New York
HYDRAULIC CONDUCIVITY ESTIMATION

WELL ID	MW–10s	STATIC WATER LEVEL	3.4 FT
RISER DIA.	0.17 FT		
ZONE DIA.	0.67 FT		
TEST LENGTH	2.2 FT		
M	1		
SLUG	IN		

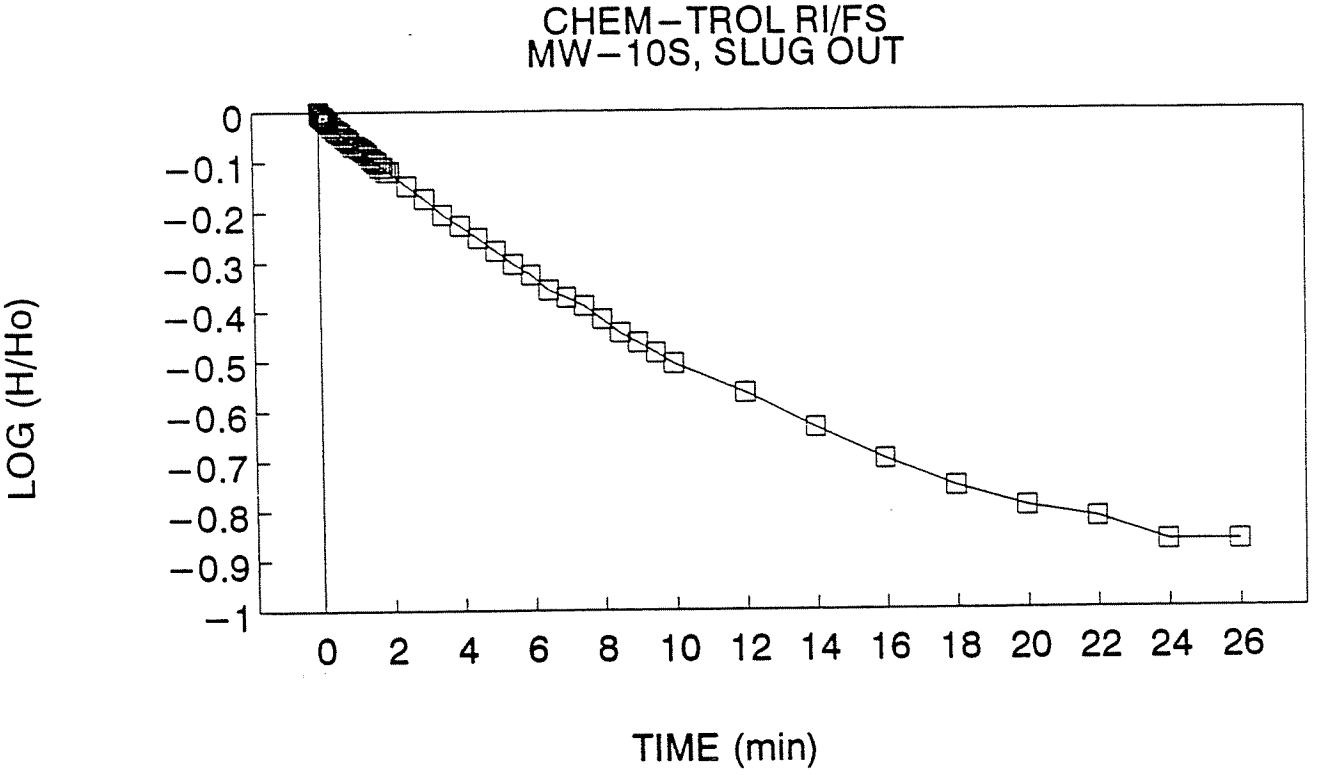


T1=	0.16	H1=	−1.10
T2=	11.97	H2=	−0.13

Kh= 7.4E–04 FT/MIN
Kh= 3.7E–04 CM/S

CHEM – TROL
REMEDIAL INVESTIGATION / FEASIBILITY STUDY
Hamburg, New York
HYDRAULIC CONDUCIVITY ESTIMATION

WELL ID	MW–10s	STATIC WATER LEVEL	3.4 FT
RISER DIA.	0.17 FT		
ZONE DIA.	0.67 FT		
TEST LENGTH	2.9 FT		
M	1		
SLUG	OUT		

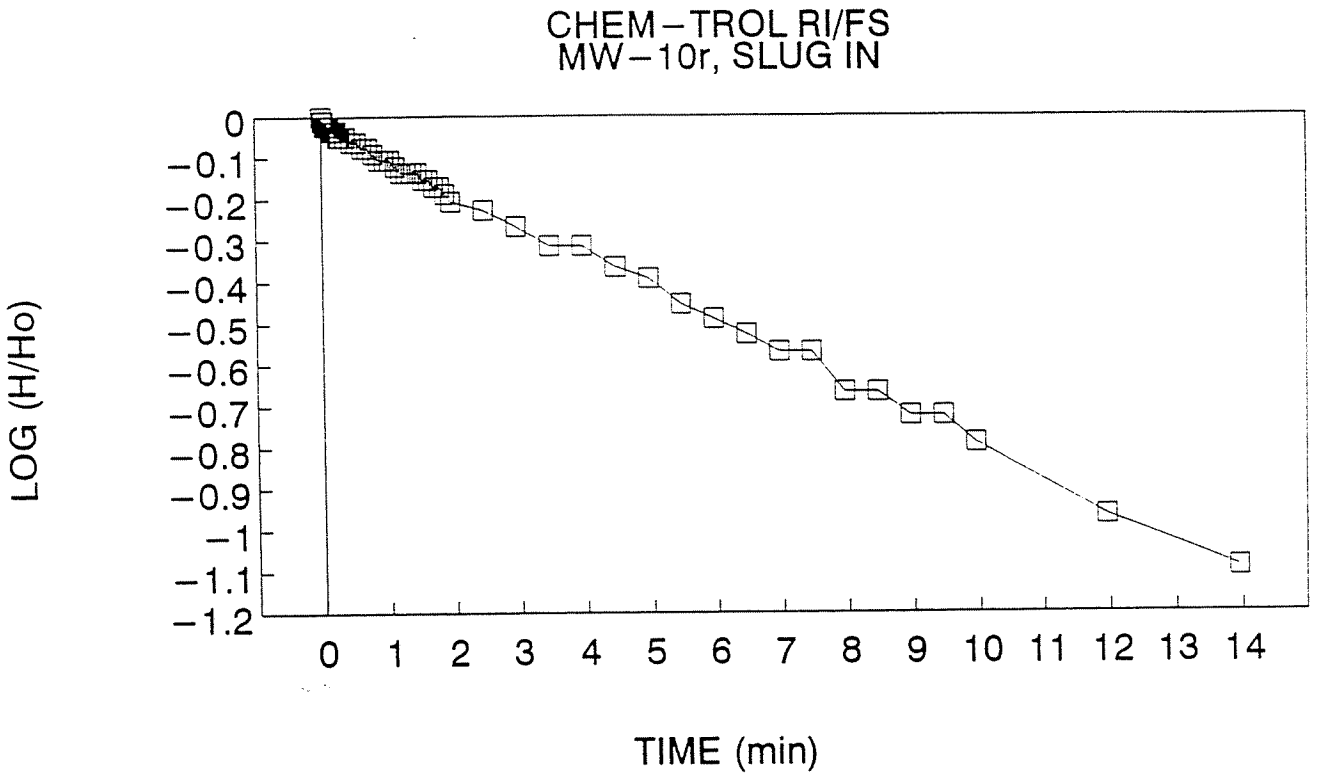


T1=	0.63	H1=	1.13
T2=	13.97	H2=	0.29

Kh= 3.5E–04 FT/MIN
Kh= 1.78E–04 CM/S

CHEM – TROL
REMEDIAL INVESTIGATION / FEASIBILITY STUDY
Hamburg, New York
HYDRAULIC CONDUCIVITY ESTIMATION

WELL ID	MW–10r	STATIC WATER LEVEL	4.79 FT
RISER DIA.	0.35 FT		
ZONE DIA.	0.25 FT		
TEST LENGTH	10.3 FT		
M	10		
SLUG	IN		

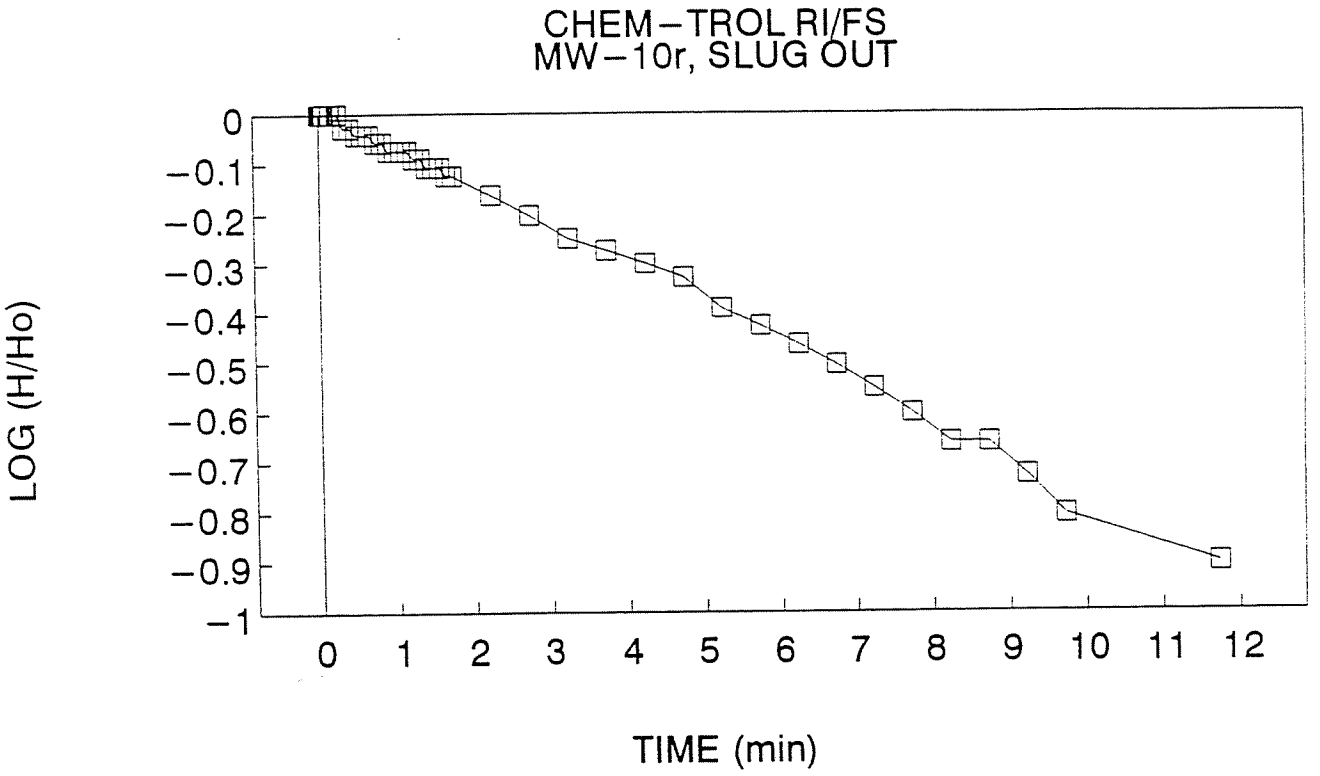


T1=	0.13	H1=	−0.34
T2=	9.95	H2=	−0.06

Kh= 2.0E−03 FT/MIN
Kh= 1.0E−03 CM/S

CHEM – TROL
REMEDIAL INVESTIGATION / FEASIBILITY STUDY
Hamburg, New York
HYDRAULIC CONDUCIVITY ESTIMATION

WELL ID	MW–10R	STATIC WATER LEVEL	4.79 FT
RISER DIA.	0.35 FT		
ZONE DIA.	0.25 FT		
TEST LENGTH	10.3 FT		
M	10		
SLUG	OUT		

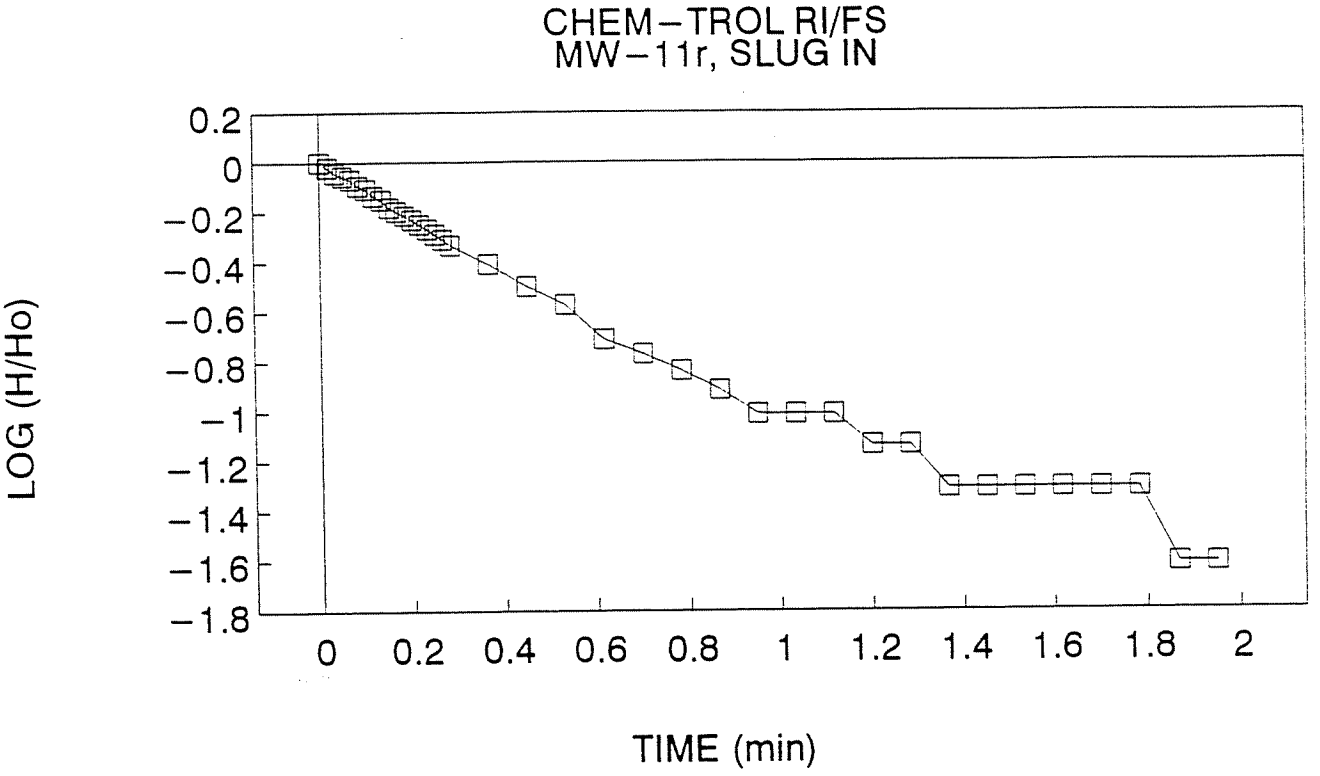


T1=	0.57	H1=	0.29
T2=	8.23	H2=	0.07

Kh= 2.1E–03 FT/MIN
Kh= 1.1E–03 CM/S

CHEM – TROL
REMEDIAL INVESTIGATION / FEASIBILITY STUDY
Hamburg, New York
HYDRAULIC CONDUCIVITY ESTIMATION

WELL ID	MW–11r	STATIC WATER LEVEL	14.48 FT
RISER DIA.	0.35 FT		
ZONE DIA.	0.25 FT		
TEST LENGTH	10 FT		
M	10		
SLUG	IN		

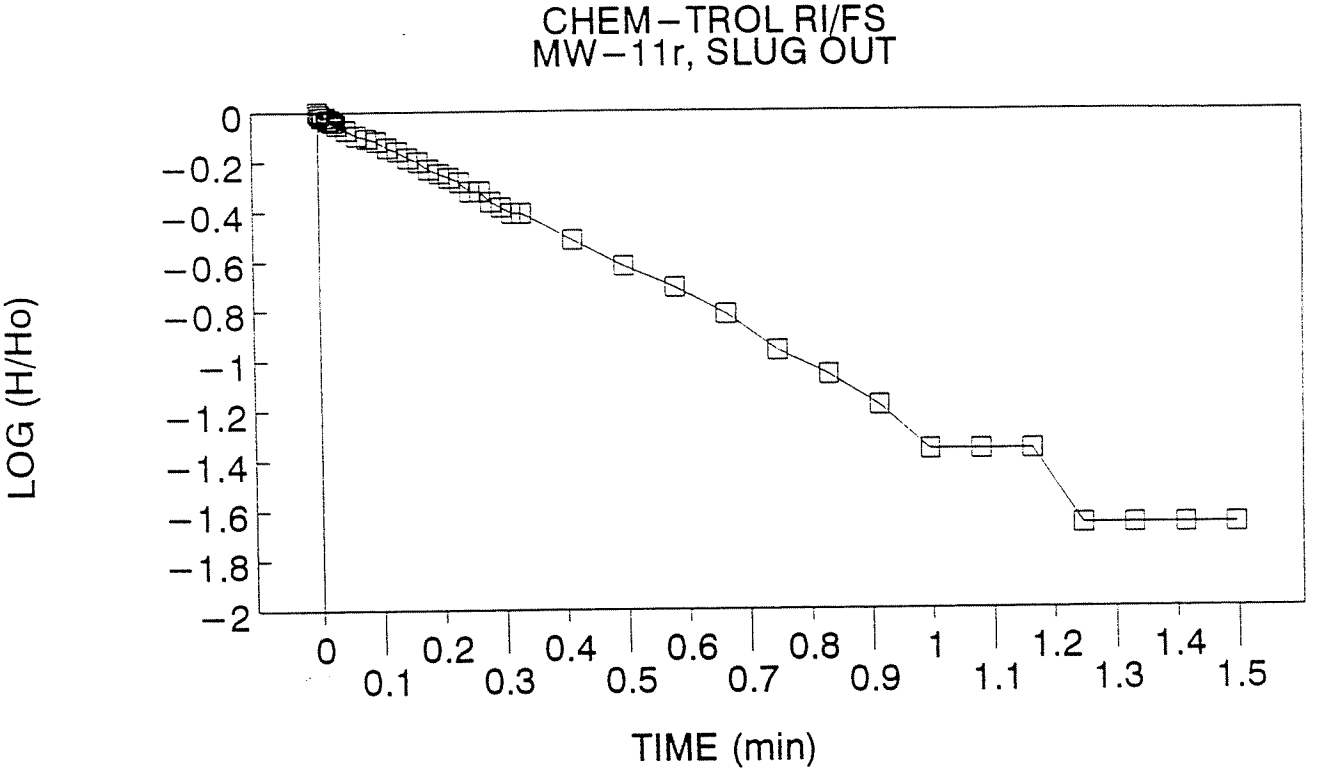


T1=	0.03	H1=	–0.37
T2=	0.78	H2=	–0.06

Kh= 2.8E–02 FT/MIN
Kh= 1.4E–02 CM/S

CHEM – TROL
REMEDIAL INVESTIGATION / FEASIBILITY STUDY
Hamburg, New York
HYDRAULIC CONDUCIVITY ESTIMATION

WELL ID	MW–11r	STATIC WATER LEVEL	14.48 FT
RISER DIA.	0.35 FT		
ZONE DIA.	0.25 FT		
TEST LENGTH	10 FT		
M	10		
SLUG	OUT		

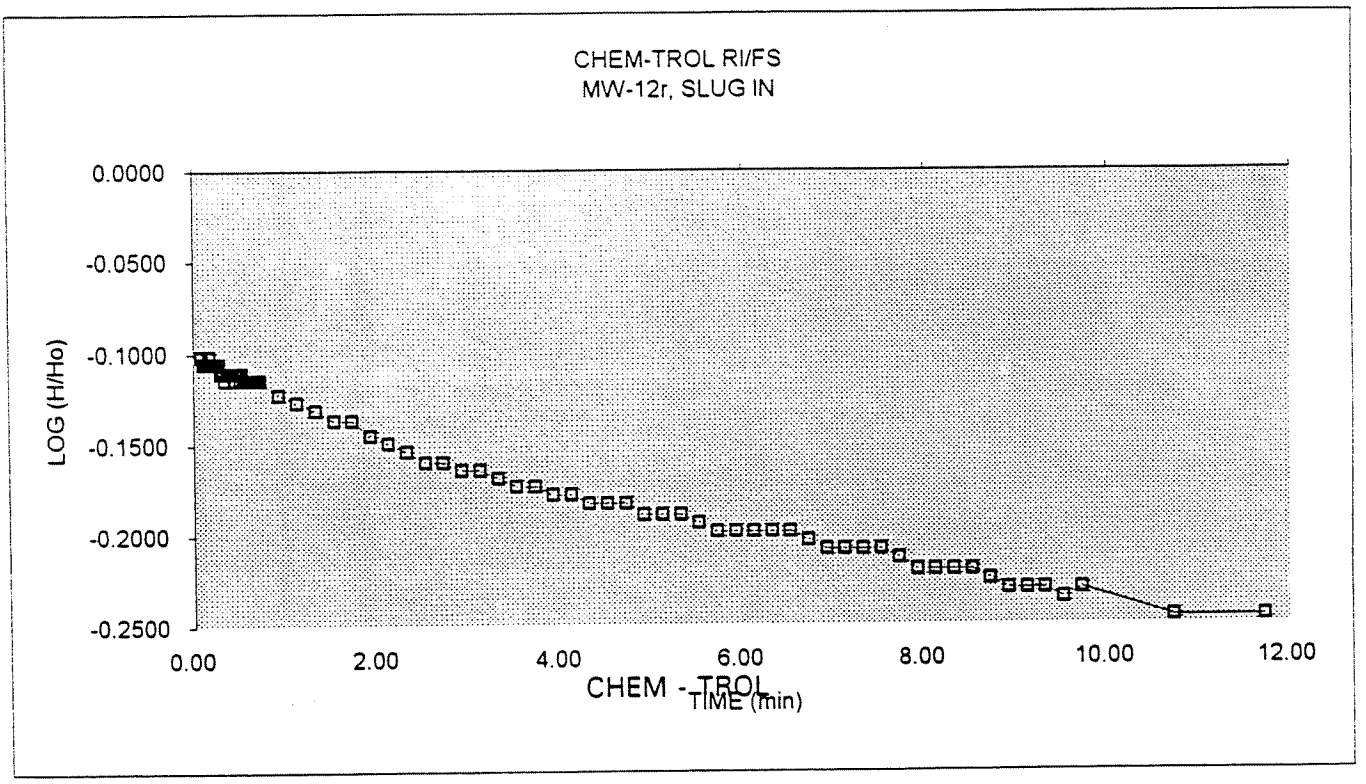


T1=	0.03	H1=	0.41
T2=	0.75	H2=	0.05

Kh= 3.4E–02 FT/MIN
Kh= 1.7E–02 CM/S

CHEM - TROL
REMEDIAL INVESTIGATION / FEASIBILITY STUDY
Hamburg, New York
HYDRAULIC CONDUCIVITY ESTIMATION

WELL ID	MW-12R	STATIC WATER LEVEL	9.89 FT
RISER DIA.	0.31	FT	
ZONE DIA.	0.25	FT	
TEST LENGTH	10.9	FT	
M	10		
SLUG	IN		

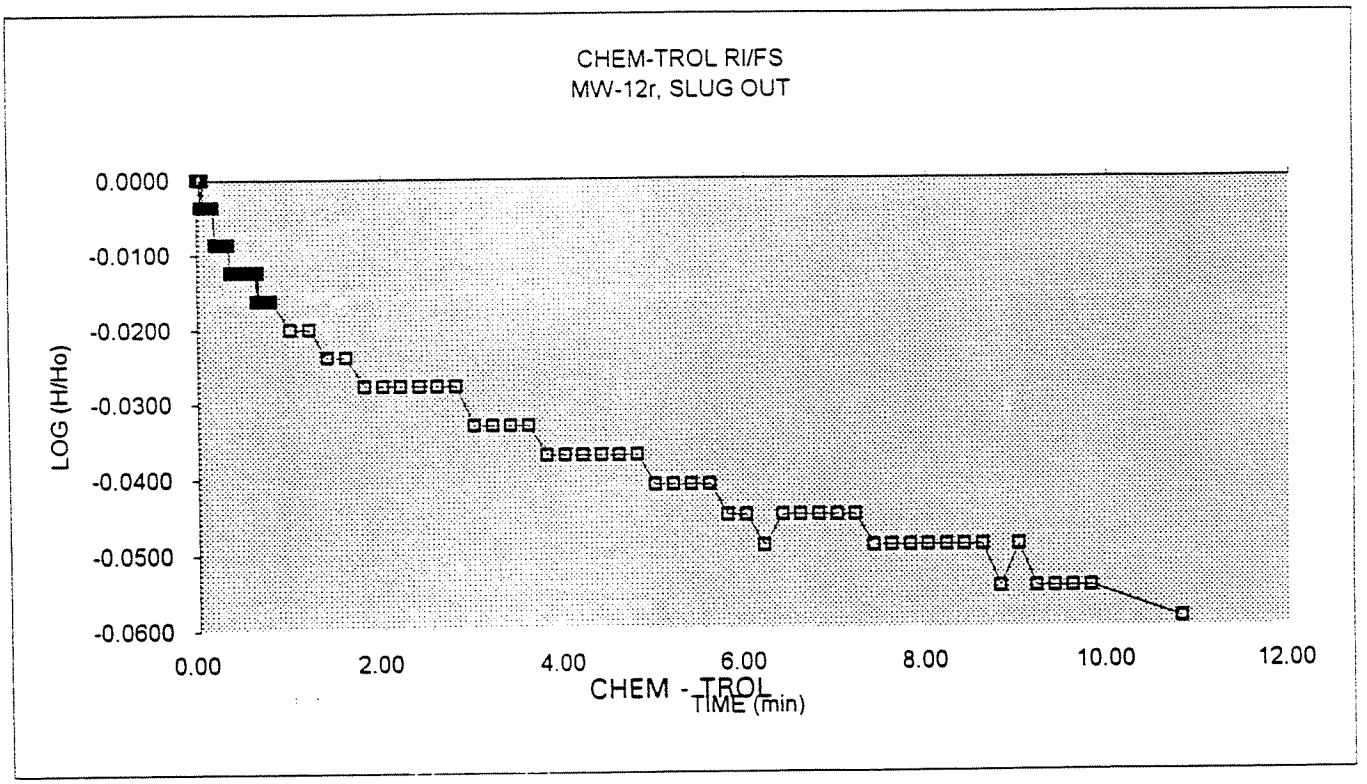


T1 =	0.93	H1 =	-0.32
T2 =	7.13	H2 =	-0.26

Kh =	2.8E-04	FT/MIN
Kh =	1.4E-04	CM/S

CHEM - TROL
REMEDIAL INVESTIGATION / FEASIBILITY STUDY
Hamburg, New York
HYDRAULIC CONDUCIVITY ESTIMATION

WELL ID	MW-12R	STATIC WATER LEVEL	9.89 FT
RISER DIA.	0.31	FT	
ZONE DIA.	0.25	FT	
TEST LENGTH	10.9	FT	
M	10		
SLUG	OUT		

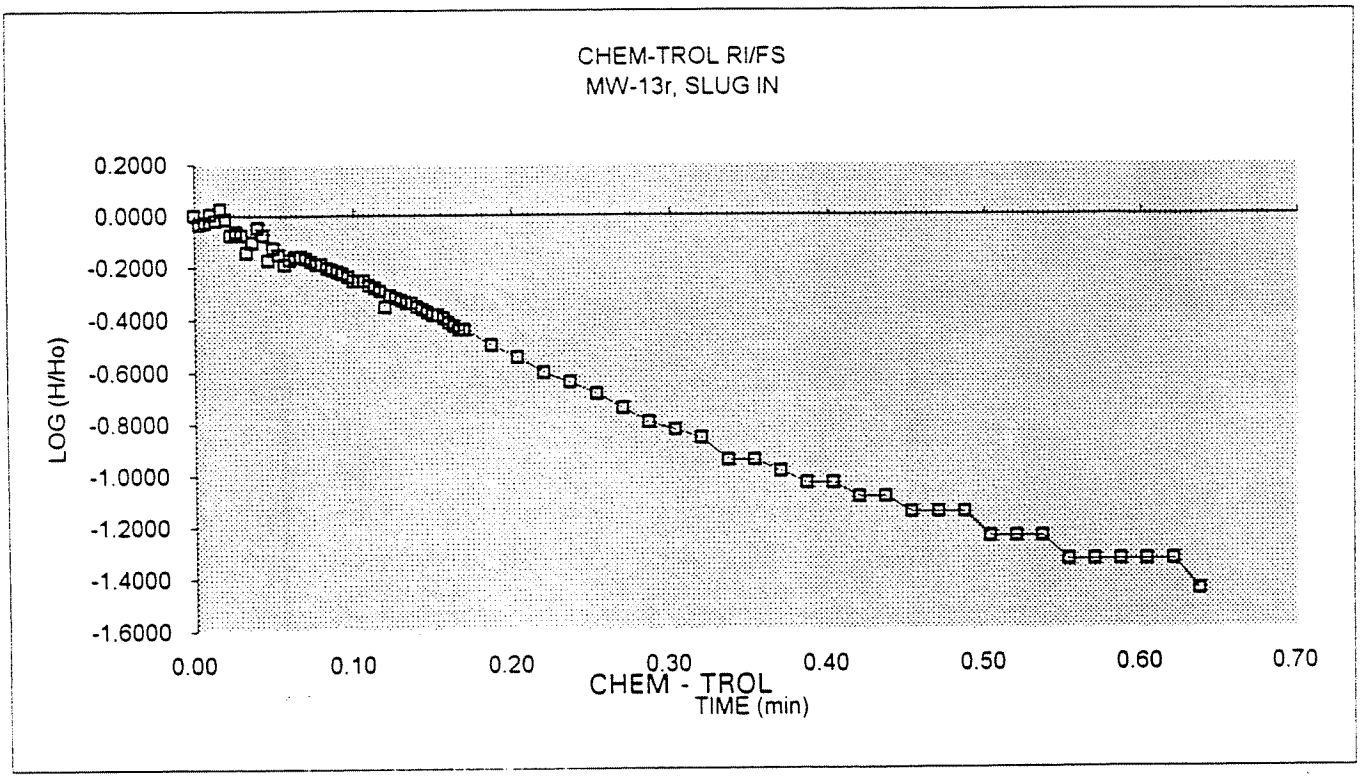


T1 =	1.20	H1 =	0.34
T2 =	6.00	H2 =	0.32

Kh =	1.1E-04	FT/MIN
Kh =	5.4E-05	CM/S

CHEM - TROL
REMEDIAL INVESTIGATION / FEASIBILITY STUDY
Hamburg, New York
HYDRAULIC CONDUCIVITY ESTIMATION

WELL ID	MW-13R	STATIC WATER LEVEL	5.95 FT
RISER DIA.	0.31	FT	
ZONE DIA.	0.25	FT	
TEST LENGTH	10.7	FT	
M	10		
SLUG	IN		

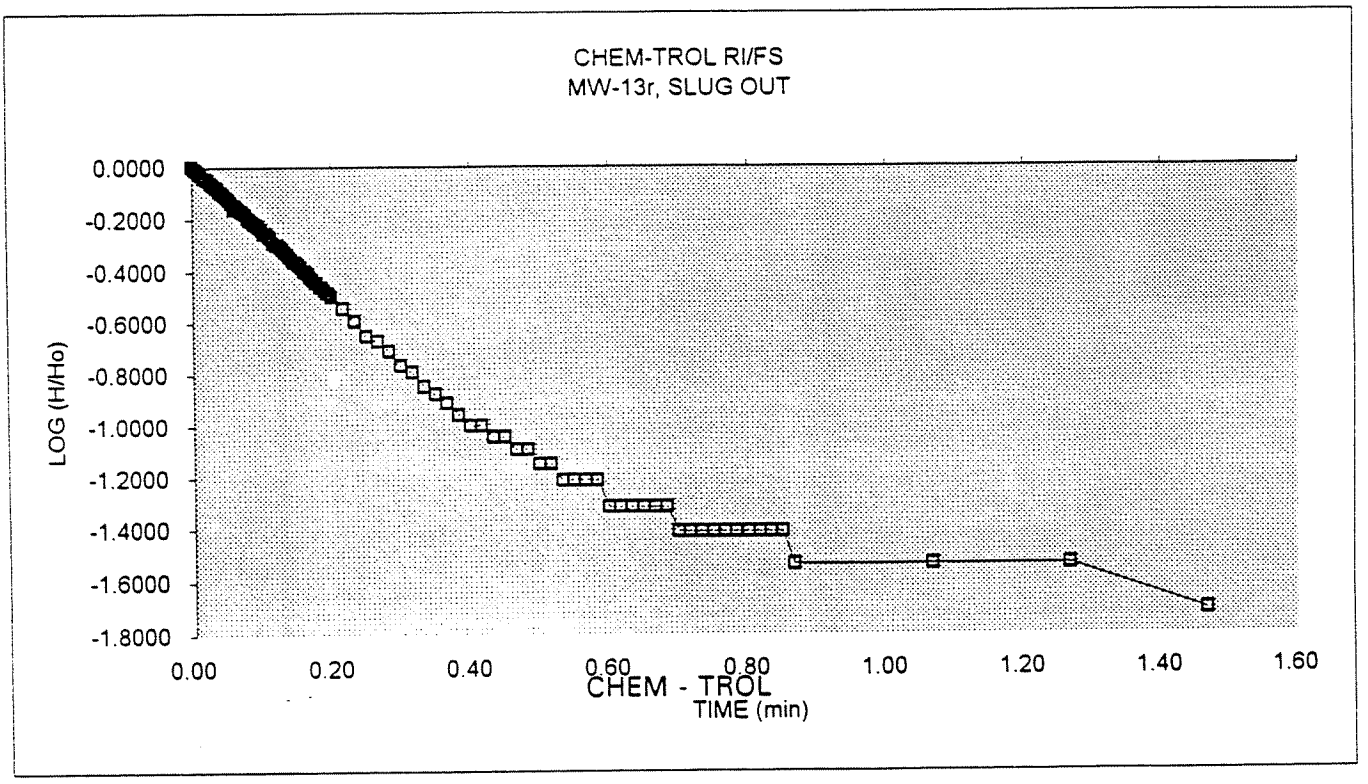


T1 =	0.10	H1 =	-0.16
T2 =	0.40	H2 =	-0.06

Kh =	2.8E-02	FT/MIN
Kh =	1.4E-02	CM/S

CHEM - TROL
REMEDIAL INVESTIGATION / FEASIBILITY STUDY
Hamburg, New York
HYDRAULIC CONDUCIVITY ESTIMATION

WELL ID	MW-13R	STATIC WATER LEVEL	5.95 FT
RISER DIA.	0.31	FT	
ZONE DIA.	0.25	FT	
TEST LENGTH	10.7	FT	
M	10		
SLUG	OUT		

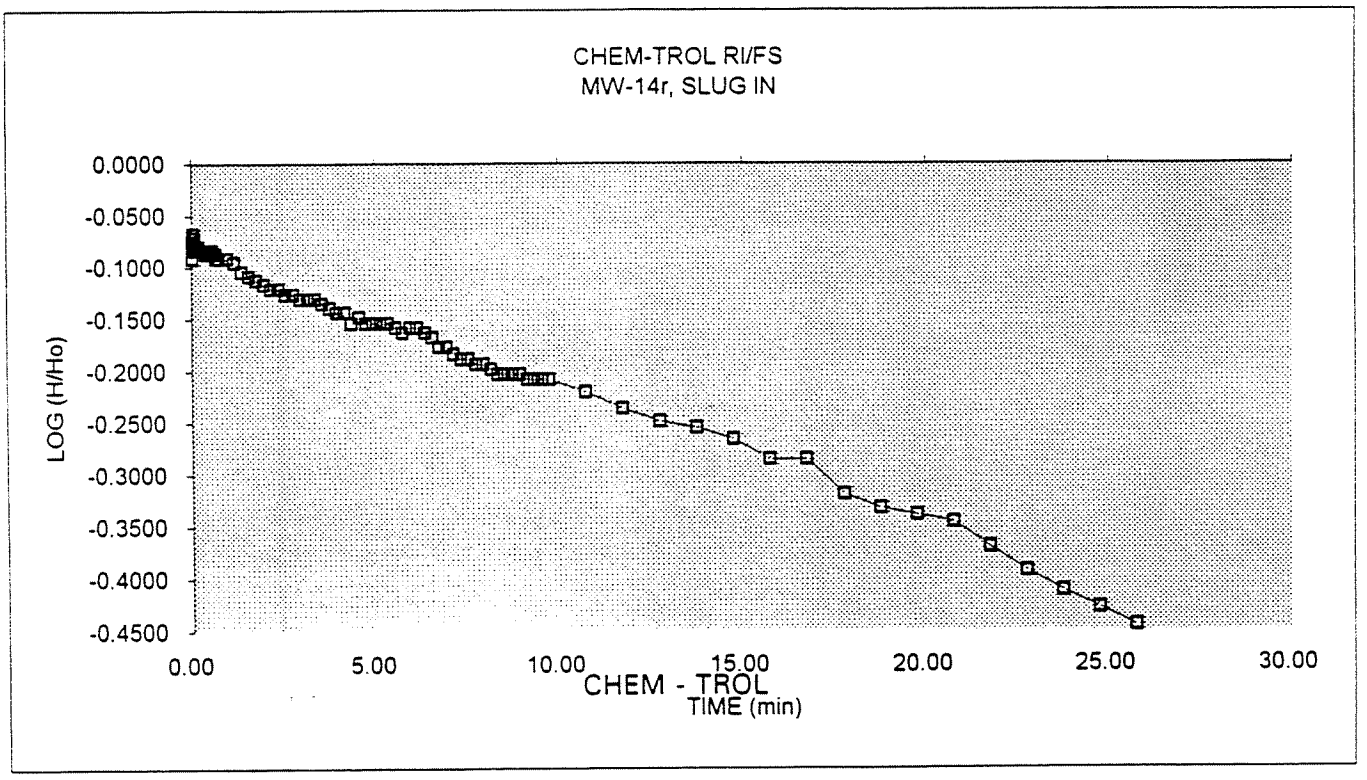


T1 =	0.20	H1 =	0.10
T2 =	0.70	H2 =	0.02

Kh =	2.7E-02	FT/MIN
Kh =	1.4E-02	CM/S

CHEM - TROL
REMEDIAL INVESTIGATION / FEASIBILITY STUDY
Hamburg, New York
HYDRAULIC CONDUCIVITY ESTIMATION

WELL ID	MW-14R	STATIC WATER LEVEL	7.26 FT
RISER DIA.	0.31	FT	
ZONE DIA.	0.25	FT	
TEST LENGTH	14.3	FT	
M	10		
SLUG	IN		

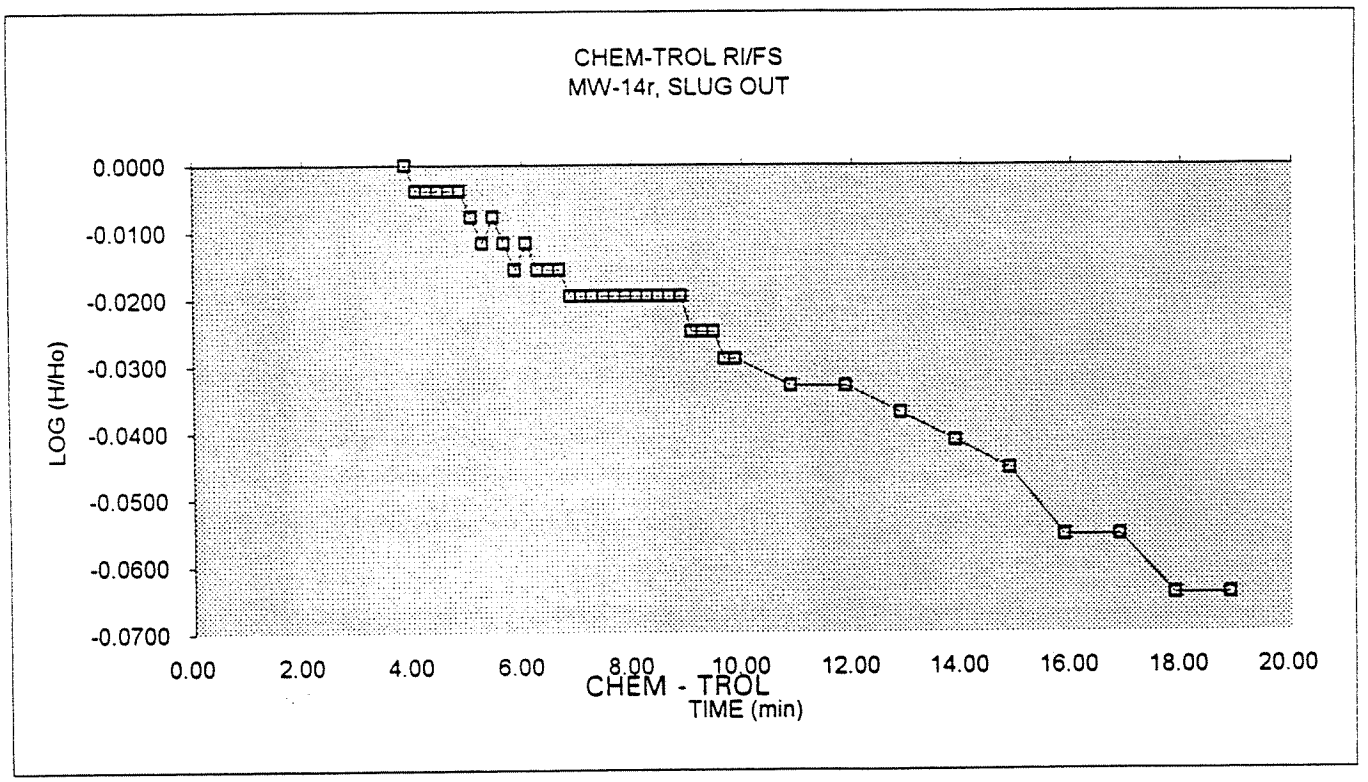


T1 =	1.97	H1 =	-0.32
T2 =	16.77	H2 =	-0.21

Kh =	1.9E-04	FT/MIN
Kh =	9.6E-05	CM/S

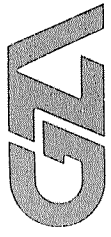
CHEM - TROL
REMEDIAL INVESTIGATION / FEASIBILITY STUDY
Hamburg, New York
HYDRAULIC CONDUCIVITY ESTIMATION

WELL ID	MW-14R	STATIC WATER LEVEL	7.26 FT
RISER DIA.	0.31	FT	
ZONE DIA.	0.25	FT	
TEST LENGTH	14.3	FT	
M	10		
SLUG	OUT		



T1 =	4.88	H1 =	0.34
T2 =	17.88	H2 =	0.29

Kh =	8.1E-05	FT/MIN
Kh =	4.1E-05	CM/S



APPENDIX F

SELECTED FIGURES FROM
THE FIELD INVESTIGATION
DATA REPORT

APPENDIX G

1994 ENVIRONMENTAL SAMPLING ANALYTICAL TEST RESULTS

Data Validation Report
Chem-Trol Site-GZA Project No. R5945
By
Althea L. Lindell
September 12, 1994

I. Introduction

This data validation report is based upon a review of data generated from the water samples collected at the Chem-Trol site in Hamburg, New York on May 31 and June 1, 1994 and received by RECRA Environmental, Inc. June 1, 1994. The analytical data received from RECRA Environmental, Amherst, New York has been reviewed in accordance with the data validation requirements listed in the Scope of Work for the Chem-Trol Remedial Investigation/Feasibility Study Work Plan dated March 1992 (with Addenda dated June 1992 & August 1992), and the Project Quality Assurance Plan dated November 22, 1989. The " Laboratory Data Validation Functional Guidelines for Evaluating Organic Analyses" (US. EPA December 1990 (Revised June 1991)) have been used to assist in the review process. Data was assessed to determine the usability of the analytical results as well as the contractual completeness and compliance. The analysis were performed in accordance with the Contract Laboratory Program and the 1991 New York State Analytical Services Protocols (ASP91). This data has under gone a quality control evaluation and qualifier codes have been placed next to analytical results to assist the data user in evaluating the qualitative and/or quantitative reliability of any result. This report highlights any problems encountered that affected data quality, and details of this quality assurance review are presented in the narrative below.

II. Organic Data - Volatiles

There were nine (9) groundwater samples along with one (1) matrix spike/ matrix spike duplicate (MS/MSD), one (1) duplicate, one (1) field blank, and one (1) trip blank analyzed by the laboratory for volatile organics. This report is based on a review of holding times, GC/MS tuning, target compound matching quality, calibration, blank analyses results, surrogate spike recoveries, internal standard areas, quantitation of positive results, and tentatively identified compounds. The qualifier codes have been placed on the report sheets.

Task I - Completeness Assessment

The data package received for volatiles was complete.

Task II - Compliance Assessment

A. Holding Times
The holding time of 7 days from VSTR for unpreserved samples was not exceeded for any water sample.

B. Blank Analysis
There were appropriate method blanks analyzed; one for each 12 hours and each sample matrix analyzed within those 12 hours. The instrument blank, VBLK70, analyzed on 6/3/94 contained 0.61 ppb of *o*-chlorotoluene, and the matrix spike blank contained 2.7 ug/l of *o*-chlorotoluene. Four of the associated samples, MW-14R, MW-1S, MW-9RD, and MW-1R, have been qualified as not detected for o-chlorotoluene since they contained less than 5x the amount in the associated blank. See Table 1 for the associated samples and the qualifications.

Table 1 - Qualified Samples Due to o-Chlorotoluene Contamination

Sample	o-Chlorotolene Conc.	Qualified o-Chlorotoluene Result
MW-1S	1 J	10 U
MW-1R	16 J	100 U
MW-9RD	3 J	10 U
MW-14R	3 J	10 U

C. Calibration .

In the continuing calibration on 6/2/94 for chlorotoluenes the percent difference (%D), between the initial calibration average RRF and the RRF in the calibration verification exceeded the maximum technical criteria of 25% (*o*-chlorotoluene - 40.1%, *m*-chlorotolene - 27.2%, and *p*-chlorotoluene - 26.2%), but the minimum RRF criteria of 0.05 was met. The associated samples, Trip Blank, Field Blank, MW-12R, MW-12S, MW-13R, MW-8R, MW-9R, and DUP1, have been flagged with a "J" code and qualified as estimated for chlorotoluenes. In the continuing calibration on 6/3/94 the %D between the initial calibration average RRF and the RRF for o-chlorotoluene in the continuing calibration exceeded the technical criteria of 25% (26.0%), but met the minimum RRF criteria. The o-chlorotoluene values for the associated samples, MW-8RDL, MW-13RDL, MW-14R, MW-1S, MW-9RD, MW-1R, MW-9RDL, and DUP1DL, have been flagged with a "J" code and qualified as estimated. See Table 2 for samples and qualifications.

Table 2 - Sample Data Qualified Due to Calibration Criteria Exceedances

Sample	*o*-Chlorotoluene	*m*-Chlorotoluene	*p*-Chlorotoluene
Trip Blank	10 UJ	10 UJ	10 UJ
Field Blank	10 UJ	10 UJ	10 UJ
MW-12R	10 UJ	10 UJ	10 UJ
MW-12S	10 UJ	10 UJ	10 UJ
MW-13R	1600 J	10 UJ	10 UJ
MW-8R	2400 J	10 UJ	10 UJ
MW-9R	2100 J	10 UJ	10 UJ
DUP1	2200 J	10 UJ	10 UJ
MW-8RDL	4200 J	-----	-----
MW-13RDL	1700 J	-----	-----
MW-14R	10 UJ	-----	-----
MW-1S	10 UJ	-----	-----
MW-9RD	10 UJ	-----	-----
MW-1R	100 UJ	-----	-----
MW-9RDL	620 J	-----	-----
DUP1DL	2500 J	-----	-----

D. Field Duplicate Analysis
There is no guidance concerning field duplicate acceptance, but according to Region I guidelines the criteria for acceptable field duplicated analysis is 30% RPD for water samples. The comparative results for the field duplicates are presented in the Table 3.

Table 3- Field Duplicate Comparative Results

Sample	MW-8R	DUP1	RPD
Vinyl Chloride	3 J	3 J	*
Chloroethane	52	51	5.1%
MeCl	0.8 J	0.8 J	*
1,1-Dichloroethene	66	67	1.5%
1,1-Dichloroethane	380	370	2.7%
1,2-Dichloroethenes	13	14	7.4%
Chloroform	2 J	2 J	*
1,1,1-Trichloroethane	580	520	11%
Trichloroethene	170	160	6.1%
1,1,2-Trichloroethane	10 U	0.9 J	*
Tetrachloroethane	0.8 J	0.7 J	*
Toluene	4 J	4 J	*
Total Xylenes	10 U	0.6 J	*
o-Chlorotoluene	4,200	2500	51%

* - One or both of the values are below the required detection limit and no useful precision data could be calculated.

The RPD between the *o*-chlorotoluene results exceed the EPA recommended guidelines, and therefore the *o*-chlorotoluene values in samples MW-8R and DUP1 have been flagged with a "J" code and qualified as estimated.

E. Matrix Spike/ Matrix Spike Duplicate (MS/MSD)
Sample MW-1R was used for the MS/MSD. The % recovery for trichloroethene in both samples was 180% and therefore exceeded the acceptance limits. However, the sample contained trichloroethene at a high level (1500 ppb) and therefore qualification of sample data is not necessary since no useful accuracy/precision data could be calculated.

The MS/MSD contained nonspiked compounds at just below the detection limits - 1,2-dichloroethenes at 22J and 21J ppb respectively and o-chlorotoluene at 9J and 12J ppb respectively. These results agree with the sample results (1,2-dichloroethenes - 26J ppb and o-chlorotoluene - 16J ppb).

F. Overall Assessment
Overall the data is usable and valid with the appropriate qualifiers.

III. Organic data - Semivolatiles

There were nine (9) groundwater samples along with one (1) field blank, one (1) matrix spike/ matrix spike duplicate (MS/MSD) and one (1) duplicate sample. This report is based upon a review of holding times, GC/MS tuning, target compound matching quality, initial and continuing calibrations, blanks, surrogate spike analyses, internal standard areas, quantitation of positive results, and tentatively identified compounds. Qualifier codes have been placed on the report sheets.

Task I - Completeness Assessment

The data package received for semivolatiles was complete.

Task II - Compliance Assessment

A. Holding Times

The samples were originally extracted and analyzed within the required holding times. However, the laboratory added twice the amount of base neutral spike and no acid spike. when they spiked the MS/MSD (MW-1R). The samples were therefore re-extracted and reanalyzed. The required holding time of 10-12 days for re-extraction was grossly exceeded (22 days). The laboratory spiked a control sample since the original field sample was used up, but they forgot to add the spiking solution. Due to this second mistake and the grossly exceeded holding times for the reextraction the original analysis is considered more valid.

B Blanks

The blanks should not contain any contamination. If there is contamination then the sample results should be qualified to indicate that the target analyte or TIC is most likely not a property of the sample itself since it was also detected in the blank. Common contaminant results such as phthalates results should be qualified if the results in the samples are less than ten (10) times the amount in the associated blank. Other contaminant results should be qualified if the levels are less than five (5) times the amount in the associated blank. There were two method blanks analyzed. One for each extraction batch. However, the blank for the re-extraction batch (6/23/94) was inadvertently fortified with spiking solution so the laboratory included the blank for the following extraction batch on 6/24/94 (SBLK40). The matrix spike blank for the extraction batch on 6/23/94 was inadvertently not spiked and therefore it is more like a method blank and the results are indicative of the extraction process for 6/23/94. No further action is necessary.

The method blank for the initial extraction of the samples (SBLK24) contained the common contaminant, di-n-butylphthalate, at 1 ug/l as well as an unknown at 4.45 min. at approximately 3 ug/l. This contamination overall did not appear to interfere with the sample analysis, and the laboratory appropriately marked the associated sample data with a "B" code for the di-n-butylphthalate results to indicate that there was contamination in the blank. Sample data has been qualified as not detected (U) for levels that are less than ten (10) times the amount in the associated method blank. The unknown was not detected in any of the associated samples. Listed in Table 4 below are the qualified sample results for di-n-butylphthalate.

Table 4 - Qualified Sample Results Due to Method Blank (6/6) Contamination

Sample	Qualified Di-*n*-butylphthalate Result
MW-1R	10 U
MW-1S	12 U
MW-9R	10 U
MW-9RD	10 U
MW-12S	11 U
MW-13R	10 U
MW-14R	10 U
DUP 1	10 U
Field Blank	10 U

The method blank for the re-extraction batch (SBLK40) contained a TIC - unsaturated hydrocarbon at approximately 6 ug/l which was also detected in some of the samples from the re-extraction and re-analysis. Results for this TIC that are less than five (5) times the amount in the associated blank have been qualified as not detected (U). Listed in Table 5 below are the associated samples and qualifications.

Table 5 - Qualified Sample Results Due to Method Blank (6/24) Contamination

Sample	Qualified TIC (unsat HC) Result
MW-1RRE	7 U
MW-9RDRE	20 U
MW-12RRE	7 U
MW-13RRE	7 U

The field blank contained di-n-butylphthalate at 1 ug/l and a TIC - unknown at approximately 3 ug/l. The di-n-butylphthalate result has already been qualified as not detected (U) due to method blank contamination. The TIC was also detected in DUP1 at approximately 6 ug/l. Therefore this TIC result in DUP1 has been qualified as not detected (U) since it is less than five (5) times the amount in the field blank.

The field blank rerun (field blankRE) contained 0.4 ug/l of di-n-butylphthalate. The di-n-butylphthalate was also detected in the MW-12SRE at 0.8 ug/l. This result has been qualified as not detected due to the contamination in the field blank rerun. See Table 6 for qualified results due to field blank and field blank rerun contamination.

Table 6 - Qualified Sample Results Due to Field Blank Contamination

Sample	TIC Result at 3.18 min.	Di-n-butylphthalate
DUP1	6 U	----
MW-12SRE	----	11 U

The Matrix Spike Blank 1 and Matrix Spike Blank Dup 1 extracted 6/23 contained *bis*(2-ethylhexyl)phthalate at 77 ug/l and 75 ug/l respectively. Thus, the

bis(2-ethylhexyl)phthalate results in the associated samples extracted on 6/23 have been qualified as not detected (U) for levels that are less than ten (10) times the amount in the associated matrix spike blank. See the Table 7 below for the associated samples and the qualifications.

Table 7 - Qualified Sample Results Due to Matrix Spike Blank (6/23)Contamination

Sample	*Bis*(2-ethylhexyl)phthalate
MW-1RRE	10 U
MW-1SRE	11 U
MW-13RRE	10 U
MW-14RRE	10 U

C. Calibration

The initial calibrations on 6/15/94, 6/21/94, 6/29/94, and 7/7/94 met all technical criteria. The relative response factors (RRFs) were greater that 0.05 and the percent relative standard deviations (%RSDs) were less than 30%. However, there were a few compounds in the continuing calibrations that did not meet the technical criteria. In the continuing calibration on 6/17/94 all of the relative response factors were greater than 0.05 , but the percent difference (%D) between the initial calibration average RRFs and continuing calibration verification RRF exceeded the technical criteria of 25% for the following compounds: 2,4-dimethylphenol (28.5%), bis(2-chloroethoxy)methane (29.5%), hexachlorocyclopentadiene (28.4%), 2,4-dinitrophenol (27.9%), 4-nitrophenol (41.2%), and benzo(g,h,i)perylene (31.8%). However, since the only sample analyzed on this day was the method blank, SBLK24, qualification of sample data is not necessary. In the continuing calibration on 6/22/94 at 1004 the minimum relative response factor was not met for 2,4-dinitrophenol (0.02), and the %D was greater than 25% for 4-chloroaniline (25.3%), 2,4-dinitrophenol (63.0%), 4,6-dinitro-2-methylphenol (41.7%), and pentachlorophenol (28.9%). The associated samples, MW-1R, MW-1S, MW-8R, MW-9R, MW-12R, MW-12S, MW-13R, and MW-14R, did not contain any of these compounds above the detection limit. The detection limits have been qualified as estimated (J) for all of these compounds except 2,4-dinitrophenol. The detection limit for 2,4-dinitrophenol has been qualified as unusable (R) since this compound did not meet the minimum RRF as well as the %D criteria; and therefore the detection limit is not usable.

Table 8 - Qualification Due to the CCV (6/22 1004) Exceedances

Sample	4-Chloroaniline	2,4-Dinitrophenol	4,6-Dinitro-2-methyl phenol	Pentachlorophenol
MW-1R	10 UJ	25 R	25 UJ	25 UJ
MW-1S	12 UJ	29 R	29 UJ	29 UJ
MW-8R	10 UJ	25 R	25 UJ	25 UJ
MW-9R	10 UJ	25 R	25 UJ	25 UJ
MW-12R	10 UJ	25 R	25 UJ	25 UJ
MW-12S	11 UJ	27 R	27 UJ	27 UJ

Sample	4-Chloroaniline	2,4-Dinitrophenol	4,6-Dinitro-2-methyl phenol	Pentachlorophenol
MW-13R	10 UJ	25 R	25 UJ	25 UJ
MW-14R	10 UJ	25 R	25 UJ	25 UJ

In the continuing calibration on 6/22/94 at 1747 the technical criteria of 25 %D between the initial calibration average RRF and continuing calibration verification RRF was not met for n-nitroso-di-n-propylamine (30.1%), 2,4-dinitrophenol (48.1%), pentachlorophenol (25.6%), and pyrene (25.4%) The minimum RRF criteria was not met for 2,4-dinitrophenol (0.028). In the associated sample MW-9RD, the detection limits have been qualified as estimated (UJ) for pentachlorophenol, n-nitroso-di-n-propylamine, and pyrene and unusable (R) for 2,4-dinitrophenol.

Table 9 Qualifications Due to CCV (6/22 1747) Exceedances

Sample	n-Nitroso-di-n-propylamine	2,4-Dinitrophenol	Pentachlorophenol	Pyrene
MW-9RD	10 UJ	25 R	25 UJ	10 UJ

In the continuing calibration on 7/1/94 the minimum RFs were met, but the %D between the initial calibration average RRF and CCV RRF exceeded the 25% criteria for 4-chloroaniline (26.0%). The only associated sample analyzed on this day was the second method blank, SBLK40, and therefore qualification of the field sample data is not necessary. In the continuing calibration on 7/8/94 the minimum RFs were met, but the %D between the initial calibration average RRF and CCV RRF exceeded the 25% criteria for 4,6-dinitro-2-methylphenol (28.4%), pyrene (29.1%), and di-n-octylphthalate (32.3%). These compounds were not detected in the associated samples, MW-1RRE, MW-8RRE, MW-9RRE, MW-9RDRE, DUP1RE, and Field BlankRE, and therefore the detection limits have been qualified as estimated (UJ).

Table 10 - Qualifications Due to CCV (7/8) Exceedances

Sample	Pyrene	4,6-Dinitro-2-methylphenol	Di-n-octylphthalate
MW-1RRE	10 UJ	25 UJ	10 UJ
MW-8RRE	11 UJ	26 UJ	11 UJ
MW-9RRE	10 UJ	25 UJ	10 UJ
MW-9RDRE	10 UJ	25 UJ	10 UJ
DUP1RE	10 UJ	25 UJ	10 UJ
Field BlankRE	10 UJ	25 UJ	10 UJ

D. Surrogates

In samples MW-12S and DUP1RE there was only one surrogate spike recovery out of acceptance limits. In sample MW-12S terphenyl-d14 had a recovery of 30% which was outside of the limits of 33-141%. In sample DUP1RE 2-fluorobiphenyl had a recovery of 37% which was outside of the limit of 43-116%. Since only one surrogate exceeded the acceptance limits per fraction and there was > 10% recovery qualification of sample data is not necessary. In samples MW-9RD and MW-9RDRE, however, there were four (4) and three (3) surrogates spikes, respectively, that exceeded acceptance limits for recoveries. See Table 11 below for the unacceptable surrogate recoveries.

Table 11 - Unacceptable Surrogate Recoveries in Samples MW-9RD and MW-9RDRE

Surrogate	Recovery-MW-9RD	Recovery- MW-9RDRE	Acceptance Limits
2-Fluorobiphenyl	0%	58%	43-116%
Phenol-D5	5%	6%	10-110%
2-Fluorophenol	0%	3%	21-110%
2-Chlorophenol-d4	2%	2%	33-110%

In sample, MW-9RD, the base neutral surrogate, 2-fluorobiphenyl, exceeded acceptance limits; and the recovery was less than 10%. However, the internal standard spikes were well within their respective recovery acceptance ranges. Three of the acid surrogates had a recovery of < 10%. The sample results have been qualified as estimated (UJ) for the base/neutral compounds and unusable (R) for the acid compounds since no compounds were detected above the detection limit and this could be due to the apparent severe matrix interference problem. In sample, MW-9RDRE, the acid surrogates had a recovery of <10%. Therefore the acid fraction results are unusable (R), but the base/ neutral compounds have not been qualified due to surrogate recoveries.

E. Matrix Spikes

The laboratory made some errors in the preparation of the matrix spike samples. Initially, they added twice the amount of base/neutral spiking solution and no acid spiking solution. Due to this error they re-extracted and reanalyzed the sample batch, and prepared a laboratory control sample to use as the MS/MSD for this batch. Unfortunately they forgot to spike the laboratory control sample. Thus, there are no valid results for the MS/MSD. Since sample data is not qualified due to the results of MS/MSD alone and other QC must be unacceptable to qualify the data for a sample batch no further action is necessary. However, it should be noted that the laboratory did not fulfill its requirement for a valid MS/MSD.

F. Duplicates

No limits were established for field duplicate precision for groundwater samples. However, Region I CLP RPD limits (waters - 30 %) were used as a guideline. The comparative results for the field duplicates are presented in Table 12 below.

Table 12 - Comparative Results of Field Duplicates

Sample	MW-8R	DUP1	RPD	MW-8RRE	DUP1RE	RPD
2-Methylnaphthalene	10 U	0.4 J	*	----	----	----
2,4-dimethylphenol	10 U	0.2 J	*	----	----	----
Naphthalene	1 J	1 J	*	----	----	----
Diethylphthalate	10 U	0.2 J	*	----	----	----
Di-n-butylphthalate	10 U	0.5 BJ	*	----	----	----
Bis(2-ethylhexyl)phthalate	10 U	0.6 J	*	----	----	----
4-Chloro-3-Methylphenol	14	4 J	*	10 U	1 J	*

* - One or both of the values were less than the required detection limits and therefore no useful precision data could be calculated.

G. GC/MS Tuning

Samples MW-9RRE and MW-9RDRE were analyzed beyond the 12 hour tuning window by 2 min. and 34 min. respectively. The following tune performed 16 hours and 32 min. after the previous tune was well within acceptance limits and therefore qualification of sample data is judged not necessary.

H. Overall Assessment

Overall the data is usable and valid with the appropriate qualifiers except for the acid fraction in the semivolatile analysis of samples MW-9RD and MW-9RDRE.

IV. Conclusions

This sample data validation has identified a few areas in the analytical results that have required qualification. In general the analytical data is acceptable for use. The data user should understand the qualifications and limitations of the results.

Althea L. Lindell, Consultant

FAX Transmission

From: Althea L. Lindell
To: Ms. Verl Preston
Company: RECRA Environmental, Inc.
Date: July 20, 1994
Time: 3:16 PM
FAX #: 1-716-691-7991
CC: Gary Klawinski - GZA GeoEnvironmental of New York

I have almost completed the review of the VOA data for GZA (RECRA ID# A94-2701, #NY2A4210), and I have a few comments/questions:

1) On the cover letter for the data package it says that the samples were received 5/31 and 6/1, but the Chain of Custody (COC) indicated that the samples were received on 6/1 only.

2) In the data package the raw data print out or quant tables were not provided for the chlorotoluene values. There were only summary tables.

3) There was o-chlorotoluene in VBLK70 at 0.61 ppb, but it was not reported.

4) In the Matrix Spike Blank there was o-chlorotoluene at 2.7 ppb, but it was not reported on Form 1. Is the Lab ID# for this sample A4270114 (Form 1) or AM006029 (Form III)?

5) In sample DUP1 I calculated the o-chlorotoluene amount to be 2000 ppb, but on Form 1 the amount was 2200 ppb.

6) In MW-9R the total xylenes value was not reported on Form 1 (2 J ppb).

7) In samples MW-12R and MW-13R the unknown peak at 4.6 min should be labeled unknown alkane to be consistent with sample MW-9RD. In sample MW-13R the TIC peak at 4.3 minutes should also be labeled unknown alkane to be consistent with sample MW-9RD.

If you have any questions please call me.

8) MW1R : initial DL = 10

9) Sample Dup-1 ; 112 Trich 0.9J > ND?
check 2° ions

VOICE: FAX: 207-223-4719

RR#1, Box 520 Old Belfast Road, Frankfort, Maine 04438

Althea L. Lindell, Consultant

FAX Transmission

From: Althea L. Lindell
To: Verl Preston
Company: RECRA Environmental, Inc.
CC: Gary Klawinski - GZA GeoEnvironmental, Inc.

Date: August 31, 1994
Time: 3:48 PM
FAX #: 716-691-7991

Dear Verl,

I have completed the initial review of the Chem-Trol semivolatile data package submitted to you by GZA GeoEnvironmental, Inc. (contract # NY92-603). Listed below are my comments and questions.

1) On page 114 the abundance of m/e 51 is 51.5 not 51.2 - Form V for 6/17 tune.

2) On the Form Vs why does the criteria for m/e 365 change from 0.75% of m/e 198 to 1.00% of m/e 198?

3) On Form VI SV-1 (pg 902) the initial calibration dates are 6/29 - 6/29 not 6/28 - 6/29, and the time starts at 1614 not 1616. Could you please verify these dates and times and correct all associated forms - i.e continuing calibration form (pgs 1003 & 1011), Form III etc..

4) On page 130 Form VIII the instrument ID is 150W not 150X.

5) In sample MW-12SRE the unknown at 4.15 min. should be labelled tetrahydrodimethylfuran isomer to be consistent with other samples.

6) In sample MW-13R the unknown at 5.82 min. should be labelled oxygenated compound to be consistent with other samples.

7) In sample MW-13RRE the TIC at 3.43 min should be cyclohexen-1-ol isomer, and the unknown at 5 min should be unsaturated hydrocarbon as in the associated blank.

8) In sample DUP1 the 4-methylphenol is the same peak as the 2-methylphenol; and therefore there is no 4-methylphenol detected.

9) Could you send a copy of the instrument run log and the internal sample tracking form.

If you have any questions please call me at (207) 223-4301.

Althea L. Lindell

VOICE: FAX:

RR#1, Box 520 Old Belfast Road, Frankfort, Maine 04438

RECRA ENVIRONMENTAL INC.

Chemical and Environmental Analysis Services

To: Althea L. Lindell/Consultant
From: Verl D. Preston VDP
Date: September 7, 1994
RE: Data Validation/GZA ChemTrol Project

At your request, we have reviewed the data packages pertaining to the GZA GeoEnvironmental of New York ChemTrol project and have prepared the following responses to your questions and comments.

Volatile Data

1) As indicated in your facsimile transmission, all samples were received on 6/1. The date of 5/31 has been deleted from the revised cover letter.

2) Since the Chlorotoluene isomers are not on the standard ASP list of compounds, these constituents were searched manually and the information entered on the summary tables. An instrument auto quantitation was not performed. The summary table provides the scan number, area units and primary ions. If one of the isomers was determined to be present, the spectra are also included.

3) VBLK70 has been modified to reflect the o-Chlorotoluene result of 0.61 ppb. All related samples in which o-Chlorotoluene was detected have been appropriately flagged with the "B" qualifier.

4) The Form I for the Matrix Spike Blank has been revised to reflect a value of 2.7 ppb for o-Chlorotoluene. The lab ID# for this sample is A4270114. The number AM006029 reflected on the Form 3 refers to the method blank used as the "base sample" for calculation of percent recoveries.

5) We have reviewed the calculated concentration of 0-Chlorotoluene in sample Dup-1 and submit that the previously reported value of 2200 ppb is correct. Our calculation for this concentration is as follows:

Area (sample) = 4738020
Area (IS) = 130602
NG (IS) = 250
Response factor = 0.8190
Volume = 5.0

$$\frac{4738020 \times 250}{130602 \times 0.8190 \times 5.0} = 2214 \text{ ug/l}$$

6) The Form 1 for sample MW9R has been revised to reflect a value of 2"J" ppb for Total Xylenes.

7) The reported TIC's have been revised in samples MW-12R and MW-13R to reflect an identification of "unknown

alkane."

8) Sample MW1R was initially analyzed at a dilution factor of ten due to the highly aromatic nature of the sample. This dilution was confirmed to be necessary by the concentration of Trichloroethane and reanalysis at a lesser dilution was not performed.

9) The presence of 1,1,2-Trichloroethane in sample Dup-1 has been reviewed by our spectral interpretation specialist. Based upon retention time information as well as the presence and ratios of all major and two secondary ions, we stand by our previous decision to report this compound as present at 0.9"J" ppb.

Semivolatile Data

1) The relative abundance of m/e 51 on page 114 has been revised to reflect a percentage of 51.5.

2) The abundance criteria represented on page 114 for m/e 365 pertains to the EPA 390 CLP protocol requirements. This "Tune" was processed using this criteria, however all criteria pertaining to the ASP 91 protocol were also met.

3) The correct initial calibration dates are 6/29 - 6/29; the times you have indicated are also correct. All associated forms have been corrected and are enclosed.

4) The instrument ID on page 130 Form VIII has been corrected to I50W.

5,6,7) The identification of the TIC's in samples MW-12SRE, MW-13R and MW13RRE have been corrected to be consistent with the other samples.

8) The concentration of 0.4"J" ppb of 4-Methylphenol in sample Dup-1 has been deleted from the Form 1 and replaced with the value of 10 "U". The instrument printout has also been manually altered to delete the presence of 4-Methylphenol.

9) A copy of the instrument run log has been included in this submission. We are currently copying all internal tracking forms for facsimile transmission.

For your convenience we have attached copies of your original fax transmissions. All revised pages have been appropriately numbered for insertion into the original reports and are enclosed. If we may be of further assistance, please do not hesitate to contact me at (716) 691-2600.

ORGANIC DATA COMMENT PAGE

Laboratory Name: Recra Environmental, Inc.

USEPA Defined Organic Data Qualifiers:

U	-	Indicates compound was analyzed for but not detected.
J	-	Indicates an estimated value. This flag is used either when estimating a concentration for tentatively identified compounds where a 1:1 response is assumed, or when the mass spectral data indicates the presence of a compound that meets the identification criteria but the result is less than the sample quantitation limit but greater than zero.
C	-	This flag applies to pesticide results where the identification has been confirmed by GC/MS.
B	-	This flag is used when the analyte is found in the associated blank as well as in the sample.
E	-	This flag identifies compounds whose concentrations exceed the calibration range of the GC/MS instrument for that specific analysis.
D	-	This flag identifies all compounds identified in an analysis at a secondary dilution factor.
G	-	The TCLP Matrix Spike recovery was greater than the upper limit of the analytical method.
L	-	The TCLP Matrix Spike recovery was lower than the lower limit of the analytical method.
T	-	This flag is used when the analyte is found in the associated TCLP extraction as well as in the sample.
N	-	Indicates presumptive evidence of a compound. This flag is only used for tentatively identified compounds, where the identification is based on a mass spectral library search. It is applied to all TIC results.
P	-	This flag is used for a pesticide/Aroclor target analyte when there is greater than 25% difference for detected concentrations between the two GC columns. The lower of the two values is reported on the Form I and flagged with a "P".
A	-	This flag indicates that a TIC is a suspected aldol-condensation product.

GOLDBERG ZOINO & ASSOCIATES
ASP91-1 - VOLATILES
ANALYSIS DATA SHEET

10005
Client No.

DUP 1

Lab Name: Recra Environmental Contract: _____

Lab Code: RECNY Case No.: _____ SAS No.: _____ SDG No.: _____

Matrix: (soil/water) WATER Lab Sample ID: A4270110

Sample wt/vol: 5.00 (g/mL) ML Lab File ID: K2451.MSQ

Level: (low/med) LOW Date Samp/Recv: 06/01/94 06/01/94

% Moisture: not dec. _____ Heated Purge: N Date Analyzed: 06/03/94

GC Column: DB-624 ID: 0.53 (mm) Dilution Factor: 1.00

Soil Extract Volume: _____ (uL) Soil Aliquot Volume: _____ (uL)

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/Kg) UG/L	Q
74-87-3	Chloromethane	10	U
74-83-9	Bromomethane	10	U
75-01-4	Vinyl chloride	3	J
75-00-3	Chloroethane	51	
75-09-2	Methylene chloride	0.8	J
67-64-1	Acetone	10	U
75-15-0	Carbon Disulfide	10	U
75-35-4	1,1-Dichloroethene	67	
75-34-3	1,1-Dichloroethane	720	E
540-59-0	1,2-Dichloroethene (Total)	14	
67-66-3	Chloroform	2	J
107-06-2	1,2-Dichloroethane	10	U
78-93-3	2-Butanone	10	U
71-55-6	1,1,1-Trichloroethane	1100	E
56-23-5	Carbon Tetrachloride	10	U
75-27-4	Bromodichloromethane	10	U
78-87-5	1,2-Dichloropropane	10	U
10061-01-5	cis-1,3-Dichloropropene	10	U
79-01-6	Trichloroethene	160	
124-48-1	Dibromochloromethane	10	U
79-00-5	1,1,2-Trichloroethane	0.9	J
71-43-2	Benzene	10	U
10061-02-6	trans-1,3-Dichloropropene	10	U
75-25-2	Bromoform	10	U
108-10-1	4-Methyl-2-pentanone	10	U
591-78-6	2-Hexanone	10	U
127-18-4	Tetrachloroethene	0.7	J
108-88-3	Toluene	4	J
79-34-5	1,1,2,2-Tetrachloroethane	10	U
108-90-7	Chlorobenzene	10	U
100-41-4	Ethyl benzene	10	U
100-42-5	Styrene	10	U
1330-20-7	Total Xylenes	0.6	J
95-49-8	o-Chlorotoluene	2200	E

GOLDBERG ZOINO & ASSOCIATES
ASP91-1 - VOLATILES
ANALYSIS DATA SHEET

0006
Client No.

DUP 1

Lab Name: Recra Environmental Contract: _____

Lab Code: RECNY Case No.: _____ SAS No.: _____ SDG No.: _____

Matrix: (soil/water) WATER Lab Sample ID: A4270110

Sample wt/vol: 5.00 (g/mL) ML Lab File ID: K2451.MSQ

Level: (low/med) LOW Date Samp/Recv: 06/01/94 06/01/94

% Moisture: not dec. _____ Heated Purge: N Date Analyzed: 06/03/94

GC Column: DB-624 ID: 0.53 (mm) Dilution Factor: 1.00

Soil Extract Volume: _____ (uL) Soil Aliquot Volume: _____ (uL)

CONCENTRATION UNITS:
(ug/L or ug/Kg) UG/L

CAS NO.	COMPOUND		Q	Val
108-41-8	m-Chlorotoluene	10	U	
106-43-4	p-Chlorotoluene	10	U	

ALL

GOLDBERG ZOINO & ASSOCIATES
ASP91-1 - VOLATILES
TENTATIVELY IDENTIFIED COMPOUNDS

0007

Client No.

DUP 1

Lab Name: Recra Environmental Contract: _____

Lab Code: RECNY Case No.: _____ SAS No.: _____ SDG No.: _____

Matrix: (soil/water) WATER Lab Sample ID: A4270110

Sample wt/vol: 5.00 (g/mL) ML Lab File ID: K2451.MSQ

Level: (low/med) LOW Date Samp/Recv: 06/01/94 06/01/94

% Moisture: not dec. _____ Date Analyzed: 06/03/94

GC Column: DB-624 ID: 0.53 (mm) Dilution Factor: 1.00

Soil Extract Volume: _____ (uL) Soil Aliquot Volume: _____ (uL)

Number TICs found: 2 CONCENTRATION UNITS: (ug/L or ug/Kg) UG/L

CAS NO.	Compound Name	RT	Est. Conc.	Q
1. 354-23-4	DICHLORO-TRIFLUOROETHANE	7.33	.11	JN
2. 76-13-1	TRICHLORO-TRIFLUOROETHANE	8.00	110	JN

FORM IE - GC/MS VOA TIC

ALL

GOLDBERG ZOINO & ASSOCIATES
ASP91-1 - VOLATILES
ANALYSIS DATA SHEET

0008

Client No.

DUP 1DL

Lab Name: Recra Environmental Contract: _____

Lab Code: RECNY Case No.: _____ SAS No.: _____ SDG No.: _____

Matrix: (soil/water) WATER Lab Sample ID: A4270110DL

Sample wt/vol: 5.00 (g/mL) ML Lab File ID: K2477.MSQ

Level: (low/med) LOW Date Samp/Recv: 06/01/94 06/01/94

% Moisture: not dec. _____ Heated Purge: N Date Analyzed: 06/03/94

GC Column: DB-624 ID: 0.53 (mm) Dilution Factor: 20.00

Soil Extract Volume: _____ (uL) Soil Aliquot Volume: _____ (uL)

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/Kg) UG/L	Q
74-87-3	Chloromethane	200	U
74-83-9	Bromomethane	200	U
75-01-4	Vinyl chloride	200	U
75-00-3	Chloroethane	36	DJ
75-09-2	Methylene chloride	200	U
67-64-1	Acetone	200	U
75-15-0	Carbon Disulfide	200	U
75-35-4	1,1-Dichloroethene	52	DJ
75-34-3	1,1-Dichloroethane	370	D
540-59-0	1,2-Dichloroethene (Total)	200	U
67-66-3	Chloroform	200	U
107-06-2	1,2-Dichloroethane	200	U
78-93-3	2-Butanone	200	U
71-55-6	1,1,1-Trichloroethane	520	D
56-23-5	Carbon Tetrachloride	200	U
75-27-4	Bromodichloromethane	200	U
78-87-5	1,2-Dichloropropane	200	U
10061-01-5	cis-1,3-Dichloropropene	200	U
79-01-6	Trichloroethene	100	DJ
124-48-1	Dibromochloromethane	200	U
79-00-5	1,1,2-Trichloroethane	200	U
71-43-2	Benzene	200	U
10061-02-6	trans-1,3-Dichloropropene	200	U
75-25-2	Bromoform	200	U
108-10-1	4-Methyl-2-pentanone	200	U
591-78-6	2-Hexanone	200	U
127-18-4	Tetrachloroethene	200	U
108-88-3	Toluene	200	U
79-34-5	1,1,2,2-Tetrachloroethane	200	U
108-90-7	Chlorobenzene	200	U
100-41-4	Ethyl benzene	200	U
100-42-5	Styrene	200	U
1330-20-7	Total Xylenes	200	U
95-49-8	o-Chlorotoluene	2500	BD

ALL

GOLDBERG ZOINO & ASSOCIATES
ASP91-1 - VOLATILES
ANALYSIS DATA SHEET

0009

Client No.

DUP 1DL

Lab Name: Recra Environmental Contract: _____

Lab Code: RECNY Case No.: _____ SAS No.: _____ SDG No.: _____

Matrix: (soil/water) WATER Lab Sample ID: A4270110DL

Sample wt/vol: 5.00 (g/mL) ML Lab File ID: K2477.MSQ

Level: (low/med) LOW Date Samp/Recv: 06/01/94 06/01/94

% Moisture: not dec. _____ Heated Purge: N Date Analyzed: 06/03/94

GC Column: DB-624 ID: 0.53 (mm) Dilution Factor: 20.00

Soil Extract Volume: _____ (uL) Soil Aliquot Volume: _____ (uL)

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/Kg) UG/L	Q
108-41-8	m-Chlorotoluene	200	U
106-43-4	p-Chlorotoluene	200	U

ALL

GOLDBERG ZOINO & ASSOCIATES
ASP91-1 - VOLATILES
TENTATIVELY IDENTIFIED COMPOUNDS

0010

Client No.

DUP 1DL

Lab Name: Recra Environmental Contract: _____

Lab Code: RECNY Case No.: _____ SAS No.: _____ SDG No.: _____

Matrix: (soil/water) WATER Lab Sample ID: A4270110DL

Sample wt/vol: 5.00 (g/mL) ML Lab File ID: K2477.MSQ

Level: (low/med) LOW Date Samp/Recv: 06/01/94 06/01/94

% Moisture: not dec. _____ Date Analyzed: 06/03/94

GC Column: DB-624 ID: 0.53 (mm) Dilution Factor: 20.00

Soil Extract Volume: _____ (uL) Soil Aliquot Volume: _____ (uL)

CONCENTRATION UNITS:
(ug/L or ug/Kg) UG/L

Number TICs found: 0

CAS NO.	Compound Name	RT	Est. Conc.	Q

FORM IE - GC/MS VOA TIC

AU

GOLDBERG ZOINO & ASSOCIATES
ASP91-1 - VOLATILES
ANALYSIS DATA SHEET

0011

Client No.

MW-1R

Lab Name: Recra Environmental Contract: _____

Lab Code: RECNY Case No.: _____ SAS No.: _____ SDG No.: _____

Matrix: (soil/water) WATER Lab Sample ID: A4270106

Sample wt/vol: 5.00 (g/mL) ML Lab File ID: K2471.MSQ

Level: (low/med) LOW Date Samp/Recv: 06/01/94 06/01/94

% Moisture: not dec. _____ Heated Purge: N Date Analyzed: 06/03/94

GC Column: DB-624 ID: 0.53 (mm) Dilution Factor: 10.00

Soil Extract Volume: _____ (uL) Soil Aliquot Volume: _____ (uL)

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/Kg) UG/L	Q	Val
74-87-3	Chloromethane	100	U	
74-83-9	Bromomethane	100	U	
75-01-4	Vinyl chloride	100	U	
75-00-3	Chloroethane	100	U	
75-09-2	Methylene chloride	100	U	
67-64-1	Acetone	100	U	
75-15-0	Carbon Disulfide	100	U	
75-35-4	1,1-Dichloroethene	100	U	
75-34-3	1,1-Dichloroethane	100	U	
540-59-0	1,2-Dichloroethene (Total)	26	J	
67-66-3	Chloroform	100	U	
107-06-2	1,2-Dichloroethane	100	U	
78-93-3	2-Butanone	100	U	
71-55-6	1,1,1-Trichloroethane	100	U	
56-23-5	Carbon Tetrachloride	100	U	
75-27-4	Bromodichloromethane	100	U	
78-87-5	1,2-Dichloropropane	100	U	
10061-01-5	cis-1,3-Dichloropropene	100	U	
79-01-6	Trichloroethene	1500		
124-48-1	Dibromochloromethane	100	U	
79-00-5	1,1,2-Trichloroethane	100	U	
71-43-2	Benzene	100	U	
10061-02-6	trans-1,3-Dichloropropene	100	U	
75-25-2	Bromoform	100	U	
108-10-1	4-Methyl-2-pentanone	100	U	
591-78-6	2-Hexanone	100	U	
127-18-4	Tetrachloroethene	100	U	
108-88-3	Toluene	100	U	
79-34-5	1,1,2,2-Tetrachloroethane	100	U	
108-90-7	Chlorobenzene	100	U	
100-41-4	Ethyl benzene	100	U	
100-42-5	Styrene	100	U	
1330-20-7	Total Xylenes	100	U	
95-49-8	o-Chlorotoluene	16	BJ	Loc

Acc

GOLDBERG ZOINO & ASSOCIATES
ASP91-1 - VOLATILES
ANALYSIS DATA SHEET

10012

Client No.

MW-1R

Lab Name: Recra Environmental Contract: _____

Lab Code: RECNY Case No.: _____ SAS No.: _____ SDG No.: _____

Matrix: (soil/water) WATER Lab Sample ID: A4270106

Sample wt/vol: 5.00 (g/mL) ML Lab File ID: K2471.MSQ

Level: (low/med) LOW Date Samp/Recv: 06/01/94 06/01/94

% Moisture: not dec. _____ Heated Purge: N Date Analyzed: 06/03/94

GC Column: DB-624 ID: 0.53 (mm) Dilution Factor: 10.00

Soil Extract Volume: _____ (uL) Soil Aliquot Volume: _____ (uL)

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/Kg) UG/L	Q
108-41-8	m-Chlorotoluene	100	U
106-43-4	p-Chlorotoluene	100	U

ALC

GOLDBERG ZOINO & ASSOCIATES
ASP91-1 - VOLATILES
TENTATIVELY IDENTIFIED COMPOUNDS

Client No.
MW-1R

Lab Name: Recra Environmental Contract: _____

Lab Code: RECNY Case No.: _____ SAS No.: _____ SDG No.: _____

Matrix: (soil/water) WATER Lab Sample ID: A4270106

Sample wt/vol: 5.00 (g/mL) ML Lab File ID: K2471.MSQ

Level: (low/med) LOW Date Samp/Recv: 06/01/94 06/01/94

% Moisture: not dec. _____ Date Analyzed: 06/03/94

GC Column: DB-624 ID: 0.53 (mm) Dilution Factor: 10.00

Soil Extract Volume: _____ (uL) Soil Aliquot Volume: _____ (uL)

CONCENTRATION UNITS:
(ug/L or ug/Kg) UG/L

Number TICs found: 0

CAS NO.	Compound Name	RT	Est. Conc.	Q

ALL

GOLDBERG ZOINO & ASSOCIATES
ASP91-1 - VOLATILES
ANALYSIS DATA SHEET

0014

Client No.

MW-1S

Lab Name: Recra Environmental Contract: _____

Lab Code: RECNY Case No.: _____ SAS No.: _____ SDG No.: _____

Matrix: (soil/water) WATER Lab Sample ID: A4270105

Sample wt/vol: 5.00 (g/mL) ML Lab File ID: K2469.MSQ

Level: (low/med) LOW Date Samp/Recv: 06/01/94 06/01/94

% Moisture: not dec. _____ Heated Purge: N Date Analyzed: 06/03/94

GC Column: DB-624 ID: 0.53 (mm) Dilution Factor: 1.00

Soil Extract Volume: _____ (uL) Soil Aliquot Volume: _____ (uL)

CONCENTRATION UNITS:
(ug/L or ug/Kg) UG/L

CAS NO.	COMPOUND		Q	Val
74-87-3	Chloromethane	10	U	
74-83-9	Bromomethane	10	U	
75-01-4	Vinyl chloride	10	U	
75-00-3	Chloroethane	10	U	
75-09-2	Methylene chloride	10	U	
67-64-1	Acetone	10	U	
75-15-0	Carbon Disulfide	10	U	
75-35-4	1,1-Dichloroethene	10	U	
75-34-3	1,1-Dichloroethane	10	U	
540-59-0	1,2-Dichloroethene (Total)	1	J	
67-66-3	Chloroform	10	U	
107-06-2	1,2-Dichloroethane	10	U	
78-93-3	2-Butanone	10	U	
71-55-6	1,1,1-Trichloroethane	10	U	
56-23-5	Carbon Tetrachloride	10	U	
75-27-4	Bromodichloromethane	10	U	
78-87-5	1,2-Dichloropropane	10	U	
10061-01-5	cis-1,3-Dichloropropene	10	U	
79-01-6	Trichloroethene	2	J	
124-48-1	Dibromochloromethane	10	U	
79-00-5	1,1,2-Trichloroethane	10	U	
71-43-2	Benzene	10	U	
10061-02-6	trans-1,3-Dichloropropene	10	U	
75-25-2	Bromoform	10	U	
108-10-1	4-Methyl-2-pentanone	10	U	
591-78-6	2-Hexanone	10	U	
127-18-4	Tetrachloroethene	10	U	
108-88-3	Toluene	10	U	
79-34-5	1,1,2,2-Tetrachloroethane	10	U	
108-90-7	Chlorobenzene	10	U	
100-41-4	Ethyl benzene	10	U	
100-42-5	Styrene	10	U	
1330-20-7	Total Xylenes	10	U	
95-49-8	o-Chlorotoluene	1	BJ	10

All

GOLDBERG ZOINO & ASSOCIATES
ASP91-1 - VOLATILES
ANALYSIS DATA SHEET

Client No.

MW-1S

Lab Name: Recra Environmental Contract: _____

Lab Code: RECNY Case No.: _____ SAS No.: _____ SDG No.: _____

Matrix: (soil/water) WATER Lab Sample ID: A4270105

Sample wt/vol: 5.00 (g/mL) ML Lab File ID: K2469.MSQ

Level: (low/med) LOW Date Samp/Recv: 06/01/94 06/01/94

% Moisture: not dec. _____ Heated Purge: N Date Analyzed: 06/03/94

GC Column: DB-624 ID: 0.53 (mm) Dilution Factor: 1.00

Soil Extract Volume: _____ (uL) Soil Aliquot Volume: _____ (uL)

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/Kg) UG/L	Q
108-41-8	m-Chlorotoluene	10	U
106-43-4	p-Chlorotoluene	10	U

Acc

GOLDBERG ZOINO & ASSOCIATES
ASP91-1 - VOLATILES
TENTATIVELY IDENTIFIED COMPOUNDS

Client No.

MW-1S

Lab Name: Recra Environmental Contract: _____

Lab Code: RECNY Case No.: _____ SAS No.: _____ SDG No.: _____

Matrix: (soil/water) WATER Lab Sample ID: A4270105

Sample wt/vol: 5.00 (g/mL) ML Lab File ID: K2469.MSQ

Level: (low/med) LOW Date Samp/Recv: 06/01/94 06/01/94

% Moisture: not dec. _____ Date Analyzed: 06/03/94

GC Column: DB-624 ID: 0.53 (mm) Dilution Factor: 1.00

Soil Extract Volume: _____ (uL) Soil Aliquot Volume: _____ (uL)

CONCENTRATION UNITS:
(ug/L or ug/Kg) UG/L

Number TICs found: 0

CAS NO.	Compound Name	RT	Est. Conc.	Q

ACC

GOLDBERG ZOINO & ASSOCIATES
ASP91-1 - VOLATILES
ANALYSIS DATA SHEET

Client No: MW-8R

Lab Name: Recra Environmental Contract: _____

Lab Code: RECNY Case No.: _____ SAS No.: _____ SDG No.: _____

Matrix: (soil/water) WATER Lab Sample ID: A4270107

Sample wt/vol: 5.00 (g/mL) ML Lab File ID: K2448.MSQ

Level: (low/med) LOW Date Samp/Recv: 06/01/94 06/01/94

% Moisture: not dec. _____ Heated Purge: N Date Analyzed: 06/03/94

GC Column: DB-624 ID: 0.53 (mm) Dilution Factor: 1.00

Soil Extract Volume: _____ (uL) Soil Aliquot Volume: _____ (uL)

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/Kg) UG/L	Q
74-87-3	Chloromethane	10	U
74-83-9	Bromomethane	10	U
75-01-4	Vinyl chloride	3	J
75-00-3	Chloroethane	52	
75-09-2	Methylene chloride	0.8	J
67-64-1	Acetone	10	U
75-15-0	Carbon Disulfide	10	U
75-35-4	1,1-Dichloroethene	66	
75-34-3	1,1-Dichloroethane	700	E
540-59-0	1,2-Dichloroethene (Total)	13	
67-66-3	Chloroform	2	J
107-06-2	1,2-Dichloroethane	10	U
78-93-3	2-Butanone	10	U
71-55-6	1,1,1-Trichloroethane	1200	E
56-23-5	Carbon Tetrachloride	10	U
75-27-4	Bromodichloromethane	10	U
78-87-5	1,2-Dichloropropane	10	U
10061-01-5	cis-1,3-Dichloropropene	10	U
79-01-6	Trichloroethene	170	
124-48-1	Dibromochloromethane	10	U
79-00-5	1,1,2-Trichloroethane	10	U
71-43-2	Benzene	10	U
10061-02-6	trans-1,3-Dichloropropene	10	U
75-25-2	Bromoform	10	U
108-10-1	4-Methyl-2-pentanone	10	U
591-78-6	2-Hexanone	10	U
127-18-4	Tetrachloroethene	0.8	J
108-88-3	Toluene	4	J
79-34-5	1,1,2,2-Tetrachloroethane	10	U
108-90-7	Chlorobenzene	10	U
100-41-4	Ethyl benzene	10	U
100-42-5	Styrene	10	U
1330-20-7	Total Xylenes	10	U
95-49-8	o-Chlorotoluene	2400	E

GOLDBERG ZOINO & ASSOCIATES
ASP91-1 - VOLATILES
ANALYSIS DATA SHEET

0018

Client No.

MW-8R

Lab Name: Recra Environmental Contract: _____

Lab Code: RECNY Case No.: _____ SAS No.: _____ SDG No.: _____

Matrix: (soil/water) WATER Lab Sample ID: A4270107

Sample wt/vol: 5.00 (g/mL) ML Lab File ID: K2448.MSQ

Level: (low/med) LOW Date Samp/Recv: 06/01/94 06/01/94

% Moisture: not dec. _____ Heated Purge: N Date Analyzed: 06/03/94

GC Column: DB-624 ID: 0.53 (mm) Dilution Factor: 1.00

Soil Extract Volume: _____ (uL) Soil Aliquot Volume: _____ (uL)

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/Kg) UG/L	Q	Val C
108-41-8	m-Chlorotoluene	10	U	J
106-43-4	p-Chlorotoluene	10	U	J

ALL

GOLDBERG ZOINO & ASSOCIATES
ASP91-1 - VOLATILES
TENTATIVELY IDENTIFIED COMPOUNDS

0019
Client No.

MW-8R

Lab Name: Recra Environmental Contract: _____

Lab Code: RECNY Case No.: _____ SAS No.: _____ SDG No.: _____

Matrix: (soil/water) WATER Lab Sample ID: A4270107

Sample wt/vol: 5.00 (g/mL) ML Lab File ID: K2448.MSQ

Level: (low/med) LOW Date Samp/Recv: 06/01/94 06/01/94

% Moisture: not dec. _____ Date Analyzed: 06/03/94

GC Column: DB-624 ID: 0.53 (mm) Dilution Factor: 1.00

Soil Extract Volume: _____ (uL) Soil Aliquot Volume: _____ (uL)

CONCENTRATION UNITS:
(ug/L or ug/Kg) UG/L

Number TICs found: 3

	CAS NO.	Compound Name	RT	Est. Conc.	Q
1.	354-23-4	DICHLORO-TRIFLUROETHANE	7.38	10	JN
2.	76-13-1	TRICHLORO-TRIFLUROETHANE	8.07	68	JN
3.		UNKNOWN	23.75	5	J

FORM IE - GC/MS VOA TIC

AK

GOLDBERG ZOINO & ASSOCIATES
ASP91-1 - VOLATILES
ANALYSIS DATA SHEET

0020

Client No.

MW-8RDL

Lab Name: Recra Environmental Contract: _____

Lab Code: RECNY Case No.: _____ SAS No.: _____ SDG No.: _____

Matrix: (soil/water) WATER Lab Sample ID: A4270107DL

Sample wt/vol: 5.00 (g/mL) ML Lab File ID: K2466.MSQ

Level: (low/med) LOW Date Samp/Recv: 06/01/94 06/01/94

% Moisture: not dec. _____ Heated Purge: N Date Analyzed: 06/03/94

GC Column: DB-624 ID: 0.53 (mm) Dilution Factor: 40.00

Soil Extract Volume: _____ (uL) Soil Aliquot Volume: _____ (uL)

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/Kg) UG/L	Q
74-87-3	Chloromethane	400	U
74-83-9	Bromomethane	400	U
75-01-4	Vinyl chloride	400	U
75-00-3	Chloroethane	400	U
75-09-2	Methylene chloride	400	U
67-64-1	Acetone	400	U
75-15-0	Carbon Disulfide	400	U
75-35-4	1,1-Dichloroethene	54	DJ
75-34-3	1,1-Dichloroethane	380	DJ
540-59-0	1,2-Dichloroethene (Total)	400	U
67-66-3	Chloroform	400	U
107-06-2	1,2-Dichloroethane	400	U
78-93-3	2-Butanone	400	U
71-55-6	1,1,1-Trichloroethane	580	D
56-23-5	Carbon Tetrachloride	400	U
75-27-4	Bromodichloromethane	400	U
78-87-5	1,2-Dichloropropane	400	U
10061-01-5	cis-1,3-Dichloropropene	400	U
79-01-6	Trichloroethene	110	DJ
124-48-1	Dibromochloromethane	400	U
79-00-5	1,1,2-Trichloroethane	400	U
71-43-2	Benzene	400	U
10061-02-6	trans-1,3-Dichloropropene	400	U
75-25-2	Bromoform	400	U
108-10-1	4-Methyl-2-pentanone	400	U
591-78-6	2-Hexanone	400	U
127-18-4	Tetrachloroethene	400	U
108-88-3	Toluene	400	U
79-34-5	1,1,2,2-Tetrachloroethane	400	U
108-90-7	Chlorobenzene	400	U
100-41-4	Ethyl benzene	400	U
100-42-5	Styrene	400	U
1330-20-7	Total Xylenes	400	U
95-49-8	o-Chlorotoluene	4200	BD

FORM I - GC/MS VOA

All

GOLDBERG ZOINO & ASSOCIATES
ASP91-1 - VOLATILES
ANALYSIS DATA SHEET

Client No.: MW-8RDL

Lab Name: Recra Environmental Contract: _____

Lab Code: RECNY Case No.: _____ SAS No.: _____ SDG No.: _____

Matrix: (soil/water) WATER Lab Sample ID: A4270107DL

Sample wt/vol: 5.00 (g/mL) ML Lab File ID: K2466.MSQ

Level: (low/med) LOW Date Samp/Recv: 06/01/94 06/01/94

% Moisture: not dec. _____ Heated Purge: N Date Analyzed: 06/03/94

GC Column: DB-624 ID: 0.53 (mm) Dilution Factor: 40.00

Soil Extract Volume: _____ (uL) Soil Aliquot Volume: _____ (uL)

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/Kg) UG/L	Q
108-41-8	m-Chlorotoluene	400	U
106-43-4	p-Chlorotoluene	400	U

AC

GOLDBERG ZOINO & ASSOCIATES
ASP91-1 - VOLATILES
TENTATIVELY IDENTIFIED COMPOUNDS

0022

Client No.

MW-8RDL

Lab Name: Recra Environmental Contract: _____

Lab Code: RECNY Case No.: _____ SAS No.: _____ SDG No.: _____

Matrix: (soil/water) WATER Lab Sample ID: A4270107DL

Sample wt/vol: 5.00 (g/mL) ML Lab File ID: K2466.MSQ

Level: (low/med) LOW Date Samp/Recv: 06/01/94 06/01/94

% Moisture: not dec. _____ Date Analyzed: 06/03/94

GC Column: DB-624 ID: 0.53 (mm) Dilution Factor: 40.00

Soil Extract Volume: _____ (uL) Soil Aliquot Volume: _____ (uL)

CONCENTRATION UNITS:
(ug/L or ug/Kg) UG/L

Number TICs found: 0

CAS NO.	Compound Name	RT	Est. Conc.	Q

FORM IE - GC/MS VOA TIC

AL

GOLDBERG ZOINO & ASSOCIATES
ASP91-1 - VOLATILES
ANALYSIS DATA SHEET

10023
Client No.

MW-9R

Lab Name: Recra Environmental Contract: _____

Lab Code: RECNY Case No.: _____ SAS No.: _____ SDG No.: _____

Matrix: (soil/water) WATER Lab Sample ID: A4270108

Sample wt/vol: 5.00 (g/mL) ML Lab File ID: K2449.MSQ

Level: (low/med) LOW Date Samp/Recv: 06/01/94 06/01/94

% Moisture: not dec. _____ Heated Purge: N Date Analyzed: 06/03/94

GC Column: DB-624 ID: 0.53 (mm) Dilution Factor: 1.00

Soil Extract Volume: _____ (uL) Soil Aliquot Volume: _____ (uL)

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/Kg) UG/L	Q
74-87-3	Chloromethane	10	U
74-83-9	Bromomethane	10	U
75-01-4	Vinyl chloride	1	J
75-00-3	Chloroethane	39	
75-09-2	Methylene chloride	26	
67-64-1	Acetone	10	U
75-15-0	Carbon Disulfide	10	U
75-35-4	1,1-Dichloroethene	130	
75-34-3	1,1-Dichloroethane	1700	E
540-59-0	1,2-Dichloroethene (Total)	24	
67-66-3	Chloroform	130	
107-06-2	1,2-Dichloroethane	10	U
78-93-3	2-Butanone	10	U
71-55-6	1,1,1-Trichloroethane	2900	E
56-23-5	Carbon Tetrachloride	10	U
75-27-4	Bromodichloromethane	10	U
78-87-5	1,2-Dichloropropane	10	U
10061-01-5	cis-1,3-Dichloropropene	10	U
79-01-6	Trichloroethene	550	E
124-48-1	Dibromochloromethane	10	U
79-00-5	1,1,2-Trichloroethane	2	J
71-43-2	Benzene	10	U
10061-02-6	trans-1,3-Dichloropropene	10	U
75-25-2	Bromoform	10	U
108-10-1	4-Methyl-2-pentanone	10	U
591-78-6	2-Hexanone	10	U
127-18-4	Tetrachloroethene	4	J
108-88-3	Toluene	4	J
79-34-5	1,1,2,2-Tetrachloroethane	10	U
108-90-7	Chlorobenzene	10	U
100-41-4	Ethyl benzene	10	U
100-42-5	Styrene	10	U
1330-20-7	Total Xylenes	2	J
95-49-8	o-Chlorotoluene	2100	E

Val

FORM I - GC/MS VOA

Acc

GOLDBERG ZOINO & ASSOCIATES
ASP91-1 - VOLATILES
ANALYSIS DATA SHEET

Client No.: MW-9R

Lab Name: Recra Environmental Contract: _____

Lab Code: RECNY Case No.: _____ SAS No.: _____ SDG No.: _____

Matrix: (soil/water) WATER Lab Sample ID: A4270108

Sample wt/vol: 5.00 (g/mL) ML Lab File ID: K2449.MSQ

Level: (low/med) LOW Date Samp/Recv: 06/01/94 06/01/94

% Moisture: not dec. _____ Heated Purge: N Date Analyzed: 06/03/94

GC Column: DB-624 ID: 0.53 (mm) Dilution Factor: 1.00

Soil Extract Volume: _____ (uL) Soil Aliquot Volume: _____ (uL)

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/Kg) UG/L	Q	Val C
108-41-8	m-Chlorotoluene	10	U	J
106-43-4	p-Chlorotoluene	10	U	J

AC

GOLDBERG ZOINO & ASSOCIATES
ASP91-1 - VOLATILES
TENTATIVELY IDENTIFIED COMPOUNDS

Client No.

MW-9R

Lab Name: Recra Environmental Contract: _____

Lab Code: RECNY Case No.: _____ SAS No.: _____ SDG No.: _____

Matrix: (soil/water) WATER Lab Sample ID: A4270108

Sample wt/vol: 5.00 (g/mL) ML Lab File ID: K2449.MSQ

Level: (low/med) LOW Date Samp/Recv: 06/01/94 06/01/94

% Moisture: not dec. _____ Date Analyzed: 06/03/94

GC Column: DB-624 ID: 0.53 (mm) Dilution Factor: 1.00

Soil Extract Volume: _____ (uL) Soil Aliquot Volume: _____ (uL)

CONCENTRATION UNITS:
(ug/L or ug/Kg) UG/L

Number TICs found: 3

CAS NO.	Compound Name	RT	Est. Conc.	Q
1. 354-23-4	DICHLORO-TRIFLUOROETHANE	7.40	25	JN
2. 76-13-1	TRICHLORO-TRIFLUOROETHANE	8.05	250	JN
3.	UNKNOWN	23.78	13	J

FORM IE - GC/MS VOA TIC

ACC

GOLDBERG ZOINO & ASSOCIATES
ASP91-1 - VOLATILES
ANALYSIS DATA SHEET

00026

Client No.

MW-9RDL

Lab Name: Recra Environmental Contract: _____

Lab Code: RECNY Case No.: _____ SAS No.: _____ SDG No.: _____

Matrix: (soil/water) WATER Lab Sample ID: A4270108DL

Sample wt/vol: 5.00 (g/mL) ML Lab File ID: K2476.MSQ

Level: (low/med) LOW Date Samp/Recv: 06/01/94 06/01/94

% Moisture: not dec. _____ Heated Purge: N Date Analyzed: 06/03/94

GC Column: DB-624 ID: 0.53 (mm) Dilution Factor: 20.00

Soil Extract Volume: _____ (uL) Soil Aliquot Volume: _____ (uL)

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/Kg) UG/L	Q
74-87-3	Chloromethane	200	U
74-83-9	Bromomethane	200	U
75-01-4	Vinyl chloride	200	U
75-00-3	Chloroethane	200	U
75-09-2	Methylene chloride	9	DJ
67-64-1	Acetone	200	U
75-15-0	Carbon Disulfide	200	U
75-35-4	1,1-Dichloroethene	120	DJ
75-34-3	1,1-Dichloroethane	860	D
540-59-0	1,2-Dichloroethene (Total)	200	U
67-66-3	Chloroform	20	DJ
107-06-2	1,2-Dichloroethane	200	U
78-93-3	2-Butanone	200	U
71-55-6	1,1,1-Trichloroethane	2800	D
56-23-5	Carbon Tetrachloride	200	U
75-27-4	Bromodichloromethane	200	U
78-87-5	1,2-Dichloropropane	200	U
10061-01-5	cis-1,3-Dichloropropene	200	U
79-01-6	Trichloroethene	300	D
124-48-1	Dibromochloromethane	200	U
79-00-5	1,1,2-Trichloroethane	200	U
71-43-2	Benzene	200	U
10061-02-6	trans-1,3-Dichloropropene	200	U
75-25-2	Bromoform	200	U
108-10-1	4-Methyl-2-pentanone	200	U
591-78-6	2-Hexanone	200	U
127-18-4	Tetrachloroethene	200	U
108-88-3	Toluene	200	U
79-34-5	1,1,2,2-Tetrachloroethane	200	U
108-90-7	Chlorobenzene	200	U
100-41-4	Ethyl benzene	200	U
100-42-5	Styrene	200	U
1330-20-7	Total Xylenes	200	U
95-49-8	o-Chlorotoluene	620	BD

Val

FORM I - GC/MS VOA

ALL

GOLDBERG ZOINO & ASSOCIATES
ASP91-1 - VOLATILES
ANALYSIS DATA SHEET

10027

Client No.

MW-9RDL

Lab Name: Recra Environmental Contract: _____

Lab Code: RECNY Case No.: _____ SAS No.: _____ SDG No.: _____

Matrix: (soil/water) WATER Lab Sample ID: A4270108DL

Sample wt/vol: 5.00 (g/mL) ML Lab File ID: K2476.MSQ

Level: (low/med) LOW Date Samp/Recv: 06/01/94 06/01/94

% Moisture: not dec. _____ Heated Purge: N Date Analyzed: 06/03/94

GC Column: DB-624 ID: 0.53 (mm) Dilution Factor: 20.00

Soil Extract Volume: _____ (uL) Soil Aliquot Volume: _____ (uL)

CONCENTRATION UNITS:
(ug/L or ug/Kg) UG/L

CAS NO.	COMPOUND		Q
108-41-8	m-Chlorotoluene	200	U
106-43-4	p-Chlorotoluene	200	U

AC

GOLDBERG ZOINO & ASSOCIATES
ASP91-1 - VOLATILES
TENTATIVELY IDENTIFIED COMPOUNDS

10028

Client No.

MW-9RDL

Lab Name: Recra Environmental Contract: _____

Lab Code: RECNY Case No.: _____ SAS No.: _____ SDG No.: _____

Matrix: (soil/water) WATER Lab Sample ID: A4270108DL

Sample wt/vol: 5.00 (g/mL) ML Lab File ID: K2476.MSQ

Level: (low/med) LOW Date Samp/Recv: 06/01/94 06/01/94

% Moisture: not dec. _____ Date Analyzed: 06/03/94

GC Column: DB-624 ID: 0.53 (mm) Dilution Factor: 20.00

Soil Extract Volume: _____ (uL) Soil Aliquot Volume: _____ (uL)

CONCENTRATION UNITS:
(ug/L or ug/Kg) UG/L

Number TICs found: 0

CAS NO.	Compound Name	RT	Est. Conc.	Q

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AL

GOLDBERG ZOINO & ASSOCIATES
ASP91-1 - VOLATILES
ANALYSIS DATA SHEET

Client No.: MW-9RD

Lab Name: Recra Environmental Contract: _____

Lab Code: RECNY Case No.: _____ SAS No.: _____ SDG No.: _____

Matrix: (soil/water) WATER Lab Sample ID: A4270109

Sample wt/vol: 5.00 (g/mL) ML Lab File ID: K2470.MSQ

Level: (low/med) LOW Date Samp/Recv: 06/01/94 06/01/94

% Moisture: not dec. _____ Heated Purge: N Date Analyzed: 06/03/94

GC Column: DB-624 ID: 0.53 (mm) Dilution Factor: 1.00

Soil Extract Volume: _____ (uL) Soil Aliquot Volume: _____ (uL)

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/Kg) UG/L	Q
74-87-3	Chloromethane	10	U
74-83-9	Bromomethane	10	U
75-01-4	Vinyl chloride	10	U
75-00-3	Chloroethane	10	U
75-09-2	Methylene chloride	10	U
67-64-1	Acetone	81	
75-15-0	Carbon Disulfide	10	U
75-35-4	1,1-Dichloroethene	10	U
75-34-3	1,1-Dichloroethane	10	U
540-59-0	1,2-Dichloroethene (Total)	10	U
67-66-3	Chloroform	10	U
107-06-2	1,2-Dichloroethane	10	U
78-93-3	2-Butanone	10	U
71-55-6	1,1,1-Trichloroethane	10	U
56-23-5	Carbon Tetrachloride	10	U
75-27-4	Bromodichloromethane	10	U
78-87-5	1,2-Dichloropropane	10	U
10061-01-5	cis-1,3-Dichloropropene	10	U
79-01-6	Trichloroethene	10	U
124-48-1	Dibromochloromethane	10	U
79-00-5	1,1,2-Trichloroethane	10	U
71-43-2	Benzene	10	U
10061-02-6	trans-1,3-Dichloropropene	10	U
75-25-2	Bromoform	10	U
108-10-1	4-Methyl-2-pentanone	10	U
591-78-6	2-Hexanone	10	U
127-18-4	Tetrachloroethene	9	J
108-88-3	Toluene	10	U
79-34-5	1,1,2,2-Tetrachloroethane	10	U
108-90-7	Chlorobenzene	0.8	J
100-41-4	Ethyl benzene	10	U
100-42-5	Styrene	7	J
1330-20-7	Total Xylenes	3	BJ
95-49-8	o-Chlorotoluene		

GOLDBERG ZOINO & ASSOCIATES
ASP91-1 - VOLATILES
ANALYSIS DATA SHEET

10030

Client No.

MW-9RD

Lab Name: Recra Environmental Contract: _____

Lab Code: RECNY Case No.: _____ SAS No.: _____ SDG No.: _____

Matrix: (soil/water) WATER Lab Sample ID: A4270109

Sample wt/vol: 5.00 (g/mL) ML Lab File ID: K2470.MSQ

Level: (low/med) LOW Date Samp/Recv: 06/01/94 06/01/94

% Moisture: not dec. _____ Heated Purge: N Date Analyzed: 06/03/94

GC Column: DB-624 ID: 0.53 (mm) Dilution Factor: 1.00

Soil Extract Volume: _____ (uL) Soil Aliquot Volume: _____ (uL)

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/Kg) UG/L	Q
108-41-8	m-Chlorotoluene	10	U
106-43-4	p-Chlorotoluene	10	U

AC

GOLDBERG ZOINO & ASSOCIATES
ASP91-1 - VOLATILES
TENTATIVELY IDENTIFIED COMPOUNDS

Client No.: MW-9RD

Lab Name: Recra Environmental Contract: _____

Lab Code: RECNY Case No.: _____ SAS No.: _____ SDG No.: _____

Matrix: (soil/water) WATER Lab Sample ID: A4270109

Sample wt/vol: 5.00 (g/mL) ML Lab File ID: K2470.MSQ

Level: (low/med) LOW Date Samp/Recv: 06/01/94 06/01/94

% Moisture: not dec. _____ Date Analyzed: 06/03/94

GC Column: DB-624 ID: 0.53 (mm) Dilution Factor: 1.00

Soil Extract Volume: _____ (uL) Soil Aliquot Volume: _____ (uL)

Number TICs found: 8 CONCENTRATION UNITS: (ug/L or ug/Kg) UG/L

	CAS NO.	Compound Name	RT	Est. Conc.	Q
1.		UNKNOWN	3.78	14	J
2.		UNKNOWN ALKANE	4.28	11	J
3.		UNKNOWN ALKANE	4.65	9	J
4.		UNKNOWN ALKANE	6.02	10	J
5.		UNKNOWN ALCOHOL	9.92	150	J
6.	75-84-4	AMYLENE HYDRATE	14.33	76	JN
7.		UNKNOWN	21.17	8	J
8.		UNKNOWN	22.07	10	J

GOLDBERG ZOINO & ASSOCIATES
ASP91-1 - VOLATILES
ANALYSIS DATA SHEET

10032
Client No.

MW-12R

Lab Name: Recra Environmental Contract: _____

Lab Code: RECNY Case No.: _____ SAS No.: _____ SDG No.: _____

Matrix: (soil/water) WATER Lab Sample ID: A4270101

Sample wt/vol: 5.00 (g/mL) ML Lab File ID: K2443.MSQ

Level: (low/med) LOW Date Samp/Recv: 05/31/94 06/01/94

% Moisture: not dec. _____ Heated Purge: N Date Analyzed: 06/03/94

GC Column: DB-624 ID: 0.53 (mm) Dilution Factor: 1.00

Soil Extract Volume: _____ (uL) Soil Aliquot Volume: _____ (uL)

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/Kg) UG/L	Q
74-87-3	Chloromethane	10	U
74-83-9	Bromomethane	10	U
75-01-4	Vinyl chloride	10	U
75-00-3	Chloroethane	24	
75-09-2	Methylene chloride	10	U
67-64-1	Acetone	10	U
75-15-0	Carbon Disulfide	10	U
75-35-4	1,1-Dichloroethene	2	J
75-34-3	1,1-Dichloroethane	32	
540-59-0	1,2-Dichloroethene (Total)	10	U
67-66-3	Chloroform	10	U
107-06-2	1,2-Dichloroethane	10	U
78-93-3	2-Butanone	10	U
71-55-6	1,1,1-Trichloroethane	34	
56-23-5	Carbon Tetrachloride	10	U
75-27-4	Bromodichloromethane	10	U
78-87-5	1,2-Dichloropropane	10	U
10061-01-5	cis-1,3-Dichloropropene	10	U
79-01-6	Trichloroethene	10	U
124-48-1	Dibromochloromethane	10	U
79-00-5	1,1,2-Trichloroethane	10	U
71-43-2	Benzene	10	U
10061-02-6	trans-1,3-Dichloropropene	10	U
75-25-2	Bromoform	10	U
108-10-1	4-Methyl-2-pentanone	10	U
591-78-6	2-Hexanone	10	U
127-18-4	Tetrachloroethene	10	U
108-88-3	Toluene	0.9	J
79-34-5	1,1,2,2-Tetrachloroethane	10	U
108-90-7	Chlorobenzene	10	U
100-41-4	Ethyl benzene	10	U
100-42-5	Styrene	10	U
1330-20-7	Total Xylenes	10	U
95-49-8	o-Chlorotoluene	10	U

Val & J

ACC

GOLDBERG ZOINO & ASSOCIATES
ASP91-1 - VOLATILES
ANALYSIS DATA SHEET

10033

Client No.

MW-12R

Lab Name: Recra Environmental Contract: _____

Lab Code: RECNY Case No.: _____ SAS No.: _____ SDG No.: _____

Matrix: (soil/water) WATER Lab Sample ID: A4270101

Sample wt/vol: 5.00 (g/mL) ML Lab File ID: K2443.MSQ

Level: (low/med) LOW Date Samp/Recv: 05/31/94 06/01/94

% Moisture: not dec. _____ Heated Purge: N Date Analyzed: 06/03/94

GC Column: DB-624 ID: 0.53 (mm) Dilution Factor: 1.00

Soil Extract Volume: _____ (uL) Soil Aliquot Volume: _____ (uL)

CONCENTRATION UNITS:
(ug/L or ug/Kg) UG/L

CAS NO.	COMPOUND		Q	Vol
108-41-8	m-Chlorotoluene	10	U	
106-43-4	p-Chlorotoluene	10	U	

ALL

GOLDBERG ZOINO & ASSOCIATES
ASP91-1 - VOLATILES
TENTATIVELY IDENTIFIED COMPOUNDS

10034
Client No.

MW-12R

Lab Name: Recra Environmental Contract: _____

Lab Code: RECNY Case No.: _____ SAS No.: _____ SDG No.: _____

Matrix: (soil/water) WATER Lab Sample ID: A4270101

Sample wt/vol: 5.00 (g/mL) ML Lab File ID: K2443.MSQ

Level: (low/med) LOW Date Samp/Recv: 05/31/94 06/01/94

% Moisture: not dec. _____ Date Analyzed: 06/03/94

GC Column: DB-624 ID: 0.53 (mm) Dilution Factor: 1.00

Soil Extract Volume: _____ (uL) Soil Aliquot Volume: _____ (uL)

Number TICs found: 2 CONCENTRATION UNITS: (ug/L or ug/Kg) UG/L

CAS NO.	Compound Name	RT	Est. Conc.	Q
1.	UNKNOWN ALKANE	4.60	8	J
2.	UNKNOWN ALKANE	5.97	7	J

FORM IE - GC/MS VOA TIC

ALC

GOLDBERG ZOINO & ASSOCIATES
ASP91-1 - VOLATILES
ANALYSIS DATA SHEET

Client No.: MW-12S

Lab Name: Recra Environmental Contract: _____

Lab Code: RECNY Case No.: _____ SAS No.: _____ SDG No.: _____

Matrix: (soil/water) WATER Lab Sample ID: A4270102

Sample wt/vol: 5.00 (g/mL) ML Lab File ID: K2444.MSQ

Level: (low/med) LOW Date Samp/Recv: 05/31/94 06/01/94

% Moisture: not dec. _____ Heated Purge: N Date Analyzed: 06/03/94

GC Column: DB-624 ID: 0.53 (mm) Dilution Factor: 1.00

Soil Extract Volume: _____ (uL) Soil Aliquot Volume: _____ (uL)

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/Kg) UG/L	Q
74-87-3	Chloromethane	10	U
74-83-9	Bromomethane	10	U
75-01-4	Vinyl chloride	10	U
75-00-3	Chloroethane	22	
75-09-2	Methylene chloride	10	U
67-64-1	Acetone	93	
75-15-0	Carbon Disulfide	2	J
75-35-4	1,1-Dichloroethene	1	J
75-34-3	1,1-Dichloroethane	54	
540-59-0	1,2-Dichloroethene (Total)	10	U
67-66-3	Chloroform	10	U
107-06-2	1,2-Dichloroethane	10	U
78-93-3	2-Butanone	15	
71-55-6	1,1,1-Trichloroethane	19	
56-23-5	Carbon Tetrachloride	10	U
75-27-4	Bromodichloromethane	10	U
78-87-5	1,2-Dichloropropane	10	U
10061-01-5	cis-1,3-Dichloropropene	10	U
79-01-6	Trichloroethene	10	U
124-48-1	Dibromochloromethane	10	U
79-00-5	1,1,2-Trichloroethane	10	U
71-43-2	Benzene	10	U
10061-02-6	trans-1,3-Dichloropropene	10	U
75-25-2	Bromoform	10	U
108-10-1	4-Methyl-2-pentanone	10	U
591-78-6	2-Hexanone	10	U
127-18-4	Tetrachloroethene	10	U
108-88-3	Toluene	10	U
79-34-5	1,1,2,2-Tetrachloroethane	10	U
108-90-7	Chlorobenzene	10	U
100-41-4	Ethyl benzene	10	U
100-42-5	Styrene	10	U
1330-20-7	Total Xylenes	10	U
95-49-8	o-Chlorotoluene	10	U

GOLDBERG ZOINO & ASSOCIATES
ASP91-1 - VOLATILES
ANALYSIS DATA SHEET

Client No.: MW-12S

Lab Name: Recra Environmental Contract: _____

Lab Code: RECNY Case No.: _____ SAS No.: _____ SDG No.: _____

Matrix: (soil/water) WATER Lab Sample ID: A4270102

Sample wt/vol: 5.00 (g/mL) ML Lab File ID: K2444.MSQ

Level: (low/med) LOW Date Samp/Recv: 05/31/94 06/01/94

% Moisture: not dec. _____ Heated Purge: N Date Analyzed: 06/03/94

GC Column: DB-624 ID: 0.53 (mm) Dilution Factor: 1.00

Soil Extract Volume: _____ (uL) Soil Aliquot Volume: _____ (uL)

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/Kg) UG/L	Q	Val C
108-41-8	m-Chlorotoluene	10	U	U
106-43-4	p-Chlorotoluene	10	U	U

ALC

GOLDBERG ZOINO & ASSOCIATES
ASP91-1 - VOLATILES
TENTATIVELY IDENTIFIED COMPOUNDS

:0037

Client No.

MW-12S

Lab Name: Recra Environmental Contract: _____

Lab Code: RECNY Case No.: _____ SAS No.: _____ SDG No.: _____

Matrix: (soil/water) WATER Lab Sample ID: A4270102

Sample wt/vol: 5.00 (g/mL) ML Lab File ID: K2444.MSQ

Level: (low/med) LOW Date Samp/Recv: 05/31/94 06/01/94

% Moisture: not dec. _____ Date Analyzed: 06/03/94

GC Column: DB-624 ID: 0.53 (mm) Dilution Factor: 1.00

Soil Extract Volume: _____ (uL) Soil Aliquot Volume: _____ (uL)

Number TICs found: 1 CONCENTRATION UNITS: (ug/L or ug/Kg) UG/L

CAS NO.	Compound Name	RT	Est. Conc.	Q
1.	OXYGENATED HYDROCARBON	22.80	6	J

FORM IE - GC/MS VOA TIC

ALC

GOLDBERG ZOINO & ASSOCIATES
ASP91-1 - VOLATILES
ANALYSIS DATA SHEET

9038
Client No.

MW-13R

Lab Name: Recra Environmental Contract: _____

Lab Code: RECNY Case No.: _____ SAS No.: _____ SDG No.: _____

Matrix: (soil/water) WATER Lab Sample ID: A4270103

Sample wt/vol: 5.00 (g/mL) ML Lab File ID: K2445.MSQ

Level: (low/med) LOW Date Samp/Recv: 05/31/94 06/01/94

% Moisture: not dec. _____ Heated Purge: N Date Analyzed: 06/03/94

GC Column: DB-624 ID: 0.53 (mm) Dilution Factor: 1.00

Soil Extract Volume: _____ (uL) Soil Aliquot Volume: _____ (uL)

CONCENTRATION UNITS:
(ug/L or ug/Kg) UG/L

CAS NO.	COMPOUND		Q	Val. C
74-87-3	Chloromethane	10	U	
74-83-9	Bromomethane	10	U	
75-01-4	Vinyl chloride	2	J	
75-00-3	Chloroethane	22		
75-09-2	Methylene chloride	1	J	
67-64-1	Acetone	10	U	
75-15-0	Carbon Disulfide	10	U	
75-35-4	1,1-Dichloroethene	26		
75-34-3	1,1-Dichloroethane	460	E	
540-59-0	1,2-Dichloroethene (Total)	6	J	
67-66-3	Chloroform	9	J	
107-06-2	1,2-Dichloroethane	10	U	
78-93-3	2-Butanone	10	U	
71-55-6	1,1,1-Trichloroethane	550	E	
56-23-5	Carbon Tetrachloride	10	U	
75-27-4	Bromodichloromethane	10	U	
78-87-5	1,2-Dichloropropane	10	U	
10061-01-5	cis-1,3-Dichloropropene	10	U	
79-01-6	Trichloroethene	49		
124-48-1	Dibromochloromethane	10	U	
79-00-5	1,1,2-Trichloroethane	10	U	
71-43-2	Benzene	2	J	
10061-02-6	trans-1,3-Dichloropropene	10	U	
75-25-2	Bromoform	10	U	
108-10-1	4-Methyl-2-pentanone	10	U	
591-78-6	2-Hexanone	10	U	
127-18-4	Tetrachloroethene	0.5	J	
108-88-3	Toluene	7	J	
79-34-5	1,1,2,2-Tetrachloroethane	10	U	
108-90-7	Chlorobenzene	10	U	
100-41-4	Ethyl benzene	10	U	
100-42-5	Styrene	10	U	
1330-20-7	Total Xylenes	4	J	
95-49-8	o-Chlorotoluene	1600	E	J

ALL

GOLDBERG ZOINO & ASSOCIATES
ASP91-1 - VOLATILES
ANALYSIS DATA SHEET

0039

Client No.

MW-13R

Lab Name: Recra Environmental Contract: _____

Lab Code: RECNY Case No.: _____ SAS No.: _____ SDG No.: _____

Matrix: (soil/water) WATER Lab Sample ID: A4270103

Sample wt/vol: 5.00 (g/mL) ML Lab File ID: K2445.MSQ

Level: (low/med) LOW Date Samp/Recv: 05/31/94 06/01/94

% Moisture: not dec. _____ Heated Purge: N Date Analyzed: 06/03/94

GC Column: DB-624 ID: 0.53 (mm) Dilution Factor: 1.00

Soil Extract Volume: _____ (uL) Soil Aliquot Volume: _____ (uL)

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/Kg) UG/L	Q
108-41-8	m-Chlorotoluene	10	U
106-43-4	p-Chlorotoluene	10	U

GOLDBERG ZOINO & ASSOCIATES
ASP91-1 - VOLATILES
TENTATIVELY IDENTIFIED COMPOUNDS

Client No.

MW-13R

Lab Name: Recra Environmental Contract: _____

Lab Code: RECNY Case No.: _____ SAS No.: _____ SDG No.: _____

Matrix: (soil/water) WATER Lab Sample ID: A4270103

Sample wt/vol: 5.00 (g/mL) ML Lab File ID: K2445.MSQ

Level: (low/med) LOW Date Samp/Recv: 05/31/94 06/01/94

% Moisture: not dec. _____ Date Analyzed: 06/03/94

GC Column: DB-624 ID: 0.53 (mm) Dilution Factor: 1.00

Soil Extract Volume: _____ (uL) Soil Aliquot Volume: _____ (uL)

Number TICs found: 5

CONCENTRATION UNITS:
(ug/L or ug/Kg) UG/L

CAS NO.	Compound Name	RT	Est. Conc.	Q
1.	UNKNOWN	3.80	22	J
2.	UNKNOWN ALKANE	4.30	7	J
3.	UNKNOWN ALKANE	4.65	26	J
4.	UNKNOWN ALKANE	6.02	13	J
5. 76-13-1	TRICHLORO-TRIFLUOROETHANE	8.03	34	JN

ALL

GOLDBERG ZOINO & ASSOCIATES
ASP91-1 - VOLATILES
ANALYSIS DATA SHEET

0041

Client No.

MW-13RDL

Lab Name: Recra Environmental Contract: _____

Lab Code: RECNY Case No.: _____ SAS No.: _____ SDG No.: _____

Matrix: (soil/water) WATER Lab Sample ID: A4270103DL

Sample wt/vol: 5.00 (g/mL) ML Lab File ID: K2467.MSQ

Level: (low/med) LOW Date Samp/Recv: 05/31/94 06/01/94

% Moisture: not dec. _____ Heated Purge: N Date Analyzed: 06/03/94

GC Column: DB-624 ID: 0.53 (mm) Dilution Factor: 10.00

Soil Extract Volume: _____ (uL) Soil Aliquot Volume: _____ (uL)

CONCENTRATION UNITS:
(ug/L or ug/Kg) UG/L

CAS NO.	COMPOUND		Q
74-87-3	Chloromethane	100	U
74-83-9	Bromomethane	100	U
75-01-4	Vinyl chloride	100	U
75-00-3	Chloroethane	16	DJ
75-09-2	Methylene chloride	100	U
67-64-1	Acetone	100	U
75-15-0	Carbon Disulfide	100	U
75-35-4	1,1-Dichloroethene	24	DJ
75-34-3	1,1-Dichloroethane	270	D
540-59-0	1,2-Dichloroethene (Total)	100	U
67-66-3	Chloroform	100	U
107-06-2	1,2-Dichloroethane	100	U
78-93-3	2-Butanone	100	U
71-55-6	1,1,1-Trichloroethane	280	D
56-23-5	Carbon Tetrachloride	100	U
75-27-4	Bromodichloromethane	100	U
78-87-5	1,2-Dichloropropane	100	U
10061-01-5	cis-1,3-Dichloropropene	100	U
79-01-6	Trichloroethene	38	DJ
124-48-1	Dibromochloromethane	100	U
79-00-5	1,1,2-Trichloroethane	100	U
71-43-2	Benzene	100	U
10061-02-6	trans-1,3-Dichloropropene	100	U
75-25-2	Bromoform	100	U
108-10-1	4-Methyl-2-pentanone	100	U
591-78-6	2-Hexanone	100	U
127-18-4	Tetrachloroethene	100	U
108-88-3	Toluene	100	U
79-34-5	1,1,2,2-Tetrachloroethane	100	U
108-90-7	Chlorobenzene	100	U
100-41-4	Ethyl benzene	100	U
100-42-5	Styrene	100	U
1330-20-7	Total Xylenes	1700	BD
95-49-8	o-Chlorotoluene		

GOLDBERG ZOINO & ASSOCIATES
ASP91-1 - VOLATILES
ANALYSIS DATA SHEET

Client No.: MW-13RDL

Lab Name: Recra Environmental Contract: _____

Lab Code: RECNY Case No.: _____ SAS No.: _____ SDG No.: _____

Matrix: (soil/water) WATER Lab Sample ID: A4270103DL

Sample wt/vol: 5.00 (g/mL) ML Lab File ID: K2467.MSQ

Level: (low/med) LOW Date Samp/Recv: 05/31/94 06/01/94

% Moisture: not dec. _____ Heated Purge: N Date Analyzed: 06/03/94

GC Column: DB-624 ID: 0.53 (mm) Dilution Factor: 10.00

Soil Extract Volume: _____ (uL) Soil Aliquot Volume: _____ (uL)

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/Kg) UG/L	Q
108-41-8	m-Chlorotoluene	100	U
106-43-4	p-Chlorotoluene	100	U

ALC

GOLDBERG ZOINO & ASSOCIATES
ASP91-1 - VOLATILES
TENTATIVELY IDENTIFIED COMPOUNDS

0043
Client No.

MW-13RDL

Lab Name: Recra Environmental Contract: _____

Lab Code: RECNY Case No.: _____ SAS No.: _____ SDG No.: _____

Matrix: (soil/water) WATER Lab Sample ID: A4270103DL

Sample wt/vol: 5.00 (g/mL) ML Lab File ID: K2467.MSQ

Level: (low/med) LOW Date Samp/Recv: 05/31/94 06/01/94

% Moisture: not dec. _____ Date Analyzed: 06/03/94

GC Column: DB-624 ID: 0.53 (mm) Dilution Factor: 10.00

Soil Extract Volume: _____ (uL) Soil Aliquot Volume: _____ (uL)

CONCENTRATION UNITS:
(ug/L or ug/Kg) UG/L

Number TICs found: 0

CAS NO.	Compound Name	RT	Est. Conc.	Q

FORM IE - GC/MS VOA TIC

ALC

GOLDBERG ZOINO & ASSOCIATES
ASP91-1 - VOLATILES
ANALYSIS DATA SHEET

0044

Client No.

MW-14R

Lab Name: Recra Environmental Contract: _____

Lab Code: RECNY Case No.: _____ SAS No.: _____ SDG No.: _____

Matrix: (soil/water) WATER Lab Sample ID: A4270104

Sample wt/vol: 5.00 (g/mL) ML Lab File ID: K2468.MSQ

Level: (low/med) LOW Date Samp/Recv: 05/31/94 06/01/94

% Moisture: not dec. _____ Heated Purge: N Date Analyzed: 06/03/94

GC Column: DB-624 ID: 0.53 (mm) Dilution Factor: 1.00

Soil Extract Volume: _____ (uL) Soil Aliquot Volume: _____ (uL)

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/Kg) UG/L	Q
74-87-3	Chloromethane	10	U
74-83-9	Bromomethane	10	U
75-01-4	Vinyl chloride	10	U
75-00-3	Chloroethane	10	U
75-09-2	Methylene chloride	10	U
67-64-1	Acetone	10	U
75-15-0	Carbon Disulfide	10	U
75-35-4	1,1-Dichloroethene	10	U
75-34-3	1,1-Dichloroethane	10	U
540-59-0	1,2-Dichloroethene (Total)	10	U
67-66-3	Chloroform	10	U
107-06-2	1,2-Dichloroethane	10	U
78-93-3	2-Butanone	10	U
71-55-6	1,1,1-Trichloroethane	10	U
56-23-5	Carbon Tetrachloride	10	U
75-27-4	Bromodichloromethane	10	U
78-87-5	1,2-Dichloropropane	10	U
10061-01-5	cis-1,3-Dichloropropene	10	U
79-01-6	Trichloroethene	10	U
124-48-1	Dibromochloromethane	10	U
79-00-5	1,1,2-Trichloroethane	10	U
71-43-2	Benzene	10	U
10061-02-6	trans-1,3-Dichloropropene	10	U
75-25-2	Bromoform	10	U
108-10-1	4-Methyl-2-pentanone	10	U
591-78-6	2-Hexanone	10	U
127-18-4	Tetrachloroethene	10	U
108-88-3	Toluene	10	U
79-34-5	1,1,2,2-Tetrachloroethane	10	U
108-90-7	Chlorobenzene	10	U
100-41-4	Ethyl benzene	10	U
100-42-5	Styrene	10	U
1330-20-7	Total Xylenes	10	U
95-49-8	o-Chlorotoluene	3	BJ

Val... 10

GOLDBERG ZOINO & ASSOCIATES
ASP91-1 - VOLATILES
ANALYSIS DATA SHEET

10045

Client No.

MW-14R

Lab Name: Recra Environmental Contract: _____

Lab Code: RECNY Case No.: _____ SAS No.: _____ SDG No.: _____

Matrix: (soil/water) WATER Lab Sample ID: A4270104

Sample wt/vol: 5.00 (g/mL) ML Lab File ID: K2468.MSQ

Level: (low/med) LOW Date Samp/Recv: 05/31/94 06/01/94

% Moisture: not dec. _____ Heated Purge: N Date Analyzed: 06/03/94

GC Column: DB-624 ID: 0.53 (mm) Dilution Factor: 1.00

Soil Extract Volume: _____ (uL) Soil Aliquot Volume: _____ (uL)

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/Kg) UG/L	Q
108-41-8	m-Chlorotoluene	10	U
106-43-4	p-Chlorotoluene	10	U

ALL

GOLDBERG ZOINO & ASSOCIATES
ASP91-1 - VOLATILES
TENTATIVELY IDENTIFIED COMPOUNDS

10046

Client No.

MW-14R

Lab Name: Recra Environmental Contract: _____

Lab Code: RECNY Case No.: _____ SAS No.: _____ SDG No.: _____

Matrix: (soil/water) WATER Lab Sample ID: A4270104

Sample wt/vol: 5.00 (g/mL) ML Lab File ID: K2468.MSQ

Level: (low/med) LOW Date Samp/Recv: 05/31/94 06/01/94

% Moisture: not dec. _____ Date Analyzed: 06/03/94

GC Column: DB-624 ID: 0.53 (mm) Dilution Factor: 1.00

Soil Extract Volume: _____ (uL) Soil Aliquot Volume: _____ (uL)

CONCENTRATION UNITS:
(ug/L or ug/Kg) UG/L

Number TICs found: 0

CAS NO.	Compound Name	RT	Est. Conc.	Q

FORM IE - GC/MS VOA TIC

ACL

GOLDBERG ZOINO & ASSOCIATES
ASP91-1 - VOLATILES
ANALYSIS DATA SHEET

10047

Client No.

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Lab Name: Recra Environmental Contract: _____

Lab Code: RECNY Case No.: _____ SAS No.: _____ SDG No.: _____

Matrix: (soil/water) WATER Lab Sample ID: A4270111

Sample wt/vol: 5.00 (g/mL) ML Lab File ID: K2442.MSQ

Level: (low/med) LOW Date Samp/Recv: 06/01/94 06/01/94

% Moisture: not dec. _____ Heated Purge: N Date Analyzed: 06/03/94

GC Column: DB-624 ID: 0.53 (mm) Dilution Factor: 1.00

Soil Extract Volume: _____ (uL) Soil Aliquot Volume: _____ (uL)

CONCENTRATION UNITS:
(ug/L or ug/Kg) UG/L

CAS NO.	COMPOUND		Q
74-87-3	Chloromethane	10	U
74-83-9	Bromomethane	10	U
75-01-4	Vinyl chloride	10	U
75-00-3	Chloroethane	10	U
75-09-2	Methylene chloride	10	U
67-64-1	Acetone	10	U
75-15-0	Carbon Disulfide	10	U
75-35-4	1,1-Dichloroethene	10	U
75-34-3	1,1-Dichloroethane	10	U
540-59-0	1,2-Dichloroethene (Total)	10	U
67-66-3	Chloroform	10	U
107-06-2	1,2-Dichloroethane	10	U
78-93-3	2-Butanone	10	U
71-55-6	1,1,1-Trichloroethane	10	U
56-23-5	Carbon Tetrachloride	10	U
75-27-4	Bromodichloromethane	10	U
78-87-5	1,2-Dichloropropane	10	U
10061-01-5	cis-1,3-Dichloropropene	10	U
79-01-6	Trichloroethene	10	U
124-48-1	Dibromochloromethane	10	U
79-00-5	1,1,2-Trichloroethane	10	U
71-43-2	Benzene	10	U
10061-02-6	trans-1,3-Dichloropropene	10	U
75-25-2	Bromoform	10	U
108-10-1	4-Methyl-2-pentanone	10	U
591-78-6	2-Hexanone	10	U
127-18-4	Tetrachloroethene	10	U
108-88-3	Toluene	10	U
79-34-5	1,1,2,2-Tetrachloroethane	10	U
108-90-7	Chlorobenzene	10	U
100-41-4	Ethyl benzene	10	U
100-42-5	Styrene	10	U
1330-20-7	Total Xylenes	10	U
95-49-8	o-Chlorotoluene	10	U

FORM I - GC/MS VOA

GOLDBERG ZOINO & ASSOCIATES
ASP91-1 - VOLATILES
ANALYSIS DATA SHEET

:0048

Client No.

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Lab Name: Recra Environmental Contract: _____

Lab Code: RECNY Case No.: _____ SAS No.: _____ SDG No.: _____

Matrix: (soil/water) WATER Lab Sample ID: A4270111

Sample wt/vol: 5.00 (g/mL) ML Lab File ID: K2442.MSQ

Level: (low/med) LOW Date Samp/Recv: 06/01/94 06/01/94

% Moisture: not dec. _____ Heated Purge: N Date Analyzed: 06/03/94

GC Column: DB-624 ID: 0.53 (mm) Dilution Factor: 1.00

Soil Extract Volume: _____ (uL) Soil Aliquot Volume: _____ (uL)

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/Kg) UG/L	Q	Val
108-41-8	m-Chlorotoluene	10	U	
106-43-4	p-Chlorotoluene	10	U	

FORM I - GC/MS VOA

ALL

GOLDBERG ZOINO & ASSOCIATES
ASP91-1 - VOLATILES
TENTATIVELY IDENTIFIED COMPOUNDS

10049

Client No.

FIELD BLANK

Lab Name: Recra Environmental Contract: _____

Lab Code: RECNY Case No.: _____ SAS No.: _____ SDG No.: _____

Matrix: (soil/water) WATER Lab Sample ID: A4270111

Sample wt/vol: 5.00 (g/mL) ML Lab File ID: K2442.MSQ

Level: (low/med) LOW Date Samp/Recv: 06/01/94 06/01/94

% Moisture: not dec. _____ Date Analyzed: 06/03/94

GC Column: DB-624 ID: 0.53 (mm) Dilution Factor: 1.00

Soil Extract Volume: _____ (uL) Soil Aliquot Volume: _____ (uL)

Number TICs found: 0 CONCENTRATION UNITS: (ug/L or ug/Kg) UG/L

CAS NO.	Compound Name	RT	Est. Conc.	Q

FORM IE - GC/MS VOA TIC

ALC

GOLDBERG ZOINO & ASSOCIATES
ASP91-1 - VOLATILES
ANALYSIS DATA SHEET

10030

Client No.

TRIP BLANK

Lab Name: Recra Environmental Contract: _____

Lab Code: RECNY Case No.: _____ SAS No.: _____ SDG No.: _____

Matrix: (soil/water) WATER Lab Sample ID: A4270112

Sample wt/vol: 5.00 (g/mL) ML Lab File ID: K2441.MSQ

Level: (low/med) LOW Date Samp/Recv: 06/01/94 06/01/94

% Moisture: not dec. _____ Heated Purge: N Date Analyzed: 06/03/94

GC Column: DB-624 ID: 0.53 (mm) Dilution Factor: 1.00

Soil Extract Volume: _____ (uL) Soil Aliquot Volume: _____ (uL)

CONCENTRATION UNITS: (ug/L or ug/Kg) UG/L

CAS NO.	COMPOUND		Q
74-87-3	Chloromethane	10	U
74-83-9	Bromomethane	10	U
75-01-4	Vinyl chloride	10	U
75-00-3	Chloroethane	10	U
75-09-2	Methylene chloride	10	U
67-64-1	Acetone	10	U
75-15-0	Carbon Disulfide	10	U
75-35-4	1,1-Dichloroethene	10	U
75-34-3	1,1-Dichloroethane	10	U
540-59-0	1,2-Dichloroethene (Total)	10	U
67-66-3	Chloroform	10	U
107-06-2	1,2-Dichloroethane	10	U
78-93-3	2-Butanone	10	U
71-55-6	1,1,1-Trichloroethane	10	U
56-23-5	Carbon Tetrachloride	10	U
75-27-4	Bromodichloromethane	10	U
78-87-5	1,2-Dichloropropane	10	U
10061-01-5	cis-1,3-Dichloropropene	10	U
79-01-6	Trichloroethene	10	U
124-48-1	Dibromochloromethane	10	U
79-00-5	1,1,2-Trichloroethane	10	U
71-43-2	Benzene	10	U
10061-02-6	trans-1,3-Dichloropropene	10	U
75-25-2	Bromoform	10	U
108-10-1	4-Methyl-2-pentanone	10	U
591-78-6	2-Hexanone	10	U
127-18-4	Tetrachloroethene	10	U
108-88-3	Toluene	10	U
79-34-5	1,1,2,2-Tetrachloroethane	10	U
108-90-7	Chlorobenzene	10	U
100-41-4	Ethyl benzene	10	U
100-42-5	Styrene	10	U
1330-20-7	Total Xylenes	10	U
95-49-8	o-Chlorotoluene	10	U

AL

GOLDBERG ZOINO & ASSOCIATES
ASP91-1 - VOLATILES
ANALYSIS DATA SHEET

10051

Client No.

TRIP BLANK

Lab Name: Recra Environmental Contract: _____

Lab Code: RECNY Case No.: _____ SAS No.: _____ SDG No.: _____

Matrix: (soil/water) WATER Lab Sample ID: A4270112

Sample wt/vol: 5.00 (g/mL) ML Lab File ID: K2441.MSQ

Level: (low/med) LOW Date Samp/Recv: 06/01/94 06/01/94

% Moisture: not dec. _____ Heated Purge: N Date Analyzed: 06/03/94

GC Column: DB-624 ID: 0.53 (mm) Dilution Factor: 1.00

Soil Extract Volume: _____ (uL) Soil Aliquot Volume: _____ (uL)

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/Kg) UG/L	Q	Val
108-41-8	m-Chlorotoluene	10	U	
106-43-4	p-Chlorotoluene	10	U	

FORM I - GC/MS VOA

ALL

GOLDBERG ZOINO & ASSOCIATES
ASP91-1 - VOLATILES
TENTATIVELY IDENTIFIED COMPOUNDS

0052
Client No.

TRIP BLANK

Lab Name: Recra Environmental Contract: _____

Lab Code: RECNY Case No.: _____ SAS No.: _____ SDG No.: _____

Matrix: (soil/water) WATER Lab Sample ID: A4270112

Sample wt/vol: 5.00 (g/mL) ML Lab File ID: K2441.MSQ

Level: (low/med) LOW Date Samp/Recv: 06/01/94 06/01/94

% Moisture: not dec. _____ Date Analyzed: 06/03/94

GC Column: DB-624 ID: 0.53 (mm) Dilution Factor: 1.00

Soil Extract Volume: _____ (uL) Soil Aliquot Volume: _____ (uL)

CONCENTRATION UNITS:
(ug/L or ug/Kg) UG/L

Number TICs found: 0

CAS NO.	Compound Name	RT	Est. Conc.	Q

FORM IE - GC/MS VOA TIC

AL

GOLDBERG ZOINO & ASSOCIATES
ASP91-2 - SEMIVOLATILES
ANALYSIS DATA SHEET

0005

Client No.

MW-1R

Lab Name: Recra Environmental Contract: _____

Lab Code: RECNY Case No.: _____ SAS No.: _____ SDG No.: _____

Matrix: (soil/water) WATER Lab Sample ID: A4270106

Sample wt/vol: 1000.0 (g/mL) ML Lab File ID: 16296W.MSQ

Level: (low/med) LOW Date Samp/Recv: 06/01/94 06/01/94

% Moisture: _____ decanted: (Y/N) N Date Extracted: 06/06/94

Concentrated Extract Volume: 1000 (uL) Date Analyzed: 06/22/94

Injection Volume: 2.00 (uL) Dilution Factor: 1.00

GPC Cleanup: (Y/N) N pH: 7.0

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/Kg) UG/L	Q	Valid Q
108-95-2	Phenol	10	U	
111-44-4	Bis(2-chloroethyl) ether	10	U	
95-57-8	2-Chlorophenol	10	U	
541-73-1	1,3-Dichlorobenzene	10	U	
106-46-7	1,4-Dichlorobenzene	10	U	
95-50-1	1,2-Dichlorobenzene	10	U	
95-48-7	2-Methylphenol	10	U	
108-60-1	Bis(2-chloroisopropyl) ether	10	U	
106-44-5	4-Methylphenol	10	U	
621-64-7	N-Nitroso-Di-n-propylamine	10	U	
67-72-1	Hexachloroethane	10	U	
98-95-3	Nitrobenzene	10	U	
78-59-1	Isophorone	10	U	
88-75-5	2-Nitrophenol	10	U	
105-67-9	2,4-Dimethylphenol	10	U	
111-91-1	Bis(2-chloroethoxy) methane	10	U	
120-83-2	2,4-Dichlorophenol	10	U	
120-82-1	1,2,4-Trichlorobenzene	10	U	
91-20-3	Naphthalene	10	U	
106-47-8	4-Chloroaniline	10	U	J
87-68-3	Hexachlorobutadiene	10	U	
59-50-7	4-Chloro-3-methylphenol	10	U	
91-57-6	2-Methylnaphthalene	10	U	
77-47-4	Hexachlorocyclopentadiene	10	U	
88-06-2	2,4,6-Trichlorophenol	10	U	
95-95-4	2,4,5-Trichlorophenol	25	U	
91-58-7	2-Chloronaphthalene	10	U	
88-74-4	2-Nitroaniline	25	U	
131-11-3	Dimethyl phthalate	10	U	
208-96-8	Acenaphthylene	10	U	
606-20-2	2,6-Dinitrotoluene	10	U	
99-09-2	3-Nitroaniline	25	U	

ALC

GOLDBERG ZOINO & ASSOCIATES
ASP91-2 - SEMIVOLATILES
ANALYSIS DATA SHEET

0006

Client No.

MW-1R

Lab Name: Recra Environmental Contract: _____

Lab Code: RECNY Case No.: _____ SAS No.: _____ SDG No.: _____

Matrix: (soil/water) WATER Lab Sample ID: A4270106

Sample wt/vol: 1000.0 (g/mL) ML Lab File ID: 16296W.MSQ

Level: (low/med) LOW Date Samp/Recv: 06/01/94 06/01/94

% Moisture: _____ decanted: (Y/N) N Date Extracted: 06/06/94

Concentrated Extract Volume: 1000 (uL) Date Analyzed: 06/22/94

Injection Volume: 2.00 (uL) Dilution Factor: 1.00

GPC Cleanup: (Y/N) N pH: 7.0

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/Kg) UG/L	Q	Val C
83-32-9	Acenaphthene	10	U	
51-28-5	2,4-Dinitrophenol	25	U	
100-02-7	4-Nitrophenol	25	U	
132-64-9	Dibenzofuran	10	U	
121-14-2	2,4-Dinitrotoluene	10	U	
84-66-2	Diethyl phthalate	10	U	
7005-72-3	4-Chlorodiphenylether	10	U	
86-73-7	Fluorene	10	U	
100-01-6	4-Nitroaniline	25	U	
534-52-1	4,6-Dinitro-2-methylphenol	25	U	
86-30-6	N-nitrosodiphenylamine	10	U	
101-55-3	4-Bromophenyl phenyl ether	10	U	
118-74-1	Hexachlorobenzene	10	U	
87-86-5	Pentachlorophenol	25	U	
85-01-8	Phenanthrene	10	U	
120-12-7	Anthracene	10	U	
86-74-8	Carbazole	10	U	
84-74-2	Di-n-butyl phthalate	2	BJ	
206-44-0	Fluoranthene	10	U	
129-00-0	Pyrene	10	U	
85-68-7	Butyl benzyl phthalate	10	U	
91-94-1	3,3'-Dichlorobenzidine	10	U	
56-55-3	Benzo(a)anthracene	10	U	
218-01-9	Chrysene	10	U	
117-81-7	Bis(2-ethylhexyl) phthalate	10	U	
117-84-0	Di-n-octyl phthalate	10	U	
205-99-2	Benzo(b)fluoranthene	10	U	
207-08-9	Benzo(k)fluoranthene	10	U	
50-32-8	Benzo(a)pyrene	10	U	
193-39-5	Indeno(1,2,3-cd)pyrene	10	U	
53-70-3	Dibenzo(a,h)anthracene	10	U	
191-24-2	Benzo(ghi)perylene	10	U	

GOLDBERG ZOINO & ASSOCIATES
ASP91-2 - SEMIVOLATILES
TENTATIVELY IDENTIFIED COMPOUNDS

0007

Client No.

MW-1R

Lab Name: Recra Environmental Contract: _____

Lab Code: RECNY Case No.: _____ SAS No.: _____ SDG No.: _____

Matrix: (soil/water) WATER Lab Sample ID: A4270106

Sample wt/vol: 1000.0 (g/mL) ML Lab File ID: 16296W.MSQ

Level: (low/med) LOW Date Samp/Recv: 06/01/94 06/01/94

% Moisture: _____ decanted: (Y/N) N Date Extracted: 06/06/94

Concentrated Extract Volume: 1000 (uL) Date Analyzed: 06/22/94

Injection Volume: 2.00 (uL) Dilution Factor: 1.00

GPC Cleanup: (Y/N) N pH: 7.0

CONCENTRATION UNITS:
(ug/L or ug/Kg) UG/L

Number TICs found: 2

CAS NO.	Compound Name	RT	Est. Conc.	Q
1. 930-68-7	2-CYCLOHEXEN-1-ONE	3.27	3	JN
2.	OXYGENATED COMPOUND	5.87	70	J

FORM IF - GC/MS SVOA TIC

ALL

GOLDBERG ZOINO & ASSOCIATES
ASP91-2 - SEMIVOLATILES
ANALYSIS DATA SHEET

9008
Client No.

MW-1RRE

Lab Name: Recra Environmental Contract: _____

Lab Code: RECNY Case No.: _____ SAS No.: _____ SDG No.: _____

Matrix: (soil/water) WATER Lab Sample ID: A4270106RE

Sample wt/vol: 1000.0 (g/mL) ML Lab File ID: 16546W.MSQ

Level: (low/med) LOW Date Samp/Recv: 06/01/94 06/01/94

% Moisture: _____ decanted: (Y/N) N Date Extracted: 06/23/94

Concentrated Extract Volume: 1000 (uL) Date Analyzed: 07/08/94

Injection Volume: 2.00 (uL) Dilution Factor: 1.00

GPC Cleanup: (Y/N) N pH: 7.0

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/Kg) UG/L	Q
108-95-2	Phenol	10	U
111-44-4	Bis(2-chloroethyl) ether	10	U
95-57-8	2-Chlorophenol	10	U
541-73-1	1,3-Dichlorobenzene	10	U
106-46-7	1,4-Dichlorobenzene	10	U
95-50-1	1,2-Dichlorobenzene	10	U
95-48-7	2-Methylphenol	10	U
108-60-1	Bis(2-chloroisopropyl) ether	10	U
106-44-5	4-Methylphenol	10	U
621-64-7	N-Nitroso-Di-n-propylamine	10	U
67-72-1	Hexachloroethane	10	U
98-95-3	Nitrobenzene	10	U
78-59-1	Isophorone	10	U
88-75-5	2-Nitrophenol	10	U
105-67-9	2,4-Dimethylphenol	10	U
111-91-1	Bis(2-chloroethoxy) methane	10	U
120-83-2	2,4-Dichlorophenol	10	U
120-82-1	1,2,4-Trichlorobenzene	10	U
91-20-3	Naphthalene	10	U
106-47-8	4-Chloroaniline	10	U
87-68-3	Hexachlorobutadiene	10	U
59-50-7	4-Chloro-3-methylphenol	10	U
91-57-6	2-Methylnaphthalene	10	U
77-47-4	Hexachlorocyclopentadiene	10	U
88-06-2	2,4,6-Trichlorophenol	25	U
95-95-4	2,4,5-Trichlorophenol	10	U
91-58-7	2-Chloronaphthalene	25	U
88-74-4	2-Nitroaniline	10	U
131-11-3	Dimethyl phthalate	10	U
208-96-8	Acenaphthylene	10	U
606-20-2	2,6-Dinitrotoluene	25	U
99-09-2	3-Nitroaniline		

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GOLDBERG ZOINO & ASSOCIATES
ASP91-2 - SEMIVOLATILES
ANALYSIS DATA SHEET

0009

Client No.

MW-1RRE

Lab Name: Recra Environmental Contract: _____

Lab Code: RECNY Case No.: _____ SAS No.: _____ SDG No.: _____

Matrix: (soil/water) WATER Lab Sample ID: A4270106RE

Sample wt/vol: 1000.0 (g/mL) ML Lab File ID: 16546W.MSQ

Level: (low/med) LOW Date Samp/Recv: 06/01/94 06/01/94

% Moisture: _____ decanted: (Y/N) N Date Extracted: 06/23/94

Concentrated Extract Volume: 1000 (uL) Date Analyzed: 07/08/94

Injection Volume: 2.00 (uL) Dilution Factor: 1.00

GPC Cleanup: (Y/N) N pH: 7.0

CONCENTRATION UNITS: (ug/L or ug/Kg) UG/L

CAS NO.	COMPOUND		Q
83-32-9	Acenaphthene	10	U
51-28-5	2,4-Dinitrophenol	25	U
100-02-7	4-Nitrophenol	25	U
132-64-9	Dibenzofuran	10	U
121-14-2	2,4-Dinitrotoluene	10	U
84-66-2	Diethyl phthalate	10	U
7005-72-3	4-Chlorodiphenylether	10	U
86-73-7	Fluorene	10	U
100-01-6	4-Nitroaniline	25	U
534-52-1	4,6-Dinitro-2-methylphenol	25	U
86-30-6	N-nitrosodiphenylamine	10	U
101-55-3	4-Bromophenyl phenyl ether	10	U
118-74-1	Hexachlorobenzene	10	U
87-86-5	Pentachlorophenol	25	U
85-01-8	Phenanthrene	10	U
120-12-7	Anthracene	10	U
86-74-8	Carbazole	10	U
84-74-2	Di-n-butyl phthalate	10	U
206-44-0	Fluoranthene	10	U
129-00-0	Pyrene	10	U
85-68-7	Butyl benzyl phthalate	10	U
91-94-1	3,3'-Dichlorobenzidine	10	U
56-55-3	Benzo(a)anthracene	10	U
218-01-9	Chrysene	2	J
117-81-7	Bis(2-ethylhexyl) phthalate	10	U
117-84-0	Di-n-octyl phthalate	10	U
205-99-2	Benzo(b)fluoranthene	10	U
207-08-9	Benzo(k)fluoranthene	10	U
50-32-8	Benzo(a)pyrene	10	U
193-39-5	Indeno(1,2,3-cd)pyrene	10	U
53-70-3	Dibenzo(a,h)anthracene	10	U
191-24-2	Benzo(ghi)perylene	10	U

GOLDBERG ZOINO & ASSOCIATES
ASP91-2 - SEMIVOLATILES
TENTATIVELY IDENTIFIED COMPOUNDS

Client No.

MW-1RRE

Lab Name: Recra Environmental Contract: _____

Lab Code: RECNY Case No.: _____ SAS No.: _____ SDG No.: _____

Matrix: (soil/water) WATER Lab Sample ID: A4270106RE

Sample wt/vol: 1000.0 (g/mL) ML Lab File ID: 16546W.MSO

Level: (low/med) LOW Date Samp/Recv: 06/01/94 06/01/94

% Moisture: _____ decanted: (Y/N) N Date Extracted: 06/23/94

Concentrated Extract Volume: 1000 (uL) Date Analyzed: 07/08/94

Injection Volume: 2.00 (uL) Dilution Factor: 1.00

GPC Cleanup: (Y/N) N pH: 7.0

CONCENTRATION UNITS:
(ug/L or ug/Kg) UG/L

Number TICs found: 3

CAS NO.	Compound Name	RT	Est. Conc.	Q
1. 930-68-7	2-CYCLOHEXEN-1-ONE	3.90	4	JN
2.	UNSATURATED HYDROCARBON	4.98	7	J
3.	OXYGENATED COMPOUND	6.65	67	J

GOLDBERG ZOINO & ASSOCIATES
ASP91-2 - SEMIVOLATILES
ANALYSIS DATA SHEET

0011

Client No.

MW-1S

Lab Name: Recra Environmental Contract: _____

Lab Code: RECNY Case No.: _____ SAS No.: _____ SDG No.: _____

Matrix: (soil/water) WATER Lab Sample ID: A4270105

Sample wt/vol: 850.00 (g/mL) ML Lab File ID: 16295W.MSQ

Level: (low/med) LOW Date Samp/Recv: 06/01/94 06/01/94

% Moisture: _____ decanted: (Y/N) N Date Extracted: 06/06/94

Concentrated Extract Volume: 1000 (uL) Date Analyzed: 06/22/94

Injection Volume: 2.00 (uL) Dilution Factor: 1.00

GPC Cleanup: (Y/N) N pH: 7.0

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/Kg) UG/L	Q
108-95-2	Phenol	12	U
111-44-4	Bis(2-chloroethyl) ether	12	U
95-57-8	2-Chlorophenol	12	U
541-73-1	1,3-Dichlorobenzene	12	U
106-46-7	1,4-Dichlorobenzene	12	U
95-50-1	1,2-Dichlorobenzene	12	U
95-48-7	2-Methylphenol	12	U
108-60-1	Bis(2-chloroisopropyl) ether	12	U
106-44-5	4-Methylphenol	12	U
621-64-7	N-Nitroso-Di-n-propylamine	12	U
67-72-1	Hexachloroethane	12	U
98-95-3	Nitrobenzene	12	U
78-59-1	Isophorone	12	U
88-75-5	2-Nitrophenol	12	U
105-67-9	2,4-Dimethylphenol	12	U
111-91-1	Bis(2-chloroethoxy) methane	12	U
120-83-2	2,4-Dichlorophenol	12	U
120-82-1	1,2,4-Trichlorobenzene	12	U
91-20-3	Naphthalene	12	U
106-47-8	4-Chloroaniline	12	U
87-68-3	Hexachlorobutadiene	12	U
59-50-7	4-Chloro-3-methylphenol	12	U
91-57-6	2-Methylnaphthalene	12	U
77-47-4	Hexachlorocyclopentadiene	12	U
88-06-2	2,4,6-Trichlorophenol	29	U
95-95-4	2,4,5-Trichlorophenol	12	U
91-58-7	2-Chloronaphthalene	29	U
88-74-4	2-Nitroaniline	12	U
131-11-3	Dimethyl phthalate	12	U
208-96-8	Acenaphthylene	12	U
606-20-2	2,6-Dinitrotoluene	29	U
99-09-2	3-Nitroaniline		

GOLDBERG ZOINO & ASSOCIATES
ASP91-2 - SEMIVOLATILES
ANALYSIS DATA SHEET

0012

Client No.

MW-1S

Lab Name: Recra Environmental Contract: _____

Lab Code: RECNY Case No.: _____ SAS No.: _____ SDG No.: _____

Matrix: (soil/water) WATER Lab Sample ID: A4270105

Sample wt/vol: 850.00 (g/mL) ML Lab File ID: 16295W.MSQ

Level: (low/med) LOW Date Samp/Recv: 06/01/94 06/01/94

% Moisture: _____ decanted: (Y/N) N Date Extracted: 06/06/94

Concentrated Extract Volume: 1000 (uL) Date Analyzed: 06/22/94

Injection Volume: 2.00 (uL) Dilution Factor: 1.00

GPC Cleanup: (Y/N) N pH: 7.0

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/Kg) UG/L	Q	Val. C
83-32-9	Acenaphthene	12	U	
51-28-5	2,4-Dinitrophenol	29	U	
100-02-7	4-Nitrophenol	29	U	
132-64-9	Dibenzofuran	12	U	
121-14-2	2,4-Dinitrotoluene	12	U	
84-66-2	Diethyl phthalate	12	U	
7005-72-3	4-Chlorodiphenylether	12	U	
86-73-7	Fluorene	12	U	
100-01-6	4-Nitroaniline	29	U	
534-52-1	4,6-Dinitro-2-methylphenol	29	U	
86-30-6	N-nitrosodiphenylamine	12	U	
101-55-3	4-Bromophenyl phenyl ether	12	U	
118-74-1	Hexachlorobenzene	12	U	
87-86-5	Pentachlorophenol	29	U	
85-01-8	Phenanthrene	12	U	
120-12-7	Anthracene	12	U	
86-74-8	Carbazole	12	U	
84-74-2	Di-n-butyl phthalate	2	BJ	
206-44-0	Fluoranthene	12	U	
129-00-0	Pyrene	12	U	
85-68-7	Butyl benzyl phthalate	12	U	
91-94-1	3,3'-Dichlorobenzidine	12	U	
56-55-3	Benzo(a)anthracene	12	U	
218-01-9	Chrysene	12	U	
117-81-7	Bis(2-ethylhexyl) phthalate	12	U	
117-84-0	Di-n-octyl phthalate	12	U	
205-99-2	Benzo(b)fluoranthene	12	U	
207-08-9	Benzo(k)fluoranthene	12	U	
50-32-8	Benzo(a)pyrene	12	U	
193-39-5	Indeno(1,2,3-cd)pyrene	12	U	
53-70-3	Dibenzo(a,h)anthracene	12	U	
191-24-2	Benzo(ghi)perylene	12	U	

GOLDBERG ZOINO & ASSOCIATES
ASP91-2 - SEMIVOLATILES
TENTATIVELY IDENTIFIED COMPOUNDS

6613

Client No.

MW-1S

Lab Name: Recra Environmental Contract: _____

Lab Code: RECNY Case No.: _____ SAS No.: _____ SDG No.: _____

Matrix: (soil/water) WATER Lab Sample ID: A4270105

Sample wt/vol: 850.00 (g/mL) ML Lab File ID: 16295W.MSQ

Level: (low/med) LOW Date Samp/Recv: 06/01/94 06/01/94

% Moisture: _____ decanted: (Y/N) N Date Extracted: 06/06/94

Concentrated Extract Volume: 1000 (uL) Date Analyzed: 06/22/94

Injection Volume: 2.00 (uL) Dilution Factor: 1.00

GPC Cleanup: (Y/N) N pH: 7.0

CONCENTRATION UNITS:
(ug/L or ug/Kg) UG/L

Number TICs found: 10

	CAS NO.	Compound Name	RT	Est. Conc.	Q
1.		OXYGENATED COMPOUND	5.90	110	J
2.		UNKNOWN	6.23	180	J
3.		UNKNOWN	6.40	12	J
4.		CHLOROBENZOIC ACID ISOMER	6.75	59	J
5.		UNKNOWN	7.42	11	J
6.		UNKNOWN	12.82	5	J
7.		SATURATED HYDROCARBON	16.57	5	J
8.		SATURATED HYDROCARBON	16.77	6	J
9.		SATURATED HYDROCARBON	16.92	4	J
10.		UNKNOWN	17.00	5	J

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GOLDBERG ZOINO & ASSOCIATES
ASP91-2 - SEMIVOLATILES
ANALYSIS DATA SHEET

0014

Client No.

MW-1SRE

Lab Name: Recra Environmental Contract: _____

Lab Code: RECNY Case No.: _____ SAS No.: _____ SDG No.: _____

Matrix: (soil/water) WATER Lab Sample ID: A4270105RE

Sample wt/vol: 910.00 (g/mL) ML Lab File ID: 16545W.MSQ

Level: (low/med) LOW Date Samp/Recv: 06/01/94 06/01/94

% Moisture: _____ decanted: (Y/N) N Date Extracted: 06/23/94

Concentrated Extract Volume: 1000 (uL) Date Analyzed: 07/07/94

Injection Volume: 2.00 (uL) Dilution Factor: 1.00

GPC Cleanup: (Y/N) N pH: 7.0

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/Kg) UG/L	Q
108-95-2	Phenol	11	U
111-44-4	Bis(2-chloroethyl) ether	11	U
95-57-8	2-Chlorophenol	11	U
541-73-1	1,3-Dichlorobenzene	11	U
106-46-7	1,4-Dichlorobenzene	11	U
95-50-1	1,2-Dichlorobenzene	11	U
95-48-7	2-Methylphenol	11	U
108-60-1	Bis(2-chloroisopropyl) ether	11	U
106-44-5	4-Methylphenol	11	U
621-64-7	N-Nitroso-Di-n-propylamine	11	U
67-72-1	Hexachloroethane	11	U
98-95-3	Nitrobenzene	11	U
78-59-1	Isophorone	11	U
88-75-5	2-Nitrophenol	11	U
105-67-9	2,4-Dimethylphenol	11	U
111-91-1	Bis(2-chloroethoxy) methane	11	U
120-83-2	2,4-Dichlorophenol	11	U
120-82-1	1,2,4-Trichlorobenzene	11	U
91-20-3	Naphthalene	11	U
106-47-8	4-Chloroaniline	11	U
87-68-3	Hexachlorobutadiene	11	U
59-50-7	4-Chloro-3-methylphenol	11	U
91-57-6	2-Methylnaphthalene	11	U
77-47-4	Hexachlorocyclopentadiene	11	U
88-06-2	2,4,6-Trichlorophenol	27	U
95-95-4	2,4,5-Trichlorophenol	11	U
91-58-7	2-Chloronaphthalene	27	U
88-74-4	2-Nitroaniline	11	U
131-11-3	Dimethyl phthalate	11	U
208-96-8	Acenaphthylene	11	U
606-20-2	2,6-Dinitrotoluene	27	U
99-09-2	3-Nitroaniline		

ARL

GOLDBERG ZOINO & ASSOCIATES
ASP91-2 - SEMIVOLATILES
ANALYSIS DATA SHEET

0015

Client No.

MW-1SRE

Lab Name: Recra Environmental Contract: _____

Lab Code: RECNY Case No.: _____ SAS No.: _____ SDG No.: _____

Matrix: (soil/water) WATER Lab Sample ID: A4270105RE

Sample wt/vol: 910.00 (g/mL) ML Lab File ID: 16545W.MSQ

Level: (low/med) LOW Date Samp/Recv: 06/01/94 06/01/94

% Moisture: _____ decanted: (Y/N) N Date Extracted: 06/23/94

Concentrated Extract Volume: 1000 (uL) Date Analyzed: 07/07/94

Injection Volume: 2.00 (uL) Dilution Factor: 1.00

GPC Cleanup: (Y/N) N pH: 7.0

CONCENTRATION UNITS: (ug/L or ug/Kg) UG/L

CAS NO.	COMPOUND		Q	Val C
83-32-9	Acenaphthene	11	U	
51-28-5	2,4-Dinitrophenol	27	U	
100-02-7	4-Nitrophenol	27	U	
132-64-9	Dibenzofuran	11	U	
121-14-2	2,4-Dinitrotoluene	11	U	
84-66-2	Diethyl phthalate	11	U	
7005-72-3	4-Chlorodiphenylether	11	U	
86-73-7	Fluorene	11	U	
100-01-6	4-Nitroaniline	27	U	
534-52-1	4,6-Dinitro-2-methylphenol	27	U	
86-30-6	N-nitrosodiphenylamine	11	U	
101-55-3	4-Bromophenyl phenyl ether	11	U	
118-74-1	Hexachlorobenzene	11	U	
87-86-5	Pentachlorophenol	27	U	
85-01-8	Phenanthrene	11	U	
120-12-7	Anthracene	11	U	
86-74-8	Carbazole	11	U	
84-74-2	Di-n-butyl phthalate	11	U	
206-44-0	Fluoranthene	11	U	
129-00-0	Pyrene	11	U	
85-68-7	Butyl benzyl phthalate	11	U	
91-94-1	3,3'-Dichlorobenzidine	11	U	
56-55-3	Benzo(a)anthracene	11	U	
218-01-9	Chrysene	3	J	
117-81-7	Bis(2-ethylhexyl) phthalate	11	U	
117-84-0	Di-n-octyl phthalate	11	U	
205-99-2	Benzo(b)fluoranthene	11		
207-08-9	Benzo(k)fluoranthene	11		
50-32-8	Benzo(a)pyrene	11		
193-39-5	Indeno(1,2,3-cd)pyrene	11		
53-70-3	Dibenzo(a,h)anthracene	11		
191-24-2	Benzo(ghi)perylene	11		

GOLDBERG ZOINO & ASSOCIATES
ASP91-2 - SEMIVOLATILES
TENTATIVELY IDENTIFIED COMPOUNDS

Client No.: MW-1SRE

Lab Name: Recra Environmental Contract: _____

Lab Code: RECNY Case No.: _____ SAS No.: _____ SDG No.: _____

Matrix: (soil/water) WATER Lab Sample ID: A4270105RE

Sample wt/vol: 910.00 (g/mL) ML Lab File ID: 16545W.MSQ

Level: (low/med) LOW Date Samp/Recv: 06/01/94 06/01/94

% Moisture: _____ decanted: (Y/N) N Date Extracted: 06/23/94

Concentrated Extract Volume: 1000 (uL) Date Analyzed: 07/07/94

Injection Volume: 2.00 (uL) Dilution Factor: 1.00

GPC Cleanup: (Y/N) N pH: 7.0

Number TICs found: 12 CONCENTRATION UNITS: (ug/L or ug/Kg) UG/L

	CAS NO.	Compound Name	RT	Est. Conc.	Q
1.		CYCLOHEXEN-1-OL ISOMER	3.42	5	J
2.	930-68-7	2-CYCLOHEXEN-1-ONE	3.90	4	JN
3.		UNSATURATED HYDROCARBON	4.95	8	J
4.		UNKNOWN	7.07	160	J
5.		UNKNOWN	7.22	8	J
6.		UNKNOWN	8.17	10	J
7.		OXYGENATED COMPOUND	8.33	13	J
8.		UNKNOWN	8.53	9	J
9.		UNKNOWN ACID	12.38	6	J
10.		UNKNOWN ALCOHOL	13.80	62	J
11.		SATURATED HYDROCARBON	17.53	4	J
12.		SATURATED HYDROCARBON	17.88	4	J

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GOLDBERG ZOINO & ASSOCIATES
ASP91-2 - SEMIVOLATILES
ANALYSIS DATA SHEET

0017

Client No.

MW-8R

Lab Name: Recra Environmental Contract: _____

Lab Code: RECNY Case No.: _____ SAS No.: _____ SDG No.: _____

Matrix: (soil/water) WATER Lab Sample ID: A4270107

Sample wt/vol: 1000.0 (g/mL) ML Lab File ID: 16299W.MSQ

Level: (low/med) LOW Date Samp/Recv: 06/01/94 06/01/94

% Moisture: _____ decanted: (Y/N) N Date Extracted: 06/06/94

Concentrated Extract Volume: 1000 (uL) Date Analyzed: 06/22/94

Injection Volume: 2.00 (uL) Dilution Factor: 1.00

GPC Cleanup: (Y/N) N pH: 7.0

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/Kg) UG/L	Q	Value C
108-95-2	Phenol	10	U	
111-44-4	Bis(2-chloroethyl) ether	10	U	
95-57-8	2-Chlorophenol	10	U	
541-73-1	1,3-Dichlorobenzene	10	U	
106-46-7	1,4-Dichlorobenzene	10	U	
95-50-1	1,2-Dichlorobenzene	10	U	
95-48-7	2-Methylphenol	10	U	
108-60-1	Bis(2-chloroisopropyl) ether	10	U	
106-44-5	4-Methylphenol	10	U	
621-64-7	N-Nitroso-Di-n-propylamine	10	U	
67-72-1	Hexachloroethane	10	U	
98-95-3	Nitrobenzene	10	U	
78-59-1	Isophorone	10	U	
88-75-5	2-Nitrophenol	10	U	
105-67-9	2,4-Dimethylphenol	10	U	
111-91-1	Bis(2-chloroethoxy) methane	10	U	
120-83-2	2,4-Dichlorophenol	10	U	
120-82-1	1,2,4-Trichlorobenzene	1	J	
91-20-3	Naphthalene	10	U	
106-47-8	4-Chloroaniline	10	U	
87-68-3	Hexachlorobutadiene	14		
59-50-7	4-Chloro-3-methylphenol	10	U	
91-57-6	2-Methylnaphthalene	10	U	
77-47-4	Hexachlorocyclopentadiene	10	U	
88-06-2	2,4,6-Trichlorophenol	25	U	
95-95-4	2,4,5-Trichlorophenol	10	U	
91-58-7	2-Chloronaphthalene	25	U	
88-74-4	2-Nitroaniline	10	U	
131-11-3	Dimethyl phthalate	10	U	
208-96-8	Acenaphthylene	10	U	
606-20-2	2,6-Dinitrotoluene	25	U	
99-09-2	3-Nitroaniline			

AC

GOLDBERG ZOINO & ASSOCIATES
ASP91-2 - SEMIVOLATILES
ANALYSIS DATA SHEET

Client No.

MW-8R

Lab Name: Recra Environmental Contract: _____

Lab Code: RECNY Case No.: _____ SAS No.: _____ SDG No.: _____

Matrix: (soil/water) WATER Lab Sample ID: A4270107

Sample wt/vol: 1000.0 (g/mL) ML Lab File ID: 16299W.MSQ

Level: (low/med) LOW Date Samp/Recv: 06/01/94 06/01/94

% Moisture: _____ decanted: (Y/N) N Date Extracted: 06/06/94

Concentrated Extract Volume: 1000 (uL) Date Analyzed: 06/22/94

Injection Volume: 2.00 (uL) Dilution Factor: 1.00

GPC Cleanup: (Y/N) N pH: 7.0

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/Kg) UG/L	Q
83-32-9	Acenaphthene	10	U
51-28-5	2,4-Dinitrophenol	25	U
100-02-7	4-Nitrophenol	25	U
132-64-9	Dibenzofuran	10	U
121-14-2	2,4-Dinitrotoluene	10	U
84-66-2	Diethyl phthalate	10	U
7005-72-3	4-Chlorodiphenylether	10	U
86-73-7	Fluorene	10	U
100-01-6	4-Nitroaniline	25	U
534-52-1	4,6-Dinitro-2-methylphenol	25	U
86-30-6	N-nitrosodiphenylamine	10	U
101-55-3	4-Bromophenyl phenyl ether	10	U
118-74-1	Hexachlorobenzene	10	U
87-86-5	Pentachlorophenol	25	U
85-01-8	Phenanthrene	10	U
120-12-7	Anthracene	10	U
86-74-8	Carbazole	10	U
84-74-2	Di-n-butyl phthalate	10	U
206-44-0	Fluoranthene	10	U
129-00-0	Pyrene	10	U
85-68-7	Butyl benzyl phthalate	10	U
91-94-1	3,3'-Dichlorobenzidine	10	U
56-55-3	Benzo(a)anthracene	10	U
218-01-9	Chrysene	10	U
117-81-7	Bis(2-ethylhexyl) phthalate	10	U
117-84-0	Di-n-octyl phthalate	10	U
205-99-2	Benzo(b)fluoranthene	10	U
207-08-9	Benzo(k)fluoranthene	10	U
50-32-8	Benzo(a)pyrene	10	U
193-39-5	Indeno(1,2,3-cd)pyrene	10	U
53-70-3	Dibenzo(a,h)anthracene	10	U
191-24-2	Benzo(ghi)perylene	10	U

GOLDBERG ZOINO & ASSOCIATES
ASP91-2 - SEMIVOLATILES
TENTATIVELY IDENTIFIED COMPOUNDS

6019

Client No.

MW-8R

Lab Name: Recra Environmental Contract: _____

Lab Code: RECNY Case No.: _____ SAS No.: _____ SDG No.: _____

Matrix: (soil/water) WATER Lab Sample ID: A4270107

Sample wt/vol: 1000.0 (g/mL) ML Lab File ID: 16299W.MSQ

Level: (low/med) LOW Date Samp/Recv: 06/01/94 06/01/94

% Moisture: _____ decanted: (Y/N) N Date Extracted: 06/06/94

Concentrated Extract Volume: 1000 (uL) Date Analyzed: 06/22/94

Injection Volume: 2.00 (uL) Dilution Factor: 1.00

GPC Cleanup: (Y/N) N pH: 7.0

Number TICs found: 3

CONCENTRATION UNITS:
(ug/L or ug/Kg) UG/L

CAS NO.	Compound Name	RT	Est. Conc.	Q
1.	CHLOROMETHYLBENZENE ISOMER	3.60	1000	J
2. 17849-38-6	2-CHLORO-BENZENEMETHANOL	5.45	13	JN
3.	OXYGENATED COMPOUND	5.80	25	J

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GOLDBERG ZOINO & ASSOCIATES
ASP91-2 - SEMIVOLATILES
ANALYSIS DATA SHEET

9020

Client No.

MW-8RRE

Lab Name: Recra Environmental Contract: _____

Lab Code: RECNY Case No.: _____ SAS No.: _____ SDG No.: _____

Matrix: (soil/water) WATER Lab Sample ID: A4270107RE

Sample wt/vol: 940.00 (g/mL) ML Lab File ID: 16547W.MSQ

Level: (low/med) LOW Date Samp/Recv: 06/01/94 06/01/94

% Moisture: _____ decanted: (Y/N) N Date Extracted: 06/23/94

Concentrated Extract Volume: 1000 (uL) Date Analyzed: 07/08/94

Injection Volume: 2.00 (uL) Dilution Factor: 1.00

GPC Cleanup: (Y/N) N pH: 7.0

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/Kg) UG/L	Q
108-95-2	Phenol	11	U
111-44-4	Bis(2-chloroethyl) ether	11	U
95-57-8	2-Chlorophenol	11	U
541-73-1	1,3-Dichlorobenzene	11	U
106-46-7	1,4-Dichlorobenzene	11	U
95-50-1	1,2-Dichlorobenzene	11	U
95-48-7	2-Methylphenol	11	U
108-60-1	Bis(2-chloroisopropyl) ether	11	U
106-44-5	4-Methylphenol	11	U
621-64-7	N-Nitroso-Di-n-propylamine	11	U
67-72-1	Hexachloroethane	11	U
98-95-3	Nitrobenzene	11	U
78-59-1	Isophorone	11	U
88-75-5	2-Nitrophenol	11	U
105-67-9	2,4-Dimethylphenol	11	U
111-91-1	Bis(2-chloroethoxy) methane	11	U
120-83-2	2,4-Dichlorophenol	11	U
120-82-1	1,2,4-Trichlorobenzene	11	U
91-20-3	Naphthalene	11	U
106-47-8	4-Chloroaniline	11	U
87-68-3	Hexachlorobutadiene	11	U
59-50-7	4-Chloro-3-methylphenol	11	U
91-57-6	2-Methylnaphthalene	11	U
77-47-4	Hexachlorocyclopentadiene	11	U
88-06-2	2,4,6-Trichlorophenol	26	U
95-95-4	2,4,5-Trichlorophenol	11	U
91-58-7	2-Chloronaphthalene	26	U
88-74-4	2-Nitroaniline	11	U
131-11-3	Dimethyl phthalate	11	U
208-96-8	Acenaphthylene	11	U
606-20-2	2,6-Dinitrotoluene	26	U
99-09-2	3-Nitroaniline		

ALL

GOLDBERG ZOINO & ASSOCIATES
ASP91-2 - SEMIVOLATILES
ANALYSIS DATA SHEET

6021

Client No.

MW-8RRE

Lab Name: Recra Environmental Contract: _____

Lab Code: RECNY Case No.: _____ SAS No.: _____ SDG No.: _____

Matrix: (soil/water) WATER Lab Sample ID: A4270107RE

Sample wt/vol: 940.00 (g/mL) ML Lab File ID: 16547W.MSQ

Level: (low/med) LOW Date Samp/Recv: 06/01/94 06/01/94

% Moisture: _____ decanted: (Y/N) N Date Extracted: 06/23/94

Concentrated Extract Volume: 1000 (uL) Date Analyzed: 07/08/94

Injection Volume: 2.00 (uL) Dilution Factor: 1.00

GPC Cleanup: (Y/N) N pH: 7.0

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/Kg) UG/L	Q
83-32-9	Acenaphthene	11	U
51-28-5	2,4-Dinitrophenol	26	U
100-02-7	4-Nitrophenol	26	U
132-64-9	Dibenzofuran	11	U
121-14-2	2,4-Dinitrotoluene	11	U
84-66-2	Diethyl phthalate	11	U
7005-72-3	4-Chlorodiphenylether	11	U
86-73-7	Fluorene	11	U
100-01-6	4-Nitroaniline	26	U
534-52-1	4,6-Dinitro-2-methylphenol	26	U
86-30-6	N-nitrosodiphenylamine	11	U
101-55-3	4-Bromophenyl phenyl ether	11	U
118-74-1	Hexachlorobenzene	11	U
87-86-5	Pentachlorophenol	26	U
85-01-8	Phenanthrene	11	U
120-12-7	Anthracene	11	U
86-74-8	Carbazole	11	U
84-74-2	Di-n-butyl phthalate	11	U
206-44-0	Fluoranthene	11	U
129-00-0	Pyrene	11	U
85-68-7	Butyl benzyl phthalate	11	U
91-94-1	3,3'-Dichlorobenzidine	11	U
56-55-3	Benzo(a)anthracene	11	U
218-01-9	Chrysene	11	U
117-81-7	Bis(2-ethylhexyl) phthalate	11	U
117-84-0	Di-n-octyl phthalate	11	U
205-99-2	Benzo(b)fluoranthene	11	U
207-08-9	Benzo(k)fluoranthene	11	U
50-32-8	Benzo(a)pyrene	11	U
193-39-5	Indeno(1,2,3-cd)pyrene	11	U
53-70-3	Dibenzo(a,h)anthracene	11	U
191-24-2	Benzo(ghi)perylene	11	U

GOLDBERG ZOINO & ASSOCIATES
ASP91-2 - SEMIVOLATILES
TENTATIVELY IDENTIFIED COMPOUNDS

3022

Client No.

MW-8RRE

Lab Name: Recra Environmental Contract: _____

Lab Code: RECNY Case No.: _____ SAS No.: _____ SDG No.: _____

Matrix: (soil/water) WATER Lab Sample ID: A4270107RE

Sample wt/vol: 940.00 (g/mL) ML Lab File ID: 16547W.MSQ

Level: (low/med) LOW Date Samp/Recv: 06/01/94 06/01/94

% Moisture: _____ decanted: (Y/N) N Date Extracted: 06/23/94

Concentrated Extract Volume: 1000 (uL) Date Analyzed: 07/08/94

Injection Volume: 2.00 (uL) Dilution Factor: 1.00

GPC Cleanup: (Y/N) N pH: 7.0

CONCENTRATION UNITS:
(ug/L or ug/Kg) UG/L

Number TICs found: 3

	CAS NO.	Compound Name	RT	Est. Conc.	Q
1.	930-68-7	2-CYCLOHEXEN-1-ONE	3.90	5	JN
2.	17849-38-6	2-CHLORO-BENZENEMETHANOL	6.20	54	JN
3.		OXYGENATED COMPOUND	6.55	10	J

ALL

GOLDBERG ZOINO & ASSOCIATES
ASP91-2 - SEMIVOLATILES
ANALYSIS DATA SHEET

0023

Client No.

MW-9R

Lab Name: Recra Environmental Contract: _____

Lab Code: RECNY Case No.: _____ SAS No.: _____ SDG No.: _____

Matrix: (soil/water) WATER Lab Sample ID: A4270108

Sample wt/vol: 1000.0 (g/mL) ML Lab File ID: 16300W.MSQ

Level: (low/med) LOW Date Samp/Recv: 06/01/94 06/01/94

% Moisture: _____ decanted: (Y/N) N Date Extracted: 06/06/94

Concentrated Extract Volume: 1000 (uL) Date Analyzed: 06/22/94

Injection Volume: 2.00 (uL) Dilution Factor: 1.00

GPC Cleanup: (Y/N) N pH: 7.0

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/Kg) UG/L	Q
108-95-2	Phenol	10	U
111-44-4	Bis(2-chloroethyl) ether	10	U
95-57-8	2-Chlorophenol	10	U
541-73-1	1,3-Dichlorobenzene	10	U
106-46-7	1,4-Dichlorobenzene	10	U
95-50-1	1,2-Dichlorobenzene	10	U
95-48-7	2-Methylphenol	10	U
108-60-1	Bis(2-chloroisopropyl) ether	10	U
106-44-5	4-Methylphenol	10	U
621-64-7	N-Nitroso-Di-n-propylamine	10	U
67-72-1	Hexachloroethane	10	U
98-95-3	Nitrobenzene	10	U
78-59-1	Isophorone	10	U
88-75-5	2-Nitrophenol	10	U
105-67-9	2,4-Dimethylphenol	10	U
111-91-1	Bis(2-chloroethoxy) methane	10	U
120-83-2	2,4-Dichlorophenol	10	U
120-82-1	1,2,4-Trichlorobenzene	4	J
91-20-3	Naphthalene	10	U
106-47-8	4-Chloroaniline	10	U
87-68-3	Hexachlorobutadiene	6	J
59-50-7	4-Chloro-3-methylphenol	10	U
91-57-6	2-Methylnaphthalene	10	U
77-47-4	Hexachlorocyclopentadiene	10	U
88-06-2	2,4,6-Trichlorophenol	25	U
95-95-4	2,4,5-Trichlorophenol	10	U
91-58-7	2-Chloronaphthalene	25	U
88-74-4	2-Nitroaniline	10	U
131-11-3	Dimethyl phthalate	10	U
208-96-8	Acenaphthylene	10	U
606-20-2	2,6-Dinitrotoluene	25	U
99-09-2	3-Nitroaniline		

GOLDBERG ZOINO & ASSOCIATES
ASP91-2 - SEMIVOLATILES
ANALYSIS DATA SHEET

Client No.

MW-9R

Lab Name: Recra Environmental Contract: _____

Lab Code: RECNY Case No.: _____ SAS No.: _____ SDG No.: _____

Matrix: (soil/water) WATER Lab Sample ID: A4270108

Sample wt/vol: 1000.0 (g/mL) ML Lab File ID: 16300W.MSQ

Level: (low/med) LOW Date Samp/Recv: 06/01/94 06/01/94

% Moisture: _____ decanted: (Y/N) N Date Extracted: 06/06/94

Concentrated Extract Volume: 1000 (uL) Date Analyzed: 06/22/94

Injection Volume: 2.00 (uL) Dilution Factor: 1.00

GPC Cleanup: (Y/N) N pH: 7.0

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/Kg) UG/L	Q	Va
83-32-9	Acenaphthene	10	U	
51-28-5	2,4-Dinitrophenol	25	U	
100-02-7	4-Nitrophenol	25	U	
132-64-9	Dibenzofuran	10	U	
121-14-2	2,4-Dinitrotoluene	10	U	
84-66-2	Diethyl phthalate	1	J	
7005-72-3	4-Chlorodiphenylether	10	U	
86-73-7	Fluorene	10	U	
100-01-6	4-Nitroaniline	25	U	
534-52-1	4,6-Dinitro-2-methylphenol	25	U	J
86-30-6	N-nitrosodiphenylamine	10	U	
101-55-3	4-Bromophenyl phenyl ether	10	U	
118-74-1	Hexachlorobenzene	10	U	
87-86-5	Pentachlorophenol	25	U	
85-01-8	Phenanthrene	10	U	
120-12-7	Anthracene	10	U	
86-74-8	Carbazole	0.4	J	
84-74-2	Di-n-butyl phthalate	2	BJ	
206-44-0	Fluoranthene	10	U	
129-00-0	Pyrene	10	U	
85-68-7	Butyl benzyl phthalate	10	U	
91-94-1	3,3'-Dichlorobenzidine	10	U	
56-55-3	Benzo(a)anthracene	10	U	
218-01-9	Chrysene	10	U	
117-81-7	Bis(2-ethylhexyl) phthalate	10	U	
117-84-0	Di-n-octyl phthalate	10	U	
205-99-2	Benzo(b)fluoranthene	10	U	
207-08-9	Benzo(k)fluoranthene	10	U	
50-32-8	Benzo(a)pyrene	10	U	
193-39-5	Indeno(1,2,3-cd)pyrene	10	U	
53-70-3	Dibenzo(a,h)anthracene	10	U	
191-24-2	Benzo(ghi)perylene	10	U	

AC

GOLDBERG ZOINO & ASSOCIATES
ASP91-2 - SEMIVOLATILES
TENTATIVELY IDENTIFIED COMPOUNDS

Client No.

MW-9R

Lab Name: Recra Environmental Contract: _____

Lab Code: RECNY Case No.: _____ SAS No.: _____ SDG No.: _____

Matrix: (soil/water) WATER Lab Sample ID: A4270108

Sample wt/vol: 1000.0 (g/mL) ML Lab File ID: 16300W.MSQ

Level: (low/med) LOW Date Samp/Recv: 06/01/94 06/01/94

% Moisture: _____ decanted: (Y/N) N Date Extracted: 06/06/94

Concentrated Extract Volume: 1000 (uL) Date Analyzed: 06/22/94

Injection Volume: 2.00 (uL) Dilution Factor: 1.00

GPC Cleanup: (Y/N) N pH: 7.0

CONCENTRATION UNITS:
(ug/L or ug/Kg) UG/L

Number TICs found: 3

CAS NO.	Compound Name	RT	Est. Conc.	Q
1.	CYCLOHEXEN-1-OL ISOMER	2.70	11	J
2.	CHLOROMETHYLBENZENE ISOMER	3.67	2000	J
3.	UNKNOWN	4.10	21	J

GOLDBERG ZOINO & ASSOCIATES
ASP91-2 - SEMIVOLATILES
ANALYSIS DATA SHEET

9026
Client No.

MW-9RRE

Lab Name: Recra Environmental Contract: _____

Lab Code: RECNY Case No.: _____ SAS No.: _____ SDG No.: _____

Matrix: (soil/water) WATER Lab Sample ID: A4270108RE

Sample wt/vol: 1000.0 (g/mL) ML Lab File ID: 16548W.MSQ

Level: (low/med) LOW Date Samp/Recv: 06/01/94 06/01/94

% Moisture: _____ decanted: (Y/N) N Date Extracted: 06/23/94

Concentrated Extract Volume: 1000 (uL) Date Analyzed: 07/08/94

Injection Volume: 2.00 (uL) Dilution Factor: 1.00

GPC Cleanup: (Y/N) N pH: 7.0

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/Kg) UG/L	Q
108-95-2	Phenol	10	U
111-44-4	Bis(2-chloroethyl) ether	10	U
95-57-8	2-Chlorophenol	10	U
541-73-1	1,3-Dichlorobenzene	10	U
106-46-7	1,4-Dichlorobenzene	10	U
95-50-1	1,2-Dichlorobenzene	0.9	J
95-48-7	2-Methylphenol	10	U
108-60-1	Bis(2-chloroisopropyl) ether	10	U
106-44-5	4-Methylphenol	10	U
621-64-7	N-Nitroso-Di-n-propylamine	10	U
67-72-1	Hexachloroethane	10	U
98-95-3	Nitrobenzene	10	U
78-59-1	Isophorone	10	U
88-75-5	2-Nitrophenol	10	U
105-67-9	2,4-Dimethylphenol	10	U
111-91-1	Bis(2-chloroethoxy) methane	10	U
120-83-2	2,4-Dichlorophenol	10	U
120-82-1	1,2,4-Trichlorobenzene	2	J
91-20-3	Naphthalene	10	U
106-47-8	4-Chloroaniline	10	U
87-68-3	Hexachlorobutadiene	6	J
59-50-7	4-Chloro-3-methylphenol	10	U
91-57-6	2-Methylnaphthalene	10	U
77-47-4	Hexachlorocyclopentadiene	10	U
88-06-2	2,4,6-Trichlorophenol	25	U
95-95-4	2,4,5-Trichlorophenol	10	U
91-58-7	2-Chloronaphthalene	25	U
88-74-4	2-Nitroaniline	10	U
131-11-3	Dimethyl phthalate	10	U
208-96-8	Acenaphthylene	10	U
606-20-2	2,6-Dinitrotoluene	25	U
99-09-2	3-Nitroaniline		

GOLDBERG ZOINO & ASSOCIATES
ASP91-2 - SEMIVOLATILES
ANALYSIS DATA SHEET

9027

Client No.

MW-9RRE

Lab Name: Recra Environmental Contract: _____

Lab Code: RECNY Case No.: _____ SAS No.: _____ SDG No.: _____

Matrix: (soil/water) WATER Lab Sample ID: A4270108RE

Sample wt/vol: 1000.0 (g/mL) ML Lab File ID: 16548W.MSQ

Level: (low/med) LOW Date Samp/Recv: 06/01/94 06/01/94

% Moisture: _____ decanted: (Y/N) N Date Extracted: 06/23/94

Concentrated Extract Volume: 1000 (uL) Date Analyzed: 07/08/94

Injection Volume: 2.00 (uL) Dilution Factor: 1.00

GPC Cleanup: (Y/N) N pH: 7.0

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/Kg) UG/L	Q
83-32-9	Acenaphthene	10	U
51-28-5	2,4-Dinitrophenol	25	U
100-02-7	4-Nitrophenol	25	U
132-64-9	Dibenzofuran	10	U
121-14-2	2,4-Dinitrotoluene	10	U
84-66-2	Diethyl phthalate	10	U
7005-72-3	4-Chlorodiphenylether	10	U
86-73-7	Fluorene	10	U
100-01-6	4-Nitroaniline	25	U
534-52-1	4,6-Dinitro-2-methylphenol	25	U
86-30-6	N-nitrosodiphenylamine	10	U
101-55-3	4-Bromophenyl phenyl ether	10	U
118-74-1	Hexachlorobenzene	10	U
87-86-5	Pentachlorophenol	25	U
85-01-8	Phenanthrene	10	U
120-12-7	Anthracene	10	U
86-74-8	Carbazole	10	U
84-74-2	Di-n-butyl phthalate	10	U
206-44-0	Fluoranthene	10	U
129-00-0	Pyrene	10	U
85-68-7	Butyl benzyl phthalate	10	U
91-94-1	3,3'-Dichlorobenzidine	10	U
56-55-3	Benzo(a)anthracene	10	U
218-01-9	Chrysene	10	U
117-81-7	Bis(2-ethylhexyl) phthalate	10	U J
117-84-0	Di-n-octyl phthalate	10	U
205-99-2	Benzo(b)fluoranthene	10	U
207-08-9	Benzo(k)fluoranthene	10	U
50-32-8	Benzo(a)pyrene	10	U
193-39-5	Indeno(1,2,3-cd)pyrene	10	U
53-70-3	Dibenzo(a,h)anthracene	10	U
191-24-2	Benzo(ghi)perylene	10	U

GOLDBERG ZOINO & ASSOCIATES
ASP91-2 - SEMIVOLATILES
TENTATIVELY IDENTIFIED COMPOUNDS

0028

Client No.

MW-9RRE

Lab Name: Recra Environmental Contract: _____

Lab Code: RECNY Case No.: _____ SAS No.: _____ SDG No.: _____

Matrix: (soil/water) WATER Lab Sample ID: A4270108RE

Sample wt/vol: 1000.0 (g/mL) ML Lab File ID: 16548W.MSQ

Level: (low/med) LOW Date Samp/Recv: 06/01/94 06/01/94

% Moisture: _____ decanted: (Y/N) N Date Extracted: 06/23/94

Concentrated Extract Volume: 1000 (uL) Date Analyzed: 07/08/94

Injection Volume: 2.00 (uL) Dilution Factor: 1.00

GPC Cleanup: (Y/N) N pH: 7.0

CONCENTRATION UNITS:
(ug/L or ug/Kg) UG/L

Number TICs found: 3

CAS NO.	Compound Name	RT	Est. Conc.	Q
1.	CHLOROMETHYLBENZENE ISOMER	4.25	1400	J
2.	UNKNOWN	4.75	4	J
3. 17849-38-6	2-CHLORO-BENZENEMETHANOL	6.20	19	JN

ALL

GOLDBERG ZOINO & ASSOCIATES
ASP91-2 - SEMIVOLATILES
ANALYSIS DATA SHEET

6029

Client No.

MW-9RD

Lab Name: Recra Environmental Contract: _____

Lab Code: RECNY Case No.: _____ SAS No.: _____ SDG No.: _____

Matrix: (soil/water) WATER Lab Sample ID: A4270109

Sample wt/vol: 1000.0 (g/mL) ML Lab File ID: 16305W.MSQ

Level: (low/med) LOW Date Samp/Recv: 06/01/94 06/01/94

% Moisture: _____ decanted: (Y/N) N Date Extracted: 06/06/94

Concentrated Extract Volume: 1000 (uL) Date Analyzed: 06/22/94

Injection Volume: 2.00 (uL) Dilution Factor: 1.00

GPC Cleanup: (Y/N) N pH: 7.0

CONCENTRATION UNITS: (ug/L or ug/Kg) UG/L

CAS NO.	COMPOUND		Q
108-95-2	Phenol	10	U
111-44-4	Bis(2-chloroethyl) ether	10	U
95-57-8	2-Chlorophenol	10	U
541-73-1	1,3-Dichlorobenzene	10	U
106-46-7	1,4-Dichlorobenzene	10	U
95-50-1	1,2-Dichlorobenzene	10	U
95-48-7	2-Methylphenol	10	U
108-60-1	Bis(2-chloroisopropyl) ether	10	U
106-44-5	4-Methylphenol	10	U
621-64-7	N-Nitroso-Di-n-propylamine	10	U
67-72-1	Hexachloroethane	10	U
98-95-3	Nitrobenzene	10	U
78-59-1	Isophorone	10	U
88-75-5	2-Nitrophenol	10	U
105-67-9	2,4-Dimethylphenol	10	U
111-91-1	Bis(2-chloroethoxy) methane	10	U
120-83-2	2,4-Dichlorophenol	10	U
120-82-1	1,2,4-Trichlorobenzene	10	U
91-20-3	Naphthalene	10	U
106-47-8	4-Chloroaniline	10	U
87-68-3	Hexachlorobutadiene	10	U
59-50-7	4-Chloro-3-methylphenol	10	U
91-57-6	2-Methylnaphthalene	10	U
77-47-4	Hexachlorocyclopentadiene	10	U
88-06-2	2,4,6-Trichlorophenol	25	U
95-95-4	2,4,5-Trichlorophenol	10	U
91-58-7	2-Chloronaphthalene	25	U
88-74-4	2-Nitroaniline	10	U
131-11-3	Dimethyl phthalate	10	U
208-96-8	Acenaphthylene	10	U
606-20-2	2,6-Dinitrotoluene	25	U
99-09-2	3-Nitroaniline		

AU

GOLDBERG ZOINO & ASSOCIATES
ASP91-2 - SEMIVOLATILES
ANALYSIS DATA SHEET

6630

Client No.

MW-9RD

Lab Name: Recra Environmental Contract: _____

Lab Code: RECNY Case No.: _____ SAS No.: _____ SDG No.: _____

Matrix: (soil/water) WATER Lab Sample ID: A4270109

Sample wt/vol: 1000.0 (g/mL) ML Lab File ID: 16305W.MSQ

Level: (low/med) LOW Date Samp/Recv: 06/01/94 06/01/94

% Moisture: _____ decanted: (Y/N) N Date Extracted: 06/06/94

Concentrated Extract Volume: 1000 (uL) Date Analyzed: 06/22/94

Injection Volume: 2.00 (uL) Dilution Factor: 1.00

GPC Cleanup: (Y/N) N pH: 7.0

CONCENTRATION UNITS: (ug/L or ug/Kg) UG/L

CAS NO.	COMPOUND		Q
83-32-9	Acenaphthene	10	U
51-28-5	2,4-Dinitrophenol	25	U
100-02-7	4-Nitrophenol	25	U
132-64-9	Dibenzofuran	10	U
121-14-2	2,4-Dinitrotoluene	10	U
84-66-2	Diethyl phthalate	10	U
7005-72-3	4-Chlorodiphenylether	10	U
86-73-7	Fluorene	25	U
100-01-6	4-Nitroaniline	25	U
534-52-1	4,6-Dinitro-2-methylphenol	10	U
86-30-6	N-nitrosodiphenylamine	10	U
101-55-3	4-Bromophenyl phenyl ether	10	U
118-74-1	Hexachlorobenzene	25	U
87-86-5	Pentachlorophenol	10	U
85-01-8	Phenanthrene	10	U
120-12-7	Anthracene	10	U
86-74-8	Carbazole	2	BJ
84-74-2	Di-n-butyl phthalate	10	U
206-44-0	Fluoranthene	10	U
129-00-0	Pyrene	10	U
85-68-7	Butyl benzyl phthalate	10	U
91-94-1	3,3'-Dichlorobenzidine	10	U
56-55-3	Benzo(a)anthracene	10	U
218-01-9	Chrysene	10	U
117-81-7	Bis(2-ethylhexyl) phthalate	10	U
117-84-0	Di-n-octyl phthalate	10	U
205-99-2	Benzo(b)fluoranthene	10	U
207-08-9	Benzo(k)fluoranthene	10	U
50-32-8	Benzo(a)pyrene	10	U
193-39-5	Indeno(1,2,3-cd)pyrene	10	U
53-70-3	Dibenzo(a,h)anthracene	10	U
191-24-2	Benzo(ghi)perylene	10	U

GOLDBERG ZOINO & ASSOCIATES
ASP91-2 - SEMIVOLATILES
TENTATIVELY IDENTIFIED COMPOUNDS

Client No.

MW-9RD

Lab Name: Recra Environmental Contract: _____

Lab Code: RECNY Case No.: _____ SAS No.: _____ SDG No.: _____

Matrix: (soil/water) WATER Lab Sample ID: A4270109

Sample wt/vol: 1000.0 (g/mL) ML Lab File ID: 16305W.MSQ

Level: (low/med) LOW Date Samp/Recv: 06/01/94 06/01/94

% Moisture: _____ decanted: (Y/N) N Date Extracted: 06/06/94

Concentrated Extract Volume: 1000 (uL) Date Analyzed: 06/22/94

Injection Volume: 2.00 (uL) Dilution Factor: 1.00

GPC Cleanup: (Y/N) N pH: 7.0

CONCENTRATION UNITS:
(ug/L or ug/Kg) UG/L

Number TICs found: 8

	CAS NO.	Compound Name	RT	Est. Conc.	Q
1.		UNKNOWN ALCOHOL	2.90	200	J
2.	930-68-7	2-CHLOROHEXEN-1-ONE	3.27	4	JN
3.		UNKNOWN	3.47	21	J
4.		UNKNOWN	3.72	18	J
5.		UNKNOWN	5.53	10	J
6.		UNKNOWN	6.25	52	J
7.		OXYGENATED COMPOUND	6.75	2000	J
8.		UNKNOWN	13.68	2	J

ALL

GOLDBERG ZOINO & ASSOCIATES
ASP91-2 - SEMIVOLATILES
ANALYSIS DATA SHEET

0032

Client No.

MW-9RDRE

Lab Name: Recra Environmental Contract: _____

Lab Code: RECNY Case No.: _____ SAS No.: _____ SDG No.: _____

Matrix: (soil/water) WATER Lab Sample ID: A4270109RE

Sample wt/vol: 1000.0 (g/mL) ML Lab File ID: 16549W.MSQ

Level: (low/med) LOW Date Samp/Recv: 06/01/94 06/01/94

% Moisture: _____ decanted: (Y/N) N Date Extracted: 06/23/94

Concentrated Extract Volume: 1000 (uL) Date Analyzed: 07/08/94

Injection Volume: 2.00 (uL) Dilution Factor: 1.00

GPC Cleanup: (Y/N) N pH: 7.0

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/Kg) UG/L	Q
108-95-2	Phenol	10	U
111-44-4	Bis(2-chloroethyl) ether	10	U
95-57-8	2-Chlorophenol	10	U
541-73-1	1,3-Dichlorobenzene	10	U
106-46-7	1,4-Dichlorobenzene	10	U
95-50-1	1,2-Dichlorobenzene	10	U
95-48-7	2-Methylphenol	10	U
108-60-1	Bis(2-chloroisopropyl) ether	10	U
106-44-5	4-Methylphenol	10	U
621-64-7	N-Nitroso-Di-n-propylamine	10	U
67-72-1	Hexachloroethane	10	U
98-95-3	Nitrobenzene	10	U
78-59-1	Isophorone	10	U
88-75-5	2-Nitrophenol	10	U
105-67-9	2,4-Dimethylphenol	10	U
111-91-1	Bis(2-chloroethoxy) methane	10	U
120-83-2	2,4-Dichlorophenol	10	U
120-82-1	1,2,4-Trichlorobenzene	10	U
91-20-3	Naphthalene	10	U
106-47-8	4-Chloroaniline	10	U
87-68-3	Hexachlorobutadiene	10	U
59-50-7	4-Chloro-3-methylphenol	10	U
91-57-6	2-Methylnaphthalene	10	U
77-47-4	Hexachlorocyclopentadiene	10	U
88-06-2	2,4,6-Trichlorophenol	25	U
95-95-4	2,4,5-Trichlorophenol	10	U
91-58-7	2-Chloronaphthalene	25	U
88-74-4	2-Nitroaniline	10	U
131-11-3	Dimethyl phthalate	10	U
208-96-8	Acenaphthylene	10	U
606-20-2	2,6-Dinitrotoluene	25	U
99-09-2	3-Nitroaniline		

ALL

GOLDBERG ZOINO & ASSOCIATES
ASP91-2 - SEMIVOLATILES
ANALYSIS DATA SHEET

0033

Client No.

MW-9RDRE

Lab Name: Recra Environmental Contract: _____

Lab Code: RECNY Case No.: _____ SAS No.: _____ SDG No.: _____

Matrix: (soil/water) WATER Lab Sample ID: A4270109RE

Sample wt/vol: 1000.0 (g/mL) ML Lab File ID: 16549W.MSQ

Level: (low/med) LOW Date Samp/Recv: 06/01/94 06/01/94

% Moisture: _____ decanted: (Y/N) N Date Extracted: 06/23/94

Concentrated Extract Volume: 1000 (uL) Date Analyzed: 07/08/94

Injection Volume: 2.00 (uL) Dilution Factor: 1.00

GPC Cleanup: (Y/N) N pH: 7.0

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/Kg) UG/L	Q
83-32-9	Acenaphthene	10	U
51-28-5	2,4-Dinitrophenol	25	U
100-02-7	4-Nitrophenol	25	U
132-64-9	Dibenzofuran	10	U
121-14-2	2,4-Dinitrotoluene	10	U
84-66-2	Diethyl phthalate	10	U
7005-72-3	4-Chlorodiphenylether	10	U
86-73-7	Fluorene	10	U
100-01-6	4-Nitroaniline	25	U
534-52-1	4,6-Dinitro-2-methylphenol	25	U
86-30-6	N-nitrosodiphenylamine	10	U
101-55-3	4-Bromophenyl phenyl ether	10	U
118-74-1	Hexachlorobenzene	10	U
87-86-5	Pentachlorophenol	25	U
85-01-8	Phenanthrene	10	U
120-12-7	Anthracene	10	U
86-74-8	Carbazole	10	U
84-74-2	Di-n-butyl phthalate	10	U
206-44-0	Fluoranthene	10	U
129-00-0	Pyrene	10	U
85-68-7	Butyl benzyl phthalate	10	U
91-94-1	3,3'-Dichlorobenzidine	10	U
56-55-3	Benzo(a)anthracene	10	U
218-01-9	Chrysene	10	U
117-81-7	Bis(2-ethylhexyl) phthalate	10	U
117-84-0	Di-n-octyl phthalate	10	U
205-99-2	Benzo(b)fluoranthene	10	U
207-08-9	Benzo(k)fluoranthene	10	U
50-32-8	Benzo(a)pyrene	10	U
193-39-5	Indeno(1,2,3-cd)pyrene	10	U
53-70-3	Dibenzo(a,h)anthracene	10	U
191-24-2	Benzo(ghi)perylene	10	U

GOLDBERG ZOINO & ASSOCIATES
ASP91-2 - SEMIVOLATILES
TENTATIVELY IDENTIFIED COMPOUNDS

Client No.

MW-9RDRE

Lab Name: Recra Environmental Contract: _____

Lab Code: RECNY Case No.: _____ SAS No.: _____ SDG No.: _____

Matrix: (soil/water) WATER Lab Sample ID: A4270109RE

Sample wt/vol: 1000.0 (g/mL) ML Lab File ID: 16549W.MSQ

Level: (low/med) LOW Date Samp/Recv: 06/01/94 06/01/94

% Moisture: _____ decanted: (Y/N) N Date Extracted: 06/23/94

Concentrated Extract Volume: 1000 (uL) Date Analyzed: 07/08/94

Injection Volume: 2.00 (uL) Dilution Factor: 1.00

GPC Cleanup: (Y/N) N pH: 7.0

Number TICs found: 10 CONCENTRATION UNITS: (ug/L or ug/Kg) UG/L

	CAS NO.	Compound Name	RT	Est. Conc.	Q
1.		CYCLOHEXEN-1-OL ISOMER	3.48	12	J
2.		UNKNOWN ALCOHOL	3.63	180	J
3.	930-68-7	2-CYCLOHEXEN-1-ONE	3.95	8	JN
4.		UNKNOWN	4.12	21	J
5.		UNKNOWN	4.33	20	J
6.		UNKNOWN	4.57	9	J
7.		UNKNOWN	6.33	25	J
8.		OXYGENATED COMPOUND	7.60	1200	J
9.		UNKNOWN	10.85	5	J
10.		UNKNOWN	14.73	8	J

GOLDBERG ZOINO & ASSOCIATES
ASP91-2 - SEMIVOLATILES
ANALYSIS DATA SHEET

0035

Client No.

MW-12R

Lab Name: Recra Environmental Contract: _____

Lab Code: RECNY Case No.: _____ SAS No.: _____ SDG No.: _____

Matrix: (soil/water) WATER Lab Sample ID: A4270101

Sample wt/vol: 1000.0 (g/mL) ML Lab File ID: 16291W.MSO

Level: (low/med) LOW Date Samp/Recv: 05/31/94 06/01/94

% Moisture: _____ decanted: (Y/N) N Date Extracted: 06/06/94

Concentrated Extract Volume: 1000 (uL) Date Analyzed: 06/22/94

Injection Volume: 2.00 (uL) Dilution Factor: 1.00

GPC Cleanup: (Y/N) N pH: 7.0

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/Kg) UG/L	Q
108-95-2	Phenol	10	U
111-44-4	Bis(2-chloroethyl) ether	10	U
95-57-8	2-Chlorophenol	10	U
541-73-1	1,3-Dichlorobenzene	10	U
106-46-7	1,4-Dichlorobenzene	10	U
95-50-1	1,2-Dichlorobenzene	10	U
95-48-7	2-Methylphenol	10	U
108-60-1	Bis(2-chloroisopropyl) ether	10	U
106-44-5	4-Methylphenol	10	U
621-64-7	N-Nitroso-Di-n-propylamine	10	U
67-72-1	Hexachloroethane	10	U
98-95-3	Nitrobenzene	10	U
78-59-1	Isophorone	10	U
88-75-5	2-Nitrophenol	10	U
105-67-9	2,4-Dimethylphenol	10	U
111-91-1	Bis(2-chloroethoxy) methane	10	U
120-83-2	2,4-Dichlorophenol	10	U
120-82-1	1,2,4-Trichlorobenzene	10	U
91-20-3	Naphthalene	10	U
106-47-8	4-Chloroaniline	10	U
87-68-3	Hexachlorobutadiene	10	U
59-50-7	4-Chloro-3-methylphenol	10	U
91-57-6	2-Methylnaphthalene	10	U
77-47-4	Hexachlorocyclopentadiene	10	U
88-06-2	2,4,6-Trichlorophenol	25	U
95-95-4	2,4,5-Trichlorophenol	10	U
91-58-7	2-Chloronaphthalene	25	U
88-74-4	2-Nitroaniline	10	U
131-11-3	Dimethyl phthalate	10	U
208-96-8	Acenaphthylene	10	U
606-20-2	2,6-Dinitrotoluene	25	U
99-09-2	3-Nitroaniline		

AKL

GOLDBERG ZOINO & ASSOCIATES
ASP91-2 - SEMIVOLATILES
ANALYSIS DATA SHEET

0036

Client No.

MW-12R

Lab Name: Recra Environmental Contract: _____

Lab Code: RECNY Case No.: _____ SAS No.: _____ SDG No.: _____

Matrix: (soil/water) WATER Lab Sample ID: A4270101

Sample wt/vol: 1000.0 (g/mL) ML Lab File ID: 16291W.MSQ

Level: (low/med) LOW Date Samp/Recv: 05/31/94 06/01/94

% Moisture: _____ decanted: (Y/N) N Date Extracted: 06/06/94

Concentrated Extract Volume: 1000 (uL) Date Analyzed: 06/22/94

Injection Volume: 2.00 (uL) Dilution Factor: 1.00

GPC Cleanup: (Y/N) N pH: 7.0

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/Kg) UG/L	Q	Valid Q
83-32-9	Acenaphthene	10	U	
51-28-5	2,4-Dinitrophenol	25	U	R
100-02-7	4-Nitrophenol	25	U	
132-64-9	Dibenzofuran	10	U	
121-14-2	2,4-Dinitrotoluene	10	U	
84-66-2	Diethyl phthalate	10	U	
7005-72-3	4-Chlorodiphenylether	10	U	
86-73-7	Fluorene	10	U	
100-01-6	4-Nitroaniline	25	U	
534-52-1	4,6-Dinitro-2-methylphenol	25	U	J
86-30-6	N-nitrosodiphenylamine	10	U	
101-55-3	4-Bromophenyl phenyl ether	10	U	
118-74-1	Hexachlorobenzene	10	U	
87-86-5	Pentachlorophenol	25	U	J
85-01-8	Phenanthrene	10	U	
120-12-7	Anthracene	10	U	
86-74-8	Carbazole	10	U	
84-74-2	Di-n-butyl phthalate	10	U	
206-44-0	Fluoranthene	10	U	
129-00-0	Pyrene	10	U	
85-68-7	Butyl benzyl phthalate	10	U	
91-94-1	3,3'-Dichlorobenzidine	10	U	
56-55-3	Benzo(a)anthracene	10	U	
218-01-9	Chrysene	10	U	
117-81-7	Bis(2-ethylhexyl) phthalate	10	U	
117-84-0	Di-n-octyl phthalate	10	U	
205-99-2	Benzo(b)fluoranthene	10	U	
207-08-9	Benzo(k)fluoranthene	10	U	
50-32-8	Benzo(a)pyrene	10	U	
193-39-5	Indeno(1,2,3-cd)pyrene	10	U	
53-70-3	Dibenzo(a,h)anthracene	10	U	
191-24-2	Benzo(ghi)perylene	10	U	

AK

GOLDBERG ZOINO & ASSOCIATES
ASP91-2 - SEMIVOLATILES
TENTATIVELY IDENTIFIED COMPOUNDS

9037

Client No.

MW-12R

Lab Name: Recra Environmental Contract: _____

Lab Code: RECNY Case No.: _____ SAS No.: _____ SDG No.: _____

Matrix: (soil/water) WATER Lab Sample ID: A4270101

Sample wt/vol: 1000.0 (g/mL) ML Lab File ID: 16291W.MSQ

Level: (low/med) LOW Date Samp/Recv: 05/31/94 06/01/94

% Moisture: _____ decanted: (Y/N) N Date Extracted: 06/06/94

Concentrated Extract Volume: 1000 (uL) Date Analyzed: 06/22/94

Injection Volume: 2.00 (uL) Dilution Factor: 1.00

GPC Cleanup: (Y/N) N pH: 7.0

CONCENTRATION UNITS:
(ug/L or ug/Kg) UG/L

Number TICs found: 3

	CAS NO.	Compound Name	RT	Est. Conc.	Q
1.		CYCLOHEXEN-1-OL ISOMER	2.65	3	J
2.	930-68-7	2-CYCLOHEXEN-1-ONE	3.27	3	JN
3.		OXYGENATED COMPOUND	5.92	140	J

AL

GOLDBERG ZOINO & ASSOCIATES
ASP91-2 - SEMIVOLATILES
ANALYSIS DATA SHEET

Client No.

MW-12RRE

Lab Name: Recra Environmental Contract: _____

Lab Code: RECNY Case No.: _____ SAS No.: _____ SDG No.: _____

Matrix: (soil/water) WATER Lab Sample ID: A4270101RE

Sample wt/vol: 1000.0 (g/mL) ML Lab File ID: 16541W.MSQ

Level: (low/med) LOW Date Samp/Recv: 05/31/94 06/01/94

% Moisture: _____ decanted: (Y/N) N Date Extracted: 06/23/94

Concentrated Extract Volume: 1000 (uL) Date Analyzed: 07/07/94

Injection Volume: 2.00 (uL) Dilution Factor: 1.00

GPC Cleanup: (Y/N) N pH: 7.0

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/Kg) UG/L	Q
108-95-2	Phenol	10	U
111-44-4	Bis(2-chloroethyl) ether	10	U
95-57-8	2-Chlorophenol	10	U
541-73-1	1,3-Dichlorobenzene	10	U
106-46-7	1,4-Dichlorobenzene	10	U
95-50-1	1,2-Dichlorobenzene	10	U
95-48-7	2-Methylphenol	10	U
108-60-1	Bis(2-chloroisopropyl) ether	10	U
106-44-5	4-Methylphenol	10	U
621-64-7	N-Nitroso-Di-n-propylamine	10	U
67-72-1	Hexachloroethane	10	U
98-95-3	Nitrobenzene	10	U
78-59-1	Isophorone	10	U
88-75-5	2-Nitrophenol	10	U
105-67-9	2,4-Dimethylphenol	10	U
111-91-1	Bis(2-chloroethoxy) methane	10	U
120-83-2	2,4-Dichlorophenol	10	U
120-82-1	1,2,4-Trichlorobenzene	10	U
91-20-3	Naphthalene	10	U
106-47-8	4-Chloroaniline	10	U
87-68-3	Hexachlorobutadiene	10	U
59-50-7	4-Chloro-3-methylphenol	10	U
91-57-6	2-Methylnaphthalene	10	U
77-47-4	Hexachlorocyclopentadiene	10	U
88-06-2	2,4,6-Trichlorophenol	25	U
95-95-4	2,4,5-Trichlorophenol	10	U
91-58-7	2-Chloronaphthalene	25	U
88-74-4	2-Nitroaniline	10	U
131-11-3	Dimethyl phthalate	10	U
208-96-8	Acenaphthylene	10	U
606-20-2	2,6-Dinitrotoluene	25	U
99-09-2	3-Nitroaniline		

AL

GOLDBERG ZOINO & ASSOCIATES
ASP91-2 - SEMIVOLATILES
ANALYSIS DATA SHEET

0009

Client No.

MW-12RRE

Lab Name: Recra Environmental Contract: _____

Lab Code: RECNY Case No.: _____ SAS No.: _____ SDG No.: _____

Matrix: (soil/water) WATER Lab Sample ID: A4270101RE

Sample wt/vol: 1000.0 (g/mL) ML Lab File ID: 16541W.MSQ

Level: (low/med) LOW Date Samp/Recv: 05/31/94 06/01/94

% Moisture: _____ decanted: (Y/N) N Date Extracted: 06/23/94

Concentrated Extract Volume: 1000 (uL) Date Analyzed: 07/07/94

Injection Volume: 2.00 (uL) Dilution Factor: 1.00

GPC Cleanup: (Y/N) N pH: 7.0

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/Kg) UG/L	Q
83-32-9	Acenaphthene	10	U
51-28-5	2,4-Dinitrophenol	25	U
100-02-7	4-Nitrophenol	25	U
132-64-9	Dibenzofuran	10	U
121-14-2	2,4-Dinitrotoluene	10	U
84-66-2	Diethyl phthalate	10	U
7005-72-3	4-Chlorodiphenylether	10	U
86-73-7	Fluorene	10	U
100-01-6	4-Nitroaniline	25	U
534-52-1	4,6-Dinitro-2-methylphenol	25	U
86-30-6	N-nitrosodiphenylamine	10	U
101-55-3	4-Bromophenyl phenyl ether	10	U
118-74-1	Hexachlorobenzene	10	U
87-86-5	Pentachlorophenol	25	U
85-01-8	Phenanthrene	10	U
120-12-7	Anthracene	10	U
86-74-8	Carbazole	10	U
84-74-2	Di-n-butyl phthalate	10	U
206-44-0	Fluoranthene	10	U
129-00-0	Pyrene	10	U
85-68-7	Butyl benzyl phthalate	10	U
91-94-1	3,3'-Dichlorobenzidine	10	U
56-55-3	Benzo(a)anthracene	10	U
218-01-9	Chrysene	10	U
117-81-7	Bis(2-ethylhexyl) phthalate	10	U
117-84-0	Di-n-octyl phthalate	10	U
205-99-2	Benzo(b)fluoranthene	10	U
207-08-9	Benzo(k)fluoranthene	10	U
50-32-8	Benzo(a)pyrene	10	U
193-39-5	Indeno(1,2,3-cd)pyrene	10	U
53-70-3	Dibenzo(a,h)anthracene	10	U
191-24-2	Benzo(ghi)perylene	10	U

ALC

GOLDBERG ZOINO & ASSOCIATES
ASP91-2 - SEMIVOLATILES
TENTATIVELY IDENTIFIED COMPOUNDS

GC10

Client No.

MW-12RRE

Lab Name: Recra Environmental Contract: _____

Lab Code: RECNY Case No.: _____ SAS No.: _____ SDG No.: _____

Matrix: (soil/water) WATER Lab Sample ID: A4270101RE

Sample wt/vol: 1000.0 (g/mL) ML Lab File ID: 16541W.MSQ

Level: (low/med) LOW Date Samp/Recv: 05/31/94 06/01/94

% Moisture: _____ decanted: (Y/N) N Date Extracted: 06/23/94

Concentrated Extract Volume: 1000 (uL) Date Analyzed: 07/07/94

Injection Volume: 2.00 (uL) Dilution Factor: 1.00

GPC Cleanup: (Y/N) N pH: 7.0

CONCENTRATION UNITS:
(ug/L or ug/Kg) UG/L

Number TICs found: 4

CAS NO.	Compound Name	RT	Est. Conc.	Q
1.	CYCLOHEXEN-1-OL ISOMER	3.42	4	J
2. 930-68-7	2-CYCLOHEXEN-1-ONE	3.92	3	JN
3.	UNSATURATED HYDROCARBON	5.02	7	J
4.	OXYGENATED COMPOUND	6.70	100	J

GOLDBERG ZOINO & ASSOCIATES
ASP91-2 - SEMIVOLATILES
ANALYSIS DATA SHEET

Client No.: MW-12S

Lab Name: Recra Environmental Contract: _____

Lab Code: RECNY Case No.: _____ SAS No.: _____ SDG No.: _____

Matrix: (soil/water) WATER Lab Sample ID: A4270102

Sample wt/vol: 935.00 (g/mL) ML Lab File ID: 16292W.MSQ

Level: (low/med) LOW Date Samp/Recv: 05/31/94 06/01/94

% Moisture: _____ decanted: (Y/N) N Date Extracted: 06/06/94

Concentrated Extract Volume: 1000 (uL) Date Analyzed: 06/22/94

Injection Volume: 2.00 (uL) Dilution Factor: 1.00

GPC Cleanup: (Y/N) N pH: 7.0

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/Kg) UG/L	Q
108-95-2	Phenol	11	U
111-44-4	Bis(2-chloroethyl) ether	11	U
95-57-8	2-Chlorophenol	11	U
541-73-1	1,3-Dichlorobenzene	11	U
106-46-7	1,4-Dichlorobenzene	11	U
95-50-1	1,2-Dichlorobenzene	11	U
95-48-7	2-Methylphenol	4	J
108-60-1	Bis(2-chloroisopropyl) ether	11	U
106-44-5	4-Methylphenol	11	U
621-64-7	N-Nitroso-Di-n-propylamine	11	U
67-72-1	Hexachloroethane	11	U
98-95-3	Nitrobenzene	11	U
78-59-1	Isophorone	11	U
88-75-5	2-Nitrophenol	11	U
105-67-9	2,4-Dimethylphenol	11	U
111-91-1	Bis(2-chloroethoxy) methane	11	U
120-83-2	2,4-Dichlorophenol	11	U
120-82-1	1,2,4-Trichlorobenzene	10	J
91-20-3	Naphthalene	11	U
106-47-8	4-Chloroaniline	11	U
87-68-3	Hexachlorobutadiene	11	U
59-50-7	4-Chloro-3-methylphenol	11	U
91-57-6	2-Methylnaphthalene	11	U
77-47-4	Hexachlorocyclopentadiene	11	U
88-06-2	2,4,6-Trichlorophenol	27	U
95-95-4	2,4,5-Trichlorophenol	11	U
91-58-7	2-Chloronaphthalene	27	U
88-74-4	2-Nitroaniline	11	U
131-11-3	Dimethyl phthalate	11	U
208-96-8	Acenaphthylene	11	U
606-20-2	2,6-Dinitrotoluene	27	U
99-09-2	3-Nitroaniline		

ALL

GOLDBERG ZOINO & ASSOCIATES
ASP91-2 - SEMIVOLATILES
ANALYSIS DATA SHEET

Client No.: MW-12S

Lab Name: Recra Environmental Contract: _____

Lab Code: RECNY Case No.: _____ SAS No.: _____ SDG No.: _____

Matrix: (soil/water) WATER Lab Sample ID: A4270102

Sample wt/vol: 935.00 (g/mL) ML Lab File ID: 16292W.MSQ

Level: (low/med) LOW Date Samp/Recv: 05/31/94 06/01/94

% Moisture: _____ decanted: (Y/N) N Date Extracted: 06/06/94

Concentrated Extract Volume: 1000 (uL) Date Analyzed: 06/22/94

Injection Volume: 2.00 (uL) Dilution Factor: 1.00

GPC Cleanup: (Y/N) N pH: 7.0

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/Kg) UG/L	Q
83-32-9	Acenaphthene	0.4	J
51-28-5	2,4-Dinitrophenol	27	U
100-02-7	4-Nitrophenol	27	U
132-64-9	Dibenzofuran	11	U
121-14-2	2,4-Dinitrotoluene	11	U
84-66-2	Diethyl phthalate	11	U
7005-72-3	4-Chlorodiphenylether	11	U
86-73-7	Fluorene	0.7	J
100-01-6	4-Nitroaniline	27	U
534-52-1	4,6-Dinitro-2-methylphenol	27	U
86-30-6	N-nitrosodiphenylamine	11	U
101-55-3	4-Bromophenyl phenyl ether	11	U
118-74-1	Hexachlorobenzene	11	U
87-86-5	Pentachlorophenol	27	U
85-01-8	Phenanthrene	2	J
120-12-7	Anthracene	11	U
86-74-8	Carbazole	0.9	J
84-74-2	Di-n-butyl phthalate	3	BJ
206-44-0	Fluoranthene	11	U
129-00-0	Pyrene	11	U
85-68-7	Butyl benzyl phthalate	11	U
91-94-1	3,3'-Dichlorobenzidine	11	U
56-55-3	Benzo(a)anthracene	11	U
218-01-9	Chrysene	11	U
117-81-7	Bis(2-ethylhexyl) phthalate	1	J
117-84-0	Di-n-octyl phthalate	11	U
205-99-2	Benzo(b)fluoranthene	11	U
207-08-9	Benzo(k)fluoranthene	11	U
50-32-8	Benzo(a)pyrene	11	U
193-39-5	Indeno(1,2,3-cd)pyrene	11	U
53-70-3	Dibenzo(a,h)anthracene	11	U
191-24-2	Benzo(ghi)perylene	11	U

GOLDBERG ZOINO & ASSOCIATES
ASP91-2 - SEMIVOLATILES
TENTATIVELY IDENTIFIED COMPOUNDS

Client No.

MW-12S

Lab Name: Recra Environmental Contract: _____

Lab Code: RECNY Case No.: _____ SAS No.: _____ SDG No.: _____

Matrix: (soil/water) WATER Lab Sample ID: A4270102

Sample wt/vol: 935.00 (g/mL) ML Lab File ID: 16292W.MSQ

Level: (low/med) LOW Date Samp/Recv: 05/31/94 06/01/94

% Moisture: _____ decanted: (Y/N) N Date Extracted: 06/06/94

Concentrated Extract Volume: 1000 (uL) Date Analyzed: 06/22/94

Injection Volume: 2.00 (uL) Dilution Factor: 1.00

GPC Cleanup: (Y/N) N pH: 7.0

CONCENTRATION UNITS:
(ug/L or ug/Kg) UG/L

Number TICs found: 14

	CAS NO.	Compound Name	RT	Est. Conc.	Q
1.		UNKNOWN	2.72	8	J
2.		UNKNOWN	3.27	88	J
3.		UNKNOWN	3.45	8	J
4.		TETRAHYDRODIMETHYLFURAN ISO.	3.53	13	J
5.	98-86-2	ACETOPHENONE	4.48	12	JN
6.		OXYGENATED COMPOUND	6.20	510	J
7.		UNKNOWN	6.67	4	J
8.		UNKNOWN	6.90	7	J
9.		UNKNOWN	7.85	7	J
10.		OXYGENATED COMPOUND	9.28	5	J
11.		OXYGENATED COMPOUND	9.43	6	J
12.		OXYGENATED COMPOUND	12.12	8	J
13.		UNKNOWN	12.87	11	J
14.		UNKNOWN	13.85	9	J

GOLDBERG ZOINO & ASSOCIATES
ASP91-2 - SEMIVOLATILES
ANALYSIS DATA SHEET

0044

Client No.

MW-12SRE

Lab Name: Recra Environmental Contract: _____

Lab Code: RECNY Case No.: _____ SAS No.: _____ SDG No.: _____

Matrix: (soil/water) WATER Lab Sample ID: A4270102RE

Sample wt/vol: 850.00 (g/mL) ML Lab File ID: 16542W.MSQ

Level: (low/med) LOW Date Samp/Recv: 05/31/94 06/01/94

% Moisture: _____ decanted: (Y/N) N Date Extracted: 06/23/94

Concentrated Extract Volume: 1000 (uL) Date Analyzed: 07/07/94

Injection Volume: 2.00 (uL) Dilution Factor: 1.00

GPC Cleanup: (Y/N) N pH: 7.0

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/Kg) UG/L	Q
108-95-2	Phenol	12	U
111-44-4	Bis(2-chloroethyl) ether	12	U
95-57-8	2-Chlorophenol	12	U
541-73-1	1,3-Dichlorobenzene	12	U
106-46-7	1,4-Dichlorobenzene	12	U
95-50-1	1,2-Dichlorobenzene	12	U
95-48-7	2-Methylphenol	12	U
108-60-1	Bis(2-chloroisopropyl) ether	12	U
106-44-5	4-Methylphenol	12	U
621-64-7	N-Nitroso-Di-n-propylamine	12	U
67-72-1	Hexachloroethane	12	U
98-95-3	Nitrobenzene	12	U
78-59-1	Isophorone	12	U
88-75-5	2-Nitrophenol	12	U
105-67-9	2,4-Dimethylphenol	12	U
111-91-1	Bis(2-chloroethoxy) methane	12	U
120-83-2	2,4-Dichlorophenol	12	U
120-82-1	1,2,4-Trichlorobenzene	12	U
91-20-3	Naphthalene	12	U
106-47-8	4-Chloroaniline	12	U
87-68-3	Hexachlorobutadiene	12	U
59-50-7	4-Chloro-3-methylphenol	12	U
91-57-6	2-Methylnaphthalene	12	U
77-47-4	Hexachlorocyclopentadiene	12	U
88-06-2	2,4,6-Trichlorophenol	29	U
95-95-4	2,4,5-Trichlorophenol	12	U
91-58-7	2-Chloronaphthalene	29	U
88-74-4	2-Nitroaniline	12	U
131-11-3	Dimethyl phthalate	12	U
208-96-8	Acenaphthylene	12	U
606-20-2	2,6-Dinitrotoluene	29	U
99-09-2	3-Nitroaniline		

GOLDBERG ZOINO & ASSOCIATES
ASP91-2 - SEMIVOLATILES
ANALYSIS DATA SHEET

0045

Client No.

MW-12SRE

Lab Name: Recra Environmental Contract: _____

Lab Code: RECNY Case No.: _____ SAS No.: _____ SDG No.: _____

Matrix: (soil/water) WATER Lab Sample ID: A4270102RE

Sample wt/vol: 850.00 (g/mL) ML Lab File ID: 16542W.MSO

Level: (low/med) LOW Date Samp/Recv: 05/31/94 06/01/94

% Moisture: _____ decanted: (Y/N) N Date Extracted: 06/23/94

Concentrated Extract Volume: 1000 (uL) Date Analyzed: 07/07/94

Injection Volume: 2.00 (uL) Dilution Factor: 1.00

GPC Cleanup: (Y/N) N pH: 7.0

CONCENTRATION UNITS: (ug/L or ug/Kg) UG/L

CAS NO.	COMPOUND		Q
83-32-9	Acenaphthene	12	U
51-28-5	2,4-Dinitrophenol	29	U
100-02-7	4-Nitrophenol	29	U
132-64-9	Dibenzofuran	12	U
121-14-2	2,4-Dinitrotoluene	12	U
84-66-2	Diethyl phthalate	12	U
7005-72-3	4-Chlorodiphenylether	12	U
86-73-7	Fluorene	12	U
100-01-6	4-Nitroaniline	29	U
534-52-1	4,6-Dinitro-2-methylphenol	29	U
86-30-6	N-nitrosodiphenylamine	12	U
101-55-3	4-Bromophenyl phenyl ether	12	U
118-74-1	Hexachlorobenzene	12	U
87-86-5	Pentachlorophenol	29	U
85-01-8	Phenanthrene	12	U
120-12-7	Anthracene	12	U
86-74-8	Carbazole	12	U
84-74-2	Di-n-butyl phthalate	0.8	J
206-44-0	Fluoranthene	12	U
129-00-0	Pyrene	12	U
85-68-7	Butyl benzyl phthalate	12	U
91-94-1	3,3'-Dichlorobenzidine	12	U
56-55-3	Benzo(a)anthracene	12	U
218-01-9	Chrysene	12	U
117-81-7	Bis(2-ethylhexyl) phthalate	12	U
117-84-0	Di-n-octyl phthalate	12	U
205-99-2	Benzo(b)fluoranthene	12	U
207-08-9	Benzo(k)fluoranthene	12	U
50-32-8	Benzo(a)pyrene	12	U
193-39-5	Indeno(1,2,3-cd)pyrene	12	U
53-70-3	Dibenzo(a,h)anthracene	12	U
191-24-2	Benzo(ghi)perylene	12	U

GOLDBERG ZOINO & ASSOCIATES
ASP91-2 - SEMIVOLATILES
TENTATIVELY IDENTIFIED COMPOUNDS

0018
Client No.

MW-12SRE

Lab Name: Recra Environmental Contract: _____

Lab Code: RECNY Case No.: _____ SAS No.: _____ SDG No.: _____

Matrix: (soil/water) WATER Lab Sample ID: A4270102RE

Sample wt/vol: 850.00 (g/mL) ML Lab File ID: 16542W.MSQ

Level: (low/med) LOW Date Samp/Recv: 05/31/94 06/01/94

% Moisture: _____ decanted: (Y/N) N Date Extracted: 06/23/94

Concentrated Extract Volume: 1000 (uL) Date Analyzed: 07/07/94

Injection Volume: 2.00 (uL) Dilution Factor: 1.00

GPC Cleanup: (Y/N) N pH: 7.0

Number TICs found: 12 CONCENTRATION UNITS: (ug/L or ug/Kg) UG/L

	CAS NO.	Compound Name	RT	Est. Conc.	Q
1.		CYCLOHEXEN-1-OL ISOMER	3.43	9	J
2.		OXYGENATED COMPOUND	3.88	18	J
3.		UNKNOWN	4.05	6	J
4.		TETRAHYDRODOMETHYLFURAN ISO.	4.15	12	J
5.		OXYGENATED COMPOUND	4.25	8	J
6.	98-86-2	ACETOPHENONE	5.10	22	JN
7.		UNKNOWN	5.82	8	J
8.		OXYGENATED COMPOUND	6.87	440	J
9.		UNKNOWN	7.30	12	J
10.		OXYGENATED COMPOUND	8.32	4	J
11.		UNKNOWN	12.60	4	J
12.		OXYGENATED COMPOUND	13.13	5	J

ALL

GOLDBERG ZOINO & ASSOCIATES
ASP91-2 - SEMIVOLATILES
ANALYSIS DATA SHEET

0047

Client No.

MW-13R

Lab Name: Recra Environmental Contract: _____

Lab Code: RECNY Case No.: _____ SAS No.: _____ SDG No.: _____

Matrix: (soil/water) WATER Lab Sample ID: A4270103

Sample wt/vol: 1000.0 (g/mL) ML Lab File ID: 16293W.MSQ

Level: (low/med) LOW Date Samp/Recv: 05/31/94 06/01/94

% Moisture: _____ decanted: (Y/N) N Date Extracted: 06/06/94

Concentrated Extract Volume: 1000 (uL) Date Analyzed: 06/22/94

Injection Volume: 2.00 (uL) Dilution Factor: 1.00

GPC Cleanup: (Y/N) N pH: 7.0

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/Kg) UG/L	Q Val
108-95-2	Phenol	10	U
111-44-4	Bis(2-chloroethyl) ether	10	U
95-57-8	2-Chlorophenol	10	U
541-73-1	1,3-Dichlorobenzene	10	U
106-46-7	1,4-Dichlorobenzene	10	U
95-50-1	1,2-Dichlorobenzene	10	U
95-48-7	2-Methylphenol	10	U
108-60-1	Bis(2-chloroisopropyl) ether	10	U
106-44-5	4-Methylphenol	10	U
621-64-7	N-Nitroso-Di-n-propylamine	10	U
67-72-1	Hexachloroethane	10	U
98-95-3	Nitrobenzene	10	U
78-59-1	Isophorone	10	U
88-75-5	2-Nitrophenol	10	U
105-67-9	2,4-Dimethylphenol	10	U
111-91-1	Bis(2-chloroethoxy) methane	10	U
120-83-2	2,4-Dichlorophenol	10	U
120-82-1	1,2,4-Trichlorobenzene	10	U
91-20-3	Naphthalene	10	U
106-47-8	4-Chloroaniline	10	U
87-68-3	Hexachlorobutadiene	9	J
59-50-7	4-Chloro-3-methylphenol	0.5	J
91-57-6	2-Methylnaphthalene	10	U
77-47-4	Hexachlorocyclopentadiene	10	U
88-06-2	2,4,6-Trichlorophenol	25	U
95-95-4	2,4,5-Trichlorophenol	10	U
91-58-7	2-Chloronaphthalene	25	U
88-74-4	2-Nitroaniline	10	U
131-11-3	Dimethyl phthalate	10	U
208-96-8	Acenaphthylene	10	U
606-20-2	2,6-Dinitrotoluene	25	U
99-09-2	3-Nitroaniline		

GOLDBERG ZOINO & ASSOCIATES
ASP91-2 - SEMIVOLATILES
ANALYSIS DATA SHEET

0628

Client No.

MW-13R

Lab Name: Recra Environmental Contract: _____

Lab Code: RECNY Case No.: _____ SAS No.: _____ SDG No.: _____

Matrix: (soil/water) WATER Lab Sample ID: A4270103

Sample wt/vol: 1000.0 (g/mL) ML Lab File ID: 16293W.MSQ

Level: (low/med) LOW Date Samp/Recv: 05/31/94 06/01/94

% Moisture: _____ decanted: (Y/N) N Date Extracted: 06/06/94

Concentrated Extract Volume: 1000 (uL) Date Analyzed: 06/22/94

Injection Volume: 2.00 (uL) Dilution Factor: 1.00

GPC Cleanup: (Y/N) N pH: 7.0

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/Kg) UG/L	Q
83-32-9	Acenaphthene	10	U
51-28-5	2,4-Dinitrophenol	25	U
100-02-7	4-Nitrophenol	25	U
132-64-9	Dibenzofuran	10	U
121-14-2	2,4-Dinitrotoluene	10	U
84-66-2	Diethyl phthalate	10	U
7005-72-3	4-Chlorodiphenylether	10	U
86-73-7	Fluorene	10	U
100-01-6	4-Nitroaniline	25	U
534-52-1	4,6-Dinitro-2-methylphenol	25	U
86-30-6	N-nitrosodiphenylamine	10	U
101-55-3	4-Bromophenyl phenyl ether	10	U
118-74-1	Hexachlorobenzene	10	U
87-86-5	Pentachlorophenol	25	U
85-01-8	Phenanthrene	10	U
120-12-7	Anthracene	10	U
86-74-8	Carbazole	10	U
84-74-2	Di-n-butyl phthalate	1	BJ
206-44-0	Fluoranthene	10	U
129-00-0	Pyrene	10	U
85-68-7	Butyl benzyl phthalate	10	U
91-94-1	3,3'-Dichlorobenzidine	10	U
56-55-3	Benzo(a)anthracene	10	U
218-01-9	Chrysene	10	U
117-81-7	Bis(2-ethylhexyl) phthalate	10	U
117-84-0	Di-n-octyl phthalate	10	U
205-99-2	Benzo(b)fluoranthene	10	U
207-08-9	Benzo(k)fluoranthene	10	U
50-32-8	Benzo(a)pyrene	10	U
193-39-5	Indeno(1,2,3-cd)pyrene	10	U
53-70-3	Dibenzo(a,h)anthracene	10	U
191-24-2	Benzo(ghi)perylene	10	U

GOLDBERG ZOINO & ASSOCIATES
ASP91-2 - SEMIVOLATILES
TENTATIVELY IDENTIFIED COMPOUNDS

0049
Client No.

MW-13R

Lab Name: Recra Environmental Contract: _____

Lab Code: RECNY Case No.: _____ SAS No.: _____ SDG No.: _____

Matrix: (soil/water) WATER Lab Sample ID: A4270103

Sample wt/vol: 1000.0 (g/mL) ML Lab File ID: 16293W.MSQ

Level: (low/med) LOW Date Samp/Recv: 05/31/94 06/01/94

% Moisture: _____ decanted: (Y/N) N Date Extracted: 06/06/94

Concentrated Extract Volume: 1000 (uL) Date Analyzed: 06/22/94

Injection Volume: 2.00 (uL) Dilution Factor: 1.00

GPC Cleanup: (Y/N) N pH: 7.0

Number TICs found: 3

CONCENTRATION UNITS:
(ug/L or ug/Kg) UG/L

	CAS NO.	Compound Name	RT	Est. Conc.	Q
1.		CHLOROMETHYLBENZENE ISOMER	3.57	620	J
2.	17849-38-6	2-CHLORO-BENZENEMETHANOL	5.45	5	JN
3.		OXYGENATED COMPOUND	5.82	16	J

ALL

GOLDBERG ZOINO & ASSOCIATES
ASP91-2 - SEMIVOLATILES
ANALYSIS DATA SHEET

Client No.

MW-13RRE

Lab Name: Recra Environmental Contract: _____

Lab Code: RECNY Case No.: _____ SAS No.: _____ SDG No.: _____

Matrix: (soil/water) WATER Lab Sample ID: A4270103RE

Sample wt/vol: 1000.0 (g/mL) ML Lab File ID: 16543W.MSQ

Level: (low/med) LOW Date Samp/Recv: 05/31/94 06/01/94

% Moisture: _____ decanted: (Y/N) N Date Extracted: 06/23/94

Concentrated Extract Volume: 1000 (uL) Date Analyzed: 07/07/94

Injection Volume: 2.00 (uL) Dilution Factor: 1.00

GPC Cleanup: (Y/N) N pH: 7.0

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/Kg) UG/L	Q
108-95-2	Phenol	10	U
111-44-4	Bis(2-chloroethyl) ether	10	U
95-57-8	2-Chlorophenol	10	U
541-73-1	1,3-Dichlorobenzene	10	U
106-46-7	1,4-Dichlorobenzene	10	U
95-50-1	1,2-Dichlorobenzene	10	U
95-48-7	2-Methylphenol	10	U
108-60-1	Bis(2-chloroisopropyl) ether	10	U
106-44-5	4-Methylphenol	10	U
621-64-7	N-Nitroso-Di-n-propylamine	10	U
67-72-1	Hexachloroethane	10	U
98-95-3	Nitrobenzene	10	U
78-59-1	Isophorone	10	U
88-75-5	2-Nitrophenol	10	U
105-67-9	2,4-Dimethylphenol	10	U
111-91-1	Bis(2-chloroethoxy) methane	10	U
120-83-2	2,4-Dichlorophenol	10	U
120-82-1	1,2,4-Trichlorobenzene	10	U
91-20-3	Naphthalene	10	U
106-47-8	4-Chloroaniline	10	U
87-68-3	Hexachlorobutadiene	10	U
59-50-7	4-Chloro-3-methylphenol	10	U
91-57-6	2-Methylnaphthalene	10	U
77-47-4	Hexachlorocyclopentadiene	10	U
88-06-2	2,4,6-Trichlorophenol	25	U
95-95-4	2,4,5-Trichlorophenol	10	U
91-58-7	2-Chloronaphthalene	25	U
88-74-4	2-Nitroaniline	10	U
131-11-3	Dimethyl phthalate	10	U
208-96-8	Acenaphthylene	10	U
606-20-2	2,6-Dinitrotoluene	25	U
99-09-2	3-Nitroaniline		

GOLDBERG ZOINO & ASSOCIATES
ASP91-2 - SEMIVOLATILES
ANALYSIS DATA SHEET

6651

Client No.

MW-13RRE

Lab Name: Recra Environmental Contract: _____

Lab Code: RECNY Case No.: _____ SAS No.: _____ SDG No.: _____

Matrix: (soil/water) WATER Lab Sample ID: A4270103RE

Sample wt/vol: 1000.0 (g/mL) ML Lab File ID: 16543W.MSQ

Level: (low/med) LOW Date Samp/Recv: 05/31/94 06/01/94

% Moisture: _____ decanted: (Y/N) N Date Extracted: 06/23/94

Concentrated Extract Volume: 1000 (uL) Date Analyzed: 07/07/94

Injection Volume: 2.00 (uL) Dilution Factor: 1.00

GPC Cleanup: (Y/N) N pH: 7.0

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/Kg) UG/L	Q
83-32-9	Acenaphthene	10	U
51-28-5	2,4-Dinitrophenol	25	U
100-02-7	4-Nitrophenol	25	U
132-64-9	Dibenzofuran	10	U
121-14-2	2,4-Dinitrotoluene	10	U
84-66-2	Diethyl phthalate	10	U
7005-72-3	4-Chlorodiphenylether	10	U
86-73-7	Fluorene	10	U
100-01-6	4-Nitroaniline	25	U
534-52-1	4,6-Dinitro-2-methylphenol	25	U
86-30-6	N-nitrosodiphenylamine	10	U
101-55-3	4-Bromophenyl phenyl ether	10	U
118-74-1	Hexachlorobenzene	10	U
87-86-5	Pentachlorophenol	25	U
85-01-8	Phenanthrene	10	U
120-12-7	Anthracene	10	U
86-74-8	Carbazole	10	U
84-74-2	Di-n-butyl phthalate	10	U
206-44-0	Fluoranthene	10	U
129-00-0	Pyrene	10	U
85-68-7	Butyl benzyl phthalate	10	U
91-94-1	3,3'-Dichlorobenzidine	10	U
56-55-3	Benzo(a)anthracene	10	U
218-01-9	Chrysene	10	U
117-81-7	Bis(2-ethylhexyl) phthalate	2	J
117-84-0	Di-n-octyl phthalate	10	U
205-99-2	Benzo(b)fluoranthene	10	U
207-08-9	Benzo(k)fluoranthene	10	U
50-32-8	Benzo(a)pyrene	10	U
193-39-5	Indeno(1,2,3-cd)pyrene	10	U
53-70-3	Dibenzo(a,h)anthracene	10	U
191-24-2	Benzo(ghi)perylene	10	U

FORM I - GC/MS BNA

GOLDBERG ZOINO & ASSOCIATES
ASP91-2 - SEMIVOLATILES
TENTATIVELY IDENTIFIED COMPOUNDS

Client No.

MW-13RRE

Lab Name: Recra Environmental Contract: _____

Lab Code: RECNY Case No.: _____ SAS No.: _____ SDG No.: _____

Matrix: (soil/water) WATER Lab Sample ID: A4270103RE

Sample wt/vol: 1000.0 (g/mL) ML Lab File ID: 16543W.MSQ

Level: (low/med) LOW Date Samp/Recv: 05/31/94 06/01/94

% Moisture: _____ decanted: (Y/N) N Date Extracted: 06/23/94

Concentrated Extract Volume: 1000 (uL) Date Analyzed: 07/07/94

Injection Volume: 2.00 (uL) Dilution Factor: 1.00

GPC Cleanup: (Y/N) N pH: 7.0

Number TICs found: 3

CONCENTRATION UNITS:
(ug/L or ug/Kg) UG/L

Val. Q

CAS NO.	Compound Name	RT	Est. Conc.	Q
1.	CYCLOHEXEN-1-OL ISOMER	3.43	8	J
2. 930-68-7	2-CYCLOHEXEN-1-ONE	3.93	4	JN
3.	UNSATURATED HYDROCARBON	5.00	7	BJ U

AU

GOLDBERG ZOINO & ASSOCIATES
ASP91-2 - SEMIVOLATILES
ANALYSIS DATA SHEET

0053

Client No.

MW-14R

Lab Name: Recra Environmental Contract: _____

Lab Code: RECNY Case No.: _____ SAS No.: _____ SDG No.: _____

Matrix: (soil/water) WATER Lab Sample ID: A4270104

Sample wt/vol: 1000.0 (g/mL) ML Lab File ID: 16294W.MSQ

Level: (low/med) LOW Date Samp/Recv: 05/31/94 06/01/94

% Moisture: _____ decanted: (Y/N) N Date Extracted: 06/06/94

Concentrated Extract Volume: 1000 (uL) Date Analyzed: 06/22/94

Injection Volume: 2.00 (uL) Dilution Factor: 1.00

GPC Cleanup: (Y/N) N pH: 7.0

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/Kg) UG/L	Q
108-95-2	Phenol	10	U
111-44-4	Bis(2-chloroethyl) ether	10	U
95-57-8	2-Chlorophenol	10	U
541-73-1	1,3-Dichlorobenzene	10	U
106-46-7	1,4-Dichlorobenzene	10	U
95-50-1	1,2-Dichlorobenzene	10	U
95-48-7	2-Methylphenol	10	U
108-60-1	Bis(2-chloroisopropyl) ether	10	U
106-44-5	4-Methylphenol	10	U
621-64-7	N-Nitroso-Di-n-propylamine	10	U
67-72-1	Hexachloroethane	10	U
98-95-3	Nitrobenzene	10	U
78-59-1	Isophorone	10	U
88-75-5	2-Nitrophenol	10	U
105-67-9	2,4-Dimethylphenol	10	U
111-91-1	Bis(2-chloroethoxy) methane	10	U
120-83-2	2,4-Dichlorophenol	10	U
120-82-1	1,2,4-Trichlorobenzene	10	U
91-20-3	Naphthalene	10	U
106-47-8	4-Chloroaniline	10	U
87-68-3	Hexachlorobutadiene	10	U
59-50-7	4-Chloro-3-methylphenol	10	U
91-57-6	2-Methylnaphthalene	10	U
77-47-4	Hexachlorocyclopentadiene	10	U
88-06-2	2,4,6-Trichlorophenol	10	U
95-95-4	2,4,5-Trichlorophenol	25	U
91-58-7	2-Chloronaphthalene	10	U
88-74-4	2-Nitroaniline	25	U
131-11-3	Dimethyl phthalate	10	U
208-96-8	Acenaphthylene	10	U
606-20-2	2,6-Dinitrotoluene	10	U
99-09-2	3-Nitroaniline	25	U

GOLDBERG ZOINO & ASSOCIATES
ASP91-2 - SEMIVOLATILES
ANALYSIS DATA SHEET

0034

Client No.

MW-14R

Lab Name: Recra Environmental Contract: _____

Lab Code: RECNY Case No.: _____ SAS No.: _____ SDG No.: _____

Matrix: (soil/water) WATER Lab Sample ID: A4270104

Sample wt/vol: 1000.0 (g/mL) ML Lab File ID: 16294W.MSQ

Level: (low/med) LOW Date Samp/Recv: 05/31/94 06/01/94

% Moisture: _____ decanted: (Y/N) N Date Extracted: 06/06/94

Concentrated Extract Volume: 1000 (uL) Date Analyzed: 06/22/94

Injection Volume: 2.00 (uL) Dilution Factor: 1.00

GPC Cleanup: (Y/N) N pH: 7.0

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/Kg) UG/L	Q	Val
83-32-9	Acenaphthene	10	U	
51-28-5	2,4-Dinitrophenol	25	U	KJ
100-02-7	4-Nitrophenol	25	U	
132-64-9	Dibenzofuran	10	U	
121-14-2	2,4-Dinitrotoluene	10	U	
84-66-2	Diethyl phthalate	10	U	
7005-72-3	4-Chlorodiphenylether	10	U	
86-73-7	Fluorene	10	U	
100-01-6	4-Nitroaniline	25	U	
534-52-1	4,6-Dinitro-2-methylphenol	25	U	KJ
86-30-6	N-nitrosodiphenylamine	10	U	
101-55-3	4-Bromophenyl phenyl ether	10	U	
118-74-1	Hexachlorobenzene	10	U	
87-86-5	Pentachlorophenol	25	U	KJ
85-01-8	Phenanthrene	10	U	
120-12-7	Anthracene	10	U	
86-74-8	Carbazole	10	U	
84-74-2	Di-n-butyl phthalate	2	BJ	10
206-44-0	Fluoranthene	10	U	
129-00-0	Pyrene	10	U	
85-68-7	Butyl benzyl phthalate	10	U	
91-94-1	3,3'-Dichlorobenzidine	10	U	
56-55-3	Benzo(a)anthracene	10	U	
218-01-9	Chrysene	10	U	
117-81-7	Bis(2-ethylhexyl) phthalate	10	U	
117-84-0	Di-n-octyl phthalate	10	U	
205-99-2	Benzo(b)fluoranthene	10	U	
207-08-9	Benzo(k)fluoranthene	10	U	
50-32-8	Benzo(a)pyrene	10	U	
193-39-5	Indeno(1,2,3-cd)pyrene	10	U	
53-70-3	Dibenzo(a,h)anthracene	10	U	
191-24-2	Benzo(ghi)perylene	10	U	

All

GOLDBERG ZOINO & ASSOCIATES
ASP91-2 - SEMIVOLATILES
TENTATIVELY IDENTIFIED COMPOUNDS

Client No.

MW-14R

Lab Name: Recra Environmental Contract: _____

Lab Code: RECNY Case No.: _____ SAS No.: _____ SDG No.: _____

Matrix: (soil/water) WATER Lab Sample ID: A4270104

Sample wt/vol: 1000.0 (g/mL) ML Lab File ID: 16294W.MSQ

Level: (low/med) LOW Date Samp/Recv: 05/31/94 06/01/94

% Moisture: _____ decanted: (Y/N) N Date Extracted: 06/06/94

Concentrated Extract Volume: 1000 (uL) Date Analyzed: 06/22/94

Injection Volume: 2.00 (uL) Dilution Factor: 1.00

GPC Cleanup: (Y/N) N pH: 7.0

CONCENTRATION UNITS:
(ug/L or ug/Kg) UG/L

Number TICs found: 3

	CAS NO.	Compound Name	RT	Est. Conc.	Q
1.		CYCLOHEXEN-1-OL ISOMER	2.67	3	J
2.	930-68-7	2-CYCLOHEXEN-1-ONE	3.27	4	JN
3.		OXYGENATED COMPOUND	6.00	320	J

GOLDBERG ZOINO & ASSOCIATES
ASP91-2 - SEMIVOLATILES
ANALYSIS DATA SHEET

6056

Client No.

MW-14RRE

Lab Name: Recra Environmental Contract: _____

Lab Code: RECNY Case No.: _____ SAS No.: _____ SDG No.: _____

Matrix: (soil/water) WATER Lab Sample ID: A4270104RE

Sample wt/vol: 1000.0 (g/mL) ML Lab File ID: 16544W.MSQ

Level: (low/med) LOW Date Samp/Recv: 05/31/94 06/01/94

% Moisture: _____ decanted: (Y/N) N Date Extracted: 06/23/94

Concentrated Extract Volume: 1000 (uL) Date Analyzed: 07/07/94

Injection Volume: 2.00 (uL) Dilution Factor: 1.00

GPC Cleanup: (Y/N) N pH: 7.0

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/Kg) UG/L	Q
108-95-2	Phenol	10	U
111-44-4	Bis(2-chloroethyl) ether	10	U
95-57-8	2-Chlorophenol	10	U
541-73-1	1,3-Dichlorobenzene	10	U
106-46-7	1,4-Dichlorobenzene	10	U
95-50-1	1,2-Dichlorobenzene	10	U
95-48-7	2-Methylphenol	10	U
108-60-1	Bis(2-chloroisopropyl) ether	10	U
106-44-5	4-Methylphenol	10	U
621-64-7	N-Nitroso-Di-n-propylamine	10	U
67-72-1	Hexachloroethane	10	U
98-95-3	Nitrobenzene	10	U
78-59-1	Isophorone	10	U
88-75-5	2-Nitrophenol	10	U
105-67-9	2,4-Dimethylphenol	10	U
111-91-1	Bis(2-chloroethoxy) methane	10	U
120-83-2	2,4-Dichlorophenol	10	U
120-82-1	1,2,4-Trichlorobenzene	10	U
91-20-3	Naphthalene	10	U
106-47-8	4-Chloroaniline	10	U
87-68-3	Hexachlorobutadiene	10	U
59-50-7	4-Chloro-3-methylphenol	10	U
91-57-6	2-Methylnaphthalene	10	U
77-47-4	Hexachlorocyclopentadiene	10	U
88-06-2	2,4,6-Trichlorophenol	25	U
95-95-4	2,4,5-Trichlorophenol	10	U
91-58-7	2-Chloronaphthalene	25	U
88-74-4	2-Nitroaniline	10	U
131-11-3	Dimethyl phthalate	10	U
208-96-8	Acenaphthylene	10	U
606-20-2	2,6-Dinitrotoluene	10	U
99-09-2	3-Nitroaniline	25	U

ALL

GOLDBERG ZOINO & ASSOCIATES
ASP91-2 - SEMIVOLATILES
ANALYSIS DATA SHEET

6037

Client No.

MW-14RRE

Lab Name: Recra Environmental Contract: _____

Lab Code: RECNY Case No.: _____ SAS No.: _____ SDG No.: _____

Matrix: (soil/water) WATER Lab Sample ID: A4270104RE

Sample wt/vol: 1000.0 (g/mL) ML Lab File ID: 16544W.MSQ

Level: (low/med) LOW Date Samp/Recv: 05/31/94 06/01/94

% Moisture: _____ decanted: (Y/N) N Date Extracted: 06/23/94

Concentrated Extract Volume: 1000 (uL) Date Analyzed: 07/07/94

Injection Volume: 2.00 (uL) Dilution Factor: 1.00

GPC Cleanup: (Y/N) N pH: 7.0

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/Kg) UG/L	Q
83-32-9	Acenaphthene	10	U
51-28-5	2,4-Dinitrophenol	25	U
100-02-7	4-Nitrophenol	25	U
132-64-9	Dibenzofuran	10	U
121-14-2	2,4-Dinitrotoluene	10	U
84-66-2	Diethyl phthalate	10	U
7005-72-3	4-Chlorodiphenylether	10	U
86-73-7	Fluorene	10	U
100-01-6	4-Nitroaniline	25	U
534-52-1	4,6-Dinitro-2-methylphenol	25	U
86-30-6	N-nitrosodiphenylamine	10	U
101-55-3	4-Bromophenyl phenyl ether	10	U
118-74-1	Hexachlorobenzene	10	U
87-86-5	Pentachlorophenol	25	U
85-01-8	Phenanthrene	10	U
120-12-7	Anthracene	10	U
86-74-8	Carbazole	10	U
84-74-2	Di-n-butyl phthalate	10	U
206-44-0	Fluoranthene	10	U
129-00-0	Pyrene	10	U
85-68-7	Butyl benzyl phthalate	10	U
91-94-1	3,3'-Dichlorobenzidine	10	U
56-55-3	Benzo(a)anthracene	10	U
218-01-9	Chrysene	1	J
117-81-7	Bis(2-ethylhexyl) phthalate	10	U
117-84-0	Di-n-octyl phthalate	10	U
205-99-2	Benzo(b)fluoranthene	10	U
207-08-9	Benzo(k)fluoranthene	10	U
50-32-8	Benzo(a)pyrene	10	U
193-39-5	Indeno(1,2,3-cd)pyrene	10	U
53-70-3	Dibenzo(a,h)anthracene	10	U
191-24-2	Benzo(ghi)perylene	10	U

GOLDBERG ZOINO & ASSOCIATES
ASP91-2 - SEMIVOLATILES
TENTATIVELY IDENTIFIED COMPOUNDS

Client No.

MW-14RRE

Lab Name: Recra Environmental Contract: _____

Lab Code: RECNY Case No.: _____ SAS No.: _____ SDG No.: _____

Matrix: (soil/water) WATER Lab Sample ID: A4270104RE

Sample wt/vol: 1000.0 (g/mL) ML Lab File ID: 16544W.MSQ

Level: (low/med) LOW Date Samp/Recv: 05/31/94 06/01/94

% Moisture: _____ decanted: (Y/N) N Date Extracted: 06/23/94

Concentrated Extract Volume: 1000 (uL) Date Analyzed: 07/07/94

Injection Volume: 2.00 (uL) Dilution Factor: 1.00

GPC Cleanup: (Y/N) N pH: 7.0

Number TICs found: 2

CONCENTRATION UNITS:
(ug/L or ug/Kg) UG/L

CAS NO.	Compound Name	RT	Est. Conc.	Q
1.	CYCLOHEXEN-1-OL ISOMER	3.43	8	J
2. 930-68-7	2-CYCLOHEXEN-1-ONE	3.92	5	JN

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GOLDBERG ZOINO & ASSOCIATES
ASP91-2 - SEMIVOLATILES
ANALYSIS DATA SHEET

0059
Client No.

DUP 1

Lab Name: Recra Environmental Contract: _____

Lab Code: RECNY Case No.: _____ SAS No.: _____ SDG No.: _____

Matrix: (soil/water) WATER Lab Sample ID: A4270110

Sample wt/vol: 1000.0 (g/mL) ML Lab File ID: 16394W.MSQ

Level: (low/med) LOW Date Samp/Recv: 06/01/94 06/01/94

% Moisture: _____ decanted: (Y/N) N Date Extracted: 06/06/94

Concentrated Extract Volume: 1000 (uL) Date Analyzed: 06/29/94

Injection Volume: 2.00 (uL) Dilution Factor: 1.00

GPC Cleanup: (Y/N) N pH: 7.0

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/Kg) UG/L	Q
108-95-2	Phenol	10	U
111-44-4	Bis(2-chloroethyl) ether	10	U
95-57-8	2-Chlorophenol	10	U
541-73-1	1,3-Dichlorobenzene	10	U
106-46-7	1,4-Dichlorobenzene	10	U
95-50-1	1,2-Dichlorobenzene	10	U
95-48-7	2-Methylphenol	0.4	J
108-60-1	Bis(2-chloroisopropyl) ether	10	U
106-44-5	4-Methylphenol	10	U
621-64-7	N-Nitroso-Di-n-propylamine	10	U
67-72-1	Hexachloroethane	10	U
98-95-3	Nitrobenzene	10	U
78-59-1	Isophorone	10	U
88-75-5	2-Nitrophenol	10	U
105-67-9	2,4-Dimethylphenol	0.2	J
111-91-1	Bis(2-chloroethoxy) methane	10	U
120-83-2	2,4-Dichlorophenol	10	U
120-82-1	1,2,4-Trichlorobenzene	10	U
91-20-3	Naphthalene	1	J
106-47-8	4-Chloroaniline	10	U
87-68-3	Hexachlorobutadiene	10	U
59-50-7	4-Chloro-3-methylphenol	4	J
91-57-6	2-Methylnaphthalene	10	U
77-47-4	Hexachlorocyclopentadiene	10	U
88-06-2	2,4,6-Trichlorophenol	10	U
95-95-4	2,4,5-Trichlorophenol	25	U
91-58-7	2-Chloronaphthalene	10	U
88-74-4	2-Nitroaniline	25	U
131-11-3	Dimethyl phthalate	10	U
208-96-8	Acenaphthylene	10	U
606-20-2	2,6-Dinitrotoluene	10	U
99-09-2	3-Nitroaniline	25	U

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GOLDBERG ZOINO & ASSOCIATES
ASP91-2 - SEMIVOLATILES
ANALYSIS DATA SHEET

6660
Client No.

DUP 1

Lab Name: Recra Environmental Contract: _____

Lab Code: RECNY Case No.: _____ SAS No.: _____ SDG No.: _____

Matrix: (soil/water) WATER Lab Sample ID: A4270110

Sample wt/vol: 1000.0 (g/mL) ML Lab File ID: 16394W.MSQ

Level: (low/med) LOW Date Samp/Recv: 06/01/94 06/01/94

% Moisture: _____ decanted: (Y/N) N Date Extracted: 06/06/94

Concentrated Extract Volume: 1000 (uL) Date Analyzed: 06/29/94

Injection Volume: 2.00 (uL) Dilution Factor: 1.00

GPC Cleanup: (Y/N) N pH: 7.0

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/Kg) UG/L	Q	Val Q
83-32-9	Acenaphthene	10	U	
51-28-5	2,4-Dinitrophenol	25	U	
100-02-7	4-Nitrophenol	25	U	
132-64-9	Dibenzofuran	10	U	
121-14-2	2,4-Dinitrotoluene	10	U	
84-66-2	Diethyl phthalate	0.2	J	
7005-72-3	4-Chlorodiphenylether	10	U	
86-73-7	Fluorene	10	U	
100-01-6	4-Nitroaniline	25	U	
534-52-1	4,6-Dinitro-2-methylphenol	25	U	
86-30-6	N-nitrosodiphenylamine	10	U	
101-55-3	4-Bromophenyl phenyl ether	10	U	
118-74-1	Hexachlorobenzene	10	U	
87-86-5	Pentachlorophenol	25	U	
85-01-8	Phenanthrene	10	U	
120-12-7	Anthracene	10	U	
86-74-8	Carbazole	10	U	
84-74-2	Di-n-butyl phthalate	0.5	BJ	IQ
206-44-0	Fluoranthene	10	U	
129-00-0	Pyrene	10	U	
85-68-7	Butyl benzyl phthalate	10	U	
91-94-1	3,3'-Dichlorobenzidine	10	U	
56-55-3	Benzo(a)anthracene	10	U	
218-01-9	Chrysene	10	U	
117-81-7	Bis(2-ethylhexyl) phthalate	0.6	J	
117-84-0	Di-n-octyl phthalate	10	U	
205-99-2	Benzo(b)fluoranthene	10	U	
207-08-9	Benzo(k)fluoranthene	10	U	
50-32-8	Benzo(a)pyrene	10	U	
193-39-5	Indeno(1,2,3-cd)pyrene	10	U	
53-70-3	Dibenzo(a,h)anthracene	10	U	
191-24-2	Benzo(ghi)perylene	10	U	

ALL

GOLDBERG ZOINO & ASSOCIATES
ASP91-2 - SEMIVOLATILES
TENTATIVELY IDENTIFIED COMPOUNDS

Client No.

DUP 1

Lab Name: Recra Environmental Contract: _____

Lab Code: RECNY Case No.: _____ SAS No.: _____ SDG No.: _____

Matrix: (soil/water) WATER Lab Sample ID: A4270110

Sample wt/vol: 1000.0 (g/mL) ML Lab File ID: 16394W.MSQ

Level: (low/med) LOW Date Samp/Recv: 06/01/94 06/01/94

% Moisture: _____ decanted: (Y/N) N Date Extracted: 06/06/94

Concentrated Extract Volume: 1000 (uL) Date Analyzed: 06/29/94

Injection Volume: 2.00 (uL) Dilution Factor: 1.00

GPC Cleanup: (Y/N) N pH: 7.0

Number TICs found: 6 CONCENTRATION UNITS: (ug/L or ug/Kg) UG/L

	CAS NO.	Compound Name	RT	Est. Conc.	Q
1.		UNKNOWN	3.18	6	J
2.		CYCLOHEXEN-1-OL ISOMER	3.65	3	J
3.		CHLOROMETHYLBENZENE ISOMER	4.45	630	J
4.	17849-38-6	2-CHLORO-BENZENEMETHANOL	6.48	21	JN
5.		CHLOROMETHYLPHENOL ISOMER	7.07	10	J
6.		CHLOROBENZOIC ACID ISOMER	7.65	4	J

GOLDBERG ZOINO & ASSOCIATES
ASP91-2 - SEMIVOLATILES
ANALYSIS DATA SHEET

9632
Client No.

DUP 1RE

Lab Name: Recra Environmental Contract: _____

Lab Code: RECNY Case No.: _____ SAS No.: _____ SDG No.: _____

Matrix: (soil/water) WATER Lab Sample ID: A4270110RE

Sample wt/vol: 1000.0 (g/mL) ML Lab File ID: 16553W.MSQ

Level: (low/med) LOW Date Samp/Recv: 06/01/94 06/01/94

% Moisture: _____ decanted: (Y/N) N Date Extracted: 06/23/94

Concentrated Extract Volume: 1000 (uL) Date Analyzed: 07/08/94

Injection Volume: 2.00 (uL) Dilution Factor: 1.00

GPC Cleanup: (Y/N) N pH: 7.0

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/Kg) UG/L	Q
108-95-2	Phenol	10	U
111-44-4	Bis(2-chloroethyl) ether	10	U
95-57-8	2-Chlorophenol	10	U
541-73-1	1,3-Dichlorobenzene	10	U
106-46-7	1,4-Dichlorobenzene	10	U
95-50-1	1,2-Dichlorobenzene	10	U
95-48-7	2-Methylphenol	10	U
108-60-1	Bis(2-chloroisopropyl) ether	10	U
106-44-5	4-Methylphenol	10	U
621-64-7	N-Nitroso-Di-n-propylamine	10	U
67-72-1	Hexachloroethane	10	U
98-95-3	Nitrobenzene	10	U
78-59-1	Isophorone	10	U
88-75-5	2-Nitrophenol	10	U
105-67-9	2,4-Dimethylphenol	10	U
111-91-1	Bis(2-chloroethoxy) methane	10	U
120-83-2	2,4-Dichlorophenol	10	U
120-82-1	1,2,4-Trichlorobenzene	10	U
91-20-3	Naphthalene	10	U
106-47-8	4-Chloroaniline	10	U
87-68-3	Hexachlorobutadiene	1	J
59-50-7	4-Chloro-3-methylphenol	10	U
91-57-6	2-Methylnaphthalene	10	U
77-47-4	Hexachlorocyclopentadiene	10	U
88-06-2	2,4,6-Trichlorophenol	25	U
95-95-4	2,4,5-Trichlorophenol	10	U
91-58-7	2-Chloronaphthalene	25	U
88-74-4	2-Nitroaniline	10	U
131-11-3	Dimethyl phthalate	10	U
208-96-8	Acenaphthylene	10	U
606-20-2	2,6-Dinitrotoluene	25	U
99-09-2	3-Nitroaniline		

AVL

GOLDBERG ZOINO & ASSOCIATES
ASP91-2 - SEMIVOLATILES
ANALYSIS DATA SHEET

6603

Client No.

DUP 1RE

Lab Name: Recra Environmental Contract: _____

Lab Code: RECNY Case No.: _____ SAS No.: _____ SDG No.: _____

Matrix: (soil/water) WATER Lab Sample ID: A4270110RE

Sample wt/vol: 1000.0 (g/mL) ML Lab File ID: 16553W.MSO

Level: (low/med) LOW Date Samp/Recv: 06/01/94 06/01/94

% Moisture: _____ decanted: (Y/N) N Date Extracted: 06/23/94

Concentrated Extract Volume: 1000 (uL) Date Analyzed: 07/08/94

Injection Volume: 2.00 (uL) Dilution Factor: 1.00

GPC Cleanup: (Y/N) N pH: 7.0

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/Kg) UG/L	Q	Val C
83-32-9	Acenaphthene	10	U	
51-28-5	2,4-Dinitrophenol	25	U	
100-02-7	4-Nitrophenol	25	U	
132-64-9	Dibenzofuran	10	U	
121-14-2	2,4-Dinitrotoluene	10	U	
84-66-2	Diethyl phthalate	10	U	
7005-72-3	4-Chlorodiphenylether	10	U	
86-73-7	Fluorene	10	U	
100-01-6	4-Nitroaniline	25	U	
534-52-1	4,6-Dinitro-2-methylphenol	25	U	J
86-30-6	N-nitrosodiphenylamine	10	U	
101-55-3	4-Bromophenyl phenyl ether	10	U	
118-74-1	Hexachlorobenzene	10	U	
87-86-5	Pentachlorophenol	25	U	
85-01-8	Phenanthrene	10	U	
120-12-7	Anthracene	10	U	
86-74-8	Carbazole	10	U	
84-74-2	Di-n-butyl phthalate	10	U	
206-44-0	Fluoranthene	10	U	
129-00-0	Pyrene	10	U	J
85-68-7	Butyl benzyl phthalate	10	U	
91-94-1	3,3'-Dichlorobenzidine	10	U	
56-55-3	Benzo(a)anthracene	10	U	
218-01-9	Chrysene	10	U	
117-81-7	Bis(2-ethylhexyl) phthalate	10	U	
117-84-0	Di-n-octyl phthalate	10	U	J
205-99-2	Benzo(b)fluoranthene	10	U	
207-08-9	Benzo(k)fluoranthene	10	U	
50-32-8	Benzo(a)pyrene	10	U	
193-39-5	Indeno(1,2,3-cd)pyrene	10	U	
53-70-3	Dibenzo(a,h)anthracene	10	U	
191-24-2	Benzo(ghi)perylene	10	U	

ACC

GOLDBERG ZOINO & ASSOCIATES
ASP91-2 - SEMIVOLATILES
TENTATIVELY IDENTIFIED COMPOUNDS

Client No.: DUP 1RE

Lab Name: Recra Environmental Contract: _____

Lab Code: RECNY Case No.: _____ SAS No.: _____ SDG No.: _____

Matrix: (soil/water) WATER Lab Sample ID: A4270110RE

Sample wt/vol: 1000.0 (g/mL) ML Lab File ID: 16553W.MSQ

Level: (low/med) LOW Date Samp/Recv: 06/01/94 06/01/94

% Moisture: _____ decanted: (Y/N) N Date Extracted: 06/23/94

Concentrated Extract Volume: 1000 (uL) Date Analyzed: 07/08/94

Injection Volume: 2.00 (uL) Dilution Factor: 1.00

GPC Cleanup: (Y/N) N pH: 7.0

Number TICs found: 4 CONCENTRATION UNITS: (ug/L or ug/Kg) UG/L

	CAS NO.	Compound Name	RT	Est. Conc.	Q
1.		CYCLOHEXEN-1-OL ISOMER	3.43	4	J
2.	930-68-7	2-CYCLOHEXEN-1-ONE	3.95	3	JN
3.	17849-38-6	2-CHLORO-BENZENEMETHANOL	6.20	58	JN
4.		UNKNOWN	14.05	3	J

GOLDBERG ZOINO & ASSOCIATES
ASP91-2 - SEMIVOLATILES
ANALYSIS DATA SHEET

0005

Client No.

FIELD BLANK

Lab Name: Recra Environmental Contract: _____

Lab Code: RECNY Case No.: _____ SAS No.: _____ SDG No.: _____

Matrix: (soil/water) WATER Lab Sample ID: A4270111

Sample wt/vol: 990.00 (g/mL) ML Lab File ID: 16395W.MSQ

Level: (low/med) LOW Date Samp/Recv: 06/01/94 06/01/94

% Moisture: _____ decanted: (Y/N) N Date Extracted: 06/06/94

Concentrated Extract Volume: 1000(uL) Date Analyzed: 06/29/94

Injection Volume: 2.00(uL) Dilution Factor: 1.00

GPC Cleanup: (Y/N) N pH: 7.0

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/Kg) UG/L	Q
108-95-2	Phenol	10	U
111-44-4	Bis(2-chloroethyl) ether	10	U
95-57-8	2-Chlorophenol	10	U
541-73-1	1,3-Dichlorobenzene	10	U
106-46-7	1,4-Dichlorobenzene	10	U
95-50-1	1,2-Dichlorobenzene	10	U
95-48-7	2-Methylphenol	10	U
108-60-1	Bis(2-chloroisopropyl) ether	10	U
106-44-5	4-Methylphenol	10	U
621-64-7	N-Nitroso-Di-n-propylamine	10	U
67-72-1	Hexachloroethane	10	U
98-95-3	Nitrobenzene	10	U
78-59-1	Isophorone	10	U
88-75-5	2-Nitrophenol	10	U
105-67-9	2,4-Dimethylphenol	10	U
111-91-1	Bis(2-chloroethoxy) methane	10	U
120-83-2	2,4-Dichlorophenol	10	U
120-82-1	1,2,4-Trichlorobenzene	10	U
91-20-3	Naphthalene	10	U
106-47-8	4-Chloroaniline	10	U
87-68-3	Hexachlorobutadiene	10	U
59-50-7	4-Chloro-3-methylphenol	10	U
91-57-6	2-Methylnaphthalene	10	U
77-47-4	Hexachlorocyclopentadiene	10	U
88-06-2	2,4,6-Trichlorophenol	10	U
95-95-4	2,4,5-Trichlorophenol	25	U
91-58-7	2-Chloronaphthalene	10	U
88-74-4	2-Nitroaniline	25	U
131-11-3	Dimethyl phthalate	10	U
208-96-8	Acenaphthylene	10	U
606-20-2	2,6-Dinitrotoluene	10	U
99-09-2	3-Nitroaniline	25	U

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GOLDBERG ZOINC & ASSOCIATES
ASP91-2 - SEMIVOLATILES
ANALYSIS DATA SHEET

Client No.

FIELD BLANK

Lab Name: Recra Environmental Contract: _____

Lab Code: RECNY Case No.: _____ SAS No.: _____ SDG No.: _____

Matrix: (soil/water) WATER Lab Sample ID: A4270111

Sample wt/vol: 990.00 (g/mL) ML Lab File ID: 16395W.MSQ

Level: (low/med) LOW Date Samp/Recv: 06/01/94 06/01/94

% Moisture: _____ decanted: (Y/N) N Date Extracted: 06/06/94

Concentrated Extract Volume: 1000 (uL) Date Analyzed: 06/29/94

Injection Volume: 2.00 (uL) Dilution Factor: 1.00

GPC Cleanup: (Y/N) N pH: 7.0

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/Kg) UG/L	Q
83-32-9	Acenaphthene	10	U
51-28-5	2,4-Dinitrophenol	25	U
100-02-7	4-Nitrophenol	25	U
132-64-9	Dibenzofuran	10	U
121-14-2	2,4-Dinitrotoluene	10	U
84-66-2	Diethyl phthalate	10	U
7005-72-3	4-Chlorodiphenylether	10	U
86-73-7	Fluorene	10	U
100-01-6	4-Nitroaniline	25	U
534-52-1	4,6-Dinitro-2-methylphenol	25	U
86-30-6	N-nitrosodiphenylamine	10	U
101-55-3	4-Bromophenyl phenyl ether	10	U
118-74-1	Hexachlorobenzene	10	U
87-86-5	Pentachlorophenol	25	U
85-01-8	Phenanthrene	10	U
120-12-7	Anthracene	10	U
86-74-8	Carbazole	10	U
84-74-2	Di-n-butyl phthalate	1	BJ
206-44-0	Fluoranthene	10	U
129-00-0	Pyrene	10	U
85-68-7	Butyl benzyl phthalate	10	U
91-94-1	3,3'-Dichlorobenzidine	10	U
56-55-3	Benzo(a)anthracene	10	U
218-01-9	Chrysene	10	U
117-81-7	Bis(2-ethylhexyl) phthalate	10	U
117-84-0	Di-n-octyl phthalate	10	U
205-99-2	Benzo(b)fluoranthene	10	U
207-08-9	Benzo(k)fluoranthene	10	U
50-32-8	Benzo(a)pyrene	10	U
193-39-5	Indeno(1,2,3-cd)pyrene	10	U
53-70-3	Dibenzo(a,h)anthracene	10	U
191-24-2	Benzo(ghi)perylene	10	U

Vol 1.0

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ALL

GOLDBERG ZOINO & ASSOCIATES
ASP91-2 - SEMIVOLATILES
TENTATIVELY IDENTIFIED COMPOUNDS

6007

Client No.

FIELD BLANK

Lab Name: Recra Environmental Contract: _____

Lab Code: RECNY Case No.: _____ SAS No.: _____ SDG No.: _____

Matrix: (soil/water) WATER Lab Sample ID: A4270111

Sample wt/vol: 990.00 (g/mL) ML Lab File ID: 16395W.MSQ

Level: (low/med) LOW Date Samp/Recv: 06/01/94 06/01/94

% Moisture: _____ decanted: (Y/N) N Date Extracted: 06/06/94

Concentrated Extract Volume: 1000 (uL) Date Analyzed: 06/29/94

Injection Volume: 2.00 (uL) Dilution Factor: 1.00

GPC Cleanup: (Y/N) N pH: 7.0

Number TICs found: 1

CONCENTRATION UNITS:
(ug/L or ug/Kg) UG/L

CAS NO.	Compound Name	RT	Est. Conc.	Q
1.	UNKNOWN	3.18	3	J

GOLDBERG ZOINO & ASSOCIATES
ASP91-2 - SEMIVOLATILES
ANALYSIS DATA SHEET

6008

Client No.

FIELD BLANKRE

Lab Name: Recra Environmental Contract: _____

Lab Code: RECNY Case No.: _____ SAS No.: _____ SDG No.: _____

Matrix: (soil/water) WATER Lab Sample ID: A4270111RE

Sample wt/vol: 990.00 (g/mL) ML Lab File ID: 16554W.MSQ

Level: (low/med) LOW Date Samp/Recv: 06/01/94 06/01/94

% Moisture: _____ decanted: (Y/N) N Date Extracted: 06/23/94

Concentrated Extract Volume: 1000 (uL) Date Analyzed: 07/08/94

Injection Volume: 2.00 (uL) Dilution Factor: 1.00

GPC Cleanup: (Y/N) N pH: 7.0

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/Kg) UG/L	Q
108-95-2	Phenol	10	U
111-44-4	Bis(2-chloroethyl) ether	10	U
95-57-8	2-Chlorophenol	10	U
541-73-1	1,3-Dichlorobenzene	10	U
106-46-7	1,4-Dichlorobenzene	10	U
95-50-1	1,2-Dichlorobenzene	10	U
95-48-7	2-Methylphenol	10	U
108-60-1	Bis(2-chloroisopropyl) ether	10	U
106-44-5	4-Methylphenol	10	U
621-64-7	N-Nitroso-Di-n-propylamine	10	U
67-72-1	Hexachloroethane	10	U
98-95-3	Nitrobenzene	10	U
78-59-1	Isophorone	10	U
88-75-5	2-Nitrophenol	10	U
105-67-9	2,4-Dimethylphenol	10	U
111-91-1	Bis(2-chloroethoxy) methane	10	U
120-83-2	2,4-Dichlorophenol	10	U
120-82-1	1,2,4-Trichlorobenzene	10	U
91-20-3	Naphthalene	10	U
106-47-8	4-Chloroaniline	10	U
87-68-3	Hexachlorobutadiene	10	U
59-50-7	4-Chloro-3-methylphenol	10	U
91-57-6	2-Methylnaphthalene	10	U
77-47-4	Hexachlorocyclopentadiene	10	U
88-06-2	2,4,6-Trichlorophenol	25	U
95-95-4	2,4,5-Trichlorophenol	10	U
91-58-7	2-Chloronaphthalene	25	U
88-74-4	2-Nitroaniline	10	U
131-11-3	Dimethyl phthalate	10	U
208-96-8	Acenaphthylene	10	U
606-20-2	2,6-Dinitrotoluene	25	U
99-09-2	3-Nitroaniline		

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GOLDBERG ZOINO & ASSOCIATES
ASP91-2 - SEMIVOLATILES
ANALYSIS DATA SHEET

0009

Client No.

FIELD BLANKRE

Lab Name: Recra Environmental Contract: _____

Lab Code: RECNY Case No.: _____ SAS No.: _____ SDG No.: _____

Matrix: (soil/water) WATER Lab Sample ID: A4270111RE

Sample wt/vol: 990.00 (g/mL) ML Lab File ID: 16554W.MSO

Level: (low/med) LOW Date Samp/Recv: 06/01/94 06/01/94

% Moisture: _____ decanted: (Y/N) N Date Extracted: 06/23/94

Concentrated Extract Volume: 1000 (uL) Date Analyzed: 07/08/94

Injection Volume: 2.00 (uL) Dilution Factor: 1.00

GPC Cleanup: (Y/N) N pH: 7.0

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/Kg) UG/L	Q
83-32-9	Acenaphthene	10	U
51-28-5	2,4-Dinitrophenol	25	U
100-02-7	4-Nitrophenol	25	U
132-64-9	Dibenzofuran	10	U
121-14-2	2,4-Dinitrotoluene	10	U
84-66-2	Diethyl phthalate	10	U
7005-72-3	4-Chlorodiphenylether	10	U
86-73-7	Fluorene	10	U
100-01-6	4-Nitroaniline	25	U
534-52-1	4,6-Dinitro-2-methylphenol	25	U
86-30-6	N-nitrosodiphenylamine	10	U
101-55-3	4-Bromophenyl phenyl ether	10	U
118-74-1	Hexachlorobenzene	10	U
87-86-5	Pentachlorophenol	25	U
85-01-8	Phenanthrene	10	U
120-12-7	Anthracene	10	U
86-74-8	Carbazole	10	U
84-74-2	Di-n-butyl phthalate	0.4	J
206-44-0	Fluoranthene	10	U
129-00-0	Pyrene	10	U
85-68-7	Butyl benzyl phthalate	10	U
91-94-1	3,3'-Dichlorobenzidine	10	U
56-55-3	Benzo(a)anthracene	10	U
218-01-9	Chrysene	10	U
117-81-7	Bis(2-ethylhexyl) phthalate	10	U
117-84-0	Di-n-octyl phthalate	10	U
205-99-2	Benzo(b)fluoranthene	10	U
207-08-9	Benzo(k)fluoranthene	10	U
50-32-8	Benzo(a)pyrene	10	U
193-39-5	Indeno(1,2,3-cd)pyrene	10	U
53-70-3	Dibenzo(a,h)anthracene	10	U
191-24-2	Benzo(ghi)perylene	10	U

GOLDBERG ZOINO & ASSOCIATES
ASP91-2 - SEMIVOLATILES
TENTATIVELY IDENTIFIED COMPOUNDS

0070

Client No.

FIELD BLANKRE

Lab Name: Recra Environmental Contract: _____

Lab Code: RECNY Case No.: _____ SAS No.: _____ SDG No.: _____

Matrix: (soil/water) WATER Lab Sample ID: A4270111RE

Sample wt/vol: 990.00 (g/mL) ML Lab File ID: 16554W.MSQ

Level: (low/med) LOW Date Samp/Recv: 06/01/94 06/01/94

% Moisture: _____ decanted: (Y/N) N Date Extracted: 06/23/94

Concentrated Extract Volume: 1000 (uL) Date Analyzed: 07/08/94

Injection Volume: 2.00 (uL) Dilution Factor: 1.00

GPC Cleanup: (Y/N) N pH: 7.0

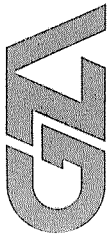
Number TICs found: 0

CONCENTRATION UNITS:
(ug/L or ug/Kg) UG/L

CAS NO.	Compound Name	RT	Est. Conc.	Q

FORM IF - GC/MS SVOA TIC

AC



APPENDIX H

SELECTED TOXICOLOGICAL PROFILES

ACENAPHTHENE

Summary

Acenaphthene is a two-ringed polycyclic aromatic hydrocarbon (PAH). Although little specific information on acenaphthene is available, information on related PAHs suggests that acenaphthene is not very persistent in the environment and that biodegradation is the ultimate fate process. Acenaphthene has not been shown to be carcinogenic or mutagenic, but it does cause liver and kidney damage at high exposure levels.

CAS Number: 83-32-9

Chemical Formula: $C_{12}H_{10}$

IUPAC Name: Acenaphthene

Chemical and Physical Properties

Molecular Weight: 154.21

Boiling Point: 279°C

Melting Point: 96.2°C

Specific Gravity: 1.225 at 0°C

Solubility in Water: 3.42 mg/liter at 25°C

Solubility in Organics: Soluble in ethanol, toluene, chloroform, benzene, and acetic acid

Log Octanol/Water Partition Coefficient: 4.33

Vapor Pressure: Less than 0.02 mm Hg at 20°C

Vapor Density: 5.32

Transport and Fate

Acenaphthene, like other polycyclic aromatic hydrocarbons (PAHs), can be emitted into the environment by both natural and

anthropogenic sources. Since very little information is available on this compound specifically, its environmental fate is largely inferred from data for PAHs in general. In air, acenaphthene can be transported as adsorbed matter on suspended particulates. Ambient air samples collected in Sydney, Australia, contained 0.07 μg/100 m^3, indicating that atmospheric transport occurs and that individuals in urban environments may be exposed to measureable levels.

In surface water, direct, rapid photolysis of dissolved acenaphthene may be an important water-related environmental fate. It is probable that singlet oxygen is the oxidant and that the reaction products are quinones. Volatilization may play a role in acenaphthene transport, depending on mixing rates in both the water and air columns. However, adsorption to sediments is probably the dominant aquatic transport process. Consideration of the log octanol/water partition coefficient for acenaphthene and of the behavior of other PAHs indicates that acenaphthene can be strongly adsorbed onto suspended and sedimentary particulate matter, especially particulates high in organic content.

Based on information concerning related compounds, it is likely that bioaccumulation of acenaphthene is short term, especially for vertebrates. Although it is rapidly accumulated after exposure, it also is rapidly metabolized and excreted. Consequently, bioaccumulation is not considered an important fate process. Biodegradation is considered the ultimate fate process for acenaphthene. Based on information for related compounds, it is probable that acenaphthene is readily degraded by microbes. Biodegradation is likely to be more rapid in the soil than in aquatic systems. However, studies indicate that biodegradation may be more important in those aquatic systems that are chronically affected by PAH contamination.

Health Effects

Negative results are reported for a test of acenaphthene carcinogenicity based upon neoplastic induction in the newt Triturus cristatus, but the reliability of the test system for predicting mammalian carcinogenicity is not established. Other carcinogenicity studies involving exposure to acenaphthene as one component of complex mixtures of PAHs and other substances report both positive and negative results. However, the relative importance of individual components in the mixtures tested cannot be determined, and no conclusions involving acenaphthene can be drawn. Studies using several different bacterial test systems provide no evidence of mutagenicity. No information concerning its teratogenicity or reproductive toxicity is available.

The most thoroughly investigated effect of acenaphthene is its ability to produce nuclear and cytological changes in a variety of microbial and plant species. Most of these changes, such as increases in cell size and DNA content, are associated with a disruption of the spindle mechanism during mitosis and the resulting induction of polyploidy. However, there is no known correlation between these effects and the biological impact of acenaphthene on mammalian cells.

Very little is known about the human toxicity of acenaphthene. It has been shown to be irritating to the skin and mucous membranes and to cause vomiting if swallowed in large quantities.

In both rats and mice, subchronic oral exposure causes loss of body weight, changes in peripheral blood, increased aminotransferase levels in blood serum, and mild morphological damage to the liver and kidneys. The oral LD_{50} is 10 g/kg for rats and 2.1 g/kg for mice. Kidney and liver damage is greater after subchronic exposure to acenaphthene than after acute exposure.

Toxicity to Wildlife and Domestic Animals

In acute toxicity tests for freshwater organisms, EC_{50} values of 41,200 and 1,700 µg/liter are reported for the cladoceran Daphnia magna and the bluegill, respectively. In saltwater species, 96-hour LC_{50} concentrations for the mysid shrimp and the sheepshead minnow are 970 and 2,230 µg/liter, respectively. A chronic value of 710 µg/liter is reported for the sheepshead minnow, and the acute-chronic ratio for this species is 3.1. No other aquatic life chronic data are available. The freshwater alga Selenastrum capricornutum and the saltwater alga Skeletonema costatum are both relatively sensitive to acenaphthene exposure, with 96-hour EC_{50} values for chlorophyll a and cell number of approximately 525 µg/liter and 500 µg/liter, respectively.

The steady state bioconcentration factor for acenaphthene in the bluegill is 387, with a tissue half-life of less than 1 day. By using the bluegill data and an adjustment factor to allow for differences in lipid content, the bioconcentration factor for acenaphthene and the edible portions of all freshwater and estuarine aquatic organisms consumed by Americans is estimated to be 242. Reports of acenaphthene in foods is limited. One study reports levels of 3.2 µg/kg (the detection limit) or greater in the tissues of shellfish of an unspecified species and location.

A study summarizing the toxicity of a variety of compounds to wild and domestic bird species indicates that the LD_{50} of acenaphthene for the redwinged blackbird is greater than 100 mg/kg.

Furthermore, the study reports that acenaphthene did not significantly deter feeding by the blackbird even when it was present in food at relatively high concentrations.

Regulations and Standards

Ambient Water Quality Criteria (USEPA):

Aquatic Life

The available data are inadequate for establishing final criteria. EPA did report the lowest valves known to cause toxicity in aquatic organisms.

Freshwater

Acute toxicity: 1,700 µg/liter
Chronic toxicity: No available data

Saltwater

Acute toxicity: 970 µg/liter
Chronic toxicity: 710 µg/liter

Human Health

The available data are inadequate for establishing a human health criterion.

Organoleptic criterion: 20 µg/liter

REFERENCES

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SCHAFER, E.W., BOWLES, W.A., and HURLBUT, J. 1983. The acute oral toxicity, repellency, and hazard potential of 998 chemicals to one or more species of wild and domestic birds. Arch. Environ. Contam. Toxicol. 12:355-382

U.S. ENVIRONMENTAL PROTECTION AGENCY (USEPA). 1979. Water-Related Environmental Fate of 129 Priority Pollutants. Vol. 2. Washington, D.C. December 1979. EPA-440/4-79-0296

U.S. ENVIRONMENTAL PROTECTION AGENCY (USEPA). 1980. Ambient Water Quality Criteria for Acenaphthene. Office of Water Regulations and Standards, Criteria and Standards Division, Washington, D.C. October 1980. EPA 440/5-80-015

WEAST, R.E., ed. 1981. Handbook of Chemistry and Physics. 62nd ed. CRC Press, Cleveland, Ohio. 2,332 pages

ACETONE

Summary

Acetone is a commonly used solvent, which probably is not very persistent in the environment. It is considered to have rather low toxicity, and no chronic health hazards have been associated with exposure to it. Acetone is not very toxic to aquatic organisms.

CAS Number: 67-64-1

Chemical Formula: $CH_3-CO-CH_3$

IUPAC Name: Propanone

Important Synonyms and Trade Names: Dimethyl ketone, 2-propanone

Chemical and Physical Properties

Molecular Weight: 58.08

Boiling Point: 56.2°C

Melting Point: -95°C

Specific Gravity: 0.7899 at 20°C

Solubility in Water: miscible

Solubility in Organics: Soluble in alcohol, ether, benzene, and chloroform

Log Octanol/Water Partition Coefficient: -0.24

Vapor Pressure: 190 mm Hg at 20°C

Vapor Density: 2.00

Flash Point: -16°C (closed cup)

Transport and Fate

Very limited information on the transport and fate of acetone was found in the literature reviewed. However, ketones in general are probably not very persistent. Acetone has a high vapor pressure and therefore would be expected to volatilize readily, but because of its high water solubility, volatilization is probably limited. Once in the atmosphere, it is apparently

oxidized. Acetone has a low octanol/water partition coefficient and therefore is probably not readily adsorbed. Biodegradation is probably important in determining the fate of acetone in the environment because of its aliphatic nature. Evidence of this is provided by the biological oxygen demand value, which was 72% of the theoretical value after 20 days at 20°C.

Health Effects

Acetone has not been tested in a carcinogenicity bioassay but gave negative results in a skin painting test and was not mutagenic in the Ames assay. No studies on animals for teratogenicity or reproductive toxicity have been done, but acetone was negative in a chicken egg injection study for teratogenicity.

Acetone is generally regarded as having low toxicity and therefore has not been extensively studied. Prolonged inhalation of high concentrations may produce irritation of the respiratory tract, coughing, headache, drowsiness, incoordination, and in severe cases, coma.

In animal studies, rats consuming doses of 18 mg/kg/day for 4 months showed reduced food consumption and growth. In behavioral studies, rats exposed to 6,000 ppm (14,200 mg/m^3) acetone for 4 hours/day, 5 days/week for 2 weeks showed modified avoidance and escape behavior after one exposure, but no changes after subsequent exposures. At 16,000 ppm (37,800 mg/m^3), altered responses were noted throughout the 2-week exposure period. No chronic health hazards have been associated with exposure to acetone.

Toxicity to Wildlife and Domestic Animals

The toxicity of acetone to aquatic organisms is low. The LC_{50} value for sunfish was reported to be 14.2 g/liter, and the threshold concentration for immobilization of *Daphnia magna* was reported to be over 9 g/liter (McKee and Wolf 1963).

No information on the toxicity of acetone to terrestrial wildlife or domestic animals was found in the literature reviewed.

Regulations and Standards

NIOSH Recommended Standard (air): 250 ppm (593 mg/m^3) TWA

ACGIH Threshold Limit Values: 750 ppm (1,780 mg/m^3) TWA
1,000 ppm (2,375 mg/m^3) STEL

REFERENCES

AMERICAN INDUSTRIAL HYGIENE ASSOCIATION (AIHA). 1980. Hygienic Guide Series: Acetone

McKEE, J.E., and WOLF, H.W. 1963. Water Quality Criteria. 2nd ed. California State Water Resources Control Board Publication 3A

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NATIONAL INSTITUTE FOR OCCUPATIONAL SAFETY AND HEALTH (NIOSH). 1983. Registry of Toxic Effects of Chemical Substances. Data Base. Washington, D.C. January 1984

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ALDRIN/DIELDRIN

Summary

Aldrin degrades to dieldrin, which is very persistent in the environment. Both pesticides are carcinogenic in rats and mice and are teratogenic and reproductive toxicants. Aldrin and dieldrin cause liver toxicity and central nervous system abnormalities following chronic exposure. Both are also acutely toxic, with oral LD_{50} values of about 50 mg/kg. Both pesticides are very toxic to aquatic organisms and have been associated with large-scale kills of terrestrial wildlife in treated areas.

Background Information

Dieldrin is the 6,7-epoxide of aldrin and is readily obtained from aldrin under normal environmental conditions and by metabolism in animals.

CAS Number: Aldrin: 309-00-2
Dieldrin: 60-57-1

Chemical Formula: Aldrin: $C_{12}H_8Cl_6$
Dieldrin: $C_{12}H_8Cl_6O$

IUPAC Name: Aldrin: 1,2,3,4,10,10-hexachloro-1,4,4a,5,8,8a-hexahydro-1,4:5,8-exo-dimethanonaphthalene

Dieldrin: 1,2,3,4,10,10-hexachloro-6,7-epoxy-1,4,4a,5,6,7,8,8a-octahydro-endo,exo-1,4:5,8-dimethanonaphthalene

Chemical and Physical Properties

Molecular Weight: Aldrin: 365
Dieldrin: 381

Melting Point: Aldrin: 104°C
Dieldrin: 176°C

Solubility in Water: Aldrin: 20 µg/liter at 25°C
Dieldrin: 200 µg/liter at 25°C

Solubility in Organics: Soluble in most organic solvents

Log Octanol/Water Partition Coefficient: No data found; probably greater than 5 for both chemicals

Vapor Pressure: Aldrin: 2.31×10^{-5} mm Hg at 20°C
Dieldrin: 2.8×10^{-6} mm Hg at 20°C

Transport and Fate

Aldrin evaporates rapidly from aquatic environments and also probably from soil. Photolysis probably occurs in the atmosphere after volatilization. Adsorption, especially by organic materials, is also an important fate process for this chemical. Aldrin is bioconcentrated by aquatic organisms by a factor of 10^3 to 10^4. Biotransformation by aquatic organisms and biodegradation are also important fate processes.

The primary product of aldrin degradation is its epoxide, dieldrin. Photolysis of aldrin also produces small amounts of photoaldrin, photodieldrin, and a polymerization product. Dieldrin is considered to be at least as toxic as aldrin and is quite persistent in the environment. Therefore, transformation of aldrin represents only a change of state and not detoxification of the chemical.

Dieldrin is one of the most persistent of the chlorinated hydrocarbons. Volatilization and possibly subsequent photolysis to photodieldrin are important transport and fate processes from surface water and probably from soil. Adsorption to sediments, especially organic materials, and bioaccumulation are also important in removing dieldrin from water. Biotransformation and biodegradation of dieldrin occur very slowly but may be the final fate processes in sediment.

Health Effects

Both ~~aldrin and~~ dieldrin are carcinogens, causing increases in a variety of tumors in rats at low but not at high doses and producing a higher incidence of liver tumors in mice. The reason for this reversed dose-response relationship is unclear. Neither appears to be mutagenic when tested in a number of systems. Aldrin and dieldrin are both toxic to the reproductive system and teratogenic. Reproductive effects include decreased fertility, increased fetal death, and effects on gestation; while teratogenic effects include cleft palate,

webbed foot, and skeletal anomalies. Chronic effects attributed to aldrin and dieldrin include liver toxicity and central nervous system abnormalities. Both chemicals are acutely toxic; the oral LD_{50} is around 50 mg/kg, and the dermal LD_{50} is about 100 mg/kg.

Toxicity to Wildlife and Domestic Animals

Aldrin and dieldrin are both acutely toxic to freshwater species at low concentrations. Tests in fish showed that the two chemicals had similar toxicities, with LC_{50} values ranging from 1 to 46 µg/liter for different species. Final acute values for freshwater species were determined to be 2.5 µg/liter for dieldrin and 3.0 µg/liter for aldrin. Saltwater species were also quite sensitive to aldrin and dieldrin. The range of LC_{50} values was similar to that for freshwater species: 2 to 100 µg/liter for aldrin and 1 to 34 µg/liter for dieldrin. The saltwater Final Acute Values were 1.3 µg/liter for aldrin and 0.71 µg/liter for dieldrin.

Chronic studies have been conducted on the effects of dieldrin on freshwater and saltwater species. For freshwater organisms, chronic values as low as 0.2 µg/liter were obtained. The Final Acute Chronic Ratio was determined to be 3.5, and the calculated Freshwater Final Chronic Value was 0.29 µg/liter. Only one chronic study was done on saltwater species. Therefore, the saltwater Final Chronic Value of 0.084 µg/liter was determined by dividing the Final Acute Value by the acute-chronic ratio. No chronic studies were performed on aldrin, but because its acute toxicity is comparable to that of dieldrin and because it is readily converted to dieldrin in animals and in the environment, it probably has similar chronic toxicity.

Both pesticides, and especially dieldrin, have been associated with large-scale bird and mammal kills in treated areas. Experimental feeding studies have shown that the chemicals are quite toxic to terrestrial wildlife and domestic animals at low levels.

Regulations and Standards

Ambient [redacted] Quality Criteria (USEPA):

Aquatic Life

Freshwater

Acute toxicity: Aldrin: 3.0 µg/liter
Dieldrin: 2.5 µg/liter

Chronic toxicity: Aldrin: No available data
Dieldrin: 0.0019 µg/liter

Saltwater

Acute toxicity: Aldrin: 1.3 µg/liter
Dieldrin: 0.71 µg/liter

Chronic toxicity: Aldrin: No available data
Dieldrin: 0.0019 µg/liter

Human Health

Estimates of the carcinogenic risks associated with lifetime exposure to various concentrations in water are:

Risk	Aldrin Concentration	Dieldrin Concentration
10^{-5}	0.74 ng/liter	0.71 ng/liter
10^{-6}	0.074 ng/liter	0.071 ng/liter
10^{-7}	0.0074 ng/liter	0.0071 ng/liter

CAG Unite Risk (USEPA): Aldrin: 11.4 $(mg/kg/day)^{-1}$
Dieldrin: 30.4 $(mg/kg/day)^{-1}$

ACGIH Threshold Limit Value:* 0.25 mg/m^3 TWA
0.75 mg/m^3 STEL

OSHA Standard (air):* 250 $\mu g/m^3$ TWA

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* Applies to both aldrin and dieldrin.

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ANTHRACENE

Summary

Anthracene is a three-ringed polycyclic aromatic hydrocarbon (PAH). It is probably moderately stable in the environment. Anthracene causes dermatitis and other skin disorders in humans.

CAS Number: 120-12-7

Chemical Formula: $C_{14}H_{10}$

IUPAC Name: Anthracene

Important Synonyms and Trade Names: Paranaphthalene

Chemical and Physical Properties

Molecular Weight: 178.22

Boiling Point: 340 to 355°C

Melting Point: 217°C

Specific Gravity: 1.24 at 27°C

Solubility in Water: 0.073 mg/liter at 25°C

Solubility in Organics: Soluble in acetone and benzene

Log Octanol/Water Partition Coefficient: 4.45

Vapor Pressure: 1.95×10^{-4} mm Hg at 20°C

Vapor Density: 6.15

Transport and Fate

Much of the information concerning transport and fate is inferred from data for polycyclic aromatic hydrocarbons (PAHs) in general, because specific information for anthracene is lacking. Rapid, direct photolysis of anthracene to quinones may occur in aqueous solution. Oxidation is probably too slow to be a significant environmental process. The available data suggest that volatilization may be a significant transport

photodynamic response concentration of 0.1 µg/liter is reported for the freshwater protozoan Paramecium caudatum. The weighted average bioconcentration factor for the edible portion of all freshwater and estuarine aquatic organisms consumed by Americans is 478.

Regulations and Standards

Ambient Water Quality Criteria (USEPA):

The available data are not adequate for establishing criteria.

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ARSENIC

Summary

Arsenic is a metal that is present in the environment as a constituent of organic and inorganic compounds; it also occurs in a number of valence states. Arsenic is generally rather mobile in the natural environment, with the degree of mobility dependent on its chemical form and the properties of the surrounding medium. Arsenic is a human carcinogen; it causes skin tumors when it is ingested and lung tumors when it is inhaled. Arsenic compounds are teratogenic and have adverse reproductive effects in animals. Chronic exposure to arsenic is associated with polyneuropathy and skin lesions. It is acutely toxic to some early life stages of aquatic organisms at levels as low as 40 µg/liter.

Background Information

Arsenic can be found in the environment in any of four valence states (-3, 0, +3, and +5) depending on the pE, Eh, and other factors. It can exist as either inorganic or organic compounds and often will change forms as it moves through the various media. The chemical and physical properties depend on the state of the metalloid. Only the properties of metallic arsenic have been listed; properties of other arsenic compounds are often quite different.

CAS Number: 7440-38-2

Chemical Formula: As

IUPAC Name: Arsenic

Chemical and Physical Properties

Atomic Weight: 74.91

Boiling Point: 613°C

Melting Point: 817°C

Specific Gravity: 5.72 at 20°C

Solubility in Water: Insoluble; some salts are soluble

Transport and Fate

In the natural environment, arsenic has four different oxidation states, and chemical speciation is important in determining arsenic's distribution and mobility. Interconversions of the +3 and +5 states as well as organic complexation, are the most important. Arsenic is generally quite mobile in the environment. In the aquatic environment, volatilization is important when biological activity or highly reducing conditions produce arsine or methylarsenics. Sorption by the sediment is an important fate for the chemical. Arsenic is metabolized to organic arsenicals by a number of organisms; this increases arsenic's mobility in the environment. Because of its general mobility, arsenic tends to cycle through the environment. Its ultimate fate is probably the deep ocean, but it may pass through numerous stages before finally reaching the sea.

Health Effects

Arsenic has been implicated in the production of skin cancer in humans. There is also extensive evidence that inhalation of arsenic compounds causes lung cancer in workers. Arsenic compounds cause chromosome damage in animals, and humans exposed to arsenic compounds have been reported to have an elevated incidence of chromosome aberrations. Arsenic compounds have been reported to be teratogenic, fetotoxic, and embryotoxic in several animal species, and an increased incidence of multiple malformations among children born to women occupationally exposed to arsenic has been reported. Arsenic compounds also cause noncancerous, possibly precancerous, skin changes in exposed individuals. Several cases of progressive polyneuropathy involving motor and sensory nerves and particularly affecting the extremities and myelinated long-axon neurons have been reported in individuals occupationally exposed to inorganic arsenic. Polyneuropathies have also been reported after the ingestion of arsenic-contaminated foods.

Toxicity to Wildlife and Domestic Animals

Various inorganic forms of arsenic appear to have similar levels of toxicity; they all seem to be much more toxic than organic forms. Acute toxicity to adult freshwater animals occurs at levels of arsenic trioxide as low as 812 µg/liter and at levels as low as 40 µg/liter in early life stages of aquatic organisms. Acute toxicity to saltwater fish occurs at levels around 15 mg/liter, while some invertebrates are affected at much lower levels (508 µg/liter). Arsenic toxicity

does not appear to increase greatly with chronic exposure, and it does not seem that arsenic is bioconcentrated to a great degree.

Arsenic poisoning is a rare but not uncommon toxic syndrome among domestic animals. Arsenic causes hyperemia and edema of the gastrointestinal tract, hemorrhage of the cardiac serosal surfaces and peritoneum, and pulmonary congestion and edema; and it may cause liver necrosis. Information on arsenic toxicity to terrestrial wildlife was not reported in the literature reviewed.

Regulations and Standards

Ambient Water Quality Criteria (USEPA):

Aquatic Life

Freshwater

Acute toxicity: 440 µg/liter
Chronic toxicity: No available data

Saltwater

Acute toxicity: 508 µg/liter
Chronic toxicity: No available data

Human Health

Estimates of the carcinogenic risks associated with lifetime exposure to various concentrations of arsenic in water are:

Risk	Concentration
10^{-5}	22 ng/liter
10^{-6}	2.2 ng/liter
10^{-7}	0.22 ng/liter

CAG Unit Risk (USEPA): 15 $(mg/kg/day)^{-1}$

National Interim Primary Drinking Water Standard (USEPA): 50 µg/liter

NIOSH Recommended Standard (air): 2 $\mu g/m^3$ Ceiling Level

OSHA Standard (air): 500 $\mu g/m^3$ TWA

ACGIH Threshold Limit Value: 200 $\mu g/m^3$ (soluble compounds, as As)

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BENZENE

Summary

Benzene is an important industrial solvent and chemical intermediate. It is rather volatile, and atmospheric photooxidation is probably an important fate process. Benzene is a known human carcinogen, causing leukemia in exposed individuals. It also adversely affects the hematopoietic system. Benzene has been shown to be fetotoxic and to cause embryolethality in experimental animals. Exposure to high concentrations of benzene in the air causes central nervous system depression and cardiovascular effects, and dermal exposure may cause dermatitis.

CAS Number: 71-43-2

IUPAC Name: Benzene

Chemical Formula: C_6H_6

Chemical and Physical Properties

Molecular Weight: 78.12

Boiling Point: 80.1°C

Melting Point: 5.56°C

Specific Gravity: 0.879 at 20°C

Solubility in Water: 1,780 mg/liter at 25°C

Solubility in Organics: Miscible with ethanol, ether, acetic acid, acetone, chloroform, carbon disulfide, and carbon tetrachloride

Log Octanol/Water Partition Coefficient: 1.95-2.13

Vapor Pressure: 75 mm Hg at 20°C

Vapor Density: 2.77

Flash Point: -11.1°C

Transport and Fate

Volatilization appears to be the major transport process of benzene from surface waters to the ambient air, and atmospheric transport of benzene occurs readily (USEPA 1979). Although direct oxidation of benzene in environmental waters is unlikely, cloud chamber data indicate that it may be photooxidized rapidly in the atmosphere. Inasmuch as volatilization is likely to be the main transport process accounting for the removal of benzene from water, the atmospheric destruction of benzene is probably the most likely fate process. Values for benzene's log octanol/water partition coefficient indicate that adsorption onto organic material may be significant under conditions of constant exposure. Sorption processes are likely removal mechanisms in both surface water and groundwater. Although the bioaccumulation potential for benzene appears to be low, gradual biodegradation by a variety of microorganisms probably occurs. The rate of benzene biodegradation may be enhanced by the presence of other hydrocarbons.

Health Effects

Benzene is a recognized human carcinogen (IARC 1982). Several epidemiological studies provide sufficient evidence of a causal relationship between benzene exposure and leukemia in humans. Benzene is a known inducer of aplastic anemia in humans, with a latent period of up to 10 years. It produces leukopenia and thrombocytopenia, which may progress to pancytopenia. Similar adverse effects on the blood-cell-producing system occur in animals exposed to benzene. In both humans and animals, benzene exposure is associated with chromosomal damage, although it is not mutagenic in microorganisms. Benzene was fetotoxic and caused embryolethality in experimental animals.

Exposure to very high concentrations of benzene [about 20,000 ppm (66,000 mg/m^3) in air] can be fatal within minutes (IARC 1982). The prominent signs are central nervous system depression and convulsions, with death usually following as a consequence of cardiovascular collapse. Milder exposures can produce vertigo, drowsiness, headache, nausea, and eventually unconsciousness if exposure continues. Deaths from cardiac sensitization and cardiac arrhythmias have also been reported after exposure to unknown concentrations. Although most benzene hazards are associated with inhalation exposure, dermal absorption of liquid benzene may occur, and prolonged or repeated skin contact may produce blistering, erythema, and a dry, scaly dermatitis.

Toxicity to Wildlife and Domestic Animals

The EC_{50} values for benzene in a variety of invertebrate and vertebrate freshwater aquatic species range from 5,300 µg/liter to 386,000 µg/liter (USEPA 1980). However, only values for the rainbow trout (5,300 µg/liter) were obtained from a flow through test and were based on measured concentrations. Results based on unmeasured concentrations in static tests are likely to underestimate toxicity for relatively volatile compounds like benzene. A chronic test with Daphnia magna was incomplete, with no adverse effects observed at test concentrations as high as 98,000 µg/liter.

For saltwater species, acute values for one fish and five invertebrate species range from 10,900 µg/liter to 924,000 µg/liter. Freshwater and saltwater plant species that have been studied exhibit toxic effects at benzene concentrations ranging from 20,000 µg/liter to 525,000 µg/liter.

Regulations and Standards

Ambient Water Quality Criteria (USEPA):

Aquatic Life

The available data are not adequate for establishing criteria. However, EPA did report the lowest concentrations of benzene known to cause toxic effects in aquatic organisms.

Freshwater

Acute toxicity: 5,300 µg/liter
Chronic toxicity: No available data

Saltwater

Acute toxicity: 5,100 µg/liter
Chronic toxicity: No available data

Human Health

Estimates of the carcinogenic risks associated with lifetime exposure to various concentrations of benzene in water are:

Risk	Concentration
10^{-5}	6.6 µg/liter
10^{-6}	0.66 µg/liter
10^{-7}	0.066 µg/liter

CAG Unit Risk (USEPA): 2.9×10^{-2} $(mg/kg/day)^{-1}$

OSHA Standards: 30 mg/m^3 TWA
75 mg/m^3 Ceiling Level
150 mg/m^3 10-min Peak Level

ACGIH Threshold Limit Values: Suspected human carcinogen
30 mg/m^3 TWA
75 mg/m^3 STEL

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BENZO(a)ANTHRACENE

Summary

Benzo(a)anthracene is a four-ringed polycylic aromatic hydrocarbon (PAH). It is readily absorbed to organic matter and is probably moderately persistent in the environment. Benzo(a) anthracene is carcinogenic in mice and is reported to be mutagenic in several test systems. Carcinogenic PAHs such as benzo(a) anthracene cause immunosuppression, and dermal exposure causes chronic dermatitis and other skin disorders. The very limited information on its toxicity to aquatic life indicates that benzo(a)anthracene is chronically toxic to fish at concentrations of less than 1,000 µg/liter.

CAS Number: 56-55-3

Chemical Formula: $C_{18}H_{12}$

IUPAC Name: 1,2-benzanthracene

Important Synonyms and Trade Names: 1,2-Benzanthracene; 2,3-Benzophenanthrene; Benzo(b)phenanthrene

Chemical and Physical Properties

Molecular Weight: 228.28

Melting Point: 155-157°C

Solubility in Water: 0.009 to 0.014 mg/liter at 25°C

Solubility in Organics: Soluble in alcohol, ether, acetone, and benzene

Log Octanol/Water Partition Coefficient: 5.61

Vapor Pressure: 5×10^{-9} mm Hg at 20°C

Transport and Fate

Dissolved benzo(a)anthracene can undergo rapid, direct photolysis, and this process may be an important environmental fate in aquatic systems. Studies indicate that singlet oxygen is the oxidant and that quinones are the products in the photolytic reactions. The free-radical oxidation of benzo(a)anthra-

cene in the environment is rapid and may be competitive with photolysis as a chemical fate process. When chlorine and ozone are present in aquatic systems in sufficient quantities, oxidation reactions resulting in the formation of quinones may be significant fate processes. Because benzo(a)anthracene does not contain groups amenable to hydrolysis, this process is not thought to be a significant environmental fate. Volatilization does not appear to be an important transport process either.

Available information indicates that benzo(a)anthracene will accumulate in the sediment and biotic portions of the aquatic environment and that adsorption to suspended matter is the dominant transport process. Sorption onto sediments, soil particles, and biota is strongly correlated with the organic carbon levels present. Although benzo(a)anthracene is readily and rapidly bioaccumulated, it is also rapidly metabolized and excreted. Therefore, bioaccumulation is short term and is not considered an important fate process. Benzo(a)anthracene is degraded by microbes and readily metabolized by multicellular organisms. Degradation by mammals is considered to be incomplete; the parent compound and metabolites are excreted by the urinary system. Biodegradation is probably the ultimate fate process for benzo(a)anthracene. It generally is more rapid in soil than in aquatic systems and is relatively fast in those systems chronically affected by polycyclic aromatic hydrocarbon contamination.

Atmospheric transport of benzo(a)anthracene can occur, and the chemical can be returned to aquatic and terrestrial systems by atmospheric fallout or with precipitation. Benzo(a)anthracene can also enter surface and groundwater by leaching from polluted soils.

Health Effects

Benzo(a)anthracene administered by different routes is carcinogenic in the mouse. It can produce hepatomas and lung adenomas following repeated oral administration and bladder tumors following implantation. Benzo(a)anthracene can also produce tumors in mice following subcutaneous injections. Although benzo(a)anthracene is a complete carcinogen for mouse skin, it produces less skin tumors with a longer latency than does benzo(a)pyrene. Benzo(a)anthracene has not been adequately tested in other species.

Benzo(a)anthracene is reported to be mutagenic in a variety of test systems. In some cases, a correlation is observed between mutagenicity and carcinogenic potency for benzo(a)anthracene and other polycyclic aromatic hydrocarbons. In other words, those compounds exhibiting greater mutagenic activity

often have higher carcinogenic potency as well. No adequate information concerning the teratogenic effects of benzo(a)anthracene in humans or experimental animals is available.

Application of the carcinogenic polycyclic aromatic hydrocarbons, including benzo(a)anthracene, to mouse skin leads to the destruction of sebaceous glands, hyperplasia, hyperkeratosis, and ulceration. Workers exposed to materials containing polynuclear aromatic hydrocarbons may exhibit chronic dermatitis, hyperkeratoses, and other skin disorders. Repeated subcutaneous injections of benzo(a)anthracene to mice and rats produces gross changes in the lymphoid tissues. It has also been shown that many carcinogenic polycyclic aromatic hydrocarbons can produce an immunosuppressive effect, although specific results with benzo(a)anthracene have not been reported.

Toxicity to Wildlife and Domestic Animals

Adequate data for characterization of toxicity to wildlife and domestic animals are not available. One study involving freshwater fish reported an 87% mortality rate in bluegills exposed to 1,000 µg/liter benzo(a)anthracene for 6 months.

Regulations and Standards

Ambient Water Quality Criteria (USEPA):

Aquatic Life

The available data are not adequate for establishing criteria.

Human Health

Estimates of the carcinogenic risks associated with lifetime exposure to various concentrations of carcinogenic PAHs in water are:

Risk	Concentration
10^{-5}	28 ng/liter
10^{-6}	2.8 ng/liter
10^{-7}	0.28 ng/liter

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BERYLLIUM

Summary

Beryllium is a metal with a complicated coordination chemistry, and it can form complexes, oxycarboxylates, and chelates with a variety of materials. Inhalation exposure to beryllium causes lung and bone cancer in animals, and epidemiological studies suggest that it may cause lung cancer in humans. Acute respiratory effects are associated with inhalation of beryllium, and dermal exposure can cause contact dermatitis. Chronic exposure to beryllium was reported to have adverse effects on aquatic organisms at levels as low as 5.3 µg/liter.

CAS Number: 7440-41-7

Chemical Formula: Be

IUPAC Name: Beryllium

Chemical and Physical Properties (Metal)

Atomic Weight: 9.012

Boiling Point: 2970°C

Melting Point: 1278°C

Specific Gravity: 1.85 at 20°C

Solubility in Water: Insoluble; most salts are soluble

Solubility in Organics: Soluble in dilute acid and alkali; insoluble in alcohol, ether, and CCl_4

Transport and Fate

Most common beryllium compounds are readily soluble in water. However, in water, soluble beryllium salts are hydrolyzed to form beryllium hydroxide. The solubility of beryllium hydroxide is quite low (2 mg/liter) in the pH range of most natural waters. Formation of hydrated complexes may increase the solubility of beryllium somewhat, especially at higher pH where polynuclear hydroxide complexes may form. It is probable, however, that in most natural aquatic environments beryllium is present in particulate rather than dissolved form.

Although little information concerning adsorption of beryllium is available, based on its geochemical similarity to aluminum it is expected to be adsorbed onto clay mineral surfaces at low pH and to be complexed into some insoluble compounds at high pH. In most natural environments, beryllium is likely to be present in sorbed or precipitated, rather than dissolved, form.

Beryllium may be accumulated to a slight extent by aquatic organisms. Although it has a low solubility in water, it is possible that benthos could accumulate beryllium from sediment and thereby transfer the metal to higher organisms via the food chain. However, there is no evidence for food chain magnification. Airborne transport of beryllium, generally in the form of particulates, may also occur.

Health Effects

The results of some epidemiological studies of workers occupationally exposed to beryllium indicate that beryllium may cause lung cancer in humans. Although this evidence is equivocal, beryllium and many of its compounds are known to be carcinogenic in several animal species. Inhalation exposure to beryllium has resulted in the development of lung or bone cancer in animals, and exposure by injection has produced bone cancer. Although beryllium compounds may impair DNA polymerization, there is no other evidence of mutagenic or clastogenic activity. However, the number of compounds tested and the types of tests conducted have been limited. There is little information concerning the possible teratogenic effects of beryllium. It is reported to inhibit embryonic development of the snail and regeneration of the limbs of the salamander.

Acute respiratory effects due to beryllium exposure include rhinitis, pharyngitis, tracheobronchitis, and acute pneumonitis. Dermal exposure to soluble beryllium compounds can cause contact dermatitis. Ocular effects include inflammation of the conjunctiva from splash burns or in association with contact dermatitis. The most common clinical symptoms caused by chronic beryllium exposure are granulomatous lung inflammation, with accompanying cough, chest pain, and general weakness. Systemic effects include right heart enlargement with accompanying cardiac failure, liver and spleen enlargement, cyanosis, digital clubbing, and kidney stone development.

Toxicity to Wildlife and Domestic Animals

Data for several freshwater fish species indicate that the acute toxicity of beryllium decreases by about two orders of magnitude with an increase in hardness from about 20 to

400 mg/liter calcium carbonate. For example, acute values for the fathead minnow range from 150 to 20,000 µg/liter over this range of hardness. There does not appear to be much variation in sensitivity among the fish species tested at similar levels of hardness. Acute and chronic values for the invertebrate Daphnia magna in the same test water (hardness equal to 220 mg/liter) were reported to be 2,500 and 5.3 µg/liter, respectively, indicating a very large difference between acute and chronic toxicity. Only limited, inconclusive data exist concerning beryllium toxicity in saltwater species. Growth of the green alga Chlorella vannieli is inhibited at a beryllium concentration of 100,000 µg/liter. A bioconcentration factor of 19 with a half-life of one day in the whole body is reported for the bluegill.

Some toxicity due to beryllium has been seen in domestic animals. One of the earliest observed effects of beryllium toxicity was the development of rachitic bone changes after the addition of soluble beryllium salts to the diet of poultry and livestock. Approximately 0.125% beryllium carbonate in the food or water is required to produce a mild case.

Regulations and Standards

Ambient Water Quality Criteria (USEPA):

Aquatic Life

The available data are not adequate for establishing criteria. However, EPA did report the lowest concentrations of beryllium known to cause toxic effects in aquatic organisms.

Freshwater

Acute toxicity: 130 µg/liter
Chronic toxicity: 5.3 µg/liter

Saltwater

Acute toxicity: No available data
Chronic toxicity: No available data

Human Health

Estimates of the carcinogenic risks associated with lifetime exposure to various concentrations of beryllium in water are:

Risk	Concentration
10^{-5}	37 ng/liter
10^{-6}	3.7 ng/liter
10^{-7}	0.37 ng/liter

CAG Unit Risk (USEPA): 2.6 $(mg/kg/day)^{-1}$

OSHA Standards (air): 2 $\mu g/m^3$ TWA
5 $\mu g/m^3$ Ceiling Level
25 $\mu g/m^3$/30 min Peak Concentration

ACGIH Threshold Limit Value: Suspected human carcinogen
2 $\mu g/m^3$

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CADMIUM

Summary

Cadmium is a metal that can be present in a variety of chemical forms in wastes or in the environment. Some forms are insoluble in water, but cadmium is relatively mobile in the aquatic environment. Cadmium is carcinogenic in animals exposed by inhalation and may also be in humans. It is uncertain whether it is carcinogenic in animals or humans exposed via ingestion. Cadmium is a known animal teratogen and reproductive toxin. It has chronic effects on the kidney, and background levels of human exposure are thought to provide only a relatively small margin of safety for these effects.

Background Information

Cadmium is a soft, bluish white metal that is obtained as a by-product from the treatment of the ores of copper, lead, and iron. Cadmium has a valence of +2 and has properties similar to those of zinc. Cadmium forms both organic and inorganic compounds. Cadmium sulfate is the most common salt.

CAS Number: 7440-43-9

Chemical Formula: Cd

IUPAC Name: Cadmium

Chemical and Physical Properties

Atomic Weight: 112.41

Boiling Point: 765°C

Melting Point: 321°C

Specific Gravity: 8.642

Solubility in Water: Salts are water soluble; metal is insoluble

Solubility in Organics: Variable, based on compound

Vapor Pressure: 1 mm Hg at 394°C

Transport and Fate

Cadmium is relatively mobile in the aquatic environment compared to other heavy metals (USEPA 1979). It is removed from aqueous media by complexing with organic materials and subsequently being adsorbed to the sediment. It appears that cadmium moves slowly through soil, but only limited information on soil transport is available. Cadmium uptake by plants is not a significant mechanism for depletion of soil accumulations but may be significant for human exposure.

Health Effects

There is suggestive evidence linking cadmium with cancer of the prostate in humans (USEPA 1980). In animal studies, exposure to cadmium by inhalation caused lung tumors in rats, and exposure by injection produced injection-site sarcomas and/or Leydig-cell tumors (Takenaka 1983, USEPA 1981). An increased incidence of tumors has not been seen in animals exposed to cadmium orally, but four of the five available studies were inadequate by current standards (Clement 1983).

The evidence from a large number of studies on the mutagenicity of cadmium is equivocal, and it has been hypothesized that cadmium is not directly mutagenic but impedes repair (Clement 1983). Cadmium is a known animal teratogen and reproductive toxin. It has been shown to cause renal dysfunction in both humans and animals. Other toxic effects attributed to cadmium include immunosuppression (in animals), anemia (in humans), pulmonary disease (in humans), possible effects on the endocrine system, defects in sensory function, and bone damage. The oral LD_{50} in the rat was 225 mg/kg (NIOSH 1983).

Toxicity to Wildlife and Domestic Animals

Laboratory experiments suggest that cadmium may have adverse effects on reproduction in fish at levels present in lightly to moderately polluted waters.

The acute LC_{50} for freshwater fish and invertebrates generally ranged from 100 to 1,000 µg/liter; salmonids are much more sensitive than other organisms (USEPA 1980). Saltwater species were in general 10-fold more tolerant to the acute effects of cadmium. Chronic tests have been performed and show that cadmium has cumulative toxicity and acute-chronic ratios that range of from 66 to 431. Bioconcentration factors were generally less than 1,000 but were as high as 10,000 for some freshwater fish species.

No adverse effects on domestic or wild animals were reported in the studies reviewed.

Regulations and Standards

Ambient Water Quality Criteria (USEPA):

Aquatic Life (Proposed 1984)

Freshwater

Acute toxicity: $e^{(1.30[\ln(\text{hardness})] - 3.92)}$ µg/liter

Chronic toxicity: $e^{(0.87[\ln(\text{hardness})] - 4.38)}$ µg/liter

Saltwater

Acute toxicity: 38 µg/liter
Chronic toxicity: 12 µg/liter

Human Health

Criterion: 10 µg/liter

CAG Unit Risk for inhalation exposure (USEPA): 6.1 $(\text{mg/kg/day})^{-1}$

Interim Primary Drinking Water Standard (USEPA): 10 µg/liter

NIOSH Recommended Standards: 40 $\mu g/m^3$ TWA
200 $\mu g/m^3$/15 min Ceiling Level

OSHA Standards: 200 $\mu g/m^3$ TWA
600 $\mu g/m^3$ Ceiling Level

ACGIH Threshold Limit Values: 50 $\mu g/m^3$ TWA

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CHLORDANE

Summary

Chlordane is an organochlorine pesticide that was formerly used on field crops and is presently used to control structural pests in homes. Technical chlordane is a complex mixture that includes two isomers of chlordane, heptachlor, and two isomers of nonachlor. It is very persistent in the environment and is strongly bioaccumulated in fish and other aquatic organisms. Chlordane causes liver tumors in mice, and the results of a mutagenicity assay were positive. It also has adverse reproductive effects in mice, and chronic exposure causes liver changes and adversely affects the central nervous system. Chlordane is very toxic to aquatic organisms.

Background Information

Technical chlordane is a complex mixture, the major components of which are cis-chlordane and trans-chlordane. The technical product also contains a variety of other chlorinated hydrocarbons, including heptachlor. It is a viscous amber-colored liquid. Much of the available literature does not distinguish between the chlordane isomers and appears to discuss mixtures of these compounds.

CAS Number: Chlordane (mixture): 57-74-9
cis-Chlordane: 5103-74-2
trans-Chlordane: 5103-71-9

Chemical Formula: $C_{10}H_6Cl_8$

IUPAC Name: 1,2,4,5,6,7,8,8-Octachloro-2,3,3a,4,7,7a-hexahydro-4,7-methanoindene

Important Synonyms and Trade Names: cis-Chlordane: alpha-Chlordane
trans-Chlordane: gamma-Chlordane

Chemical and Physical Properties

Molecular Weight: 409.8

Boiling Point: 175°C at 2 mm Hg

Melting Point: cis-Chlordane: 107-109°C,
trans-Chlordane: 103-105°C

Specific Gravity: 1.59-1.635 at 16°C (technical chlordane)

Solubility in Water: From 0.056 to 1.85 mg/liter at 25°C

Solubility in Organics: Miscible in aliphatic and aromatic solvents (technical chlordane)

Log Octanol/Water Partition Coefficient: 2.78

Vapor Pressure: 1×10^{-5} mm Hg at 20°C (refined product)

Flash Point: Minimum 81°C (technical chlordane)

Transport and Fate

Chlordane is very persistent in the environment, resisting chemical and biological degradation into harmless substances. Chlordane in clear water is somewhat volatile, and this may be an important loss process. Less loss of chlordane from aquatic systems occurs when organics are present, and residue concentrations in sediment are often much higher than in water. Therefore, sorption to sediments is probably important in removing the chemical from the aquatic environment. Chlordane binds tightly to soil particles and persists for years in soil after surface application. However, chlordane applied as an emulsifiable concentrate is more readily volatilized than when it is applied as a granular formulation. Certain food and feed crops accumulate residues by absorption from the soil. Atmospheric transport of vapors and contaminated dust particles from soil application sites can occur.

Health Effects

Mixtures of cis-chlordane and trans-chlordane produce liver cancer in mice. Chlordane also has mutagenic effects in at least one test system. Reproductive effects, including developmental defects and neonatal metabolic and biochemical disorders, are observed in the offspring of mice exposed to chlordane. Tests with laboratory animals, primarily rodents, demonstrate acute and chronic toxic effects. Either isomer alone, or a mixture of the two, appears to exhibit approximately equal toxicity. Acute effects include anorexia, weight loss, tremors, convulsions, and death. Chronic exposure to chlordane causes liver changes and induces or suppresses a variety of enzyme systems. In addition, chlordane may act as a cumulative neurotoxin. The oral LD_{50} in the rat is 283 mg/kg. Oxychlordane, an epoxide metabolite formed from either chlordane isomer, is significantly more acutely toxic than chlordane. The oral LD_{50} of oxychlordane administered to rats in corn oil is 19 mg/kg, and it is 43 mg/kg when administered in an aqueous suspension.

Acute oral or skin exposure to chlordane can cause vomiting, seizures, electroencephalographic dysrhythmia, convulsions, and death in humans. However, most reports of human toxicity are inconclusive. Oxychlordane has been found in a high percentage of human adipose tissue samples and also in human milk samples.

Toxicity to Wildlife and Domestic Animals

The toxic effects of chlordane are seen at relatively low concentrations in some fish and invertebrate species. Chlordane also shows strong tendencies for bioaccumulation in some aquatic and terrestrial organisms. It can concentrate at levels thousands of times greater than the surrounding water medium in a variety of aquatic organisms, including bacteria, algae, daphnids, and fish. The EPA criteria for acute exposure to freshwater species is 2.4 µg/liter, and it is 0.17 µg/liter for chronic exposure. The corresponding Acute and Chronic Values for saltwater species are 0.09 µg/liter, 0.0064 µg/liter, and 0.0040 µg/liter. The Final Acute-Chronic Ratio is 14. Very little information exists concerning the biotransformation of chlordane. Although biotransformations may be important for the ultimate degradation of chlordane, these processes are likely to be very slow.

Chlordane or oxychlordane residues have been found in a wide variety of wildlife and domestic animal species, but usually at relatively low levels. Chlordane does not appear to be extensively concentrated in the higher members of the terrestrial food chain. Studies indicate that chlordane may produce toxic effects in certain soil invertebrates after surface application. Although little information concerning bioaccumulation in these organisms is available, the potential bioconcentration of chlordane or oxychlordane by terrestrial insectivores is of concern. Little information on the toxic effects of chlordane to mammalian wildlife and domestic animal species is available. Chlordane or oxychlordane residues have been found in crops, meat, fish and poultry, dairy products, and eggs. Oral LD_{50} values for chlordane ranging from 331 to 858 ppm in the diet (approximately 25-50 mg/kg) are reported for a variety of wild bird species. Oral LD_{50} values ranging from 100 to 1,000 mg/kg are reported for a variety of animals, including rodents, goats, sheep, and chickens.

Regulations and Standards

Ambient Water Quality Criteria (USEPA):

Aquatic Life

Freshwater

Acute toxicity: 2.4 µg/liter
Chronic toxicity: 0.0043 µg/liter

Saltwater

Acute toxicity: 0.09 µg/liter
Chronic toxicity: 0.0040 µg/liter

Human Health

Estimates of the carcinogenic risks associated with lifetime exposure to various concentrations of chlordane in water are:

Risk	Concentration
10^{-5}	4.6 ng/liter
10^{-6}	0.46 ng/liter
10^{-7}	0.046 ng/liter

CAG Unit Risk (USEPA): 1.6 $(mg/kg/day)^{-1}$

OSHA Standard (skin): 0.5 mg/m^3 TWA

ACGIH Threshold Limit Values (skin): 0.5 mg/m^3 TWA
2 mg/m^3 STEL

Department of Transportation: Combustible liquid

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CHLOROETHANE

Summary

Chloroethane is used as a solvent, as a refrigerant, and as a raw material in the manufacture of tetraethyl lead. It is fairly volatile in the environment. Chloroethane caused headaches and dizziness in workers exposed to high levels. It causes kidney damage and liver changes in chronically exposed animals.

CAS Number: 75-00-3

Chemical Formula: C_2H_5Cl

IUPAC Name: Chloroethane

Important Synonyms and Trade Names: Ethyl chloride, monochloroethane

Chemical and Physical Properties

Molecular Weight: 64.52

Boiling Point: 12.3°C

Melting Point: -136.4°C

Specific Gravity: 0.8978 at 20°C

Solubility in Water: 5740 mg/liter at 20°C

Solubility in Organics: Soluble in alcohol and ether

Log Octanol/Water Partition Coefficient: 1.54

Vapor Pressure: 1,000 mm Hg at 20°C

Vapor Density: 2.23

Transport and Fate

Chloroethane is probably not very persistent in the environment. It volatilizes rapidly from water; once in the atmosphere, it is photooxidized, and formyl chloride is the initial oxidation product. Hydrolysis may also occur in surface water or in moist soil. Biodegradation, sorption, and bioaccumulation probably are not important fate processes for chloroethane.

Health Effects

Chloroethane is presently being tested by the National Toxicology Program (NTP) for carcinogenicity and genetic toxicity. No information evaluating its reproductive toxicity or teratogenicity was found. Chloroethane caused minor neurological effects (e.g., headache, dizziness) in workers exposed to high levels. In animals, chronic exposure to chloroethane caused kidney damage and fatty changes in the liver, and at high levels upset cardiac rhythm. Monochloroethane is considered to be the least toxic of the chlorinated ethanes.

Toxicity to Wildlife and Domestic Animals

No information was found on the toxicity of chloroethane to wildlife or domestic animals. The toxicity of other chlorinated ethanes to aquatic organisms generally declines with decreasing chlorine content. Therefore, chloroethane is probably less toxic than 1,2-dichloroethane, which causes acute toxicity at about 120 mg/liter and chronic toxicity at 20 mg/liter.

Regulations and Standards

Ambient Water Quality Criteria (USEPA):

The available data were not adequate for establishing criteria.

OSHA Standard (air): 2,600 mg/m^3 TWA

ACGIH Threshold Limit Values: 2,600 mg/m^3 TWA
3,250 mg/m^3 STEL

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CHLOROFORM

Summary

Chloroform (trichloromethane) is often produced during the chlorination of drinking water and thus is a common drinking water contaminant. It is volatile in surface waters and is not likely to be persistent in the environment. Chloroform caused an increase in kidney epithelial tumors in rats and in hepatocellular carcinomas in mice. In addition, there is suggestive evidence from epidemiological studies that exposure to chloroform and other trihalomethanes is associated with an increased incidence of bladder tumors in humans. Other toxic effects of chloroform include central nervous system depression; eye, skin, and gastrointestinal irritation; and damage to the liver, heart, and kidney.

CAS Number: 67-66-3

Chemical Formula: $CHCl_3$

IUPAC Name: Trichloromethane

Chemical and Physical Properties

Molecular Weight: 119.38

Boiling Point: 61.7°C

Melting Point: -63.5°C

Specific Gravity: 1.4832 at 20°C

Solubility in Water: 8,200 mg/liter at 20°C

Solubility in Organics: Soluble in acetone; miscible with alcohol, ether, benzene, and ligroin

Log Octanol/Water Partition Coefficient: 1.97

Vapor Pressure: 150.5 mm Hg at 20°C

Vapor Density: 4.12

Transport and Fate

Volatilization into the atmosphere is the major transport process for removal of chloroform from aquatic systems (USEPA 1979). Once in the troposphere, chloroform is attacked by hydroxyl radicals with the subsequent formation of phosgene ($COCl_2$) and possibly chlorine oxide (ClO) radicals. Neither of these reaction products is likely to persist; phosgene is readily hydrolyzed to hydrochloric acid and carbon dioxide. Reaction with hydroxy radicals is thought to be the primary environmental fate of chloroform. However, chloroform that remains in the troposphere may return to earth in precipitation or adsorbed on particulates, and a small amount may diffuse upward to the stratosphere where it photodissociates via interaction with ultraviolet light.

Photolysis, hydrolysis, and sorption do not appear to be significant environmental fate processes for chloroform. However, sorption processes may have some importance as a removal mechanism in groundwater and soil. The log octanol/water partition coefficient indicates that this compound may bioaccumulate under conditions of constant exposure. Studies with marine organisms provide evidence for only weak to moderate bioaccumulation. Although chloroform is somewhat lipophilic and tends to be found at higher concentrations in fatty tissues, there is no evidence for biomagnification in aquatic food chains.

Health Effects

Chronic administration of chloroform by gavage is reported to produce a dose-related increase in the incidence of kidney epithelial tumors in rats and a dose-related increase in the incidence of hepatocellular carcinomas in mice (IARC 1979, USEPA 1980). Epidemiological studies suggest that higher concentrations of chloroform and other trihalomethanes in water supplies may be associated with an increased frequency of bladder cancer in humans. However, these results are not sufficient to establish causality. An increased incidence of fetal abnormalities was reported in offspring of pregnant rats exposed to chloroform by inhalation. Oral doses of chloroform that caused maternal toxicity produced relatively mild fetal toxicity in the form of reduced birth weights. There are limited data suggesting that chloroform has mutagenic activity in some test systems. However, negative results have been reported for bacterial mutagenesis assays.

Humans may be exposed to chloroform by inhalation, ingestion, or skin contact. Toxic effects include local irritation of the skin or eyes, central nervous system depression, gastrointestinal irritation, liver and kidney damage, cardiac arrhythmia, ventricular tachycardia, and bradycardia. Death from

chloroform overdosing can occur and is attributed to ventricular fibrillation. Chloroform anesthesia can produce delayed death as a result of liver necrosis.

Exposure to chloroform by inhalation, intragastric administration, or intraperitoneal injection produces liver and kidney damage in laboratory animals. The oral LD_{50} and inhalation LC_{Lo} values for the rat are 908 mg/kg and 39,000 mg/m^3 per 4 hours, respectively (ACGIH 1980).

Toxicity to Wildlife and Domestic Animals

Limited information is available concerning the toxicity of chloroform to organisms exposed at known concentrations (USEPA 1980). Median effect concentrations for two freshwater and one invertebrate species range from 28,900 to 115,000 µg/liter. Twenty-seven day LC_{50} values of 2,030 and 1,240 µg/liter were reported for embryo-larval tests with rainbow trout in water at two levels of hardness. The only reliable result concerning the toxicity of chloroform to saltwater aquatic life is a 96-hour LC_{50} value of 81,500 µg/liter for pink shrimp.

An equilibrium bioconcentration factor of six with a tissue half-life of less than 1 day was determined for the bluegill. Although chloroform is not strongly bioaccumulated, it is thought to be widely distributed in the environment and can be detected in fish, water birds, marine mammals, and various crops.

Regulations and Standards

Ambient Water Quality Criteria (USEPA):

Aquatic Life

The available data are not adequate for establishing criteria.

Human Health

Estimates of the carcinogenic risks associated with lifetime exposure to various concentrations of chloroform in water are:

Risk	Concentration
10^{-5}	1.90 µg/liter
10^{-6}	0.19 µg/liter
10^{-7}	0.019 µg/liter

CAG Unit Risk (USEPA): 8.1×10^{-2} (mg/kg/day)$^{-1}$

Primary Drinking Water Standard: 0.10 mg/liter (total trihalomethanes)

NIOSH Recommended Standard: 9.8 mg/m^3 1-hr Ceiling Level

OSHA Standard: 244 mg/m^3 Ceiling Level

ACGIH Threshold Limit Value: 50 mg/m^3 (suspected human carcinogen)

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Summary

Chromium is a heavy metal that generally exists in either a trivalent or hexavalent oxidation state. Hexavalent chromium (Cr VI) is rather soluble and is quite mobile in groundwater and surface water. However, in the presence of reducing agents it is rapidly converted to trivalent chromium (Cr III), which is strongly adsorbed to soil components and consequently is much less mobile. A number of salts of hexavalent chromium are carcinogenic in rats. In addition, an increased incidence of lung cancer was seen in workers occupationally exposed to chromium VI. Hexavalent chromium also causes kidney damage in animals and humans. Trivalent chromium is less toxic than hexavalent chromium; its main effect is contact dermatitis in sensitive individuals.

CAS Number: 7440-47-3

Chemical Formula: Cr

IUPAC Name: Chromium

Chemical and Physical Properties (Metal)

Atomic Weight: 51.996

Boiling Point: 2672°C

Melting Point: 1857 ± 20°C

Specific Gravity: 7.20 at 28°C

Solubility in Water: Insoluble; some compounds are soluble

Transport and Fate

Hexavalent Cr is quite soluble, existing in solution as a component of a complex anion. It is not sorbed to any significant degree by clays or hydrous metal oxides. The anionic form varies according to pH and may be a chromate, hydrochromate, or dichromate. Because all anionic forms are so soluble, they are quite mobile in the aquatic environment. Cr VI is efficiently

removed by activated carbon and thus may have some affinity for organic materials in natural water. Cr VI is a moderately strong oxidizing agent and reacts with reducing materials to form trivalent chromium. Most Cr III in the aquatic environment is hydrolyzed and precipitates as chromium hydroxide. Sorption to sediments and bioaccumulation will remove much of the remaining Cr III from solution. Cr III is adsorbed only weakly to inorganic materials. Cr III and Cr VI are readily interconvertible in nature depending on microenvironmental conditions such as pH, hardness, and the types of other compounds present. Soluble forms of chromium accumulate if ambient conditions favor Cr VI. Conditions favorable for conversion to Cr III lead to precipitation and adsorption of chromium in sediments.

In air, chromium is associated almost entirely with particulate matter. Sources of chromium in air include windblown soil and particulate emissions from industrial processes. Little information is available concerning the relative amounts of Cr III and Cr VI in various aerosols. Relatively small particles can form stable aerosols and can be transported many miles before settling out.

Cr III tends to be adsorbed strongly onto clay particles and organic particulate matter, but can be mobilized if it is complexed with organic molecules. Cr III present in minerals is mobilized to different extents depending on the weatherability and solubility of the mineral in which it is contained. Hexavalent compounds are not strongly adsorbed by soil components and Cr VI is mobile in groundwater. Cr VI is quickly reduced to CR III in poorly drained soils having a high content of organic matter. Cr VI of natural origin is rarely found in soils.

Health Effects

The hexavalent form of chromium is of major toxicological importance in higher organisms. A variety of chromate (Cr VI) salts are carcinogenic in rats and an excess of lung cancer has been observed among workers in the chromate-producing industry. Cr VI compounds can cause DNA and chromsome damage in animals and humans, and Cr (VI) trioxide is teratogenic in the hamster. Inhalation of hexavalent chromium salts causes irritation and inflammation of the nasal mucosa, and ulceration and perforation of the nasal septum. Cr VI also produces kidney damage in animals and humans. The liver is also sensitive to the toxic effects of hexavalent Cr, but apparently less so than the kidneys or respiratory system. Cr III is less toxic than Cr VI; its main effect in humans is a form of contact dermatitis in sensitive individuals.

Toxicity to Wildlife and Domestic Animals

Chromium is an essential nutrient and is accumulated in a variety of aquatic and marine biota, especially benthic organisms, to levels much higher than in ambient water. Levels in biota, however, usually are lower than levels in the sediments. Passage of chromium through the food chain can be demonstrated. The food chain appears to be a more efficient pathway for chromium uptake than direct uptake from seawater.

Water hardness, temperature, dissolved oxygen, species, and age of the test organism all modify the toxic effects of chromium on aquatic life. Cr III appears to be more acutely toxic to fish than Cr VI; the reverse is true in long term chronic exposure studies.

None of the plants normally used as food or animal feed are chromium accumulators. Chromium absorbed by plants tends to remain primarily in the roots and is poorly translocated to the leaves. There is little tendency for chromium to accumulate along food chains in the trivalent inorganic form. Organic chromium compounds, about which little is known, can have significantly different bioaccumulation tendencies. Little information concerning the toxic effects of chromium on mammalian wildlife and domestic animal species is available.

Regulations and Standards

Ambient Water Quality Criteria (USEPA):

Cr VI:

Aquatic Life (Proposed Criteria)

Freshwater

Acute toxicity: 11 µg/liter
Chronic toxicity: 7.2 µg/liter

Saltwater

Acute toxicity: 1,200 µg/liter
Chronic toxicity: 54 µg/liter

Human Health

Criterion: 50 µg/liter

Cr III:

Aquatic Life (Proposed Criteria)

Freshwater

Acute toxicity: $e^{(0.819[\ln(\text{hardness})]+3.568)}$ µg/liter

Chronic toxicity: $e^{(0.819\ [\ln(\text{hardness})])+0.537)}$ µg/liter

Saltwater

The available data are not adequate for establishing criteria.

Human Health

Criterion: 170 mg/liter

CAG Unit Risk for inhalation exposure to CR VI (USEPA): 41 $(\text{mg/kg/day})^{-1}$

National Interim Primary Drinking Water Standard: 50 µg/liter

NIOSH Recommended Standards for CR VI: 1 $\mu g/m^3$ carcinogenic
25 $\mu g/m^3$ noncarcinogenic TWA
50 $\mu g/m^3$ noncarcinogenic (15-min sample)

OSHA Standards: OSHA air standards have been set for several chromium compounds. Most recognized or suspected carcinogenic chromium compounds have ceiling limits of 100 $\mu g/m^3$.

ACGIH Threshold Limit Values: Several chromium compounds have TWAs ranging from 0.05 to 0.5 mg/m^3. Chromite ore processing (chromate), certain water insoluble Cr VI compounds, and chromates of lead and zinc are recognized or suspected human carcinogens and have 0.05 mg/m^3 TWAs.

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CHRYSENE

Summary

Chrysene is a five-ringed polycyclic aromatic hydrocarbon (PAH). It is rather persistent in the environment; biodegradation is probably the ultimate fate process. Dermal application of chrysene produces skin tumors in mice, and subcutaneous injection produces local sarcomas. Chrysene was found to be mutagenic using several test systems. Although there is little information on other toxic effects of chrysene, carcinogenic PAHs as a group cause skin disorders and have an immunosuppressive effect.

CAS Number: 218-01-9

Chemical Formula: $C_{18}H_{12}$

IUPAC Name: Chrysene

Important Synonyms and Trade Names: 1,2-Benzophenanthrene; benz(a)phenanthrene

Chemical and Physical Properties

Molecular Weight: 228.28

Boiling Point: 448°C

Melting Point: 256°C

Specific Gravity: 1.274 at 20°C

Solubility in Water: 0.002 mg/liter at 25°C

Solubility in Organics: Soluble in ether, alcohol, glacial and acetic acid

Log Octanol/Water Partition Coefficient: 5.61

Vapor Pressure: 10^{-11} to 10^{-6} mm Hg at 20°C

Transport and Fate

Very little specific information concerning the environmental transport and fate of chrysene is available. However, data can be derived with reasonable confidence from information concerning benzo(a)anthracene and other related polycyclic aromatic hydrocarbons (PAHs). Dissolved chrysene may undergo rapid, direct photolysis in aquatic systems. However, the relative importance of this process as an environmental fate is unknown. Singlet oxygen is the oxidant and quinones are the products in photolysis reactions involving polycyclic aromatic hydrocarbons. Free-radical oxidation of chrysene is likely to be slow and is not likely to be a significant fate process. Because chrysene does not contain groups amenable to hydrolysis, this process is not thought to be a significant environmental fate. Volatilization does not appear to be an important transport process.

Chrysene probably accumulates in the sediment and biota portions of the aquatic environment, and adsorption to suspended matter is likely to be the dominant transport process. It is probable that sorption onto sediments, soil particles, and biota is strongly correlated with the organic carbon levels present. Bioaccumulation of chrysene is expected to be short term and is not an important fate process. Although polycyclic aromatic hydrocarbons with four or less aromatic rings, like chrysene, are readily and quickly bioaccumulated, they also are rapidly metabolized and excreted. These kinds of PAHs are degraded by microbes and readily metabolized by multicellular organisms. Degradation by mammals is considered to be incomplete; the parent compound and metabolites are excreted by the urinary system. Biodegradation is probably the ultimate fate process for chrysene. However, the speed and extent of this process are unknown. Biodegradation of PAHs generally occurs more rapidly in soil than in aquatic systems and is also faster in those systems chronically contaminated with these compounds.

Atmospheric transport of chrysene can occur, and chrysene can be returned to aquatic and terrestrial systems by atmospheric fallout and with precipitation. It can enter surface and groundwaters by leaching from polluted soils.

Health Effects

The potential for polycyclic aromatic hydrocarbons to induce malignant transformation dominates the consideration given to health hazards resulting from exposure. This is because overt signs of toxicity are often not produced until the dose is sufficient to produce a high tumor incidence.

No case reports or epidemiological studies on the significance of chrysene exposure to humans are available. However, coal tar and other materials known to be carcinogenic to humans may contain chrysene. Chrysene produces skin tumors in mice following repeated dermal application. High subcutaneous doses are reported to result in a low incidence of tumors with a long induction time in mice. Chrysene is considered to have weak carcinogenic activity compared to benzo(a)pyrene. Chrysene is reported to be mutagenic in a variety of test systems. No information concerning the teratogenic effects of chrysene in humans or experimental animals is available.

Although there is little information concerning other toxic effects of chrysene, it is reported that applying the carcinogenic PAHs to mouse skin leads to the destruction of sebaceous glands, hyperplasia, hyperkeratosis, and ulceration. Workers exposed to materials containing these compounds may exhibit chronic dermatitis, hyperkeratoses, and other skin disorders. Although specific results with chrysene are not reported, it has been shown that many carcinogenic PAHs have an immunosuppressive effect.

Toxicity to Wildlife and Domestic Animals

Adequate data for characterization of the toxicity of chrysene to domestic animals and wildlife are not available.

Regulations and Standards

Ambient Water Quality Criteria (USEPA):

Aquatic Life

The available data are not adequate for establishing criteria.

Human Health

Estimates of the carcinogenic risks associated with lifetime exposure to various concentrations of carcinogenic PAHs in water are:

Risk	Concentration
10^{-5}	28 ng/liter
10^{-6}	2.8 ng/liter
10^{-7}	0.28 ng/liter

COPPER

Summary

Copper is among the more mobile metals in the environment. It is toxic to humans at high levels; it causes irritation following acute exposure and anemia following chronic exposure. Sheep are very susceptible to copper toxicosis, as are many aquatic organisms.

Background Information

Copper exists in a valence state of +1 or +2. It is a lustrous, reddish metal. The physical properties of copper include ductility and conductivity of heat and electricity. Copper is found in nature as sulfide, oxide, or carbonate ore.

CAS Number: 7440-50-8

Chemical Formula: Cu

IUPAC Name: Copper

Chemical and Physical Properties

Atomic Weight: 63.546

Boiling Point: 2,567°C

Melting Point: 1,083°C

Specific Gravity: 8.92

Solubility in Water: Most copper salts are insoluble, with the exception of $CuSO_4$, $Cu(NO_3)_2$, and $CuCl_2$ (the more common copper salts). The metal is insoluble in water.

Vapor Pressure: 1 mm Hg at 1,628°C

Transport and Fate

Copper has two oxidation states, +1 (cuprous) and +2 (cupric). Cuprous copper is unstable in aerated water over the pH range of most natural waters (6 to 8) and oxidizes to the cupric state. Several processes determine the fate of copper in the aquatic environment: formation of complexes, especially with humic substances; sorption to hydrous metal oxides, clays, and organic materials; and bioaccumulation. In waters polluted

with soluble organic material, complexation with organic ligands can occur, thus favoring the prolonged dispersion of copper in solution. The presence of organic acids also can lead to the mobilization of copper from the sediments to solution. Copper has a strong affinity for hydrous iron and manganese oxides, clays, carbonate minerals, and organic matter. Sorption to these materials, both suspended in the water column and in the sediment, results in relative enrichment of the solid phase and reduction in dissolved levels. Sorption processes are quite efficient in scavenging dissolved copper and in controlling its mobility in natural unpolluted streams. The amounts of the various copper compounds and complexes that actually exist in solution depend on the pH, temperature, alkalinity, and concentrations of other chemical species. The levels of copper able to remain in solution are directly dependent on water chemistry. Generally, ionic copper is more soluble in low pH waters and less soluble in high pH waters.

As an essential nutrient, copper is accumulated by plants and animals, although apparently it is not generally biomagnified. Because copper is strongly bioaccumulated and because biogenic ligands play an important role in complexing copper, biological activity is a major factor in determining the distribution and occurrence of copper in the ecosystem. For example, bioaccumulation patterns may exhibit seasonal variations related to biological activity.

Because many copper compounds and complexes are readily soluble, copper is among the more mobile heavy metals in soil and other surface environments. The major process that limits the environmental mobility of copper is adsorption to organic matter, clays, and other materials. Atmospheric transport of copper compounds can also occur.

Health Effects

Copper appears to increase the mutagenic activity of triose reductone and ascorbic acid in bacterial test systems. However, copper itself does not appear to have mutagenic, teratogenic or carcinogenic effects in animals or humans. Dietary levels of trace elements such as molybdenum, sulfur, zinc, and iron can affect the level of copper that produces certain deficiency or toxicity symptoms. In general, more attention is given to the problems associated with copper deficiency than to problems of excess copper in the environment. However, high levels of copper can be toxic to humans.

Exposure to metallic copper dust can cause a short-term illness similar to metal fume fever that is characterized by chills, fever, aching muscles, dryness of mouth and throat, and headache. Exposure to copper fumes can produce upper

respiratory tract irritation, a metallic or sweet taste, nausea, metal fume fever, and sometimes discoloration of skin and hair. Individuals exposed to dusts and mists of copper salts may exhibit congestion of nasal mucous membranes, sometimes of the pharynx, and occasionally ulceration with perforation of the nasal septum.

If sufficient concentrations of copper salts reach the gastrointestinal tract, they act as irritants and can produce salivation, nausea, vomiting, gastritis, and diarrhea. Elimination of ingested ionic copper by vomiting and diarrhea generally protects the patient from more serious systemic toxic effects, which can include hemolysis, hepatic necrosis, gastrointestinal bleeding, oliguria, azotemia, hemoglobinuria, hematuria, proteinuria, hypotension, tachycardia, convulsions, and death. Chronic exposure may result in anemia.

Copper salts act as skin irritants producing an itching eczema. Conjunctivitis or even ulceration and turbidity of the cornea may result from direct contact of ionic copper with the eye.

Toxicity to Wildlife and Domestic Animals

Mean acute toxicity values for a large number of freshwater animals range from 7.2 µg/liter for Daphnia pulicaria to 10,200 µg/liter for the bluegill. Toxicity tends to decrease as hardness, alkalinity, and total organic carbon increase. Chronic values for a variety of freshwater species range from 3.9 µg/liter for brook trout to 60.4 µg/liter for northern pike. Hardness does not appear to affect chronic toxicity. The acute-chronic ratios for different species range from 3 to 156. The more sensitive species tend to have lower ratios than the less sensitive species. In addition, the ratio seems to increase with hardness. Acute toxicity values for saltwater organisms range from 17 µg/liter for a calanoid copepod to 600 µg/liter for the shore crab. A chronic value of 54 µg/liter and an acute-chronic ratio of 3.4 is reported for the mysid shrimp. Long-term exposure to 5 µg/liter is fatal to the bay scallop.

Bioconcentration factors in freshwater species range from zero for the bluegill to 2,000 for the alga Chlorella regularis. Among saltwater species, the highest bioaccumulation factors are those for the bivalve molluscs. Oysters can bioaccumulate copper up to 28,200 times without any significant mortality.

Sheep are very susceptible to copper toxicosis, and poisoning may be acute or chronic. Acute poisoning is caused by direct action of copper salts on the gastrointestinal tract, resulting in gastroenteritis, shock, and death. The toxic dose is about 200 mg/kg and is usually obtained through an

accidental overdose of an antihelminthic. Ingestion of excess copper over a long period of time results in absorption and accumulation of copper by the liver. This type of chronic cumulative poisoning may suddenly develop into an acute hemolytic crisis. Copper intake of 1.5 g/day for 30 days is known to be fatal for many breeds of sheep. Excessive copper may be stored in the liver as a result of excess copper ingestion, as a consequence of impaired liver function, or in connection with a deficiency or excess of other trace elements. Sheep eliminate accumulated copper very slowly after cessation of exposure.

Swine develop copper poisoning at levels of 250 mg/kg in the diet unless zinc and iron levels are increased. Toxicosis develops with hypochromic microcytic anemia, jaundice, and marked increases in liver and serum copper levels as well as serum aspartate amino transferase. High copper levels may be found in swine because of the practice of feeding them high copper diets in order to increase daily weight gain. However, swine rapidly eliminate copper once it is removed from the diet. Cattle are much more resistant to copper in the diet than sheep or swine. Copper toxicity in ruminants can be counteracted by including molybdenum and sulfate in the diet.

Regulations and Standards

Ambient Water Quality Criteria (USEPA):

Aquatic Life (Proposed)

Freshwater

Acute toxicity: $e^{(0.905\ [\ln(\text{hardness})]\ -\ 1.413)}$ µg/liter

Chronic toxicity: $e^{(0.905\ [\ln(\text{hardness})]\ -\ 1.785)}$ µg/lite

Saltwater

Acute toxicity: 3.2 µg/liter
Chronic toxicity: 2.0 µg/liter

Human Health

Organoleptic criterion: 1 mg/liter

National Secondary Drinking Water Standards (USEPA): 1 mg/liter

OSHA Standards: 1.0 mg/m^3 TWA (dust and mist)
0.1 mg/m^3 TWA (fume)

ACGIH Threshold Limit Values: 1.0 mg/m^3 TWA (dusts and mists)
0.2 mg/m^3 TWA (fume)
2.0 mg/m^3 STEL (dusts and mists)

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Summary

DDT is an organochlorine pesticide, which together with its metabolites, is very persistent in the environment. DDT, DDE, and DDD have been shown to be carcinogenic in mice. They primarily cause liver tumors, but they also increase the incidence of lung tumors and lymphomas. In addition, DDT is a reproductive toxin. Chronic exposure can damage the central nervous system and liver. DDT and other organochlorine pesticides are highly toxic to aquatic organisms and are responsible for the decreased reproductive success of many bird species.

Background Information

Technical DDT is a mixture containing 65-80% p,p'-DDT, 15-20% o,p'-DDT, up to 4% p,p'-DDD, and traces of other materials. Metabolites of DDT include p,p'-DDE and o,p'-DDD. The DDT isomers and metabolites are usually found together and generally have similar properties; therefore, they will be considered together. Where differences occur the specific isomer will be identified. DDT will be used to refer to the combination of technical material and metabolites. Specific DDT isomers will be identified as such.

CAS Number:
- p,p'-DDT: 50-29-3
- o,p'-DDT: 789-02-6
- p,p'-DDD: 72-54-8
- o,p'-DDD: 53-19-0
- p,p'-DDE: 72-55-9

Chemical Formula:
- p,p'- and o,p'-DDT: $C_{14}H_9Cl_5$
- p,p'- and o,p'-DDD: $C_{13}H_{10}Cl_4$
- p,p'- and o,p'-DDE: $C_{14}H_8Cl_4$

IUPAC Name:
- p,p'-DDT: 1,1,1-Trichloro-2,2-bis(4-chlorophenyl) ethane
- o,p'-DDT: 1,1,1-Trichloro-2-(2-chlorophenyl)-2-(4-chlorophenyl)ethane
- p,p'-DDD: 1,1-Dichloro-2,2-bis(4-chlorophenyl)-ethane
- o,p'-DDE: 1,1-Dichloro-2,2-bis(4-chlorophenyl)-ethene

Important Synonyms and Trade Names:

DDT: Dichlorodiphenyltrichloroethane, dicophane, chlorophenothane, Gesarol, Neocid
P,P'-DDD: TDE, Rothane

Chemical and Physical Properties

Molecular Weight: o,p'- and P,P'-DDT: 354.5
DDD: 320
DDE: 318

Boiling Point: DDT: 260°C

Melting Point: DDT: 109°C
DDD: 112°C
DDE: 90°C

Solubility in Water: P,P'-DDT: 5.5 µg/liter
o,P'-DDT: 26 µg/liter
P,P'-DDD: 20 µg/liter
DDE: 14 µg/liter

Solubility in Organics: DDT: Soluble in acetone, benzene, cyclohexanane, morpholine, pyridine, and dioxane

Log Octanol/Water Partition Coefficient:

DDT:	4.98
P,P'-DDT:	3.98
P,P'-DDD:	5.99
o,P'-DDD:	6.08
DDE:	5.69

Vapor Pressure:

P,P'-DDT:	1.9×10^{-7}	mm Hg at 25°C
P,P'-DDT:	7.3×10^{-7}	mm Hg at 30°C
o,P'-DDT:	5.5×10^{-6}	mm Hg at 30°C
P,P'-DDD:	1.0×10^{-6}	mm Hg at 30°C
o,P'-DDD:	1.9×10^{-6}	mm Hg at 30°C
DDE:	6.5×10^{-6}	mm Hg at 20°C

Transport and Fate

DDT and its metabolites are very persistent in the environment. Volatilization is probably the most important transport process from soil and water for P,P'-DDT and o,P'-DDT, as evidenced by the ubiquitous nature of DDT in the environment.

Sorption and bioaccumulation are the most important transport processes for the DDT isomers. Although it only occurs slowly, the ultimate fate process for p,p'-DDT, o,p'-DDT, and DDD is biotransformation to form bis(2-chlorophenyl)methanone (DDCO). Indirect photolysis may also be important for p,p'-DDT and o,p'-DDT in aquatic environments. For DDE, direct photolysis is the most important ultimate fate process in the environment, although biotransformation may also be important.

Health Effects

DDT, DDE, and DDD have been shown to be carcinogenic to mice, primarily causing liver tumors, but also causing lung tumors and lymphomas. DDT does not appear to be mutagenic, but it has caused chromosomal damage. There is no evidence that DDT is a teratogen; but it is a reproductive toxin, causing reduced fertility, reduced growth of offspring, and fetal mortality.

Chronic exposure to DDT causes a number of adverse effects, especially to the liver and central nervous system (CNS). DDT induces various microsomal enzymes and therefore probably affects the metabolism of steroid hormones and exogenous chemicals. Other effects on the liver include hypertrophy of the parenchymal cells and increased fat deposition. In the CNS, exposure to DDT causes behavioral effects such as decreased aggression and decreased conditional reflexes. Acute exposure to large doses or chronic exposure to lower doses causes seizures. The oral LD_{50} is between 113 and 450 mg/kg for the rat and is generally higher for other animals.

DDT, DDD, and DDE are bioconcentrated and stored in the adipose tissues of most animals.

Toxicity to Wildlife and Domestic Animals

DDT has been extensively studied in freshwater invertebrates and fishes and is quite toxic to most species. The range of toxicities was 0.18 to 1,800 µg/liter and the freshwater final acute value for DDT and its isomers was determined by EPA to be 1.1 µg/liter. Saltwater species were somewhat more sensitive to DDT; the saltwater final acute value for the DDT isomers was 0.13 µg/liter. Only one chronic toxicity test on aquatic species was reported. This test indicated that the acute-chronic ratio for DDT might be high (65 in the reported study), but the data were insufficient to allow calculation of a final acute-chronic ratio. DDT, DDD, and DDE are bioconcentrated by a factor of 10^3 to 10^5.

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DDT, DDD, DDE and the other persistent organochlorine pesticides are primarily responsible for the great decrease in the reproductive capabilities and consequently in the populations of fish-eating birds, such as the bald eagle, brown pelican, and osprey. DDT has also been shown to decrease the populations of numerous other species of waterbirds, raptors, and passerines significantly.

Regulations and Standards

Ambient Water Quality Criteria (USEPA):

Aquatic Life

DDT: Freshwater

Acute toxicity: 1.1 µg/liter
Chronic toxicity: 0.001 µg/liter

Saltwater

Acute toxicity: 0.13 µg/liter
Chronic toxicity: 0.001 µg/liter

DDD and DDE: The available data are not adequate for establishing criteria. However, EPA did report the lowest values known to be toxic in aquatic organisms.

Freshwater

Acute toxicity: DDD: 0.6 µg/liter
DDE: 1050 µg/liter
Chronic toxicity: DDD & DDE: No available data

Saltwater

Acute toxicity: DDD: 3.6 µg/liter
DDE: 14 µg/liter
Chronic toxicity: DDD & DDE: No available data

Human Health

Estimates of the carcinogenic risks associated with lifetime exposure to various concentrations of DDT in water are:

Risk	Concentration
10^{-5}	0.24 ng/liter
10^{-6}	0.024 ng/liter
10^{-7}	0.0024 ng/liter

CAG Unit Risk (USEPA): 0.34 $(mg/kg/day)^{-1}$

OSHA Standard (air): 1 mg/m^3 TWA

ACGIH Threshold Limit Value: 1 mg/m^3 TWA

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1,1-DICHLOROETHANE

Summary

1,1-Dichloroethane is quite volatile and probably is not very persistent in aquatic environments. Inhalation exposure to high doses causes central nervous system depression in humans and may cause hepatotoxicity. In animals, high doses cause liver and kidney damage and retard fetal development.

CAS Number: 75-34-3

Chemical Formula: CH_3CHCl_2

IUPAC Name: 1,1-Dichloroethane

Important Synonyms and Trade Names: Ethylidene chloride, ethylidene dichloride

Chemical and Physical Properties

Molecular Weight: 98.96

Boiling Point: 57.3°C

Melting Point: -97.0°C

Specific Gravity: 1.1776 at 20°C

Solubility in Water: 5 g/liter

Solubility in Organics: Miscible in alcohol

Log Octanol/Water Partition Coefficient: 1.79

Vapor Pressure: 180 mm Hg at 20°C

Transport and Fate

1,1-Dichloroethane disperses from surface water primarily by volatilization into the troposphere, where it is subsequently broken down by hydroxylation. No studies on adsorption were found in the literature reviewed, but because of its water solubility and relatively low log octanol/water partition coefficient, 1,1-dichloroethane potentially could move through soil and enter the groundwater.

Health Effects

Limited toxicological testing of 1,1-dichloroethane has been conducted, although the literature indicates that 1,1-dichloroethane is one of the least toxic of the chlorinated ethanes. An NCI bioassay on 1,1-dichloroethane was limited by poor survival of test animals of test animals, but some marginal tumorigenic effects were seen. Inhalation exposure to high doses of 1,1-dichloroethane (over 16,000 mg/m^3) caused retarded fetal development in rats (Schwetz et al. 1974). 1,1-Dichloroethane was not found to be mutagenic using the Ames assay. 1,1-Dichloroethane causes central nervous system depression when inhaled at high concentrations, and evidence suggests that the compound is hepatotoxic in humans. Kidney and liver damage was seen in animals exposed to high levels of 1,1-dichloroethane. The oral LD_{50} value in the rat is 725 mg/kg.

Toxicity to Wildlife and Domestic Animals

No information on the toxicity of 1,1-dichloroethane to aquatic species was reported in the literature reviewed. However, the available information on the chloroethanes indicates that toxicity declines with decreases in chlorination and that the 1,1,1-isomer is less active than the 1,1,2-isomer. Therefore 1,1-dichloroethane is probably no more toxic than 1,2-dichloroethane, which is acutely toxic at levels of 100-500 mg/liter and has a chronic toxicity beginning at about 20 mg/liter.

No information on the toxicity of 1,1-dichloroethane to terrestrial wildlife or domestic animals was found in the sources reviewed.

Regulations and Standards

Ambient Water Quality Criteria (USEPA):

The available data were inadequate for establishing criteria.

OSHA Standard (air): 400 mg/m^3 TWA

ACGIH Threshold Limit Value: 810 mg/m^3 TWA

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1,1-DICHLOROETHYLENE

Summary

1,1-Dichloroethylene (VDC, vinylidene chloride) caused kidney tumors (in males only) and leukemia in one study of mice exposed by inhalation, but the results of other studies were equivocal or negative. 1,1-Dichloroethylene is mutagenic, and it caused adverse reproductive effects when administered to rats and rabbits by inhalation. Chronic exposure causes liver damage, and acute exposure to high doses produces nervous system damage.

CAS Number: 75-35-4

Chemical Formula: CH_2CCl_2

IUPAC Name: 1,1-Dichloroethene

Important Synonyms and Trade Names: Vinylidene chloride, VDC, 1,1-dichloroethene, 1,1-DCE

Chemical and Physical Properties

Atomic Weight: 96.94

Boiling Point: 37°C

Melting Point: -122.1°C

Specific Gravity: 1.218 at 20°C

Solubility in Water: 400 mg/liter at 20°C

Solubility in Organics: Sparingly soluble in alcohol, ether, acetone, benzene, and chloroform

Log Octanol/Water Partition Coefficient: 1.48

Vapor Pressure: 500 mm Hg at 20°C

Vapor Density: 3.25

Transport and Fate

Volatilization appears to be the primary transport process for 1,1-dichloroethylene (VDC), and its subsequent photooxida-

tion in the atmosphere by reaction with hydroxyl radicals is apparently the predominant fate process. Information on other transport and fate mechanisms was generally lacking for 1,1-dichloroethylene. However, by inference from related compounds, hydrolysis, sorption, bioaccumulation, biotransformation, and biodegradation probably all occur but at rates too slow to be of much significance.

Health Effects

1,1-Dichloroethylene caused kidney tumors in males and leukemia in males and females in one study of mice exposed by inhalation, gave equivocal results in other inhalation studies, and gave negative results in rats and mice following oral exposure and in hamsters following inhalation exposure. VDC was mutagenic in several bacterial assays. 1,1-Dichloroethylene did not appear to be teratogenic but did cause embryotoxicity and fetotoxicity when administered to rats and rabbits by inhalation. Chronic exposure to oral doses of VDC as low as 5 mg/kg/day caused liver changes in rats. Acute exposure to high doses causes central nervous system depression, but neurotoxicity has not been associated with low-level chronic exposure. The oral LD_{50} value for the rat is 1,500 mg/kg, and for the mouse it is 200 mg/kg.

Toxicity to Wildlife and Domestic Animals

1,1-Dichloroethylene is not very toxic to freshwater or saltwater species, with acute LC_{50} values generally ranging from 80 to 200 mg/liter. A chronic study in which no adverse effects were observed indicated that the acute-chronic ratio was less than 40; a 13-day study that produced an LC_{50} of 29 mg/liter indicated that the acute-chronic ratio is greater than 4.

No reports of the toxicity of 1,1-dichloroethylene to terrestrial wildlife or domestic animals were found in the literature reviewed.

Regulations and Standards

Ambient Water Quality Criteria (USEPA):

Aquatic Life

The available data are inadequate for establishing criteria. However, EPA did report the lowest values known to cause toxicity in aquatic organisms.

Freshwater

Acute toxicity: 11,600 µg/liter
Chronic toxicity: No available data

Saltwater

Acute toxicity: 224,000 µg/liter
Chronic toxicity: No available data

Human Health

Estimates of the carcinogenic risks associated with lifetime exposure to various concentrations of 1,1-dichloroethylene in water are:

Risk	Concentration
10^{-5}	0.33 µg/liter
10^{-6}	0.033 µg/liter
10^{-7}	0.0033 µg/liter

CAG Unit Risk (USEPA): 1.16 $(mg/kg/day)^{-1}$

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1,2-trans-DICHLOROETHYLENE

Summary

Chronic inhalation exposure to 1,2-trans-dichloroethylene (1,2-trans-DCE) causes liver degeneration, and acute exposure to high levels has adverse effects on the central nervous system.

CAS Number: 540-59-0

Chemical Formula: $C_2H_2Cl_2$

IUPAC Name: 1,2-trans-Dichloroethene

Important Synonyms and Trade Names: trans-Acetylene dichloride, dioform

Chemical and Physical Properties

Molecular Weight: 96.94

Boiling Point: 47.5°C

Melting Point: -50°C

Specific Gravity: 1.2565 at 20°C

Solubility in Water: 600 mg/liter

Solubility in Organics: Miscible with alcohol, ether, and acetone; very soluble in benzene and chloroform

Log Octanol/Water Partition Coefficient: 1.48 (calculated)

Vapor Pressure: 200 mm Hg at 14°C

Flash Point: 3°C (undefined isomers)

Transport and Fate

Due to the relatively high vapor pressure of 1,2-trans-dichloroethylene (1,2-trans-DCE), volatilization from aquatic systems to the atmosphere is quite rapid and appears to be the primary transport process. Aerial transport of this compound can occur and is partly responsible for its relatively wide

environmental distribution. Although little applicable information is available, adsorption is probably an insignificant environmental fate process for 1,2-trans-DCE. The relatively low log octanol/water partition coefficient of 1,2-trans-DCE suggests that bioaccumulation also is a relatively insignificant process. Although no information pertaining specifically to biodegradation of 1,2-trans-DCE is available, results with similar compounds suggest that this process probably occurs but at a very slow rate.

Photooxidation in the troposphere appears to be the dominant environmental fate of 1,2-trans-DCE. Once in the troposphere, the compound is attacked at the double bond by hydroxyl radicals, resulting in the formation of formic acid, hydrochloric acid, carbon monoxide, and formaldehyde. The half-life of 1,2-trans-DCE in the troposphere is estimated to be less than one day. Given the properties of similar compounds, photolysis of 1,2-trans-DCE in aquatic systems and photodissociation in the terrestrial environment are probably insignificant.

Health Effects

Very little information concerning exposure only to 1,2-trans-DCE is available. There are no reports of carcinogenic or teratogenic activity by 1,2-trans-DCE in animals or humans. It is reportedly nonmutagenic in a variety of test systems. Like other members of the chlorinated ethylene series, 1,2-trans-DCE has anesthetic properties. Exposure to high vapor concentrations has been found to cause nausea, vomiting, weakness, tremor, and cramps in humans. Repeated exposure via inhalation of 800 mg/m^3 (8 hours/day, 5 days/week, for 16 weeks) was reported to produce fatty degeneration of the liver in rats. The intraperitoneal injection LD_{50} value for the rat is 7,536 mg/kg.

Although nephrotoxic and cardiac sensitizing effects are associated with exposure to 1,1-dichloroethylene, the 1,2-DCE isomers have not been investigated with respect to this type of effects. 1,2-trans-Dichloroethylene can inhibit aminopyrine demethylation in rat liver microsomes in vitro, and it may thus interact with the hepatic drug-metabolizing monooxygenase system.

Toxicity to Wildlife and Domestic Animals

Practically no information concerning the toxicity of 1,2-trans-DCE to wildlife and domestic animals exists. The reported 96-hour LC_{50} value under static conditions is 135,000 µg/liter for the bluegill. Under the same test conditions, the LC_{50} value for 1,1-dichloroethylene is 73,900 µg/liter. Recommended criteria for protection of aquatic life are based primarily on data concerning 1,1-dichloroethylene.

Regulations and Standards

Ambient Water Quality Criteria (USEPA):

The available data are not adequate for establishing criteria.

OSHA Standard: 790 mg/m^3 TWA

ACGIH Threshold Limit Values: 790 mg/m^3 TWA
1,000 mg/m^3 STEL

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2,4-DIMETHYLPHENOL

Summary

2,4-Dimethylphenol has been shown to act as a cancer promoter in skin-painting studies, but it has not been tested for carcinogenicity in a complete bioassay. It is an ATP blocking agent. Other dimethylphenols have been shown to cause pathological changes in the heart, liver, and kidneys.

CAS Number: 105-67-9

Chemical Formula: $(CH_3)_2C_6H_3OH$

IUPAC Name: 2,4-Dimethyl-1-hydroxybenzene

Important Synonyms and Trade Names: m-Xylenol, cresylic acid, 2,4-xylenol

Chemical and Physical Properties

Molecular Weight: 122.2

Boiling Point: 210°C

Melting Point: 27°C

Specific Gravity: 0.956 at 20°C

Solubility in Water: 17 g/liter

Solubility in Organics: Freely soluble in alcohol, chloroform, ether, and benzene

Log Octanol/Water Partition Coefficient: 2.50

Vapor Pressure: 0.06 mm Hg at 20°C

pKa: 10.60

Transport and Fate

Photooxidation is probably the primary mechanism for removal of 2,4-dimethylphenol in clear, aerated surface waters, although metal-catalyzed oxidation, sorption, and biodegradation may also have some effect. In murky, unaerated water, biodegradation is

probably the primary fate of 2,4-dimethylphenol, with absorption onto organic materials also being somewhat important. 2,4-Dimethylphenol would be expected to adsorb onto organic material in the soil but because of its water solubility it probably moves readily through soil. However, biodegradation would somewhat limit the amount of chemical able to enter the groundwater.

Health Effects

2,4-Dimethylphenol has been shown to be a cancer promoting agent in skin painting studies on rats but has not been tested for its total carcinogenic potential. No studies on the teratogenicity, reproductive toxicity, or mutagenicity of 2,4-dimethylphenol were found in the literature reviewed. At high doses, other dimethylphenols have been shown to cause pathological changes in the liver, kidneys, and heart. 2,4-Dimethylphenol is known to be an ATP blocking agent. Dermal exposure was more toxic to rats than oral dosing. The reported LD_{50} values for the rat were 1,040 mg/kg (dermal) and 3,200 mg/kg (oral).

Toxicity to Wildlife and Domestic Animals

No signs of acute toxicity attributable to 2,4-dimethylphenol were seen in freshwater species exposed to levels less than approximately 2,000 µg/liter. Chronic toxicity studies indicate that the acute-chronic ratio is probably between 5 and 10. The bioconcentration factor in bluegills exposed to 2,4-dimethylphenol for 28 days was 150, but a half-life in the body of less than one day suggests that residues are probably not a significant hazard for freshwater species. No information on the toxicity of 2,4-dimethylphenol to other wildlife or domestic animals was available in the literature reviewed.

Regulations and Standards

Ambient Water Quality Criteria (USEPA):

Aquatic Life

The available data are not adequate for establishing criteria. However, EPA did report the lowest values known to cause toxicity in aquatic organisms.

Freshwater

Acute toxicity: 2,120 µg/liter
Chronic toxicity: No available data

Acute toxicity: No available data
Chronic toxicity: No available data

Human Health

Health criterion: No available data
Organoleptic criterion: 400 µg/liter

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ENDRIN

Summary

Endrin is a cyclodiene insecticide that is an isomer of dieldrin. It is probably retained in soils and sediments and is persistent in the environment. It is strongly bioaccumualted by aquatic organisms. Endrin is highly toxic to mammals, aquatic organisms, and terrestrial wildlife after acute exposure. It has not been shown to be carcinogenic or mutagenic, but it is a potent teratogen and reproductive toxin.

CAS Number: 72-20-8

Chemical Formula: $C_{12}H_8Cl_6O$

IUPAC Name: 1,2,3,4,10,10-Hexachloro-6,7-epoxy-1,4,4a,5,6,7,8,8a octahydro-endo-1,4:5,8-dimethanonaphthalene

Important Synonyms and Trade Names: Endrex, hexadrin, mendrin

Chemical and Physical Properties

Molecular Weight: 380.9

Melting Point: Decomposes at 235°C

Specific Gravity: 1.65 at 25°C

Solubility in Water: 250 µg/liter at 25°C

Solubility in Organics: Soluble in acetone, benzene, carbon tetrachloride, hexane, and xylene

Log Octanol/Water Partition Coefficient: 5.6

Vapor Pressure: 2.7×10^{-7} mm Hg at 25°C

Transport and Fate

Endrin is quite persistent in the environment. Volatilization from soil surfaces and probably from surface water is an important transport process (Nash 1983). Subsequent photolysis to delta-keto endrin and endrin aldehyde are apparently important fate processes. No information on the ability of

endrin to adsorb to soils and sediments was found in the literature reviewed, but the physical properties of the chemical suggest that sorption would be an important fate process. Endrin is readily bioconcentrated by aquatic organisms, with concentration factors of 10^3 to 10^4. Biotransformation and biodegradation may also be important fate processes for endrin.

Health Effects

Endrin has not been shown to be carcinogenic or mutagenic. However, it is a potent reproductive toxin and teratogen in experimental animals. Reproductive effects included fetal mortality and growth retardation, while teratogenic effects included cleft palate, open eye, clubbed foot, meningoencephales, and fused ribs. Chronic exposure to low levels of endrin primarily results in nervous system damage but also has adverse effects on the heart, lungs, liver, and kidneys. The acute toxicity of endrin is due to its effects on the central nervous system. The acute oral and dermal LD_{50} values for endrin to the rat were both approximately 15 mg/kg.

Toxicity to Wildlife and Domestic Animals

Endrin is very toxic to aquatic organisms. Freshwater fish were generally more sensitive than invertebrates, with species mean acute values ranging from 0.15 to 2.1 µg/liter. LC_{50} values for saltwater organisms ranged from 0.037 to 14.2 µg/liter. Final acute values for freshwater and saltwater species were 0.18 µg/liter and 0.037 µg/liter, respectively. An acute-chronic ratio of 4.0 was determined from chronic tests on freshwater and saltwater species. Therefore, the freshwater final chronic value was calculated to be 0.045 µg/liter and the saltwater final chronic value was determined to be 0.0093 µg/liter.

Endrin is acutely toxic to terrestrial wildlife and domestic animals and has been used as a rodenticide and an avicide. It can also cause central nervous system effects and reproductive disorders following chronic exposure. Sublethal effects observed in animals exposed to endrin include abnormal behavior, increased postnatal mortality, and increased fetal death.

Regulations and Standards

Ambient Water Quality Criteria (USEPA):

Freshwater

Acute toxicity: 0.18 µg/liter
Chronic toxicity: 0.0023 µg/liter

Saltwater

Acute toxicity: 0.037 µg/liter
Chronic toxicity: 0.0023 µg/liter

Human Health

Criterion: 1.0 µg/liter

Primary Drinking Water Standard: 1.0 µg/liter

OSHA Standard: 100 $\mu g/m^3$ TWA

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BIS(2-ETHYLHEXYL)PHTHALATE

Summary

bis(2-Ethylhexyl)phthalate (DEHP) is probably persistent in the environment. It is carcinogenic in rats and mice, causing hepatocellular carcinomas. Teratogenic and reproductive effects have been observed in experimental animals. Chronic exposure to DEHP retarded growth and increased liver and kidney weights in animals.

CAS Number: 117-81-7

Chemical Formula: $C_6H_4(COOCH_2CH(C_2H_5)C_4H_9)_2$

IUPAC Name: bis(2-Ethylhexyl)ester phthalic acid

Important Synonyms and Trade Names: DEHP, Di(2-ethylhexyl)phthalate
bis(2-ethylhexyl)ester
phthalic acid

Chemical and Physical Properties

Molecular Weight: 391.0

Boiling Point: 386.9°C at 5 mm Hg

Melting Point: -50°C

Specific Gravity: 0.985

Solubility in Water: 0.4 mg/liter at 25°C

Solubility in Organics: Miscible with mineral oil and hexane

Log Octanol/Water Partition Coefficient: 5.3

Vapor Pressure: 2×10^{-7} mm Hg at 20°C

Flash Point: 218.33°C

Transport and Fate

bis(2-Ethylhexyl)phthalate (DEHP) is the most thoroughly studied of the phthalate esters. It probably hydrolyzes in surface waters, but at such a slow rate that this process is not environmentally significant under most conditions. Photo-

lysis and oxidation do not appear to be important environmental fate processes. Although some researchers suggest that volatilization of DEHP from aqueous solution may be significant under some conditions, it probably is not an important environmental transport process in natural waters. In contrast, there is evidence that this compound can be slowly volatilized from DEHP-containing materials at relatively high temperatures. Consequently, some atmospheric dispersion of DEHP due to vaporization during manufacture, use, or waste disposal probably occurs.

Adsorption onto suspended solids and particulate matter and complexation with natural organic substances are probably the most important environmental transport processes for DEHP. The log octanol/water partition coefficient for DEHP suggests that this compound would be adsorbed onto particulates high in organic matter. This contention is supported by the fact that phthalate esters are commonly found in freshwater and saltwater sediment samples. DEHP can be dispersed from sources of manufacture and use to aquatic and terrestrial systems by complexation with natural organic substances. It readily interacts with the fulvic acid present in humic substances in water and soil, forming a complex that is very soluble in water.

A variety of unicellular and multicellular organisms take up and accumulate DEHP, and bioaccumulation is considered an important fate process. Biodegradation is also considered an important fate process in aquatic systems and soil. DEHP is degraded under most conditions and can be metabolized by multicellular organisms. Therefore, it is unlikely that long-term biomagnification occurs.

Analysis using EPA's Exposure Analysis Modeling System suggests that chemical and biochemical transformation processes for DEHP are slow and that transport processes will predominate both in ecosystems that have long retention times (ponds, lakes) and in those that have short retention times (rivers). If the input of DEHP remains constant, its concentration is expected to increase in aquatic ecosystems. If the input stops, the DEHP present is expected to persist for an undetermined length of time. The oceans are the ultimate sink for DEHP introduced into unimpeded rivers.

Health Effects

DEHP is reported to be carcinogenic in rats and mice, causing increased incidences of hepatocellular carcinomas or neoplastic nodules after oral administration (NTP 1982). Its status as a human carcinogen is considered indeterminate by the International Agency for Research on Cancer (IARC). The results of dominant lethal experiments with mice suggest that

DEHP is mutagenic when injected intraperitoneally. However, most experiments conducted with microorganisms and mammalian cells have failed to demonstrate genotoxic activity. Teratogenic and fetotoxic effects have been observed in experimental animals after oral and intraperitoneal administration. Other reproductive effects, including testicular changes in rats and mice, have also been reported.

DEHP appears to have a relatively low toxicity in experimental animals. The oral, intraperitoneal, and intravenous LD_{50} values reported for DEHP in rats are 31 g/kg, 30.7 g/kg, and 0.25 g/kg, respectively. DEHP is poorly absorbed through the skin, and no irritant response or sensitizing potential from dermal application has been noted in experimental animals or humans.

Chronic exposure to relatively high concentrations of DEHP in the diet has caused retardation of growth and increased liver and kidney weights in experimental animals.

Toxicity to Wildlife and Domestic Animals

Acute median effect values ranged from 1,000 to 11,100 µg/liter DEHP for the freshwater cladoceran Daphnia magna. The LC_{50} values for the midge, scud, and bluegill all exceeded the highest concentrations tested, which were 18,000, 32,000, and 770,000 µg/liter, respectively. As these values are greater than the water solubility of the chemical, it is unlikely that DEHP will be acutely toxic to organisms in natural waters. In a chronic toxicity test with Daphnia magna, significant reproductive impairment was found at the lowest concentration tested, 3 µg/liter. A chronic toxicity value of 8.4 µg/liter was reported for the rainbow trout. No acute or chronic values were reported for saltwater invertebrates or vertebrates. Reported bioconcentration factors for DEHP in fish and invertebrates range from 14 to 2,680.

Although insufficient data were presented to calculate the acute-chronic ratio for DEHP, it is apparently on the order of 100 to 1,000. Therefore, acute exposure to the chemical is unlikely to affect aquatic organisms adversely, but chronic exposure may have detrimental effects on the environment.

Regulations and Standards

Ambient Water Quality Criteria (USEPA):

Aquatic Life

The available data are not adequate for establishing criteria

for bis(2-ethylhexyl)phthalate or for phthalate esters as a group.

Human Health

Criterion: 15 mg/liter

ACGIH Threshold Limit Values: 5 mg/m^3 TWA
10 mg/m^3 STEL

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FLUORANTHENE

Summary

Fluoranthene is a polycyclic aromatic hydrocarbon (PAH). It is probably persistent in the environment. Fluoranthene dos not appear to be a complete carcinogen, but it has been shown to be a potent cocarcinogen in animal test systems.

CAS Number: 206-44-0

Chemical Formula: $C_{16}H_{10}$

Chemical and Physical Properties

Molecular Weight: 202.26

Boiling Point: Approximately 375°C

Melting Point: 111°C

Specific Gravity: 1.252 at 0°C

Solubility in Water: 0.26 mg/liter

Solubility in Organics: Soluble in ethanol, ether, benzene, chloroform, acetic acid, and carbon disulfide

Log Octanol/Water Partition Coefficient: 5.33 (calculated)

Vapor Pressure: 10^{-6} to 10^{-4} mm Hg at 20°C (estimated)

Transport and Fate

Much of the information concerning transport and fate is inferred from data for polycyclic aromatic hydrocarbons (PAHs) in general because of a lack of specific information on fluoranthene. Rapid, direct photolysis of fluoranthene to quinones may occur in aqueous solution. The oxidation of fluoranthene is probably too slow to be a significant environmental process, and the available data suggest that volatilization generally is not an important transport process for fluoranthene. The calculated log octanol/water partition coefficient of 5.33 indicates that the compound should be strongly adsorbed onto particulate matter, especially particulates high in organic content. It is likely that fluoranthene can be transported

as adsorbed matter on suspended particulates in air or water. Data for PAHs in general indicate that fluoranthene will accumulate in the sediment and biota of the aquatic environment and that adsorption is probably the dominant aquatic transport process.

Data for a variety of PAHs suggest that bioaccumulation is a short-term process, and long-term partitioning into biota is not a significant fate process. Fluoranthene can be metabolized by multicellular organisms and degraded by microbes. Degradation by mammals is likely to be incomplete; the parent compound and the metabolites are excreted by the urinary system. Biodegradation by microorganisms is probably the ultimate fate process. Biodegradation generally appears to be slower in aquatic systems than in soil. However, it may be important in those aquatic systems that are chronically affected by PAH contamination. Fluoranthene is stable enough in air to be transported over relatively large distances.

Health Effects

There is no information concerning the carcinogenicity of fluoranthene in humans, and fluoranthene shows no activity as a complete carcinogen in experimental animals. However, fluoranthene appears to possess potent cocarcinogenic activity in test animals. Fluoranthene has displayed no mutagenic activity in in vitro bacterial test systems. No other information is available concerning its potential mutagenic or teratogenic effects, nor with regard to its acute or chronic toxicity to humans. Results from animal studies indicate that fluoranthene has relatively low acute toxicity. Where deaths of experimental animals have occurred, no information concerning target organs or specific causes of death has been reported. Descriptions of chronic toxicity are limited to reports of mortality produced in mice by repeated dermal application or subcutaneous injection.

Toxicity to Wildlife and Domestic Animals

Among freshwater species, the bluegill, with a 96-hour LC_{50} value of 3,980 µg/liter, is more sensitive to fluoranthene than the cladoceran Daphnia magna, with a 48-hour EC_{50} value of 325,000 µg/liter. No chronic data are available for freshwater organisms. Among saltwater species, the 96-hour LC_{50} values for the mysid shrimp and a polychaete are 40 and 500 µg/liter, respectively. The 96-hour LC_{50} value for the sheepshead minnow is greater than 560,000 µg/liter. The chronic value and acute-chronic ratio for the mysid shrimp are 16 µg/liter and 2.5, respectively. The freshwater and saltwater algal species tested exhibit similar sensitivities to fluoranthene, with EC_{50} values of about 50,000 µg/liter. There is evidence of fluoranthene

accumulation in edible aquatic organisms, although no measured, steady-state bioconcentration factors are available for freshwater or saltwater organisms.

Regulations and Standards

Ambient Water Quality Criteria (USEPA):

Aquatic Life

The available data are not adequate for establishing criteria. However, EPA did report the lowest concentrations of fluoranthene known to cause toxic effects in aquatic organisms.

Freshwater

Acute toxicity: 3,980 µg/liter
Chronic toxicity: No available data

Saltwater

Acute toxicity: 40 µg/liter
Chronic toxicity: 16 µg/liter

Human Health

Criterion: 42 µg/liter

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HEPTACHLOR

Summary

Heptachlor is an organochlorine pesticide. Together with its active metabolite, heptachlor epoxide, it is very persistent in the environment. When administered orally to mice, both substances cause liver tumors. They also have mutagenic effects. These chemicals have a number of reproductive and teratogenic effects, including decreased litter size, shortened life span of suckling young, and the development of cataracts in offspring. The acute toxicity of both heptachlor and heptachlor epoxide is very high. Chronic exposure induces liver changes and may cause kidney damage. Heptachlor is also highly toxic to fish and wildlife.

Background Information

Technical heptachlor is a complex mixture containing approximately 72% heptachlor and 28% related compounds. It is a soft wax with a melting point of 46-74°C.

CAS Number: 76-44-8

Chemical Formula: $C_{10}H_5Cl_7$

IUPAC Name: 1,4,5,6,7,8,8-Heptachloro-3a,4,7,7a-tetrahydro-4,7-methanoindene

Chemical and Physical Properties

Molecular Weight: 373.3

Melting Point: 95-96°C

Specific Gravity: 1.57-1.59 at 9°C

Solubility in Water: 0.056 to 0.180 mg/liter at 25-29°C depending on particle size

Solubility in Organics: Soluble in ethanol, ether, benzene, acetone, carbon tetrachloride, xylene, kerosene, cyclohexanone, and ligroin

Vapor Pressure: 0.0003 mm Hg at 25°C

Transport and Fate

Heptachlor and its active metabolite, heptachlor epoxide, are very persistent in the environment, resisting chemical and biological breakdown into harmless substances. Sorption of heptachlor to sediments appears to be an important process for removal of the pesticide from water, as residue concentrations in sediment are often much higher than in water. Some volatilization may also occur.

Heptachlor and heptachlor epoxide bind tightly to soil particles and will persist for years in soil after surface application. However, heptachlor applied as an emulsifiable concentrate is more readily volatized than when applied as a granular formulation. Certain crops accumulate residues of these compounds by absorption from the soil.

Atmospheric transport of vapors and contaminated dust particles from soil application sites can occur. Heptachlor and heptachlor epoxide are widespread in ambient air, but generally occur at low concentrations. However, levels vary both geographically and seasonally.

Health Effects

Heptachlor and heptachlor epoxide are liver carcinogens when administered orally to mice. Results from mutagenicity bioassays suggest that these compounds also may have genotoxic activity. Reproductive and teratogenic effects in rats include decreased litter size, shortened life span of suckling rats, and development of cataracts in offspring.

Tests with laboratory animals, primarily rodents, demonstrate acute and chronic toxic effects due to heptachlor exposure. Although heptachlor and heptachlor epoxide are absorbed most readily through the gastrointestinal tract, inhalation and skin contact are also potential routes of exposure. Acute exposure by various routes can cause development of hepatic vein thrombi and can affect the central nervous system and cause death. Chronic exposure induces liver changes, affects hepatic microsomal enzyme activity, and causes increased mortality in offspring. The oral LD_{50} in the rat is 40 mg/kg for heptachlor and 47 mg/kg for heptachlor epoxide.

Although there are reports of acute and chronic toxicity in humans, with symptoms including tremors, convulsions, kidney damage, respiratory collapse, and death, details of such episodes are not well documented. Heptachlor epoxide has been found in a high percentage of human adipose tissue samples, and also in human milk samples and biomagnification of heptachlor/heptachlor epoxide occurs. This compound also has been found in

the tissues of stillborn infants, suggesting an ability to cross the placenta and bioaccumulate in the fetus.

Toxicity to Wildlife and Domestic Animals

Heptachlor is toxic at low concentrations in some aquatic invertebrate and fish species. Heptachlor epoxide appears to be a minor product of heptachlor transformations in aquatic systems but the capability of different organisms to effect epoxidation varies. Mean acute values for freshwater species range from 0.9 to 78 µg/liter for invertebrates and from 13.1 to 320 µg/liter for fish. A life cycle test conducted with the fathead minnow provides a chronic value of 1.26 µg/liter and an acute-chronic ratio of 80 for this species. Saltwater mean acute values range from 0.04 to 194 µg/liter for a variety of fish and invertebrate species. A chronic value of 1.58 µg/liter and an acute-chronic ratio of 3.9 are reported for the sheepshead minnow.

Heptachlor shows a strong tendency to bioaccumule. It can concentrate at levels thousands of times greater than those in the surrounding water in a variety of aquatic organisms. Because of this tendency for bioaccumulation, chronic exposure to levels greater than 0.004 µg/liter is considered potentially harmful to aquatic life. However, this value may be too high because the average concentration in a high lipid species will be at FDA action levels for human consumption.

Heptachlor and heptachlor epoxide residues have been found in a wide variety of wildlife and domestic animal species, but usually at relatively low levels. The use of heptachlor as a seed dressing for cereal grains has been linked to mortality among granivorous birds and to increased residues in the tissues of granivorous birds and mammals. Residues have also been found in raptors but a causal relationship with observed toxic effects has not been established. Increased mortality among birds, mammals, fish, and aquatic species has been reported in areas treated with heptachlor. Heptachlor or heptachlor epoxide residues have regularly been found in food and feed crops, meat, fish, poultry, dairy products, and eggs. Oral LC_{50} values for heptachlor ranging from 92 to 480 ppm in their diet (around 20 mg/kg body weight) are reported for wild bird species.

Regulations and Standards

Ambient Water Quality Criteria (USEPA):

Aquatic Life

Freshwater

Acute toxicity: 0.52 µg/liter
Chronic toxicity: 0.0038 µg/liter

Saltwater

Acute toxicity: 0.053 µg/liter
Chronic toxicity: 0.0036 µg/liter

Human Health

Estimates of the carcinogenic risks associated with lifetime exposure to various concentrations of heptachlor in water are:

Risk	Concentration
10^{-5}	2.78 ng/liter
10^{-6}	0.28 ng/liter
10^{-7}	0.028 ng/liter

CAG Unit Risk (USEPA): 3.37 $(mg/kg/day)^{-1}$

OSHA Standard (skin): 0.5 mg/m^3 TWA

ACGIH Threshold Limit Values (skin): 0.5 mg/m^3 TWA
2 mg/m^3 STEL

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HEXACHLOROBENZENE

Summary

Hexachlorobenzene is very persistent in the environment and can be bioaccumulated. It is carcinogenic in mice, rats, and hamsters, causing liver tumors in all three species and tumors of the spleen and thyroid in hamsters. There is equivocal evidence that hexachlorobenzene is teratogenic; reproductive effects have been observed in rats and monkeys. Humans accidentall exposed to hexachlorobenzene displayed numerous adverse effects, including enlarged livers, rheumatoid arthritis-like symptoms, and severe skin damage.

CAS Number: 118-74-1

Chemical Formula: C_6Cl_6

IUPAC Name: Hexachlorobenzene

Important Synonyms and Trade Names: HCB, perchlorobenzene

Chemical and Physical Properties

Molecular Weight: 285

Boiling Point: 326°C

Melting Point: 230°C

Specific Gravity: 1.57 at 20°C

Solubility in Water: 10 µg/liter at 25°C

Solubility in Organics: Soluble in acetone, ether, benzene, and chloroform

Log Octanol/Water Partition Coefficient: 6.18

Vapor Pressure: 1×10^{-5} mm Hg at 20°C

Vapor Density: 918

Flash Point: 242°C

Transport and Fate

Hexachlorobenzene (HCB) is persistent in the environment. Although it has a low vapor pressure, it may volatilize because of its low water solubility and high level of activity in water. HCB has a high log octanol/water partition coefficient and therefore would not be expected to move readily through soil. Also, its high specific gravity suggests that it would probably move through soil as a nonaqueous-phase liquid (NAPL) and not necessarily in the groundwater.

The major fate of hexachlorobenzene is probably nonpermanent sorption to organic material in the soil and sediment. Although this binding will immobilize HCB, it will not do so permanently, and desorption may produce continuous, low-level concentrations of HCB in the surrounding media. Organisms can bioaccumulate HCB, but it is unclear whether biomagnification occurs in the food chain. Degradation in the environment, occurs very slowly, if at all. The two possible routes of degradation are photolysis, possibly assisted by the presence of photosensitizing organic materials in aqueous media, and biodegradation by soil and aquatic organisms.

Health Effects

Hexachlorobenzene is carcinogenic in mice, rats, and hamsters. Liver tumors are induced in all three species. In addition, tumors of the spleen and thyroid were induced in HCB-treated hamsters (Cabral et al. 1977). There is equivocal evidence suggesting that HCB is teratogenic at high dose levels in rats (Khera 1974) and mice (Courtney et al. 1976). The addition of HCB to the diets of rats at 160 ppm (approximately 10 mg/kg/day) or more adversely affects reproduction (Grant et al. 1977). HCB has also had adverse effects on reproduction in monkeys (Iatropoulos et al. 1976). In an epidemic of HCB poisoning in Turkey in which the overall mortality rate among exposed persons was about 10%, 95% of the breast-fed infants whose mothers were exposed to HCB died. This incident was caused by consumption of seed grain that had been treated with a fungicide containing HCB; more than 3,000 people were affected by porphyria cutanea tarda, a defect in porphyrin metabolism caused by HCB. The affected individuals displayed severe skin manifestations including photosensitivity, increased pigmentation, bullae formation, deep scarring, a permanent increase in body hair, and atrophy of the skin. Many children were affected with rheumatoid arthritis-like symptoms, and about one-third of all victims had enlarged livers (Courtney 1979). A similar effect on porphyrin metabolism has been seen in experimental animals fed HCB. HCB also appears to have an adverse effect on the immune system in mice, and it is an inducer of mixed function oxidase enzymes in the liver.

Toxicity to Wildlife and Domestic Animals

Hexachlorobenzene was tested in several short-term aquatic bioassays, but no toxicity was observed at the limit of solubility of the compound. Quail fed 20 ppm or more of HCB in their diets for 90 days had increased liver weights, and the size and hatchability of their eggs decreased. Feeding Kestrels 20 or 80 ppm HCB caused histological damage to both their livers and kidneys. Field studies of predatory and specifically fish-eating birds showed some correlation between increased HCB levels and increased mortality, low breeding success, and increased porphyria. However, other contaminants could also have been responsible for these effects.

Reduced reproductive success was observed in mink fed 1, 5, or 25 ppm of HCB in their diets (Bleavins et al. 1984). Effects included decreased litter size, increased frequency of still births, increased fetal mortality, and decreased post-natal growth.

Regulations and Standards

Ambient Water Quality Criteria (USEPA):

Aquatic Life

The available data are not adequate for establishing criteria.

Human Health

Estimates of the carcinogenic risk associated with lifetime exposure to various concentrations of hexachlorobenzene in water are:

Risk	Concentration
10^{-5}	7.2 ng/liter
10^{-6}	0.72 ng/liter
10^{-7}	0.07 ng/liter

CAG Unit Risk (USEPA): 1.67 $(mg/kg/day)^{-1}$

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IRON

Summary

There is some evidence that high concentrations of certain soluble iron salts may be teratogenic. The ingestion of excess amounts of iron can irritate the gastrointestinal tract. Inhaling some iron-containing dusts and fumes can cause siderosis, a type of benign pneumoconiosis.

Background Information

Iron is the fourth most abundant element in the earth's crust. The pure metal is very reactive chemically. It corrodes readily in the presence of oxygen and moisture, forming iron (III) hydroxide [$Fe(OH)_3$].

CAS Number: 7439-89-6

Chemical Formula: Fe

Chemical and Physical Properties

Atomic Weight: 55.847

Boiling Point: 2,750°C

Melting Point: 1,535°C

Specific Gravity: 7.86

Solubility in Water: Insoluble

Solubility in Organics: Soluble in alcohol and ether

Transport and Fate

Elemental iron and many iron compounds, including $Fe(OH)_3$ and the iron oxides, are insoluble in water. Iron also tends to chelate with organic and inorganic matter. Consequently, much of the iron present in aquatic systems tends to partition into the bottom sediments. Iron has relatively low mobility in soil. Atmospheric transport of iron can occur.

Health Effects

Some studies have indicated that inhalation exposure to high concentrations of iron oxide is associated with increased risk of lung and laryngeal cancers in hematite miners and foundry workers. However, the significance of these findings is not established since exposures were to a mixture of substances, including radon gas and decomposition products of synthetic resins. Iron dextran solutions are reported to cause injection site sarcomas in experimental animals. Some iron compounds, notably ferrous sulfate, are reported to have high mutagenic activity in test systems. Intravenous injection of high concentrations of soluble iron salts is reported to cause teratogenic effects, including hydrocephalus and anophthalmia, in various species of experimental animals.

Iron is an essential element in plants and animals. However, the ingestion of excess amounts of iron produces toxic effects, primarily associated with gastrointestinal irritation. Severe poisoning may cause gastrointestinal bleeding, pneumonitis, convulsions, and hepatic toxicity. A dose of about 30 g of a soluble ferric salt is likely to be fatal in humans. Persons ingesting more than 30 mg/kg should be observed for clinical symptoms and possibly hospitalized. Chronic ingestion of excess iron may lead to hemosiderosis or hemochromatosis. Long-term inhalation exposure to iron-containing dusts and fumes, especially iron oxide, can produce siderosis. This condition is considered to be a type of benign pneumoconiosis that does not progress to fibrosis. Exposure to aerosols and mists of soluble iron salts may produce respiratory and skin irritation. The toxic effects of iron in experimental animals are similar to those observed in humans.

Toxicity to Wildlife and Domestic Animals

The available data are not adequate to characterize the toxicity of iron to wildlife or domestic animals. Iron is unlikely to cause ecological toxicity.

Regulations and Standards

OSHA Standard: 10 mg/m^3 TWA (iron oxide fume)

ACGIH Threshold Limit Values:

5 mg/m^3 TWA (iron oxide fume, as Fe)
10 mg/m^3 STEL (iron oxide fume, as Fe)
1 mg/m^3 TWA (soluble iron salts, as Fe)
2 mg/m^3 STEL (soluble iron salts, as Fe)

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MAGNESIUM

Summary

Exposure to magnesium oxide fumes can cause metal fume fever in humans. Exposure to magnesium oxide dust can irritate the eyes and respiratory tract. Ingestion of very high levels of magnesium salts can cause central nervous sytem effects; it can also have a laxative action.

Background Information

Magnesium is the eighth most abundant element on earth. It is very reactive chemically and does not occur uncombined in nature. Finely divided magnesium can react with water to yield hydrogen gas and magnesium hydroxide. However, reaction of solid magnesium with water is self-limiting because of the formation of a film of magnesium hydroxide. As a result, elemental magnesium is considered insoluble in water.

CAS Number: 7439-95-4

Chemical Formula: Mg

IUPAC Name: Magnesium

Chemical and Physical Properties

Atomic Weight: 24.312

Boiling Point: 1107°C

Melting Point: 648.8°C

Specific Gravity: 1.738

Solubility in Water: Insoluble; most salts are very soluble

Transport and Fate

Most magnesium salts are very soluble at pH levels normally found in natural waters, and the magnesium ion is readily transported in surface water, soil, and groundwater. The extent of magnesium transport in soil is dependent, in part, on the cation exchange capacity of the soil. Evaporation of ocean spray particles and subsequent atmospheric transport of magnesium

can occur. Atmospheric transport of dusts and fumes of compounds such as magnesim oxide can also occur.

Health Effects

There is no evidence to suggest that magnesium has carcinogenic, mutagenic, teratogenic, or reproductive effects in humans or experimental animals. Magnesium oxide fumes can produce metal fume fever in humans and experimental animals. Exposure to magnesium oxide dust may cause irritation of the eyes and respiratory tract. Human exposure to magnesium usually occurs by ingestion. Magnesium is an essential element for humans, animals, and plants. Ingestion of 3.6 to 4.2 mg/kg/day is thought to be adequate for maintenance of magnesium balance in humans. The average adult American is estimated to ingest 240 to 480 mg/kg/day in food and water. However, magnesium is absorbed relatively poorly by the gastrointestinal tract and also is readily excreted in the urine. Excessive magnesium retention in the body generally only occurs as a result of severe kidney disease. Symptoms of hypermagnesemia can include a sharp drop in blood pressure, and respiratory paralysis due to central nervous system depression. Ingestion of magnesium salts at concentrations over 700 mg/liter can have a laxative effect. However, humans can adapt to ingestion of these levels in a relatively short time. Magnesium has a very unpleasant taste in water at concentrations producing toxic effects.

Different magnesium compounds vary in the severity of their toxic effects to experimental animals. Such effects include central nervous system and purgative effects similar to those seen in humans. Subcutaneous injection of powdered magnesium or magnesium alloys can produce symptoms in experimental animals resembling gas gangrene. Application of powdered magnesium to abraded skin can produce an inflammatory reaction. However, these types of skin effects have not been reported in exposed workers.

Toxicity to Wildlife and Domestic Animals

Available data are not adequate to characterize the toxicity of magnesium to wildlife or domestic animals. Observed effects are generally related to deficiency symptoms.

Regulations and Standards

OSHA Standard: 15 mg/m^3 (magnesium oxide fume)

ACGIH Threshold Limit Values:

10 mg/m^3 TWA (magnesite, nuisance particulate)
20 mg/m^3 STEL (magnesite, nuisance particulate)

U.S. Department of Transportation: Flammable solid; dangerous when wet

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MANGANESE

Summary

Manganese chloride produced lymphomas and manganese sulfate, tumors after injestion into mice. In humans, chronic exposure to manganese causes degenerative changes in the central nervous system in the form of a Parkinson-like disease; liver changes also occur. Acute exposure causes manganese pneumonitis.

CAS Number: 7439-96-5

Chemical Formula: Mn

IUPAC Name: Manganese

Chemical and Physical Properties

Atomic Weight: 54.938

Boiling Point: 1962°C

Melting Point: 1244°C

Specific Gravity: 7.20

Solubility in Water: Decomposes; some compounds are soluble

Transport and Fate

Manganese occurs most commonly in the +2 and +4 oxidation states in aquatic systems. Its solubility depends to a great extent on pH, dissolved oxygen, and presence of complexing agents. In saltwater, it is estimated that 85% or more of the manganese present exists in a soluble form. In freshwater, manganese can occur as the soluble ion, in complex organic ions, or in colloidal suspensions. Manganese often occurs at higher concentrations near the bottom of stratified lakes because it can be released from sediments, as the manganous ion, under reducing conditions.

In the soil, the concentration and chemical form in which manganese occur can be affected by pH, cation exchange capacity, drainage, organic matter content, and other factors. The solubility of manganese is increased at low pH and under reducing conditions. The presence of high concentrations of chlorides, nitrates, or sulfates may also increase solubility. Under these conditions, manganese is more easily taken up by plants

or transported in aqueous solution. Lack of sufficient cation exchange sites, which are provided by organic matter or clay, can also result in greater leaching of manganese to surface or groundwater.

Atmospheric transport of manganese fumes or dusts can occur. These materials can be returned to the earth by wet or dry deposition.

Health Effects

There are no epidemiological studies suggesting that manganese or its compounds are carcinogenic or have teratogenic or reproductive effects in humans. Exposure to manganese chloride by intraperitoneal or subcutaneous routes was reported to cause lymphomas in mice. Manganese sulfate was found to produce tumors after intraperitoneal administration in mice. No other reports of unequivocal carcinogenic activity are available for common manganese compounds. Some manganese compounds, notably manganese chloride, have exhibited mutagenic activity in a variety of test systems. Manganese compounds do not appear to be teratogenic, however.

In humans, manganese dusts and compounds have relatively low oral and dermal toxicity, but they can cause a variety of toxic effects after inhalation exposure. Acute exposure to very high concentrations can cause manganese pneumonitis, increased susceptibility to respiratory disease, and pathologic changes including epithelial necrosis and mononuclear proliferation. Chronic manganese poisoning is more common, but generally occurs only among persons occupationally exposed to manganese compounds. Degenerative changes in the central nervous system are the major toxic effects. Early symptoms include emotional changes, followed by a masklike face, retropulsion or propulsion, and a Parkinson's-like syndrome. Liver changes are also frequently seen. Individuals with an iron deficiency may be more susceptible to chronic poisoning.

Duplication of human exposure symptoms in experimental animals has only been partially successful. In rabbits exposed by inhalation to manganese dust, manganese pneumonitis did not develop, but fibrotic changes in the lungs were observed. Central nervous system effects characteristic of chronic exposure in humans have only been reproduced in monkeys.

Toxicity to Wildlife and Domestic Animals

Adequate data for characterization of the toxicity of manganese to wildlife or domestic animals are not available.

reported for embryos of the oyster Crassostrea virginica. For the softshell clam Mya arenaria a 168-hour LC_{50} value of 300 mg/liter is reported.

Regulations and Standards

OSHA Standard: 5 mg/m^3 Ceiling Level

ACGIH Threshold Limit Values:

- 1 mg/m^3 TWA (fume)
- 3 mg/m^3 STEL (fume)
- 5 mg/m^3 Ceiling Level (dust and compounds)

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MERCURY

Summary

Both organic and inorganic forms of mercury are reported to be teratogenic and embryotoxic in experimental animals. In humans, prenatal exposure to methylmercury has been associated with brain damage. Other major target organs for organic mercury compounds in humans are the central and peripheral nervous system and the kidney. In animals, toxic effects also occur in the liver, heart, gonads, pancreas, and gastrointestinal tract. Inorganic mercury is generally less acutely toxic than organic mercury compounds, but it does affect the central nervous system adversely.

Background Information

Several forms of mercury, including insoluble elemental mercury, inorganic species, and organic species, can exist in the environment. In general, the mercurous (+1) salts are much less soluble than the more commonly found mercuric (+2) salts. Mercury also forms many stable organic complexes that are generally much more soluble in organic liquids than in water. The nature and solubility of the chemical species that occur in an environmental system depend on the redox potential and the pH of the environment.

CAS Number: 7439-97-6

Chemical Formula: Hg

IUPAC Name: Mercury

Chemical and Physical Properties (Metal)

Atomic Weight: 200.59

Boiling Point: 356.58°C

Melting Point: -38.87°C

Specific Gravity: 13.5939 at 20°C

Solubility in Water: 81.3 µg/liter at 30°C; some salts and organic compounds are soluble

Solubility in Organics: Depends on chemical species

Vapor Pressure: 0.0012 mm Hg at 20°C

Transport and Fate

Mercury and certain of its compounds, including several inorganic species and dimethyl mercury, can volatilize to the atmosphere from aquatic and terrestrial sources. Volatilization is reduced by conversion of metallic mercury to complexed species and by deposition of HgS in reducing sediments, but even so atmospheric transport is the major environmental distribution pathway for mercury. Precipitation is the primary mechanism for removal of mercury from the atmosphere. Photolysis is important in the breakdown of airborne mercurials and may be important in some aquatic systems. Adsorption onto suspended and bed sediments is probably the most important process determining the fate of mercury in the aquatic environment. Sorption is strongest into organic materials. Mercury in soils is generally complexed to organic compounds.

Virtually any mercury compound can be remobilized in aquatic systems by microbial conversion to methyl and dimethyl forms. Conditions reported to enhance biomethylation include large amounts of available mercury, large numbers of bacteria, the absence of strong complexing agents, near neutral pH, high temperatures, and moderately aerobic environments. Mercury is strongly bioaccumulated by numerous mechanisms. Methylmercury is the most readily accumulated and retained form of mercury in aquatic biota, and once it enters a biological system it is very difficult to eliminate.

Health Effects

When administered by intraperitoneal injection, metallic mercury produces implantation site sarcomas in rats. No other studies were found connecting mercury exposure with carcinogenic effects in animals or humans. Several mercury compounds exhibit a variety of genotoxic effects in eukaryotes. In general, organic mercury compounds are more toxic than inorganic compounds. Although brain damage due to prenatal exposure to methylmercury has occurred in human populations, no conclusive evidence is available to suggest that mercury causes anatomical defects in humans. Embryotoxicity and teratogenicity of methylmercury has been reported for a variety of experimental animals. Mercuric chloride is reported to be teratogenic in experimental animals. No conclusive results concerning the teratogenic effects of mercury vapor are available.

In humans, alkyl mercury compounds pass through the blood brain barrier and the placenta very rapidly, in contrast to inorganic mercury compounds. Major target organs are the central and peripheral nervous systems, and the kidney. Methylmercury is particularly hazardous because of the difficulty of eliminating it from the body. In experimental animals, organic mercury compounds can produce toxic effects in the gastrointestinal tract, pancreas, liver, heart, and gonads, with involvement of the endocrine, immunocompetent, and central nervous systems.

Elemental mercury is not highly toxic as an acute poison. However, inhalation of high concentrations of mercury vapor can cause pneumonitis, bronchitis, chest pains, dyspnea, coughing, stomatitis, gingivitis, salivation, and diarrhea. Soluble mercuric salts are highly poisonous on ingestion, with oral LD_{50} values of 20 to 60 mg/kg reported. Mercurous compounds are less toxic when administered orally. Acute exposure to mercury compounds at high concentrations causes a variety of gastrointestinal symptoms and severe anuria with uremia. Signs and symptoms associated with chronic exposure involve the central nervous system and include behavioral and neurological disturbances.

Toxicity to Wildlife and Domestic Animals

The toxicity of mercury compounds has been tested in a wide variety of aquatic organisms. Although methylmercury appears to be more toxic than inorganic mercuric salts, few acute or chronic toxicity tests have been conducted with it. Among freshwater species, the 96-hour LC_{50} values for inorganic mercuric salts range from 0.02 µg/liter for crayfish to 2,000 µg/liter for caddisfly larvae. Acute values for methylmercuric compounds and other mercury compounds are only available for fishes. In rainbow trout, methylmercuric chloride is about ten times more toxic to rainbow trout than mercuric chloride, which is acutely toxic at about 300 µg/liter at 10°C. Methylmercury is the most chronically toxic of the tested compounds, with chronic values for Daphnia magna and brook trout of 1.00 and 0.52 µg/liter, respectively. The acute-chronic ratio for Daphnia magna is 3.2.

Mean acute values for saltwater species range from 3.5 to 1,680 µg/liter. In general, molluscs and crustaceans are more sensitive than fish to the acute toxic effects of mercury. A life-cycle experiment with the mysid shrimp showed that inorganic mercury at a concentration of 1.6 µg/liter significantly influences time of appearance of first brood, time of first spawn, and productivity. The acute-chronic ratio for the mysid shrimp is 2.9.

Chronic dietary exposure of chickens to mercuric chloride at growth inhibitory levels causes immune suppression, with a differential reduction effect on specific immunoglobulins.

Regulations and Standards

Ambient Water Quality Criteria (USEPA):

Aquatic Life (Proposed Criteria)

Freshwater

Acute toxicity: 1.1 µg/liter
Chronic toxicity: 0.20 µg/liter

Saltwater

Acute toxicity: 1.9 µg/liter
Chronic toxicity: 0.10 µg/liter

Human Health

Criterion: 144 ng/liter

Primary Drinking Water Standard: 0.002 mg/liter

NIOSH Recommended Standard: 0.05 mg/m^3 TWA (inorganic mercury)

OSHA Standard: 0.1 mg/m^3 Ceiling Level

ACGIH Threshold Limit Values:

0.01 mg/m^3 TWA (alkyl compounds)
0.03 mg/m^3 STEL (alkyl compounds)
0.05 mg/m^3 TWA (vapor)
0.1 mg/m^3 TWA (aryl and inorganic compounds)

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METHYLENE CHLORIDE

Summary

Methylene chloride increased the incidence of lung and liver tumors and sarcomas in rats and mice. It was found to be mutagenic in bacterial test systems. In humans, methylene chloride irritates the eyes, mucous membranes, and skin. Exposure to high levels adversely affects the central and peripheral nervous systems and the heart. In experimental animals, methylene chloride is reported to cause kidney and liver damage, convulsions, and paresis.

CAS Number: 75-09-2

Chemical Formula: CH_2Cl_2

IUPAC Name: Dichloromethane

Important Synonyms and Trade Names: Methylene dichloride, methane dichloride

Chemical and Physical Properties

Molecular Weight: 84.93

Boiling Point: 40°C

Melting Point: -95.1°C

Specific Gravity: 1.3266 at 20°C

Solubility in Water: 13,200-20,000 mg/liter at 25°C

Solubility in Organics: Miscible with alcohol and ether

Log Octanol/Water Partition Coefficient: 1.25

Vapor Pressure: 362.4 mm Hg at 20°C

Vapor Density: 2.93

Transport and Fate

Volatilization to the atmosphere appears to be the major mechanism for removal of methylene chloride from aquatic systems

and its primary environmental transport process (USEPA 1979). Photooxidation in the troposphere appears to be the dominant environmental fate of methylene chloride. Once in the troposphere, the compound is attacked by hydroxyl radicals, resulting in the formation of carbon dioxide, and to a lesser extent, carbon monoxide and phosgene. Phosgene is readily hydrolyzed to HCl and CO_2. About one percent of tropospheric methylene chloride would be expected to reach the stratosphere where it would probably undergo photodissociation resulting from interaction with high energy ultraviolet radiation. Aerial transport of methylene chloride is partly responsible for its relatively wide environmental distribution. Atmospheric methylene chloride may be returned to the earth in precipitation.

Photolysis, oxidation, and hydrolysis do not appear to be significant environmental fate processes for methylene chloride, and there is no evidence to suggest that either adsorption or bioaccumulation are important fate processes for this chemical. Although methylene chloride is potentially biodegradable, especially by acclimatized microorganisms, biodegradation probably only occurs at a very slow rate.

Health Effects

Methylene chloride is currently under review by the National Toxicology Program (NTP 1984, USEPA 1985). Preliminary results indicate that it produced an increased incidence of lung and liver tumors in mice and mammary tumors in female and male rats. In a chronic inhalation study, male rats exhibited an increased incidence of sarcomas in the ventral neck region (Burek et al. 1984). However, the authors suggested that the relevance and toxicological significance of this finding were uncertain in light of available toxicity data. Methylene chloride is reported to be mutagenic in bacterial test systems. It also has produced positive results in the Fischer rat embryo cell transformation test. However, it has been suggested that the observed cell-transforming capability may have been due to impurities in the test material. There is no conclusive evidence that methylene chloride can produce teratogenic effects.

In humans, direct contact with methylene chloride produces eye, respiratory passage, and skin irritation (USEPA 1985). Mild poisonings due to inhalation exposure produce somnolence, lassitude, numbness and tingling of the limbs, anorexia, and lightheadedness, followed by rapid and complete recovery. More severe poisonings generally involve correspondingly greater disturbances of the central and peripheral nervous systems. Methylene chloride also has acute toxic effects on the heart, including the induction of arrhythmia. Fatalities reportedly

due to methylene chloride exposure have been attributed to cardiac injury and heart failure. Methylene chloride is metabolized to carbon monoxide in vivo, and levels of carboxyhemoglobin in the blood are elevated after acute exposures. In experimental animals, methylene chloride is reported to cause kidney and liver damage, convulsions, and distal paresis. An oral LD_{50} value of 2,136 mg/kg, and an inhalation LC_{50} value of 88,000 mg/m^3/30 min are reported for the rat.

Toxicity to Wildlife and Domestic Animals

Very little information concerning the toxicity of methylene chloride to domestic animals and wildlife exists (USEPA 1980). Acute values for the freshwater species Daphnia magna, the fathead minnow, and the bluegill are 224,000, 193,000, and 224,000 µg/liter, respectively. Acute values for the saltwater species, mysid shrimp and sheepshead minnow, are 256,000 and 331,000 µg/liter, respectively. No data concerning chronic toxicity are available. The 96-hour EC_{50} values for both freshwater and saltwater algae are greater than the highest test concentration, 662,000 µg/liter.

Regulations and Standards

Ambient Water Quality Criteria (USEPA):

Aquatic Life

The available data are not adequate for establishing criteria.

Human Health

Criterion: 12.4 mg/liter (for protection against the noncarcinogenic effects of methylene chloride)

CAG Unit Risk (USEPA): 1.4×10^{-2} $(mg/kg/day)^{-1}$

NIOSH Recommended Standards:

261 mg/m^3 TWA in the presence of no more than 9.9 mg/m^3 of CO
1,737 mg/m^3/15 min Peak Concentration

OSHA Standards: 1,737 mg/m^3 TWA
3,474 mg/m^3 Ceiling Level
6,948 mg/m^3 Peak Concentration (5 min in any 3 hr)

ACGIH Threshold Limit Values: 350 mg/m^3 TWA
1,740 mg/m^3 STEL

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NICKEL

Summary

In a number of epidemiological studies, occupational exposure to nickel compounds has been associated with excess cancer of the lung and nasal cavity. In addition, inhalation exposure to nickel subsulfide and nickel carbonyl has been shown to cause cancer in rats, while studies of other nickel compounds administered to animals by other routes have reported carcinogenic effects as well. Several nickel compounds are mutagenic and can cause cell transformation. In humans, nickel and nickel compounds can cause a sensitization dermatitis. The chronic toxicity of nickel to aquatic organisms is high.

Background Information

The commonly occurring valences of nickel are 0, +1, +2, and +3, with +4 rarely encountered. Although elemental nickel is seldom found in nature and is not soluble in water, many nickel compounds are highly soluble in water. Nickel is almost always found in the divalent oxidation state in aquatic systems.

CAS Number: 7440-02-0

Chemical Formula: Ni

IUPAC Name: Nickel

Chemical and Physical Properties

Atomic Weight: 58.71

Boiling Point: 2,732°C

Melting Point: 1,453°C

Specific Gravity: 8.902 at 25°C

Solubility in Water: Insoluble; some salts are soluble

Solubility in Organics: Depends on the properties of the specific nickel salt

Vapor Pressure: 1 mm Hg at 1,810°C

Transport and Fate

Nickel is a highly mobile metal in aquatic systems because many nickel compounds are highly soluble in water. However, the insoluble sulfide is formed under reducing conditions and in the presence of sulfur. Above pH 9, precipitation of the hydroxide or carbonate exhibits some control on nickel mobility. In aerobic environments below pH 9, soluble compounds are formed with hydroxide, carbonate, sulfate, and organic ligands.

In natural, unpolluted waters, sorption and coprecipitation processes involving hydrous iron and manganese oxides are probably at least moderately effective in limiting the mobility of nickel. In more organic-rich, polluted waters, it appears that little sorption of nickel is likely. The lack of other controls on nickel mobility probably makes incorporation into bed sediments an important fate of nickel in surface waters. However, much of the nickel entering the aquatic environment will be transported to the oceans.

In general, nickel is not accumulated in significant amounts by aquatic organisms. Bioconcentration factors are usually on the order of 100 to 1,000. Uptake of nickel from the soil by plants can also occur. Photolysis, volatilization, and biotransformation are not important environmental fate processes for nickel. However, atmospheric transport of nickel and nickel compounds on particulate matter can occur.

Health Effects

There is extensive epidemiological evidence indicating excess cancer of the lung and nasal cavity for workers at nickel refineries and smelters, and weaker evidence for excess risk in workers at nickel electroplating and polishing operations. Respiratory tract cancers have occurred in excess at industrial facilities that are metallurgically diverse in their operations. The nickel compounds that have been implicated as having carcinogenic potential are insoluble dusts of nickel subsulfide and nickel oxides, the vapor of nickel carbonyl, and soluble aerosols of nickel sulfate, nitrate, or chloride. Inhalation studies with experimental animals suggest that nickel subsulfide and nickel carbonyl are carcinogenic in rats. Evidence for the carcinogenicity of nickel metal and other compounds is relatively weak or inconclusive. Studies with experimental animals indicate that nickel compounds can also produce various types of malignant tumors in experimental animals after administration by other routes, including subcutaneous, intramuscular, implantation, intravenous, intrarenal, and intrapleural. Carcinogenic potential is not strongly dependent on route or site of administration but appears to be inversely related to the solubility of the compounds in aqueous media. Insoluble compounds, such

as nickel dust, nickel sulfide, nickel carbonate, nickel oxide, nickel carbonyl, and nickelocene are carcinogenic, whereas soluble nickel salts such as nickel chloride, nickel sulfate, and nickel ammonium sulfate, are not.

Mammalian cell transformation data indicate that several nickel compounds are mutagenic and can cause chromosomal alterations. The available information is inadequate for assessing teratogenic and reproductive effects of nickel in humans and experimental animals.

Dermatitis and other dermatological effects are the most frequent effects of exposure to nickel and nickel-containing compounds. The dermatitis is a sensitization reaction. Most information regarding acute toxicity of nickel involves inhalation exposure to nickel carbonyl. Clinical manifestations of acute poisoning include both immediate and delayed symptoms. Acute chemical pneumonitis is produced, and death may occur at exposures of 30 ppm (107 mg/m^3) for 30 minutes. Rhinitis, nasal sinusitis, and nasal mucosal injury are among the effects reported among workers chronically exposed to various nickel compounds. Studies with experimental animals suggest that nickel and nickel compounds have relatively low acute and chronic oral toxicity.

Toxicity to Wildlife and Domestic Animals

In freshwater, toxicity depends on hardness; nickel tends to be more toxic in softer water. Acute values for exposure to a variety of nickel salts, expressed as nickel, range from 510 µg/liter for *Daphnia magna* to 46,200 µg/liter for banded killifish at comparable hardness levels. Chronic values range from 14.8 µg/liter for *Daphnia magna* in soft water to 530 µg/liter for the fathead minnow in hard water. Acute-chronic ratios for *Daphnia magna* range from 14 in hard water to 83 in soft water, and are approximately 50 in both hard and soft water for the fathead minnow. Residue data for the fathead minnow indicate a bioconcentration factor of 61. Freshwater algae experience reduced growth at nickel concentrations as low as 100 µg/liter.

Acute values for saltwater species range from 152 µg/liter for mysid shrimp to 350,000 µg/liter for the mummichog. A chronic value of 92.7 µg/liter is reported for the mysid shrimp, which gives an acute-chronic ratio of 5.5 for the species. Reduced growth is seen in saltwater algae at concentrations as low as 1,000 µg/liter. Bioconcentration factors ranging from 299 to 416 have been reported for the oyster and mussel.

Regulations and Standards

Ambient Water Quality Criteria (USEPA):

Aquatic Life

Freshwater

Acute toxicity: $e^{(0.76\ [\ln(\text{hardness})] + 4.02)}$ µg/liter

Chronic toxicity: $e^{(0.76\ [\ln(\text{hardness})] + 1.06)}$ µg/liter

Saltwater

Acute toxicity: 140 µg/liter
Chronic toxicity: 7.1 µg/liter

Human Health

Criterion: 13.4 µg/liter

CAG Unit Risk (USEPA): 1.15 $(\text{mg/kg/day})^{-1}$

NIOSH Recommended Standard: 15 $\mu g/m^3$ TWA (inorganic nickel)

OSHA Standard: 1 mg/m^3 (metal and soluble compounds, as nickel)

ACGIH Threshold Limit Values:

0.1 mg/m^3 TWA (soluble compounds, as nickel)
0.3 mg/m^3 STEL (soluble compounds, as nickel)
0.35 mg/m^3 TWA (nickel carbonyl, as nickel)
1 mg/m^3 TWA (nickel sulfide roasting, fume and dust, as nickel; human carcinogen)

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PHENANTHRENE

Summary

Phenanthrene is a polycyclic aromatic hydrocarbon (PAH) and is moderately persistent in natural environments. In two skin painting studies, it produced application-site tumors, and it was shown to be mutagenic in several other studies. Workers exposed to materials containing phenanthrene developed chronic dermatitis and other skin disorders.

CAS Number: 85-01-8

Chemical Formula: $C_{14}H_{10}$

IUPAC Name: Phenanthrene

Chemical and Physical Properties

Molecular Weight: 178.24

Boiling Point: 340°C

Melting Point: 101°C

Specific Gravity: 1.025

Solubility in Water: 1.29 mg/liter at 25°C

Solubility in Organics: Soluble in alcohol, ether, acetone, benzene, and acetic acid

Log Octanol/Water Partition Coefficient: 4.46

Vapor Pressure: 6.8×10^{-4} mm Hg at 20°C

Vapor Density: 6.14

Transport and Fate

Much of the information concerning transport and fate is inferred from data for polycyclic aromatic hydrocarbons (PAHs) in general because specific information for phenanthrene is lacking. Rapid, direct photolysis of phenanthrene to quinones may occur in aqueous solution. Oxidation is probably too slow to be a significant environmental process and the available data suggest that volatilization generally is not an important transport process. The calculated log octanol/water partition

coefficient of 4.46 indicates that the compound should be strongly absorbed onto particulate matter, especially particulates high in organic content. It is likely that phenanthrene can be transported as absorbed matter on suspended particulates in air or water. Data for PAHs in general indicate that phenanthrene will accumulate in the sediment and biota of the aquatic environment. Removal rates associated with absorption and subsequent sedimentation are probably slower than photolysis and degradation, but may be competitive with volatilization.

Data for a variety of PAHs suggest that bioaccumulation is a short term process, and long-term partitioning into biota is not a significant fate process. Phenanthrene can be metabolized by multicellular organisms and degraded by microbes.

Degradation by mammals is likely to be incomplete, with parent compound and the metabolites being excreted by the urinary system. Biodegradation by microorganisms is probably the ultimate fate process. Biodegradation generally appears to be more efficient in soil than in aquatic systems. However, it may be more important in those aquatic systems which are chronically affected by PAH contamination. Phenanthrene is stable enough in air to be transported over relatively great distances.

Health Effects

There are no epidemiological or case studies available suggesting that phenanthrene is carcinogenic in humans. This compound generally is not considered to be carcinogenic in experimental animals. However, at least two skin painting studies report development of tumors at the site of application in mice. Phenanthrene exhibits mutagenic activity in some test systems, but not in others. There are no reports of teratogenic or reproductive effects due to phenanthrene exposure.

Little information concerning acute and chronic toxic effects is available. Although specific data concerning exposure to phenanthrene are not available, workers exposed to materials containing this compound may exhibit chronic dermatitis, hyperkeratoses, and other skin disorders.

Toxicity to Wildlife and Domestic Animals

Adequate data for characterization of toxicity to domestic animals and wildlife are not available. A 96-hour LC_{50} value of 600 µg/liter is reported for a saltwater polychaete worm exposed to a crude oil fraction containing phenanthrene. The weighted average bioconcentration factor for the edible portion of all freshwater and estuarine aquatic organisms consumed by Americans is 486.

Regulations and Standards

Ambient Water Quality Criteria (USEPA):

Aquatic Life

The available data are not adequate for establishing criteria.

Human Health

Estimates of the carcinogenic risks associated with lifetime exposure to various concentrations of carcinogenic PAHs in water are:

Risk	Concentration
10^{-5}	28 ng/liter
10^{-6}	2.8 ng/liter
10^{-7}	0.28 ng/liter

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Regulations and Standards

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PHENOL

Summary

When applied to the skin of mice, phenol appears to have some tumor-promoting effects and may be a weak carcinogen. There is equivocal evidence that phenol is mutagenic. Subchronic exposure to phenol caused liver, kidney, lung, and heart damage in experimental animals. In humans, phenol has been shown to irritate the eyes, nose, and throat.

CAS Number: 108-95-2

Chemical Formula: C_6H_5OH

IUPAC Name: Phenol

Chemical and Physical Properties

Molecular Weight: 94.11

Boiling Point: 181.75°C

Melting Point: 43°C

Specific Gravity: 1.0576 at 20°C

Solubility in Water: 93,000 mg/liter at 25°C

Solubility in Organics: Soluble in alcohol, chloroform, and carbon disulfide; very soluble in ether; miscible with carbon tetrachloride and hot benzene

Log Octanol/Water Partition Coefficient: 1.46

Vapor Pressure: 0.3513 mm Hg at 25°C

Vapor Density: 3.24

pKa: 10.02

Flash Point: 85°C (closed cup)

Transport and Fate

Photooxidation may be an important degradative process, especially in aerated, clear, surface waters. Phenol may also be nonphotolytically oxidized in highly aerated waters that contain iron and copper in solution or as part of the suspended particulates. The relatively low log octanol/water partition coefficient of phenol, as well as the available experimental evidence, suggest that sorption and bioaccumulation are not important environmental fate processes. Biodegradation can be a significant fate pathway in aquatic systems and soil when significant concentrations of microorganisms are present. In addition to microorganisms, at least one species of fish is reported to be able to biotransform phenol.

The dominance of photooxidation, metal-catalyzed oxidation, or biodegradation as destructive pathways depends on the particular environmental conditions, but the degradation products are similar for all fate pathways. The first step usually involves further hydroxylation of the aromatic ring, followed by oxidation to benzoquinone and cleavage of the ring structure. There is a possibility that phenol present in surface waters can volatilize into the atmosphere. However, since this phenol would be rapidly photooxidized in the troposphere, any significant atmospheric transport is unlikely.

Health Effects

Phenol appears to have tumor-promoting activity in many strains of mice when repeatedly applied to the shaved skin after initiation with known carcinogens. Although there is equivocal evidence that phenol may be weakly carcinogenic when applied to the skin of one sensitive strain of mice, it does not appear to be carcinogenic when applied to the skin of standard strains of mice. NCI reported that phenol was not carcinogenic when administered in drinking water to rats and mice. There is equivocal evidence that phenol may have mutagenic effects, although further evaluation is needed. There are no reports of teratogenic effects caused by exposure to phenol.

Subchronic inhalation exposure to phenol is reported to cause liver, kidney, lung, and heart damage in guinea pigs. Slight liver and kidney damage was seen in rats exposed by gavage to 100 mg/kg/day for 20 days. The oral and skin LD_{50}s for the rat are 414 and 669 mg/kg, respectively, and the inhalation LC_{50} is 316 mg/m^3. Phenol is an eye, nose, and throat irritant and can cause systemic damage to the nervous system in humans following dermal, oral, or inhalation exposure.

Toxicity to Wildlife and Domestic Animals

The acute toxicity of phenol to freshwater species is expressed over a range of 2 to 3 orders of magnitude. Acute values for fish species range from 5,020 µg/liter for juvenile rainbow trout to 67,500 µg/liter for the fathead minnow. The acute value for the rainbow trout, and a value of 5,000 µg/liter for Daphnia magna are the lowest acute values observed. An early life stage test on the fathead minnow resulted in a chronic value of 2,560 µg/liter, with an acute-chronic ratio of 14. Median effect concentrations for oyster and clam embryos are approximately 55,000 µg/liter. For the grass shrimp and the mountain bass, LC_{50} values of 5,800 and 11,000 µg/liter, respectively, are reported. No chronic effects are available for saltwater species. Reported bioconcentration factors of 1.2 to 2.3 for goldfish suggest that no residue problem should occur from exposure to phenol. No appropriate data concerning effects of phenol on other wildlife or domestic animals are available.

Regulations and Standards

Ambient Water Quality Criteria (USEPA):

Aquatic Life

The available data are not adequate for establishing criteria. However, the lowest concentrations of phenol known to cause toxic effects in aquatic organisms are:

Freshwater

Acute toxicity: 10,200 µg/liter
Chronic toxicity: 2,560 µg/liter

Saltwater

Acute toxicity: 5,800 µg/liter
Chronic toxicity: No available data

Human Health

Health criterion: 3.5 mg/liter
Organoleptic criterion: 0.3 mg/liter

NIOSH Recommended Standards: 20 mg/m^3 TWA
60 mg/m^3/15 min Ceiling Level

OSHA Standard: 19 mg/m^3

.... Limit Values: 19 mg/m^3 TWA
38 mg/m^3 STEL

Department of Transportation: Poison

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POLYCHLORINATED BIPHENYLS

Summary

Polychlorinated biphenyls (PCBs) are very persistent in the natural environment and are readily bioaccumulated. In humans, exposure to PCBs has been associated with chloracne, impairment of liver function, a variety of neurobehavioral symptoms, menstrual disorders, minor birth abnormalities, and an increased incidence of cancer. Experimental animals exposed to PCBs experienced an increased incidence of cancer; reproductive problems; neurobehavioral degradation; pathological changes in the liver, stomach, skin, and other organs; and suppression of immunological function. PCBs are often contaminated, and these contaminants may be much more toxic than the PCBs themselves.

Background Information

Polychlorinated biphenyls (PCBs) are complex mixtures of chemicals composed of two connected benzene rings with 1 to 10 chlorine atoms attached. The chemical, physical, and biological properties of these materials depend to a large degree on the amount and location of the chlorine atoms on the two benzene rings of each specific PCB and on the particular mixture of individual chlorobiphenyls that comprise the mixture.

CAS Number: 1336-36-3

Chemical Formula: $C_6H_5Cl_xC_6H_5Cl_x$

IUPAC Name: Specific for each polychlorinated biphenyl

Important Synonyms and Trade Names: PCBs, chlorinated biphenyls, polychlorobiphenyls, Aroclor, Kanechlor, Clophen

Chemical and Physical Properties

Molecular Weight: 189-399*

Boiling Point: 267°C and up*

Melting Point: 54-310°C*

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*Increases with increasing chlorination.

Specific Gravity: 1.3 to 1.5 at 20°C*

Solubility in Water: 0.003-0.6 mg/liter

Solubility in Organics: Soluble in most common organic solvents

Log Octanol/Water Partition Coefficient: 4-6*

Vapor Pressure: 10^{-3}-10^{-5} mm Hg at 20°C**

Henry's Law Constant: 10^{-3} to -10^{-5} atm m^3/mole

Transport and Fate

The transport and fate of polychlorinated biphenyls has been studied extensively, and although individual chemicals vary in the rates at which processes occur, some generalizations can be made about PCBs as a class. PCBs are relatively inert, and therefore persistent, compounds, with low vapor pressures, low water solubility, and high log octanol/water partition coefficients. Despite their low vapor pressures, they have a high activity coefficient in water, which causes a higher rate of volatilization than might normally be expected. Volatilization and persistence account for the ubiquitous nature of PCBs in the environment. Adsorption to the organic material in soil or sediments is probably the major fate of at least the more heavily chlorinated PCBs. Once bound, the PCBs may persist for years with slow desorption providing continuous, low-level exposure to the surrounding locality. Bioaccumulation of PCBs also occurs, with most of the compound stored in the adipose tissue of the body. PCBs are degraded primarily by two routes. Less heavily chlorinated PCBs (mainly the mono-, di-, and trichlorinated PCBs) can be biodegraded by some soil microorganisms. PCBs with five or more chlorines are not measurably biodegraded. These heavier PCBs can be photolyzed by ultraviolet light. This process is extremely slow, but it may be the most important degradation process for these very persistent compounds.

Assessing the toxicity of PCBs is complicated by the fact that several different mixtures have been produced and distributed commercially and by the presence of highly toxic contaminants in some commercial mixtures. Some of these contaminants can be formed by combustion of PCBs or even by high-temperature treatment in service, so that used materials may be more toxic than the commercial mixtures whose toxicity has been studied.

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*Increases with increasing chlorination.
**Decreases with increasing chlorination.

Health Effects

In humans exposed to PCBs (in the workplace or via accidental contamination of food), reported adverse effects include chloracne (a long-lasting, disfiguring skin disease), impairment of liver function, a variety of neurobehavioral and affective symptoms, menstrual disorders, minor birth abnormalities, and probably increased incidence of cancer. Animals experimentally exposed to PCBs have shown most of the same symptoms, as well as impaired reproduction; pathological changes in the liver, stomach, skin, and other organs; and suppression of immunological functions. PCBs are carcinogenic in rats and mice and, in appropriate circumstances, enhance the effects of other carcinogens. Reproductive and neurobiological effects of PCBs have been reported in rhesus monkeys at the lowest dose level tested, 11 µg/kg body weight/day over a period of several months.

Toxicity to Wildlife and Domestic Animals

Polychlorinated biphenyls are bioaccumulated and can be biomagnified. Therefore, their toxicity increases with length of exposure and position of the exposed species on the food chain. The toxicity of the various PCB mixtures is also dependent on their composition. Because of the complexity of PCB toxicity, only general effects will be discussed here.

The 96-hour LC_{50} values for rainbow trout, bluegills, and channel catfish were around 20 mg/liter. The same species exposed for 10 to 20 days had LC_{50} values of about 0.1 mg/liter. Invertebrate species were also adversely affected, with some species having 7-day LC_{50} values as low as 1 µg/liter. In general, juvenile organisms appeared more susceptible to the effects of PCBs than either eggs or adults.

Three primary ways in which PCBs can affect terrestrial wildlife are outright mortality, adversely affecting reproduction, and changing behavior. PCB doses greater than 200 ppm in the diet or 10 mg/kg body weight (bw) caused some mortality in sensitive bird species exposed for several days. Doses around 1,500 ppm (diet) or about 100 mg/kg (bw) caused extensive mortality in these sensitive species. They generally caused some mortality in all species, with the level being dependent on the length of exposure and the particular PCB mixture. Some mammalian species are especially susceptible to PCBs. For example, mink died when fed as little as 5 ppm in the diet (equivalent to less than 1 mg/kg bw/day). PCBs caused lower egg production; deformities; decreased hatchability, growth, and survival; and some eggshell thinning in reproductive studies on chickens fed doses of 20 ppm in the diet (1 mg/kg bw). Mink fed 1 ppm in the diet (0.2 mg/kg bw) had lower reproductive success, and there are indications that an increased incidence

of premature births in some marine mammals was linked to PCB exposure. Behavioral effects on wildlife include increased activity, decreased avoidance response, and decreased nesting, all of which could significantly influence survival in the wild.

No toxic effects on domestic animals other than chickens were reported in the sources reviewed, but susceptible species would probably be affected in a similar manner to laboratory animals and wildlife.

Regulations and Standards

Ambient Water Quality Criteria (USEPA):

Aquatic Life

Freshwater

Acute toxicity: 2 µg/liter
Chronic toxicity: 0.014 µg/liter

Saltwater

Acute toxicity: 10 µg/liter
Chronic toxicity: 0.030 µg/liter

Human Health

Estimates of the carcinogenic risks associated with lifetime exposure to various concentrations of PCBs in water are:

Risk	Concentration
10^{-5}	0.79 ng/liter
10^{-6}	0.079 ng/liter
10^{-7}	0.0079 ng/liter

CAG Unit Risk (USEPA): 4.34 $(mg/kg/day)^{-1}$

NIOSH Recommended Standard: 1.0 $\mu g/m^3$ TWA

ACGIH Threshold Limit Value: 0.5 mg/m^3 TWA

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POLYCYCLIC AROMATIC HYDROCARBONS

Summary

Polycyclic aromatic hydrocarbons (PAHs) are rather persistent in the environment. Some PAHs are carcinogenic, causing tumors both at the site of application and systemically. The carcinogenic PAHs are generally active in mutagenic assays. They also cause skin disorders and immunosuppression. Adverse effects on the liver and kidney have been associated with exposure to PAHs in general.

Important Synonyms and Trade Names: Polynuclear aromatic hydrocarbons, PAH, PNA

Chemical and Physical Properties

The polycyclic aromatic hydrocarbons are a class of compounds consisting of substituted and unsubstituted polycyclic aromatic rings formed by the incomplete combustion of organic materials. Their chemical, physical, and biological properties vary with their size and shape.

Molecular Weight: 116-278

Melting Point: 80°C-270°C*

Specific Gravity: 1.1-1.3 at 20°C*

Solubility in Water: 0.0003-34 mg/liter**

Solubility in Organics: Soluble in most common organic solvents

Log Octanol/Water Partition Coefficient: 3.4-7.6*

Vapor Pressure: 10^{-10} to 10^{-2} mm Hg at 20°C**

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*Generally increases with increasing molecular weight.

**Generally decreases with increasing molecular weight.

Transport and Fate

Very little information on specific polycyclic aromatic hydrocarbons (PAHs) is available. The environmental fate and transport of these compounds are largely inferred from data on benzo(a)pyrene and mixtures of PAHs. The relatively high log octanol/water partition coefficients of PAHs indicate that they should be strongly adsorbed onto suspended particulate matter, especially particulates high in organic content. The available information suggests that these compounds can accumulate in the sediment and biota portions of the aquatic environment and that adsorption is probably the dominant aquatic transport process. Atmospheric transport of PAHs is also possible. This generally occurs by adsorbtion onto airborne particulate matter, but some of the PAHs with relatively low molecular weights are volatile. Regardless of the method of atmospheric transport, PAHs are returned to aquatic and terrestrial systems by atmospheric fallout or precipitation. They can also reach ground or surface waters by leaching from polluted soils.

PAHs are relatively insoluble in water, but the dissolved portion may undergo rapid, direct photolysis. Singlet oxygen is the oxidant, and quinones are the products in these reactions. Oxidation by chlorine and ozone may be an important fate process when these oxidants are available in sufficient quantities.

Although polycyclic aromatic hydrocarbons are rapidly bioaccumulated, they are also quickly metabolized and eliminated from most organisms (shellfish are a known exception). Bioaccumulation, especially in vertebrate organisms, is usually short term, so it is not considered an important fate process in multicellular organisms. Biodegration and biotransformation are probably the ultimate fate processes for PAHs. The available data suggest that the PAHs with high molecular weights are degraded slowly by microbes and readily metabolized by multicellular organisms. Microbes appear to degrade PAHs much more completely than mammals. Biodegradation probably occurs more slowly in aquatic systems than in soil, and it may be much more important in systems that are chronically affected by PAH contamination.

Health Effects

The potential for PAHs to induce malignant transformation dominates the consideration of health hazards resulting from exposure, because there often are no overt signs of toxicity until the dose is high enough to produce a high tumor incidence. The attached table contains IARC's classification of some PAHs according to their carcinogenicity.

No case reports or epidemological studies concerning the significance of human exposure to individual PAHs are available.

However, coal tar and other materials known to be carcinogenic to humans contain PAHs.

PAHs administered by various routes have been found to be carcinogenic in several animal species and to have both local and systemic carcinogenic effects. On oral administration, carcinogenic PAHs produce tumors of the forestomach in mice. Lung tumors are produced in hamsters after intratracheal administration and in mice after intravenous administration. In skin painting experiments with mice, carcinogenic PAHs produced skin carcinomas. Other observed effects include induction of local sarcomas and an increased incidence of lung adenomas in mice following single, subcutaneous injections. Studies in other species, while indicating that PAHs have universal carcinogenic effects, are less complete. Carcinogenic PAHs are reported to be mutagenic in a variety of test systems. The limited available information suggests that PAHs are not very potent teratogens or reproductive toxins.

There is very little information regarding nonmalignant changes caused by exposure to PAHs. Application of carcinogenic PAHs to mouse skin is reported to cause destruction of sebaceous glands, hyperplasia, hyperkeratosis, and ulceration. Many carcinogenic PAHs also have immunosuppressive effects. Subcutaneous injections of some PAHs for several weeks reportedly caused hemolymphatic changes in the lymph nodes in rats. Workers exposed to PAH-containing materials have exhibited chronic dermatitis, hyperkeratoses, and other skin disorders.

Toxicity to Wildlife and Domestic Animals

There is very little information on the environmental toxicity of PAHs; they probably are not very toxic to aquatic organisms.

Regulations and Standards

Ambient Water Quality Criteria (USEPA):

Aquatic Life

The available data are not adequate for establishing criteria.

Human Health

Estimates of the carcinogenic risks associated with lifetime exposure to various concentrations of carcinogenic PAHs in water are:

Risk	Concentration
10^{-5}	28.0 ng/liter
10^{-6}	2.8 ng/liter
10^{-7}	0.28 ng/liter

CAG Unit Risk (USEPA): Benzo(a)pyrene: 11.5 $(mg/kg/day)^{-1}$

SILVER

Summary

Exposure to high levels of silver can cause argyria (an impregnation of the tissues) and lesions of the liver, kidney, bone marrow, and lungs in humans. Liver and kidney damage, central nervous system effects, and pulmonary edema and congestion have been reported in experimental animals exposed to various silver compounds.

CAS Number: 7440-22-4

Chemical Formula: Ag

IUPAC Name: Silver

Chemical and Physical Properties

Atomic Weight: 107.868

Boiling Point: 2212°C

Melting Point: 961.93°C

Specific Gravity: 10.5 at 20°C

Solubility in Water: Insoluble (some compounds are soluble)

Solubility in Organics: Soluble in alkali cyanide solutions

Transport and Fate

Silver can exist in several chemical forms in aqueous systems. Metallic silver, which has very low solubility, is stable over much of the Eh-pH range for water. Concentrations of hydrated silver cations, usually present as the univalent species, may be controlled by reaction with chloride, bromide, and iodide ions to give insoluble silver halides. Precipitation of AgCl may exert a major control on solubility of silver where chloride concentrations are relatively high. Under the reducing conditions often found in bed sediments, formation of insoluble silver sulfides and metallic silver may also control levels of soluble silver species. Silver is strongly sorbed by manganese dioxide, ferric hydroxide, and clay minerals. Sorption is probably the dominant process leading to removal of dissolved

silver from the water column. In general, concentrations of silver are higher in the bed sediments than in overlying waters. For example, these concentrations were reported to differ by a factor of 1,000 in an alpine lake.

Bioaccumulation of silver by aquatic plants, invertebrates, and vertebrates occurs readily and appears to depend primarily on sorption/desorption from sediments. However, the amount of silver partitioned to the biota appears to be minor in comparison with the amount partitioned to the sediments. Little food-chain magnification seems to occur. Photolysis, volatilization, atmospheric transport, and biotransformation do not appear to be important fate or transport processes for silver.

Health Effects

Only equivocal evidence exists to suggest that silver has carcinogenic activity in experimental animals. Silver implants and injected colloidal suspensions are reported to produce tumors or hyperplasia at the site of application in several studies. However, it is suggested that the effects are due to the physical form of the metal or to its action as an exogenous irritant. There are no studies to suggest that silver is carcinogenic in humans. Silver does not appear to have significant mutagenic or teratogenic activity in humans or experimental animals.

Silver can be absorbed in humans by inhalation or ingestion. The most common and most noticeable effects of excessive absorption are a local or generalized impregnation of the tissues referred to as argyria. In cases of argyria, accumulation of silver can result in a blue-gray pigmentation of the skin, hair, internal organs, and conjunctiva of the eye. Large oral doses of silver compounds may produce serious effects in humans. For example, silver nitrate can cause violent abdominal pain, vomiting, and convulsions, and ingestion of 10 grams is reported to usually be fatal. Lesions of the liver, kidney, bone marrow, and lungs have also been attributed to industrial or medicinal exposure.

Intravenous administration of silver nitrate is reported to produce pulmonary edema and congestion in experimental animals. Liver and kidney damage, central nervous system effects, and death have also been reported in experimental animals exposed to various silver compounds. The intraperitoneal LD_{50} (30 days) for Ag^{+} as the nitrate in male Swiss albino mice is 13.9 mg/kg. Rats exposed to silver in their drinking water for 11 months showed no toxic effects at concentrations less than 0.4 mg/liter. Hemorrhaging occurred in the kidneys at 0.4 mg/liter. Conditioned reflex activity and immunological resistance were lowered, and brain nucleic acid content was increased at 0.5 mg/liter.

Numerous physiological changes, including growth depression, and pathomorphological changes in the liver, kidney, stomach, and small intestine were evident in rats exposed to 20 mg/liter for 5 months.

Toxicity to Wildlife and Domestic Animals

Acute toxicity values for freshwater invertebrates range from 0.25 µg/liter for Daphnia magna to 4,500 µg/liter for the scud Gammarus pseudolimnaeus. Acute values for fish range from 3.9 µg/liter for the fathead minnow in soft water to 280 µg/liter for rainbow trout in hard water. In fresh water, the acute toxicity of silver appears to decrease as hardness increases. Soluble compounds, such as silver nitrate, are generally much more toxic than insoluble compounds. Chronic values ranging from 2.6 to 29 µg/liter are reported for Daphnia magna. Two early life stage studies with rainbow trout report chronic values of 0.12 µg/liter. Acute-chronic ratios for Daphnia magna and rainbow trout are 2.0 and 54, respectively. Fresh water aquatic plants appear to be more resistant to silver than the more sensitive animals.

Acute values for saltwater organisms range from 4.7 µg/liter for the summer flounder to 1,400 µg/liter for the sheepshead minnow. A chronic value of 18 µg/liter, and an acute-chronic ratio of 14 is reported for the mysid shrimp.

Reduced cell numbers are observed in the saltwater alga Skeletonema costatum after exposure to 130 µg/liter of silver.

Excess silver can induce selenium, vitamin E, and copper deficiency symptoms in animals fed adequate diets, and can aggravate deficiency symptoms in animals whose diets lack one or more of these nutrients. These effects are reported in dogs, sheep, pigs, chicks, turkey poults, and ducklings.

Regulations and Standards

Ambient Water Quality Criteria (USEPA):

Aquatic Life

Freshwater

Acute toxicity: $e^{(1.72\ [\ln(\text{hardness})] - 6.52)}$ µg/liter
Chronic toxicity: No criteria have been established

Saltwater

Acute toxicity: 2.3 µg/liter
Chronic toxicity: No criteria have been established

Human Health

Criterion: 50 µg/liter

Primary Drinking Water Standard: 50 µg/liter

OSHA Standard: 10 $\mu g/m^3$ TWA

ACGIH Threshold Limit Values: 0.1 mg/m^3 (metal)
0.01 mg/m^3 (soluble compounds)

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SODIUM

Summary

High doses of certain sodium compounds are reported to have teratogenic and reproductive effects in animals. Several studies suggest that brain damage and sudden unexpected death in human infants may be induced by high sodium levels. Exposure to high levels of sodium has also been associated with age-related increases in high blood pressure in genetically susceptible individuals.

Background Information

Sodium is the sixth most abundant element on earth. It is very reactive and is never found free in nature. It reacts violently with water, decomposing it with the evolution of H_2 and the formation of NaOH. Sodium normally does not ignite in air at temperatures below 115°C, but it may ignite spontaneousl on water. Because of its reactivity, sodium must be handled with great care, and contact between it and water and other substances with which it reacts should be avoided.

CAS Number: 7440-23-5

Chemical Formula: Na

IUPAC Name: Sodium

Chemical and Physical Properties

Atomic Weight: 22.9898

Boiling Point: 882.9°C

Melting Point: 97.81°C

Specific Gravity: 0.97

Solubility in Water: Metal decomposes explosively in water; many sodium compounds are soluble

Transport and Fate

Many sodium compounds are soluble in water, and the sodium ion is readily transported in surface water, soil, and groundwater. The extent of sodium transport in soil is dependent,

to some extent, on the cation exchange capacity of the soil. Atmospheric transport of sodium occurs readily. Evaporation of ocean spray particles and their subsequent incorporation into precipitation is an important sodium cycling process. Sodium is ubiquitous in nature and is an important component of all ecosystems.

Health Effects

There is no evidence to suggest that sodium has carcinogenic or mutagenic effects in humans or experimental animals. Sodium chloride is reported to produce teratogenic and reproductive effects in experimental animals exposed to high doses by various routes. For example, mice exposed subcutaneously to over 2,000 mg/kg of sodium chloride on day 10 or 11 of gestation had an increased incidence of dead or resorbed young. Live young in this study had decreased body weights and an increased incidence of appendicular malformations, such as clubfoot and deviation of the digits (Nishimuri and Miyamoto 1969).

In humans, adverse effects of sodium occur as a result of ingestion of excess amounts of this element. Acute effects appear to occur only in neonates and young infants. Several studies suggest that permanent brain damage and sudden, unexpected deaths of infants between the ages of 2 weeks and 2 years may be due to hypernatremia. Sodium produces toxic effects and can cause death in experimental animals exposed to high concentrations. For example, the oral LD_{50} value for NaCl in rats is 3,000 mg/kg.

Clinical and epidemiological studies suggest that ingestion of excess sodium may contribute to the development of age-related increases in blood pressure and hypertension in genetically susceptible persons. Studies with experimental animals support the contention that excess sodium ingestion is related to the development of hypertension. It is estimated that at least 40 percent of the population would benefit if consumption of sodium were limited to 2,000 mg/day or less. The sodium present in drinking water contributes to the total daily intake of this element. One survey, which sampled the water supplies used by about half of the U.S. population, reported sodium ion concentrations ranging from 0.4 to 1,900 mg/liter.

Toxicity to Wildlife and Domestic Animals

Although few studies documenting effects are available, high concentrations of sodium chloride probably have detrimental effects on aquatic organisms and terrestrial plants. In lakes, increased salinity will cause stratification and thereby delay the spring turnover that oxygenates the lower levels of the

lake. In addition, salinity changes due to high sodium chloride concentrations may adversely affect aquatic systems by changing the osmotic pressure and by increasing the mobility of some heavy metals such as mercury. In terrestrial systems, high sodium chloride concentrations caused by road deicing have proved fatal to roadside vegetation, and the increased soil salinity associated with irrigation has rendered cropland unusable.

Regulations and Standards

Department of Transportation: Flammable solid; dangerous when wet

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Summary

Tetrachloroethylene (PCE, perchloroethylene) induced liver tumors when administered orally to mice and was found to be mutagenic using a microbial assay system. Reproduction toxicity was observed in pregnant rats and mice exposed to high concentrations. Animals exposed by inhalation to tetrachloroethylene exhibited liver, kidney, and central nervous system damage.

CAS Number: 127-18-4

Chemical Formula: C_2Cl_4

IUPAC Name: Tetrachloroethene

Important Synonyms and Trade Names: Perchloroethylene, PCE

Chemical and Physical Properties

Molecular Weight: 165.83

Boiling Point: 121°C

Melting Point: -22.7°C

Specific Gravity: 1.63

Solubility in Water: 150 to 200 mg/liter at 20°C

Solubility in Organics: Soluble in alcohol, ether, and benzene

Log Octanol/Water Partition Coefficient: 2.88

Vapor Pressure: 14 mm Hg at 20°C

Transport and Fate

Tetrachloroethylene (PCE) rapidly volatiziles into the atmosphere where it reacts with hydroxyl radicals to produce HCl, CO, CO_2 and carboxylic acid. This is probably the most important transport and fate process for tetrachloroethylene in the environment. PCE will leach into the groundwater, especially in soils of low organic content. In soils with high levels of organics, PCE adsorbs to these materials and can

be bioaccumulated to some degree. However, it is unclear if tetrachloroethylene bound to organic material can be degraded by microorganisms or must be desorbed to be destroyed. There is some evidence that higher organisms can metabolize PCE.

Health Effects

Tetrachloroethylene was found to produce liver cancer in male and female mice when administered orally by gavage (NCI 1977). Unpublished gavage studies in rats and mice performed by the National Toxicology Program (NTP) showed hepatocellular carcinomas in mice and a slight, statistically insignificant increase in a rare type of kidney tumor.[1] NTP is also conducting an inhalation carcinogenicity study. Elevated mutagenic activity was found in Salmonella strains treated with tetrachloroethylene. Delayed ossification of skull bones and sternebrae were reported in offspring of pregnant mice exposed to 2,000 mg/m^3 of tetrachloroethylene for 7 hours/day on days 6-15 of gestation. Increased fetal resorptions were observed after exposure of pregnant rats to tetrachloroethylene. Renal toxicity and hepatotoxicity have been noted following chronic inhalation exposure of rats to tetrachloroethylene levels of 1,356 mg/m^3. During the first 2 weeks of a subchronic inhalation study, exposure to concentrations of 1,622 ppm (10,867 mg/m^3) of tetrachloroethylene produced signs of central nervous system depression, and cholinergic stimulation was observed among rabbits, monkeys, rats, and guinea pigs.

Toxicity to Wildlife and Domestic Animals

Tetrachloroethylene is the most toxic of the chloroethylenes to aquatic organisms but is only moderately toxic relative to other types of compounds. The limited acute toxicity data indicate that the LC_{50} value for saltwater and freshwater species are similar, around 10,000 µg/liter; the trout was the most sensitive (LC_{50} = 4,800 µg/liter). Chronic values were 840 and 450 µg/liter for freshwater and saltwater species, respectively, and an acute-chronic ratio of 19 was calculated.

No information on the toxicity of tetrachloroethylene to terrestrial wildlife or domestic animals was available in the literature reviewed.

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[1] J. Mennear, NTP Chemical Manager; personal communication, 1984.

Regulations and Standards

Ambient Water Quality Criteria (USEPA):

Aquatic Life

The available data are not adequate for establishing criteri However, EPA did report the lowest values known to be toxic to aquatic organisms.

Freshwater

Acute toxicity: 5,280 µg/liter
Chronic toxicity: 840 µg/liter

Saltwater

Acute toxicity: 10,200 µg/liter
Chronic toxicity: 450 µg/liter

Human Health

Estimates of the carcinogenic risks associated with lifetime exposure to various concentrations of tetrachloroethylene in water are:

Risk	Concentration
10^{-5}	8.0 µg/liter
10^{-6}	0.8 µg/liter
10^{-7}	0.08 µg/liter

CAG Unit Risk (USEPA): 5.1×10^{-2} $(mg/kg/day)^{-1}$

NIOSH Recommended Standards (air): 335 mg/m^3 TWA
670 mg/m^3 15-min Ceiling Level

OSHA Standards (air): 670 mg/m^3 TWA
1,340 mg/m^3 Ceiling Level
2,010 mg/m^3 for 5 min every 3 hr, Peak Level

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TOLUENE

Summary

Toluene has been shown to be embryotoxic in experimental animals, and the incidence of cleft palate increased in the offspring of dosed mice. Chronic inhalation exposure to high levels of toluene caused cerebellar degeneration and an irreversibl encephalopathy in animals. In humans, acute exposure depressed the central nervous system and caused narcosis.

CAS Number: 108-88-3

Chemical Formula: $C_6H_5CH_3$

IUPAC Name: Methylbenzene

Important Synonyms and Trade Names: Toluol, phenylmethane

Chemical and Physical Properties

Molecular Weight: 92.13

Boiling Point: 110.6°C

Melting Point: -95°C

Specific Gravity: 0.8669 at 20°C

Solubility in Water: 534.8 mg/liter

Solubility in Organics: Soluble in acetone, ligroin, and carbon disulfide; miscible with alcohol, ether, benzene, chloroform, glacial acetic acid, and other organic solvents

Log Octanol/Water Partition Coefficient: 2.69

Vapor Pressure: 28.7 mm Hg at 25°C

Vapor Density: 3.14

Flash Point: 4.4°C

Transport and Fate

Volatilization appears to be the major route of removal of toluene from aquatic environments, and atmospheric reactic of toluene probably subordinate all other fate processes (USI 1979). Photooxidation is the primary atmospheric fate proces for toluene, and benzaldehyde is reported to be the principal organic product. Subsequent precipitation or dry deposition can deposit toluene and its oxidation products into aquatic and terrestrial systems. Direct photolytic cleavage of tolue is energetically improbable in the troposphere, and oxidation and hydrolysis are probably not important as aquatic fates.

The log octanol/water partition coefficient of toluene indicates that sorption processes may be significant. Howeve no specific environmental sorption studies are available, and the extent to which adsorption by sedimentary and suspended organic material may interfere with volatilization is unknown Bioaccumulation is probably not an important environmental fate process. Although toluene is known to be degraded by microorganisms and can be detoxified and excreted by mammals, the available data do not allow estimation of the relative importance of biodegradation/biotransformation processes. Almost all toluene discharged to the environment by industry is in the form of atmospheric emissions.

Health Effects

There is no conclusive evidence that toluene is carcinogenic or mutagenic in animals or humans (USEPA 1980). The National Toxicological Program is currently conducting an inhalation carcinogenicity bioassay in rats and mice.

Oral administration of toluene at doses as low as 260 mg/ produced a significant increase in embryonic lethality in mice (USEPA 1980). Decreased fetal weight was observed at doses as low as 434 mg/kg, and an increased incidence of cleft palat was seen at doses as low as 867 mg/kg. However, other researc have reported that toluene is embryotoxic but not teratogenic in laboratory animals. There are no accounts of a teratogenic effect in humans after exposure to toluene.

Acute exposure to toluene at concentrations of 375-1,500 r produces central nervous system depression and narcosis in humans (ACGIH 1980). However, even exposure to quantities sufficient to produce unconsciousness fail to produce residual organ damage. The rat oral LD_{50} value and inhalation LC_{LO} value are 5,000 mg/kg and 15,000 mg/m^3, respectively. Chronic inhalation exposure to toluene at relatively high concentratior produces cerebellar degeneration and an irreversible encephalo in mammals.

Toluene in sufficient amounts appears to have the potential to alter significantly the metabolism and resulting bioactivity of certain chemicals. For example, coadministration of toluene along with benzene or styrene has been shown to suppress the metabolism of benzene or styrene in rats.

Toxicity to Wildlife and Domestic Animals

Of five freshwater species tested with toluene, the cladoceran Daphnia magna was most resistant to any acute effects (USEPA 1980). The EC_{50} and LC_{50} values for all five species range from 12,700 to 313,000 µg/liter. No chronic tests are available for freshwater species. The two freshwater algal species tested are relatively insensitive to toluene with EC_{50} values of 245,000 µg/liter or greater being reported. For saltwater species, EC_{50} and LC_{50} values range from 3,700 µg/liter for the bay shrimp to 1,050 mg/liter for the Pacific oyster. The chronic value in an embryo-larval test for the sheepshead minnow is reported to be between 3,200 and 7,700 µg/liter, and the acute-chronic ratio is between 55 and 97. In several saltwater algal species and kelp, effects occur at toluene concentrations from 8,000 to more than 433,000 µg/liter.

Regulations and Standards

Ambient Water Quality Criteria (USEPA):

Aquatic Life

The available data are not adequate for establishing criteria. However, EPA did report the lowest concentrations of toluene known to be toxic in aquatic organisms.

Freshwater

Acute toxicity: 17,500 µg/liter
Chronic toxicity: No available data

Saltwater

Acute toxicity: 6,300 µg/liter
Chronic toxicity: 5,000 µg/liter

Human Health

Criterion: 14.3 mg/liter

NIOSH Recommended Standards: 375 mg/m^3 TWA
560 mg/m^3 STEL

OSHA Standards: 750 mg/m^3 TWA
1,120 mg/m^3 Ceiling Level

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1,1,1-TRICHLOROETHANE

Summary

Preliminary results suggest that 1,1,1-trichloroethane (1,1,1-TCA) induces liver tumors in female mice. It was shown to be mutagenic using the Ames assay, and it causes transformation in cultured rat embryo cells. Inhalation exposure to high concentrations of 1,1,1-TCA depressed the central nervous system; affected cardiovascular function; and damaged the lungs, liver, and kidneys in animals and humans. Irritation of the skin and mucous membranes has also been associated with human exposure to 1,1,1-trichloroethane.

CAS Number: 71-55-6

Chemical Formula: CH_3CCl_3

IUPAC Name: 1,1,1-Trichloroethane

Important Synonyms and Trade Names: Methyl chloroform, chlorothene, 1,1,1-TCA

Chemical and Physical Properties

Molecular Weight: 133.4

Boiling Point: 74.1°C

Melting Point: -30.4°C

Specific Gravity: 1.34 at 20°C (liquid)

Solubility in Water: 480-4,400 mg/liter at 20°C (several divergent values were reported in the literature)

Solubility in Organics: Soluble in acetone, benzene, carbon tetrachloride, methanol, ether, alcohol, and chlorinated solvents

Log Octanol/Water Partition Coefficient: 2.17

Vapor Pressure: 123 mm Hg at 20°C

Vapor Density: 4.63

Transport and Fate

1,1,1-Trichloroethane (1,1,1-TCA) disperses from surface water primarily by volatilization. Several studies have indicated that 1,1,1-trichloroethane may be adsorbed onto organic materials in the sediment, but this is probably not an important route of elimination from surface water. 1,1,1-Trichloroethane can be transported in the groundwater, but the speed of transport depends on the composition of the soil.

Photooxidation by reaction with hydroxyl radicals in the atmosphere is probably the principal fate process for this chemical.

Health Effects

1,1,1-Trichloroethane was retested for carcinogenicity because in a previous study by NCI (1977), early lethality precluded assessment of carcinogenicity. Preliminary results indicate that 1,1,1-TCA increased the incidence of combined hepatocellular carcinomas and adenomas in female mice when administered by gavage (NTP 1984). There is evidence that 1,1,1-trichloroethane is mutagenic in Salmonella typhimurium and causes transformation in cultured rat embryo cells (USEPA 1980). These data suggest that the chemical may be carcinogenic.

Other toxic effects of 1,1,1-TCA are seen only at concentrations well above those likely in an open environment. The most notable toxic effects of 1,1,1-trichloroethane in humans and animals are central nervous system depression, including anesthesia at very high concentrations and impairment of coordination, equilibrium, and judgment at lower concentrations (350 ppm and above); cardiovascular effects, including premature ventricular contractions, decreased blood pressure, and sensitization to epinephrine-induced arrhythmia; and adverse effects on the lungs, liver, and kidneys. Irritation of the skin and mucous membranes resulting from exposure to 1,1,1-trichloroethane has also been reported. The oral LD_{50} value of 1,1,1-trichloroethane in rats is about 11,000 mg/kg.

Toxicity to Wildlife and Domestic Animals

The acute toxicity of 1,1,1-trichloroethane to aquatic species is rather low, with the LC_{50} concentration for the most sensitive species tested being 52.8 mg/l. No chronic toxicity studies have been done on 1,1,1-trichloroethane, but acute-chronic ratios for the other chlorinated ethanes ranged from 2.8 to 8.7. 1,1,1-Tricholoroethane was only slighty bioaccumulated with a steady-state bioconcentration factor of nine and an elimination half-life of two days.

No information on the toxicity of 1,1,1-trichloroethane to terrestrial wildlife or domestic animals was available in the literature reviewed.

Regulations and Standards

Ambient Water Quality Criteria (USEPA):

Aquatic Life

The available data are not adequate for establishing crite However, EPA did report, the lowest values of the two trichloroethanes (1,1,1 and 1,1,2) known to be toxic in aquatic organisms.

Freshwater

Acute toxicity: 18 mg/liter
Chronic toxicity: 8.4 mg/liter

Saltwater

Acute toxicity: 31.2 mg/liter
Chronic toxicity: No available data

Human Health

Criterion: 18.4 mg/liter

NIOSH Recommended Standard: 350 ppm (1,910 mg/m^3)/15 min Ceili: Level

OSHA Standard: 350 ppm (1,910 mg/m^3) TWA

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TRICHLOROETHYLENE

Summary

Trichloroethylene (TCE) induced hepatocellular carcinomas in mice and was mutagenic when tested using several microbial assay systems. Chronic inhalation exposure to high concentrations caused liver, kidney, and neural damage and dermatological reactions in animals.

CAS Number: 79-01-6

Chemical Formula: C_2HCl_3

IUPAC Name: Trichloroethene

Important Synonyms and Trade Names: Trichloroethene, TCE, and ethylene trichloride

Chemical and Physical Properties

Molecular Weight: 131.5

Boiling Point: 87°C

Melting Point: -73°C

Specific Gravity: 1.4642 at 20°C

Solubility in Water: 1,000 mg/liter

Solubility in Organics: Soluble in alcohol, ether, acetone, and chloroform

Log Octanol/Water Partition Coefficient: 2.29

Vapor Pressure: 60 mm Hg at 20°C

Vapor Density: 4.53

Transport and Fate

Trichloroethylene (TCE) rapidly volatilizes into the atmosphere where it reacts with hydroxyl radicals to produce hydrochloric acid, carbon monoxide, carbon dioxide, and carboxylic acid. This is probably the most important transport and fate process for trichloroethylene in surface water and in the upper

layer of soil. TCE adsorbs to organic materials and can be bioaccumulated to some degree. However, it is unclear whether trichloroethylene bound to organic material can be degraded by microorganisms or must be desorbed to be destroyed. There is some evidence that higher organisms can metabolize TCE. Trichloroethylene leaches into the groundwater fairly readily, and it is a common contaminant of groundwater around hazardous waste sites.

Health Effects

Trichloroethylene is carcinogenic to mice after oral administration, producing hepatocellular carcinomas (NCI 1976, NTP 1982). It was found to be mutagenic using several microbial assay systems. Trichloroethylene does not appear to cause reproductive toxicity or teratogenicity. TCE has been shown to cause renal toxicity, hepatotoxicity, neurotoxicity, and dermatological reactions in animals following chronic exposure to levels greater than 2,000 mg/m^3 for 6 months. Trichloroethylene has low acute toxicity; the acute oral LD_{50} value in several species ranged from 6,000 to 7,000 mg/kg.

Toxicity to Wildlife and Domestic Animals

There was only limited data on the toxicity of trichloroethylene to aquatic organisms. The acute toxicity to freshwater species was similar in the three species tested, with LC_{50} values of about 50 mg/liter. No LC_{50} values were available for saltwater species. However, a dose of 2 mg/liter caused erratic swimming and loss of equilibrium in the grass shrimp. No chronic toxicity tests were reported.

No information on the toxicity of trichloroethylene to domestic animals or terrestrial wildlife was available in the literature reviewed.

Regulations and Standards

Ambient Water Quality Criteria (USEPA):

Aquatic Toxicity

The available data are not adequate for establishing criteria. However, EPA did report the lowest values known to be toxic in aquatic organisms.

Freshwater

Acute toxicity: 45 mg/liter
Chronic toxicity: No available data

Saltwater

Acute toxicity: 2 mg/liter
Chronic toxicity: No available data

Human Health

Estimates of the carcinogenic risks associated with lifetim exposure to various concentrations of trichloroethylene in water are:

Risk	Concentration
10^{-5}	27 µg/liter
10^{-6}	2.7 µg/liter
10^{-7}	0.27 µg/liter

CAG Unit Risk (USEPA): 1.1×10^{-2} $(mg/kg/day)^{-1}$

NIOSH Recommended Standards (air): 540 mg/m^3 TWA
760 mg/m^3 10-min Ceiling Leve

OSHA Standards (air): 540 mg/m^3 TWA
1,075 mg/m^3/15-min Ceiling Level
1,620 mg/m^3 for 5 min every 3 hr, Peak Concentration

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VINYL CHLORIDE

Summary

Vinyl chloride is a human carcinogen that causes angiosarcomas of the liver and tumors of the brain, lung, and hemolymphopoietic system. There is suggestive evidence that vinyl chloride has teratogenic and reproductive effects in both humans and animals. Chronic human exposure to vinyl chloride is associated with multiple systemic disorders, including a sclerotic syndrome, acro-osteolysis, and liver damage. Acute human exposure to high concentrations can cause narcosis, respiratory tract irritation, bronchitis, and memory disturbances. Chronic exposure by animals can result in lesions of the liver, kidneys, spleen, and lungs.

CAS Number: 75-01-4

Chemical Formula: CH_2CHCl

IUPAC Name: Chloroethene

Important Synonyms and Trade Names: Chloroethylene, VC, monochloroethylene

Chemical and Physical Properties

Molecular Weight: 62.5

Boiling Point: -13.37°C

Melting Point: -153.8°C

Specific Gravity: 0.9106 at 20°C

Solubility in Water: 1,100 mg/liter at 25°C

Solubility in Organics: Soluble in alcohol ether and carbon tetrachloride

Log Octanol/Water Partition Coefficient: 1.4 (estimated)

Vapor Pressure: 2,660 mm Hg at 25°C

Vapor Density: 2.15

Flash Point: -77.8°C

Transport and Fate

Volatilization from aquatic and terrestrial systems is the most important transport process for distribution of vinyl chloride throughout the environment. Half-lives in aquatic systems range from several minutes to a few hours, depending on temperature, water turbulence, and mixing efficiency. Photooxidation in the troposphere is the dominant environmental fate of vinyl chloride. Vinyl chloride reacts rapidly with hydroxyl radicals, forming hydrogen chloride or formyl chloride. Formyl chloride, if formed, rapidly decomposes to yield carbon monoxide and hydrogen chloride. Vinyl chloride in the atmosphere is expected to be destroyed within one or two days of its release. The hydrogen chloride formed is reported to be removed from the troposphere during precipitation.

Photolysis does not appear to be an important fate process in aquatic systems. Furthermore, photooxidation destroys vinyl chloride before it can reach the stratosphere, where direct photolysis could occur. Based on available information, hydrolysis, sorption, bioaccumulation, and biodegradation do not appear to be important environmental fate processes.

Health Effects

IARC considers vinyl chloride to be a Category I human carcinogen, causing angiosarcomas of the liver and tumors of the brain, lung, and hemolymphopoietic system in humans. Vinyl chloride is carcinogenic in mice, rats, and hamsters; it produces tumors at several sites, including angiosarcomas of the liver, after oral or inhalation exposure. Vinyl chloride, both as a vapor and in solution, is mutagenic in several biological assay systems. In addition, chromosome aberrations including fragments, dicentics and rings, breaks, and gaps have been found in workers occupationally exposed to vinyl chloride. The evidence on its teratogenic and reproductive effects is equivocal. Minor skeletal abnormalities and increased fetal death rates have been observed in the offspring of experimental animals exposed by inhalation to vinyl chloride. In humans, a significant increase in fetal deaths was seen in women whose husbands were exposed to vinyl chloride. Also, an excess number of central nervous system disorders and deformities of the upper alimentary tract, genital organs, and feet were observed in stillborn and live children born in cities with vinyl chloride facilities. However, further research is necessary before the link between vinyl chloride and these observed effects can be positively established.

Acute occupational exposure to high concentrations of vinyl chloride can produce symptoms of narcosis in humans. Respiratory tract irritation, bronchitis, headache, irrita-

occur. Chronic exposure to vinyl chloride is associated with multiple systemic disorders, including a sclerotic syndrome, acro-osteolysis, thrombocytopenia, and liver damage, consisting of damage to parenchymal cells, fibrosis of the liver capsule, periportal fibrosis associated with hepatomegaly, and splenomegaly. Concentrations encountered by workers in industries using or producing vinyl chloride are reportedly quite variable and may range from less than the limit of detection to several grams per cubic meter.

Acute inhalation exposure of experimental animals to high concentrations of vinyl chloride can result in narcosis and death. The 2-hour LC_{50} value for rats is 390 g/m^3. Chronic exposure of experimental animals can result in growth disturbances and histopathological and histochemical lesions in the liver, kidneys, spleen, and lungs.

Toxicity to Wildlife and Domestic Animals

No information is available concerning the toxicity of vinyl chloride to domestic animals or wildlife.

Regulation and Standards

Ambient Water Quality Criteria (USEPA):

Aquatic Life

The available data are not adequate for establishing criteria.

Human Health

Estimates of the carcinogenic risks associated with lifetime exposure to various concentrations of vinyl chloride in water are:

Risk	Concentration
10^{-5}	20 µg/liter
10^{-6}	2.0 µg/liter
10^{-7}	0.2 µg/liter

CAG Unit Risk (USEPA): 1.75×10^{-2} $(mg/kg/day)^{-1}$

OSHA Standards: 26 mg/m^3 TWA
13 mg/m^3/15 min Ceiling Level

ACGIH Threshold Limit Value: Human carcinogen 10 mg/m^3

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XYLENES

Summary

Xylene has been shown to be fetotoxic in rats and mice. In humans, exposure to high concentrations of xylene adversely affects the central nervous system and irritates the mucous membranes.

Background Information

Xylene has three isomers, o-, m-, and p-xylene. These three generally have similar chemical and biological characteristics and therefore will be discussed together.

CAS Number:
- Mixed: 1330-20-7
- m-Xylene: 108-38-3
- o-Xylene: 95-47-6
- p-Xylene: 106-42-3

Chemical Formula: $C_6H_4(CH_3)_2$

IUPAC Name: Dimethylbenzene

Important Synonyms and Trade Names:

- Mixed xylene: Dimethylbenzene, xylol
- m-Xylene: 1,3-Dimethylbenzene, m-xylol
- o-Xylene: 1,2-Dimethylbenzene, o-xylol
- p-Xylene: 1,4-Dimethylbenzene, p-xylol

Chemical and Physical Properties

Molecular Weight: 106.17

Boiling Point:
- Mixed: 137-140°C
- m-Xylene: 139°C
- o-Xylene: 144°C
- p-Xylene: 138°C

Melting Point:
- m-Xylene: -48°C
- o-Xylene: -25°C
- p-Xylene: 13°C

Specific Gravity: 0.86

Solubility in Water: 160 mg/liter at 25°C

Solubility in Organics: Soluble in alcohol, ether, and other organic solvents

Log Octanol/Water Partition Coefficient: 3

Vapor Pressure: 10 mm Hg at 25°C

Vapor Density: 3.7

Flash Point: 25°C (closed cup)

Transport and Fate

Volatilization and subsequent photooxidation by reaction with hydroxyl radicals in the atmosphere are probably important transport and fate processes for xylene in the upper layer of soil and in aquatic environments. Products of the hydroxylation reaction include carbon dioxide, peroxyacetylnitrate (PAN), and cresol. Xylene binds to sediment in water and to organics in soils and undergoes microbial degradation. Biodegradation is probably the most important fate process in both soils and the aquatic environment. Xylenes have been shown to persist for up to 6 months in soil. Because of their low water solubility and rapid biodegradation, xylenes are unlikely to leach into groundwater in high concentrations.

Health Effects

The National Toxicology Program (NTP) is testing xylene for carcinogenicity by administering it orally to rats and mice. Although the results have not been finalized, it does not appear to be carcinogenic in rats.[1] Results have not been reported for mice. Xylene was not found to be mutagenic in a battery of short-term assays. Xylene is not teratogenic but has caused fetotoxicity in rats and mice. Acute exposure to rather high levels of xylene affects the central nervous system and irritates the mucous membranes. There is limited evidence of effects on other organ systems, but it was not possible to attribute these effects solely to xylene as other solvents were present. The oral LD_{50} value of xylene in rats is 5,000 mg/kg.

Toxicity to Wildlife and Domestic Animals

Xylene adversely affected adult trout at concentrations as low as 3.6 mg/liter in a continuous flow system and trout

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[1] W.C. Eastin, NTP Chemical Manager; personal communication, 1984.

fry avoided xylene at concentrations greater than 0.1 mg/liter. The LC_{50} value in adult trout was determined to be 13.5 mg/liter. LC_{50} values for other freshwater fish were around 30 mg/liter in a static system, which probably underestimated toxicity. Only a few studies have been done on the toxicity of xylene to saltwater species. These indicated that the m- and o-xylene isomers probably have similar toxicities and are probably less toxic than p-xylene, and that saltwater species are generally more susceptible than freshwater species to the detrimental effects of xylene (LC_{50} = 10 mg/liter for m- and o-xylene and LC_{50} = 2 mg/liter for p-xylene). However, it should be stressed that these generalizations are based on limited data.

No information on the toxicity of xylenes to terrestrial wildlife and domestic animals was available in the literature reviewed. However, because of the low acute toxicity of xylenes it is unlikely that they would be toxic to wild or domestic birds and mammals.

Regulations and Standards

NIOSH Recommended Standards (air): 435 mg/m^3 TWA
870 mg/m^3 10-min Ceiling Level

OSHA Standard (air): 435 mg/m^3 TWA

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