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SOIL VAPOR STUDY REPORT
CALMAR SITE
CITY OF INDUSTRY, CALIFORNIA
REGIONAL BOARD FILE NO. 102.005

Prepared for:

Calmar Incorporated
333 South Turnbull Canyon Road
P.O. Box 1203
City of Industry, CA 91749

CDM Project Number:
2424-110-RT-REPT

Prepared by:

Camp Dresser & McKee Inc.
18881 Von Karman Ave., Suite 650
Irvine, California 92715

At the Request of:

Arthur Fine, Attorney at Law
11377 West Olympic Blvd.
Los Angeles, CA 90064

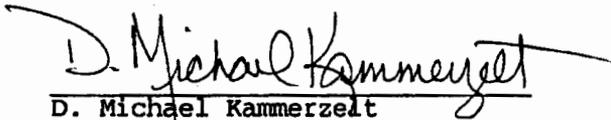
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The information contained in this report has received appropriate technical review and approval. The conclusions and recommendations presented represent professional judgments and are based upon the findings from the investigation identified in the report and the interpretation of such data based on our experience and background. This acknowledgement is made in lieu of all warranties, either express or implied.

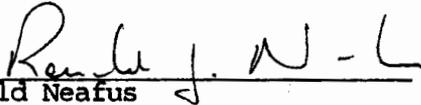
Reviewed and Approved by



Michael C. Lee, Ph.D., P.E.
Civil Engineer, California, 1983 No. 36761
Environmental Assessor, California, 1989 No. 01422



D. Michael Kammerzell
Project Manager



Ronald Neafus
Senior Hydrogeologist

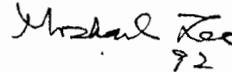


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1.0 INTRODUCTION

This report presents the findings of a soil vapor investigation conducted at Calmar Inc., City of Industry, California. This investigation was conducted in accordance with an approved workplan submitted to the California Regional Water Quality Control Board (RWQCB) - Los Angeles Region in February 1990, with technical revisions approved by the RWQCB in July 1990.

The first phase of this study was conducted on December 3-4, 1990, sampling a total of 18 locations (27 soil gas samples). Based on the data from the December sampling, 38 soil vapor locations were sampled (76 soil gas samples) from May 10 through May 17, 1991, to further characterize the soil vapor at the Calmar site.

During both sampling events, soil vapor was collected and analyzed on a real-time basis by Tracer Research Corporation (TRC) under subcontract to Camp Dresser & McKee Inc. (CDM).

2.0 SOIL VAPOR SAMPLING LOCATIONS

The locations for soil vapor sampling were chosen to investigate areas of concern listed in the "Environmental Site Audit of Calmar Incorporated" prepared by BCL Associates in May 1989 and some additional areas chosen to provide background information. Table 1 shows the area investigated and the number of soil vapor probes placed to collect samples. The locations of these sampling points are shown in Plate 1.

3.0 FIELD INVESTIGATION

3.1 Soil Gas Sampling Procedures

Sampling probes consisted of 7 foot lengths of 3/4-inch diameter hollow steel pipe that were fitted with detachable drive tips. Soil gas probes were advanced 3 and 6 feet below grade. Once inserted into the ground, the above-ground end of the sampling probes were fitted with a steel reducer

TABLE 1
SOIL VAPOR PROBE LOCATIONS

<u>Area</u>	<u>Number of Sample Probes</u>
Turnbull Canyon Boundary	4
Proctor Boundary	2
Calmar/Futura Boundary	4
Warehouse	1
Assembly	5
Molding (utility trenches)	3
Clarifier	10
Utility Trenches	2
Building Footings	2
Extrusion	1
Trench Outlet A	4
Trench Outlet B	2
Trench Outlet C	3
Waste Storage Area	<u>13</u>
	56 Total

and a length of polyethylene tubing leading to a vacuum pump. Gas flow was monitored by a vacuum gauge to insure that an adequate flow was obtained.

To purge the volume of air within the probe, 2 to 5 liters of gas were evacuated with a vacuum pump. During the soil gas evacuation, samples were collected in a glass syringe by inserting a syringe needle through a silicone rubber segment in the evacuation line and down into the steel probe. Ten milliliters of gas were collected for immediate analysis in the TRC analytical field van. Soil gas was subsampled (duplicate injections) in volumes ranging from 1 uL to 2 mL, depending on the VOC concentration at any particular location.

3.2 Analytical Procedures

A Varian 3300 gas chromatograph was used for the soil gas analyses. It was equipped with an electron capture detector (ECD). Compounds were separated on a 6-foot by 1/8-inch OD packed column with SP-1000 as the stationary phase in a temperature controlled oven. Nitrogen was used as the carrier gas.

Halocarbon compounds detected in the samples were identified by chromatographic retention time. Quantification of compounds was achieved by comparison of the detector response of the sample with the response measured for calibration standards (external standardization). Instrument calibration checks were run periodically throughout the day and system blanks were run at the beginning of the day to check for contamination in the soil gas sampling equipment. Air samples were also routinely analyzed to check for background levels in the atmosphere.

Detection limits for the compounds of interest were a function of the injection volume as well as the detector sensitivity for individual compounds. Thus the detection limit varied with the sample size. Generally, the larger the injection size the greater the sensitivity. However, peaks for compounds of interest were kept within the linear range of the analytical equipment. If any compound had a high concentration, it was necessary to use small injections, and in some cases to dilute the

sample to keep it within linear range. This may have caused decreased detection limits for other compounds in the analyses.

The detection limits for the halocarbon compounds were approximately 0.00005 ug/L. Detection limits were dependent upon the conditions of the measurement, in particular, the sample size. If any component being analyzed was not detected, the detection limit for that compound in that analysis is given as a "less than" value (e.g., <0.5 ug/L). Detection limits obtained from GC analyses were calculated from the current response factor, the sample size, and the estimated minimum peak size (area) that would have been visible under the conditions of the measurement.

A discussion of the Quality Assurance/Quality Control procedures followed by TRC to prevent cross-contamination of soil gas samples is included in Appendices A and B.

3.3 Target Compounds

Samples were analyzed for the following volatile organic compounds:

1,1-dichloroethene (1,1-DCE)
methylene chloride (CH_2Cl_2)
1,1,2-trichlorotrifluoroethane (F-113)
chloroform (CHCl_3)
1,1,1-trichloroethane (TCA)
carbon tetrachloride (CCl_4)
trichloroethene (TCE)
1,1,2-trichloroethane (1,1,2-TCA)
1,1,1,2-tetrachloroethane (1,1,1,2-TCA)
tetrachloroethene (PCE)

These compounds were chosen because of their suspected presence in the subsurface and amenability to soil gas technology. Soil gas samples were screened on a gas chromatograph equipped with an electron capture detector (ECD).

Field laboratory data are included for the December 3-4 sampling in Appendix A and for the May 10-17 sampling in Appendix B.

4.0 FINDINGS AND CONCLUSIONS

Table 2 shows a summary of the field laboratory results from this study. This table presents the vapor probe number which correlates to its location shown on Plate 1, the date sampled, clarification notes, depth of collection, the field laboratory results the detection frequency and maximum concentrations detected for TCA, TCE, PCE, 1,1-DCE and F-113. The following compounds were not detected in any of the samples analyzed:

methylene chloride
chloroform
carbon tetrachloride
1,1,2-trichloroethane
1,1,1,2-tetrachloroethane

It is recommended that these compounds be eliminated from the analytical program of any further soil vapor investigation conducted at the Calmar site, if such a study is required.

In general, concentrations of compounds detected in soil vapor are compared to concentrations detected in ambient air (Table 2) and in samples from background areas (Turnbull Canyon and Proctor boundaries in Table 2) to evaluate the significance of the soil vapor data. Concentrations of TCA, TCE, PCE, 1,1-DCE and F-113 that are less than two times the indicated baseline concentrations are considered to be insignificant for any purpose.

Figures 1 through 6 present a graphic representation (isoconcentrations) of the distribution of TCE, TCA and PCE in soil vapor. Isoconcentration lines connect points of equal soil vapor concentrations and represent interpolation of soil vapor concentration between observed soil vapor data points. The concentration lines do not represent soil contaminant levels, but rather indicate possible source areas and possible relative degree of magnitude of soil vapor.

There are some occurrences of solvents found in the soil vapor samples obtained at Calmar. While levels of these compounds allowable in soil have not been established, Recommended Soil Cleanup Levels (RSCLs) have been proposed by the Toxic Substances Control Division, California Department of Health Services. These RSCLs may be used to define an acceptable limit of organic contaminants in soil. Using the Maximum Contaminant Levels (MCL) for drinking water published for the compounds found at Calmar and applying the following formula, RSCLs may be determined. This formula is found in the California Site Mitigation Decision Tree Manual (May 1986), Section VIII, California Soil.

$$\text{RSCL} = \text{MCL} \times 100 \times 10$$

Where: RSCL = Recommended Soil Cleanup Level
MCL = Maximum Contaminant Level
100 = Attenuation of contaminant by soil
10 = Dilution of contaminant by groundwater

Using this rationale, the following RSCLs may be derived:

<u>Compound Found at Calmar</u>	<u>MCL (ppb)</u>	<u>RSCL (ppb)</u>
1,1,1-trichloroethane (TCA)	200	200,000
trichloroethene (TCE)	5	5,000
tetrachloroethene (PCE)	5	5,000
1,1-dichloroethene (1,1-DCE)	6	6,000
1,1,2-trichloro-1,2,2-trifluoroethane (F-113)	1200	1,200,000

The series labeled Table 3 shows these calculated RSCLs compared to the peak occurrences of compounds found at the areas within the soil vapor study. It should be noted that soil vapor concentrations of these compounds are not indicative of actual soil contamination levels.

These calculated RSCLs must be considered in relation to the proximity of groundwater with the contaminant occurrence. Establishment of acceptable concentrations of the contaminants found at Calmar must be determined through negotiation with the CRWQCB or by some other means as may be appropriate, prior to evaluating the data gathered, prior to determining what further investigation may be needed of these compounds in which areas of the site, and prior to determining what mitigation measures may be necessary, if any.

**TABLE 2: SOIL GAS DATA
FIELD LABORATORY RESULTS (ug/L)**

AREA: Turnbull Canyon Boundary

Vapor Probe No.:	Date Sampled	Notes	Depth (feet bgs)	TCA	TCE	PCE	1,1-DCE	F-113
26	5/13/91		3	0.04	<0.006	0.5	<0.03	0.06
			6	0.04	0.9	0.02	<0.005	
27	5/13/91		3	0.08	<0.006	0.01	<0.03	0.1
			6	0.02	0.4	0.007	<0.03	<0.005
28	5/13/91		3	0.07	<0.006	0.01	<0.03	0.2
			6	0.07	<0.006	<0.002	<0.03	<0.005
29	5/13/91		3	0.07	<0.006	<0.002	<0.03	0.06
			6	0.08	0.6	<0.002	<0.03	<0.005
				8	8	8	8	8
				8/8	3/8	5/8	0/8	4/8

Number of samples
Detection Frequency

Area peak concentrations

**TABLE 2: SOIL GAS DATA
FIELD LABORATORY RESULTS (ug/L)**

AREA: Proctor Boundary

Vapor Probe No.:	Date Sampled	Notes	Depth (feet bgs)	TCA	TCE	PCE	1,1-DCE	F-113
24	5/13/91	abandoned water well	3	0.02	<0.009	<0.004	<0.05	<0.008
			6	0.04	0.04	0.02	<0.05	<0.008
25	5/13/91		3	0.04	<0.006	<0.002	<0.03	<0.005
			6	0.02	0.04	<0.002	<0.03	<0.005
				4	4	4	4	4
		Number of samples Detection Frequency		4/4	2/4	1/4	0/4	0/4

Area peak concentrations

**TABLE 2: SOIL GAS DATA
FIELD LABORATORY RESULTS (ug/L)**

AREA: Calmar/Futura Fenceline

Vapor Probe No.:	Date Sampled	Notes	Depth (feet bgs)	TCA	TCE	PCE	1,1-DCE	F-113
20	5/10/91		3	0.07	0.3	0.7	<0.005	<0.003
			6	0.02	0.3	0.05	<0.005	<0.003
21	5/10/91		3	19	15	4	1	<0.01
			6	1	2	4	<0.03	<0.02
22	5/10/91		3	8	0.05	0.4	0.03	<0.01
			6	0.1	1	<0.008	<0.01	<0.01
23	5/10/91		3	0.1	1	<0.008	<0.01	<0.01
			6	0.2	2	1	<0.01	<0.01
				8	8	8	8	8
				8/8	8/8	6/8	2/8	0/8

Number of samples
Detection Frequency

Area peak concentrations

**TABLE 2: SOIL GAS DATA
FIELD LABORATORY RESULTS (ug/L)**

AREA: Clarifier

Vapor Probe No.:	Date Sampled	Notes	Depth (feet bgs)	TCA	TCE	PCE	1,1-DCE	F-113
4	12/3/90		3	3	<0.006	0.03	NA	NA
			6	1	<0.006	0.05	NA	NA
5	12/3/90		3	NC	NC	NC	NC	NC
			6	6	<0.006	0.1	NA	NA
6	12/3/90		3	28	<0.006	0.1	NA	NA
			6	4	<0.01	0.2	NA	NA
7	12/3/90		3	6	<0.01	0.1	NA	NA
			6	6	<0.01	<0.2	NA	NA
8	12/3/90		3	NC	NC	NC	NC	NC
			6	2	<0.01	<0.2	NA	NA
9	12/4/90		3	40	<0.01	0.2	NA	NA
			6	9	<0.01	0.04	NA	NA
34	5/14/91		3	12	<0.009	0.02	<0.07	<0.02
			6	0.5	<0.009	<0.004	<0.07	<0.02
35	5/14/91		3	10	<0.009	0.03	<0.07	0.4
			6	7	<0.009	0.04	<0.07	1
36	5/14/91		3	3	<0.009	0.01	<0.07	<0.02
			6	2	<0.009	0.02	<0.07	<0.02
37	5/14/91		3	5	<0.009	0.04	<0.07	0.04
			6	2	<0.009	0.03	<0.07	1
			Number of samples		18	18	8	8
			Detection Frequency		18/18	0/18	0/8	4/8

NA= Not Analyzed

NC= Not Collected

AREA: 0203000000000000

**TABLE 2: SOIL GAS DATA
FIELD LABORATORY RESULTS (ug/L)**

AREA: Assembly

Vapor Probe No.:	Date Sampled	Notes	Depth (feet bgs)	TCA	TCE	PCE	1,1-DCE	F-113
11	12/4/90		3	47	<0.01	0.3	NA	NA
			6	35	<0.01	0.07	NA	
30	5/14/91		3	5	<0.006	0.03	<0.05	0.3
			6	4	<0.006	0.01	<0.05	
31	5/14/91		3	5	<0.006	0.08	<0.05	2
			6	9	<0.009	0.2	<0.07	5
32	5/14/91		3	6	<0.009	0.02	<0.07	2
			6	5	<0.009	0.02	<0.07	
33	5/14/91		3	8	<0.009	0.02	<0.07	0.7
			6	10	<0.009	0.03	<0.07	1
				10	10	10	8	8
				10/10	10/10	10/10	0/8	8/8
				Number of samples				
				Detection Frequency				

NA= Not Analyzed

NC= Not Collected

Area peak concentrations

TABLE 2: SOIL GAS DATA
FIELD LABORATORY RESULTS (ug/L)

AREA: Various

Vapor Probe No.:	Date Sampled	Notes	Depth (feet bgs)	TCA	TCE	PCE	1,1-DCE	F-113
1	12/3/90	Warehouse	3	0.1	<0.01	<0.002	NA	NA
			6	0.2	<0.006	0.01	NA	
10	12/4/90	extrusion	3	8	<0.01	0.2	NA	NA
			6	0.09	<0.01	0.06	NA	
50	5/16/91	Footing	3	0.02	<0.03	0.1	<2	0.3
			6	0.2	0.5	0.5	<2	0.9
51	5/17/91	Footing	3	0.02	0.05	0.04	<0.2	<0.02
			6	0.03	0.05	0.1	<0.2	0.2
56	5/17/91	Utility Trench	3	<0.009	<0.03	<0.01	<0.2	<0.03
			6	3	0.8	17	0.5	0.06
57	5/17/91	Utility Trench	3	2	0.5	0.8	3	<0.03
			6	6	2	2	9	<0.03
19		Vapor probe number never used	3					
			6					
		Number of samples		12	12	12	10	10
		Detection Frequency		11/12	8/12	10/12	3/10	4/10

NA= Not Analyzed

Area peak concentrations

**TABLE 2: SOIL GAS DATA
FIELD LABORATORY RESULTS (ug/L)**

AREA: Trench Outlet A

Vapor Probe No.:	Date Sampled	Notes	Depth (feet bgs)	TCA	TCE	PCE	1,1-DCE	F-113
14	12/4/90		3	NC	NC	NC	NC	NC
			6	80	2	0.2	NA	NA
15	12/4/90		3	0.6	0.3	0.06	NA	NA
			6	NC	NC	NC	NC	NC
16	12/4/90		3	6	0.4	0.05	NA	NA
			6	NC	NC	NC	NA	NA
49	5/16/91		3	<0.008	<0.03	0.1	<2	<0.06
			6	30	2	0.5	250	<0.06
				5	5	5	2	2
				4/5	4/5	5/5	1/2	0/2

NA = Not Analyzed

NC= Not Collected

Area peak concentrations

**TABLE 2: SOIL GAS DATA
FIELD LABORATORY RESULTS (ug/L)**

AREA: Trench Outlet B

Vapor Probe No.:	Date Sampled	Notes	Depth (feet bgs)	TCA	TCE	PCE	1,1-DCE	F-113
12	12/4/90		3	1	<0.02	<0.001	NA	NA
			6	<0.007	<0.01	<0.0006	NA	NA
13	12/4/90		3	0.3	<0.01	0.1	NA	NA
			6	NC	NC	NC	NC	NC
				3	3	3	0	0
		Number of samples Detection Frequency		2/3	0/3	2/3	0/0	0/0

NA= Not Analyzed
NC= Not Collected

Area peak concentrations

**TABLE 2: SOIL GAS DATA
FIELD LABORATORY RESULTS (ug/L)**

AREA: Trench Outlet C

Vapor Probe No.:	Date Sampled	Notes	Depth (feet bgs)	TCA	TCE	PCE	1,1-DCE	F-113
17	12/4/90		3	<0.007	<0.01	<0.0006	NA	NA
			6	NC	NC	NC	NC	
18	12/4/90		3	<0.003	<0.006	<0.0003	NA	NA
			6	NC	NC	NC	NC	
52	5/17/91		3	0.02	<0.03	0.1	<0.2	0.09
			6	<0.009	<0.03	<0.01	<0.2	<0.03
		Number of samples		4	4	4	2	2
		Detection Frequency		1/4	0/4	1/4	0/2	1/2

NA= Not Analyzed
NC= Not Collected

Area peak concentrations

**TABLE 2: SOIL GAS DATA
FIELD LABORATORY RESULTS (ug/L)**

AREA: Waste Storage Area

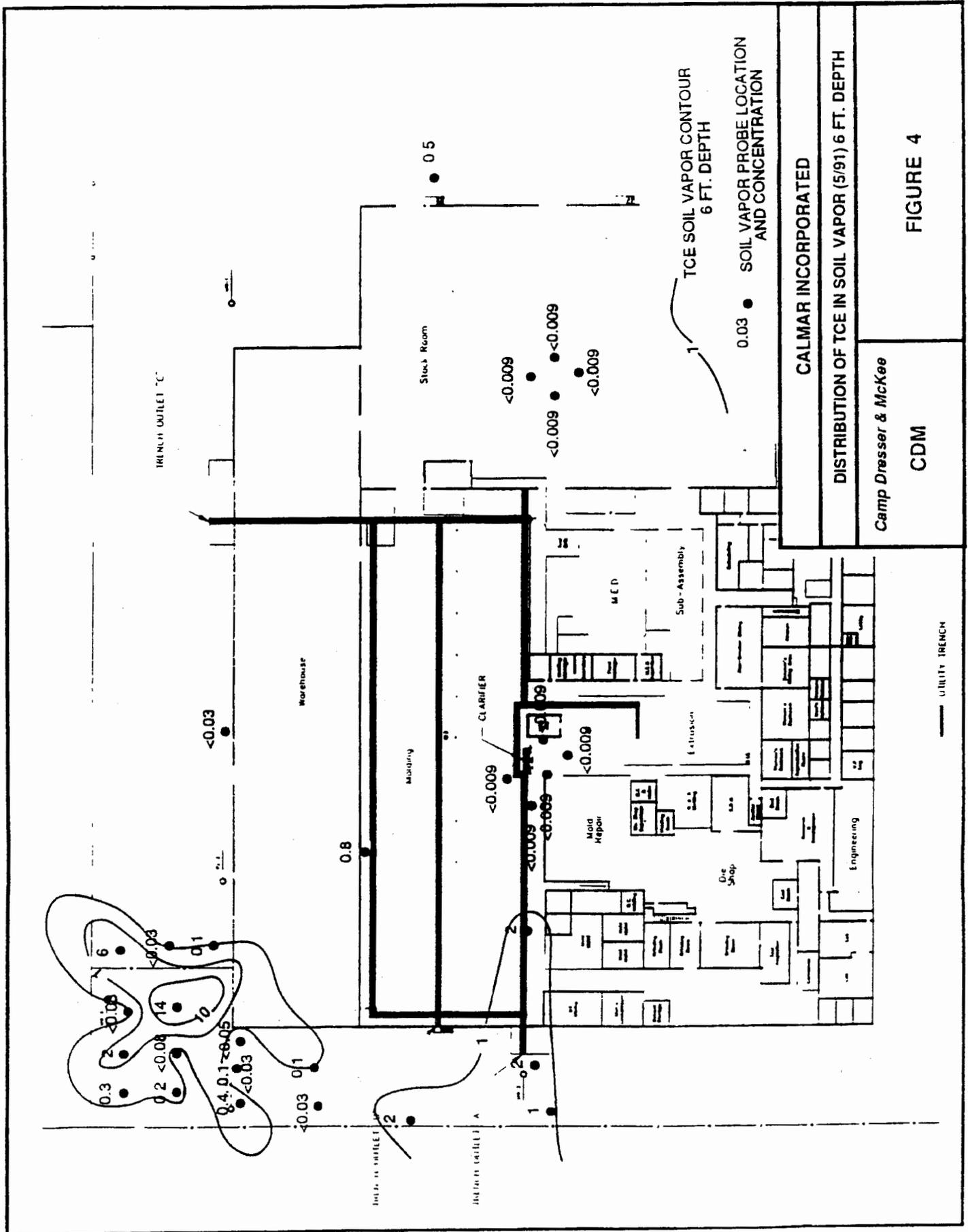
Vapor Probe No.:	Date Sampled	Notes	Depth (feet bgs)	TCA	TCE	PCE	1,1-DCE	F-113
39	5/15/91		3	0.5	1	6	<0.1	<0.01
			6	0.7	2	7	0.5	<0.01
40	5/15/91		3	4	10	11	1	<0.01
			6	<0.01	<0.03	0.6	<0.2	<0.02
41	5/15/91		3	0.9	6	12	<0.2	<0.02
			6	3	14	17	0.9	<0.02
42	5/15/91		3	0.8	5	15	<0.2	<0.02
			6	<0.01	<0.03	2	<0.2	<0.02
43	5/15/91		3	0.7	2	11	<0.2	<0.02
			6	0.03	0.2	0.5	<0.2	<0.02
44	5/16/91		3	14	31	590	35	0.2
			6	<0.02	<0.05	108	<39	<1
45	5/16/91		3	26	20	820	<39	<1
			6	<0.008	<0.03	0.2	<2	<0.06
46	5/16/91		3	0.3	<0.05	0.7	<4	<0.1
			6	2	0.4	12	<2	<0.06
47	5/16/91		3	0.2	<0.03	5	<2	<0.06
			6	<0.008	<0.03	0.2	<2	<0.06
48	5/16/91		3	0.6	<0.03	0.2	<2	<0.06
			6	0.7	0.1	0.4	<2	<0.06
53	5/17/91		3	<0.009	<0.03	0.2	6	0.4
			6	3	6	45	<0.2	<0.03

TABLE 2: SOIL GAS DATA
FIELD LABORATORY RESULTS (ug/L)

AREA: Waste Storage Area (Continued)

Vapor Probe No.:	Date Sampled	Notes	Depth (feet bgs)	TCA	TCE	PCE	1,1-DCE	F-113
54	5/17/91		3	0.1	0.3	2	1	<0.03
			6	<0.009	<0.03	0.2	<0.2	<0.03
55	5/17/91		3	0.02	0.08	0.1	<0.2	<0.03
			6	0.1	0.1	2	<0.2	<0.03
		Number of samples		26	26	26	26	26
		Detection Frequency		19/26	16/26	26/26	6/26	2/26

Area peak concentrations



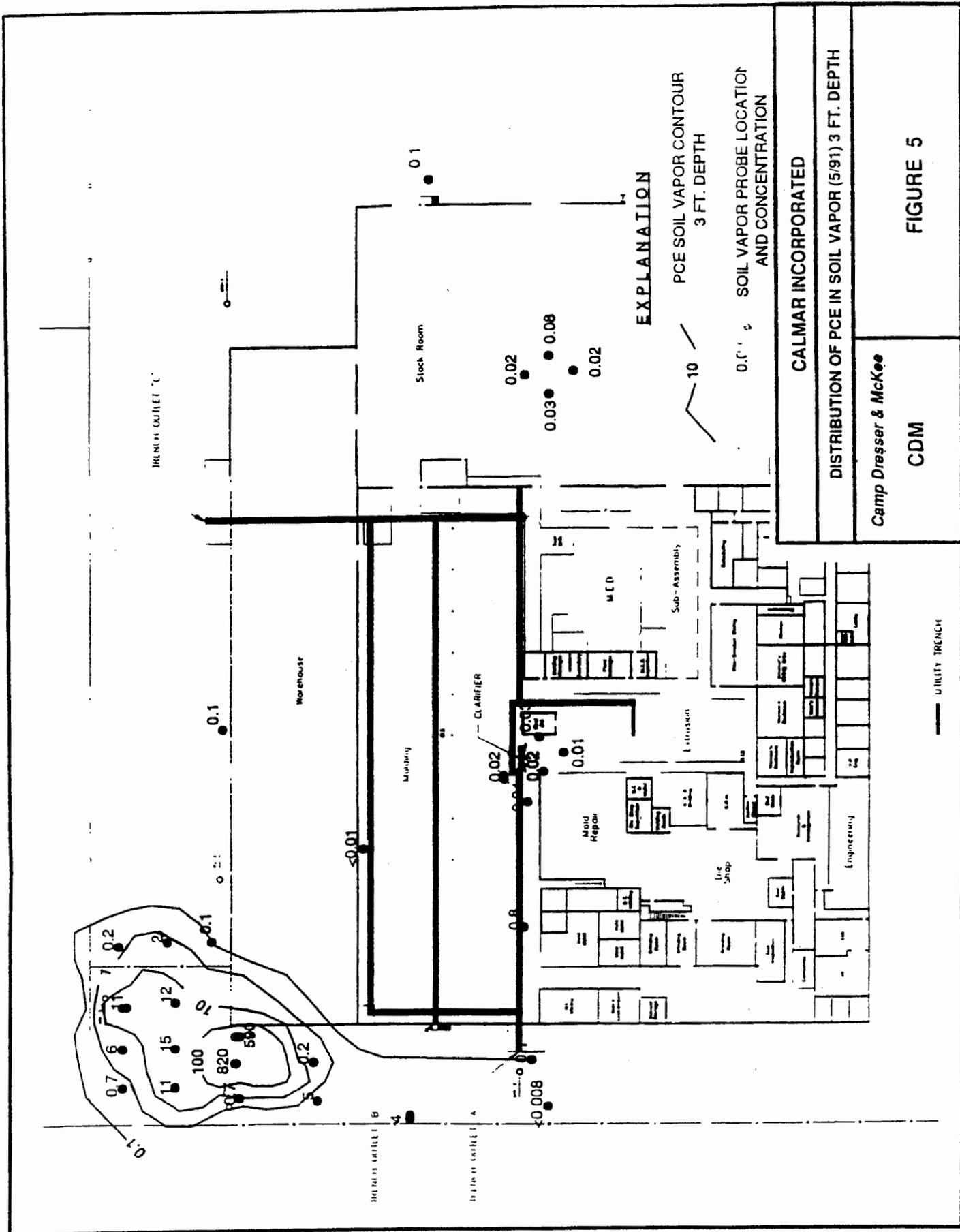
CALMAR INCORPORATED

DISTRIBUTION OF TCE IN SOIL VAPOR (5/91) 6 FT. DEPTH

Camp Dresser & McKee

CDM

FIGURE 4



**TABLE 3
PEAK CONCENTRATION COMPARISON (ug/L)**

AREA: Turnbull Cyn Boundary

Compound	A		B		C		Decimal Comparison A/C
	Area peak concentration Soil Vapor	Area peak concentration Soil Vapor	Maximum Contaminant Levels (MCL) Drinking Water	Maximum Contaminant Levels (MCL) Drinking Water	Recommended Soil Clean-up Levels	Recommended Soil Clean-up Levels	
TCA	0.08	0.08	200	200	200000	200000	0.0000004
TCE	0.09	0.09	5	5	5000	5000	0.000018
PCE	0.5	0.5	5	5	5000	5000	0.0001
1,1-DCE	ND	ND	6	6	6000	6000	ND
F-113	0.1	0.1	1200	1200	1200000	1200000	0.00000008

ND= Not Detected

**TABLE 3
PEAK CONCENTRATION COMPARISON (ug/L)**

AREA: Proctor Boundary

Compound	A		B		C		Decimal Comparison A/C
	Area peak concentration Soil Vapor	Maximum Contaminant Levels (MCL) Drinking Water	Maximum Contaminant Levels (MCL) Drinking Water	Recommended Soil Clean-up Levels			
TCA	0.04	200	200	200000	0.0000002		
TCE	0.04	5	5	5000	0.000008		
PCE	0.02	5	5	5000	0.000004		
1,1-DCE	ND	6	6	6000	ND		
F-113	ND	1200	1200	1200000	ND		

ND- Not Detected

**TABLE 3
PEAK CONCENTRATION COMPARISON (ug/L)**

AREA: Calmar/Futura Fenceline

Compound	A		B		C		Decimal Comparison A/C
	Area peak concentration Soil Vapor	Maximum Contaminant Levels (MCL) Drinking Water	Maximum Contaminant Levels (MCL) Drinking Water	Recommended Soil Clean-up Levels	Recommended Soil Clean-up Levels	Recommended Soil Clean-up Levels	
TCA	19	200	200	200000	200000	200000	0.000095
TCE	15	5	5	5000	5000	5000	0.003
PCE	4	5	5	5000	5000	5000	0.0008
1,1-DCE	1	6	6	6000	6000	6000	0.000166667
F-113	ND	1200	1200	1200000	1200000	1200000	ND

ND= Not Detected

TABLE 3
PEAK CONCENTRATION COMPARISON (ug/L)

AREA: Clarifier

Compound	A		B		C		Decimal Comparison A/C
	Area peak concentration	Soil Vapor	Maximum Contaminant Levels (MCL) Drinking Water	Recommended Soil Clean-up Levels			
TCA	40	ND	200	200000			0.0002
TCE	ND	ND	5	5000			ND
PCE	0.2	ND	5	5000			0.00004
1,1-DCE	ND	ND	6	6000			ND
F-113	1	ND	1200	1200000			0.00000083

ND= Not Detected

**TABLE 3
PEAK CONCENTRATION COMPARISON (ug/L)**

AREA: Molding

Compound	A		B		C		Decimal Comparison A/C
	Area peak concentration	Soil Vapor	Maximum Contaminant Levels (MCL) Drinking Water	Recommended Soil Clean-up Levels			
TCA	3	ND	200	200000	0.000015		
TCE	ND	ND	5	5000	ND		
PCE	0.1	ND	5	5000	0.00002		
1,1-DCE	ND	ND	6	6000	ND		
F-113	ND	ND	1200	1200000	ND		

ND= Not Detected

**TABLE 3
PEAK CONCENTRATION COMPARISON (ug/L)**

AREA: _____ Assembly _____

Compound	A		B		C		Decimal Comparison A/C
	Area peak concentration Soil Vapor		Maximum Contaminant Levels (MCL) Drinking Water		Recommended Soil Clean-up Levels		
TCA	47		200		200000		0.000235
TCE	ND		5		5000		ND
PCE	0.3		5		5000		0.00006
1,1-DCE	ND		6		6000		ND
F-113	5		1200		1200000		0.00000417

ND= Not Detected

**TABLE 3
PEAK CONCENTRATION COMPARISON (ug/L)**

AREA: Various

Compound	A		B		C		Decimal Comparison A/C
	Area peak concentration Soil Vapor		Maximum Contaminant Levels (MCL) Drinking Water		Recommended Soil Clean-up Levels		
TCA	8		200		200000		0.00004
TCE	2		5		5000		0.0004
PCE	17		5		5000		0.0034
1,1-DCE	9		6		6000		0.0015
F-113	0.9		1200		1200000		0.00000075

ND= Not Detected

**TABLE 3
PEAK CONCENTRATION COMPARISON (ug/L)**

AREA: Trench Outlet A

Compound	A		B		C	Decimal Comparison A/C
	Area peak concentration Soil Vapor	Maximum Contaminant Levels (MCL) Drinking Water	Recommended Soil Clean-up Levels			
TCA	80	200	200000		0.0004	
TCE	2	5	5000		0.0004	
PCE	0.5	5	5000		0.0001	
1,1-DCE	250	6	6000		0.04	
F-113	ND	1200	1200000		ND	

ND=Not Detected

**TABLE 3
PEAK CONCENTRATION COMPARISON (ug/L)**

AREA: Trench Outlet B

Compound	A		B		C	Decimal Comparison A/C
	Area peak concentration Soil Vapor	Maximum Contaminant Levels (MCL) Drinking Water	Maximum Contaminant Levels (MCL) Drinking Water	Recommended Soil Clean-up Levels		
TCA	1	200	200	200000		0.000005
TCE	ND	5	5	5000		ND
PCE	0.1	5	5	5000		0.00002
1,1-DCE	ND	6	6	6000		ND
F-113	ND	1200	1200	1200000		ND

ND= Not Detected

**TABLE 3
PEAK CONCENTRATION COMPARISON (ug/L)**

AREA: Trench Outlet C

Compound	A			B		C		Decimal Comparison A/C
	Area peak concentration Soil Vapor	Maximum Contaminant Levels (MCL) Drinking Water	Recommended Soil Clean-up Levels	Maximum Contaminant Levels (MCL) Drinking Water	Recommended Soil Clean-up Levels			
TCA	0.02	200	200000				0.0000001	
TCE	ND	5	5000				ND	
PCE	0.1	5	5000				0.00002	
1,1-DCE	ND	6	6000				ND	
F-113	0.09	1200	1200000				0.000000075	

ND= Not Detected

**TABLE 3
PEAK COMPARISON CONCENTRATION (ug/L)**

AREA: Waste Storage Area

Compound	A		B		C		Decimal Comparison A/C
	Area peak concentration	Soil Vapor	Maximum Contaminant Levels (MCL) Drinking Water	Recommended Soil Clean-up Levels			
TCA	26	200	5	200000	0.00013		
TCE	31	5	5000	0.01			
PCE	820	5	5000	0.16			
1,1-DCE	35	6	6000	0.00583			
F-113	0.4	1200	1200000	0.00000033			

ND= Not Detected

APPENDIX A

TRACER RESEARCH CORPORATION
SHALLOW SOIL GAS INVESTIGATION
CALMAR, DECEMBER 3-4, 1990



PREPARED FOR:

**Camp, Dresser & McKee
18881 Von Karman
Suite 650
Irvine, California 92715
(714)752-5452**

**SHALLOW SOIL GAS INVESTIGATION
CALMAR DISPENSING SYSTEMS**

**TURNBULL CANYON ROAD
CITY OF INDUSTRY, CALIFORNIA**

DECEMBER 3-4, 1990

SUBMITTED BY:

Tracer Research Corporation

**190869S.REP
1-90-869-S**

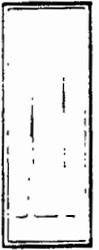


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INTRODUCTION

A shallow soil gas investigation was performed by Tracer Research Corporation (TRC) at the Calmar Dispensing Systems site located in City Of Industry, California. The investigation was conducted on December 3-4, 1990 under contract to Camp, Dresser & McKee. The purpose of the investigation was to delineate the extent of possible contamination in the subsurface.

During this survey, a total of 27 soil gas samples were collected at 18 different locations and analyzed. Samples were analyzed for volatile organic compounds from the following suite:

<u>COMPOUND</u>	<u>DETECTOR</u>
methylene chloride (CH ₂ CL ₂)	ECD
chloroform (CHCL ₃)	ECD
1,1,1-trichloroethane (TCA)	ECD
carbon tetrachloride (CCL ₄)	ECD
trichloroethene (TCE)	ECD
1,1,2-trichloroethane	ECD
1,1,1,2-tetrachloroethane	ECD
tetrachloroethene (PCE)	ECD

The compounds in this suite were chosen as target compounds because of their suspected presence in the subsurface and amenability to soil gas technology. Soil gas samples were screened on a gas chromatograph equipped with an electron capture detector (ECD).



SHALLOW SOIL GAS INVESTIGATION - METHODOLOGY

Shallow soil gas investigation refers to a method developed by TRC for investigating underground contamination from volatile organic chemicals (VOCs) such as industrial solvents, cleaning fluids and petroleum products by looking for their vapors in the shallow soil gas. The method involves pumping a small amount of soil gas out of the ground through a hollow probe driven into the ground and analyzing the gas for the presence of volatile contaminants. The presence of VOCs in shallow soil gas indicates the observed compounds may either be in the vadose zone near the probe or in groundwater below the probe. The soil gas technology is most effective in mapping low molecular weight halogenated solvent chemicals and petroleum hydrocarbons possessing high vapor pressures and low aqueous solubilities. These compounds readily partition out of the groundwater and into the soil gas as a result of their high gas/liquid partitioning coefficients. Once in the soil gas, VOCs diffuse vertically and horizontally through the soil to the ground surface where they dissipate into the atmosphere. The contamination acts as a source and the above ground atmosphere acts as a sink, and typically a concentration gradient develops between the two. The concentration gradient in soil gas between the source and ground surface may be locally distorted by hydrologic and geologic anomalies (e.g. clays, perched water); however, soil gas mapping generally remains effective because distribution of the contamination is usually broader in areal extent than the local geologic barriers and is defined using a large database. The presence of geologic obstructions on a small scale tends to create anomalies in the soil gas-groundwater correlation, but generally does not obscure the broader areal picture of the contaminant distribution.

Soil gas contaminant mapping helps to reduce the time and cost required to delineate underground contamination by volatile contaminants. The soil gas investigation does this by outlining the general areal extent of contamination. Conventional bore holes or observation wells are used to verify both the presence and extent of the subsurface



contamination as indicated in the soil gas survey. In this manner, soil gas contaminant mapping can assist in determining the placement of monitoring wells. Thus the likelihood of drilling unnecessary monitoring wells is reduced. The soil gas survey is not intended to be substitute for conventional methodology, but rather to enable conventional methods to be used efficiently.

EQUIPMENT

Tracer Research Corporation utilized a one ton Ford analytical van that was equipped with one gas chromatograph and two Spectra Physics computing integrators. In addition, the van had two built-in gasoline powered generators that provide the electrical power (110 volts AC) to operate all of the gas chromatographic instruments and field equipment. A specialized hydraulic mechanism consisting of two cylinders and a set of jaws was used to drive and withdraw the sampling probes. A hydraulic hammer was used to assist in driving probes past cobbles and through unusually hard soil.

SOIL GAS SAMPLING PROCEDURES

Sampling probes consisted of 7 foot lengths of 3/4 inch diameter hollow steel pipe that were fitted with detachable drive tips. Soil gas probes were advanced 3 and 6 feet below grade. Once inserted into the ground, the above-ground end of the sampling probes were fitted with a steel reducer and a length of polyethylene tubing leading to a vacuum pump. Gas flow was monitored by a vacuum gauge to insure that an adequate flow was obtained.

To adequately purge the volume of air within the probe, 2 to 5 liters of gas was evacuated with a vacuum pump. During the soil gas evacuation, samples were collected in a glass syringe by inserting a syringe needle through a silicone rubber segment in the evacuation line and down into the steel probe. Ten milliliters of gas were collected for



immediate analysis in the TRC analytical field van. Soil gas was sub-sampled (duplicate injections) in volumes ranging from 1 uL to 2 mL, depending on the VOC concentration at any particular location.

Sample probe vacuums ranged from 2-20 inches Hg. The maximum pump vacuum was measured at 24 inches Hg.

ANALYTICAL PROCEDURES

A Varian 3300 gas chromatograph was used for the soil gas analyses. It was equipped with an electron capture detector (ECD). Compounds were separated on a 6' by 1/8" OD packed column with SP-1000 as the stationary phase in a temperature controlled oven. Nitrogen was used as the carrier gas.

Halocarbon compounds detected in the samples were identified by chromatographic retention time. Quantification of compounds was achieved by comparison of the detector response of the sample with the response measured for calibration standards (external standardization). Instrument calibration checks were run periodically throughout the day and system blanks were run at the beginning of the day to check for contamination in the soil gas sampling equipment. Air samples were also routinely analyzed to check for background levels in the atmosphere.

Detection limits for the compounds of interest were a function of the injection volume as well as the detector sensitivity for individual compounds. Thus the detection limit varied with the sample size. Generally, the larger the injection size the greater the sensitivity. However, peaks for compounds of interest were kept within the linear range of the analytical equipment. If any compound had a high concentration, it was necessary to use small injections, and in some cases to dilute the sample to keep it within linear range. This may have caused decreased detection limits for other compounds in the analyses.



The detection limits for the halocarbon compounds were approximately 0.00005 ug/L. Detection limits were dependant upon the conditions of the measurement, in particular, the sample size. If any component being analyzed was not detected, the detection limit for that compound in that analysis is given as a "less than" value (e. g. < 0.1 ug/L). Detection limits obtained from GC analyses were calculated from the current response factor, the sample size, and the estimated minimum peak size (area) that would have been visible under the conditions of the measurement.

QUALITY ASSURANCE/QUALITY CONTROL PROCEDURES

Tracer Research Corporation's normal quality assurance procedures were followed in order to prevent any cross-contamination of soil gas samples. These procedures are described below:

- . Steel probes are used only once during the day and then washed with high pressure soap and hot water spray or steam-cleaned to eliminate the possibility of cross-contamination. Enough probes are carried on each van to avoid the need to reuse any during the day.
- . Probe adaptors (TRC's patented design) are used to connect the sample probe to the vacuum pump. The adaptor is designed to eliminate the possibility of exposing the sample stream to any part of the adaptor. Associated tubing connecting the adaptor to the vacuum pump is replaced periodically as needed during the job to insure cleanliness and good fit. At the end of each day the adaptor is cleaned with soap and water and baked in the GC oven.
- . Silicone tubing (which acts as a septum for the syringe needle) is replaced as needed to insure proper sealing around the syringe needle. This tubing does not directly contact soil gas samples.



- . Glass syringes are usually used for only one sample per day and are washed and baked out at night. If they must be used twice, they are purged with carrier gas (nitrogen) and baked out between probe samplings.
- . Injector port septa through which soil gas samples are injected into the chromatograph are replaced on a daily basis to prevent possible gas leaks from the chromatographic column.
- . Analytical instruments are calibrated each day by analytical standards from Chem Service, Inc. Calibration checks are also run after approximately every five soil gas sampling locations.
- . Sub-sampling syringes are checked for contamination prior to sampling each day by injecting nitrogen carrier gas into the gas chromatograph.
- . Prior to sampling each day, system blanks are run to check the sampling apparatus (probe, adaptor, 10 cc syringe) for contamination by drawing ambient air from above ground through the system and comparing the analysis to concurrently sampled ambient air analysis.
- . All sampling and sub-sampling syringes are decontaminated each day and no such equipment is reused before being decontaminated each day and no such equipment is reused before being decontaminated. Microliter size sub-sampling syringes are reused only after a nitrogen carrier gas blank is run to insure it is not contaminated by the previous sample.
- . Soil gas pumping is monitored by a vacuum gauge to insure that an adequate gas flow from the vadose zone is maintained. A reliable gas sample can be obtained if the sample vacuum gauge reading is at least 2 inches Hg less than the maximum pump vacuum.



APPENDIX A: ANALYTICAL DATA

CDM/CALMAR DISPENSING SYSTEMS/INDUSTRY,CALIFORNIA JOB#1-90-869-S

12/03/90
CONDENSED DATA

SAMPLE	CH2Cl2 ug/l	CHCl3 ug/l	TCA ug/l	CCl4 ug/l	TCE ug/l	1,1,2 ICA ug/l	1,1,1,2 TCA ug/l	PCE ug/l
AIR	<0.02	<0.0008	0.02	<0.00006	<0.0006	<0.004	<0.0001	<0.0001
SG-01-3'	<0.3	<0.02	0.1	<0.001	<0.01	<0.08	<0.002	<0.002
SG-02-3'	<0.2	<0.008	0.8	<0.0006	<0.006	<0.04	<0.001	0.1
SG-03-3'	<0.2	<0.008	0.2	<0.0006	<0.006	<0.04	<0.001	0.1
SG-04-3'	<0.2	<0.008	3	<0.0006	<0.006	<0.04	<0.001	0.03
SG-04-6'	<0.2	<0.008	1	<0.0006	<0.006	<0.04	<0.001	0.05
SG-05-6'	<0.2	<0.008	6	<0.0006	<0.006	<0.04	<0.001	0.1
SG-06-3'	<0.2	<0.008	28	<0.0006	<0.006	<0.04	<0.001	0.1
SG-06-6'	<0.3	<0.02	4	<0.001	<0.01	<0.08	<0.002	0.2
SG-07-3'	<0.3	<0.02	6	<0.001	<0.01	<0.08	<0.002	0.1
SG-07-6'	<0.3	<0.02	6	<0.001	<0.01	<0.08	<0.002	<0.002
SG-08-6'	<0.3	<0.02	2	<0.001	<0.01	<0.08	<0.002	<0.2
AIR INSIDE	<0.03	<0.002	8	<0.0001	<0.001	<0.0015	<0.0002	0.01

Analyzed by: K. Wilson
 Proofed by: *[Signature]*

CDM/CALMAR DISPENSING SYSTEMS/INDUSTRY, CALIFORNIA JOB#1-90-869-S

12/04/90

CONDENSED DATA

SAMPLE	CHC12 ug/l	CHC13 ug/l	TCA ug/l	CC14 ug/l	TCE ug/l	1,1,2 TCA ug/l	1,1,1,2 TCA ug/l	PCL ug/l
AIR-INSIDE	<0.04	<0.002	13	<0.0001	<0.001	<0.008	<0.0002	0.07
SG-09-3'	<0.5	<0.02	40	<0.001	<0.01	<0.08	<0.002	0.2
SG-10-3'	<0.5	<0.02	8	<0.001	<0.01	<0.08	<0.002	0.2
SG-11-3'	<0.5	<0.02	47	<0.001	<0.01	<0.08	<0.002	0.3
SG-12-3'	<0.9	<0.03	1	<0.003	<0.02	<0.2	<0.003	<0.001
SG-13-3'	<0.5	<0.02	0.3	<0.001	<0.01	<0.08	<0.002	0.1
SG-14-6'	<0.5	<0.02	80	<0.001	2	<0.08	<0.002	0.2
SG-12-6'	<0.5	<0.02	<0.007	<0.001	<0.01	<0.08	<0.002	<0.0006
SG-15-3'	<0.2	<0.008	0.6	<0.0007	0.3	<0.04	<0.001	0.06
SG-10-6'	<0.5	<0.02	0.09	<0.001	<0.01	<0.08	<0.002	0.06
SG-09-6'	<0.5	<0.02	9	<0.001	<0.01	<0.08	<0.002	0.04
SG-11-6'	<0.5	<0.02	35	<0.001	<0.01	<0.08	<0.002	0.07
SG-16-3'	<0.5	<0.02	6	<0.001	0.4	<0.08	<0.002	0.05
SG-17-3'	<0.5	<0.02	<0.007	<0.001	<0.01	<0.08	<0.002	<0.0006
SG-18-3'	<0.2	<0.008	<0.003	<0.0007	<0.006	<0.04	<0.001	<0.0003
AIR	<0.05	<0.002	0.02	<0.0001	<0.001	<0.008	<0.0002	0.003
SG-01-6'	<0.2	<0.008	0.2	<0.0007	<0.006	<0.04	<0.001	0.01
SG-02-6'	<0.2	<0.008	0.9	<0.0007	<0.006	<0.04	<0.001	0.04
AIR	<0.05	<0.002	0.03	<0.0001	<0.001	<0.008	<0.0002	0.003

Analyzed by: K Wilson
 Proofed by: *[Signature]*

TRACER RESEARCH CORPORATION'S
SAMPLING PROCEDURES
AND
QA/QC PROCEDURES

PREPARED BY:

TRACER RESEARCH CORPORATION



SOIL GAS SAMPLING PROCEDURE

I. Probe Placement

- A) A clean probe (pipe) is removed from the "clean" storage tube on top of the van.
- B) The soil gas probe is placed in the jaws of hydraulic pusher/puller mechanism.
- C) A sampling point is put on the bottom of the probe.
- D) The hydraulic pushing mechanism is used to push the probe into the ground.
- E) If the pusher mechanism will not push the probe into the ground a sufficient depth for sampling, the hydraulic hammer is used to pound the probe into the ground.

II. Sample Extraction

- A) An adaptor (Figure 1) is put onto the top of the soil gas probe.
- B) The vacuum pump is hooked onto the adaptor.
- C) The vacuum pump is turned on and used to evacuate soil gas.
- D) Evacuation will be at least 30 seconds but never more than 5 minutes for samples having evacuation pressures less than 15 inches of mercury. Evacuation times will be at least 1 minute, but no more than 5 minutes for probes reading greater than 15 inches of mercury.
- E) Gauges on the vacuum pump are checked for inches of mercury.
 1. Gauge must read at least 2 inches of mercury less than maximum vacuum to be extracting sufficient soil gas to collect a valid sample.

III. Sample Collection

- A) With vacuum pump running, a hypodermic syringe needle is inserted through the silicone rubber and down into the metal tubing of adaptor



(Figure 1).

- B) Gas samples should only contact metal surfaces and never contact potentially sorbing materials (i.e., tubing, hose, pump diaphragm).
- C) The syringe is purged with soil gas then, without removing syringe needle from adaptor, a 2-10 mL soil gas sample is collected.
- D) The syringe and needle are removed from the adaptor and the end of the needle is capped.
- E) If necessary, a second 10 mL sample is collected using the same procedure.

IV. Deactivation of Sampling Apparatus

- A) The vacuum pump is turned off and unhooked from the adaptor.
- B) The adaptor is removed and stored with equipment to be cleaned.
- C) Using the hydraulic puller mechanism, the probe is removed from the ground.
- D) The probe is stored in the "dirty" probe tube on top of the van.
- E) The probe hole is backfilled, if required.

V. Log Book and U.S. EPA Field Sheet Notations For Sampling (Figures 2A-2D)

- A) Time (military notation)
- B) Sample number (use client's numbering system)
- C) Location (approximate description - i.e., street names)
- D) Sampling depth
- E) Evacuation time before sampling
- F) Inches of mercury on vacuum pump gauge
- G) Probe and adaptor numbers
- H) Number of sampling points used



I) Observations (i.e., ground conditions, concrete, asphalt, soil appearance, surface water, odors, vegetation, etc.)

J) Backfill procedure and materials, if used.

VI. Other Recordkeeping

A) Client-provided data sheets are filled out, if required

B) Sample location is marked on the site map

VII. Determination of Sampling Locations

A) Initial sample locations will be determined by client (perhaps after consultation with TRC personnel) prior to start of job.

B) Remaining sample locations may be determined by:

1) Client

a) Entire job sampling locations set up on grid system.

b) Client decides location of remaining sample locations based on results of initial study, or

2) Client and TRC Personnel

a) Client and TRC personnel decide location of remaining sample locations based on results of initial sample locations.



ANALYTICAL PROCEDURES

- I. Varian 3300 Gas Chromatograph
 - A) Equipped with Electron Capture Detectors (ECD), Flame Ionization Detectors (FID), Photo Ionization Detectors (PID) and/or Thermal Conductivity (TC) Detectors.
 - B) The chromatographic column used by TRC for the analysis of halocarbons is a 1/8" diameter packed column containing Alltech OV-101. This nicely separates most of the tri-chloro and tetra-chloro compounds that are encountered in soil gas investigations. The di-chloro compounds tend to elute ahead of the tri-chloro and tetra-chloro compounds, thus creating no interference. In the event that assurance of the identity of a compound in any particular sample is needed, it will be analyzed on a SP-1000 column after the OV-101 analysis.

- II. Two Spectra Physics SP4270 Computing Integrators.

The integrators are used to plot the chromatogram and measure the size of the chromatographic peaks. The integrators compute and record the area of each peak. The peak areas are used directly in calculation of contaminant concentration.

- III. Chemical Standards From ChemServices, Inc. of Westchester, Pennsylvania.
 - A) TRC uses analytical standards that are preanalyzed, of certified purities and lot numbered for quality control assurance. Each vial is marked with an expiration date. All analytical standards are the highest grade available. Certified purities are typically 99%.
 - B) The Quality Assurance procedures used by ChemService were described by the Laboratory Supervisor, Dr. Lyle Phipper:



- 1) The primary measurement equipment at ChemServices, the analytical balance, is serviced by the Mettler Balance Company on an annual basis and recalibrated with NBS traceable weights.
- 2) All chemicals purchased for use in making the standards are checked for purity by means of gas chromatography using a thermal conductivity detector. Their chemicals are purified as needed.
- 3) The information on the purification and analysis of the standards is made available upon request for any item they ship when the item is identified by lot number. All standards and chemicals are shipped with their lot numbers printed on them. The standards used by TRC are made up in a two step dilution of the pure chemical furnished by ChemServices.

IV. Analytical Supplies

1. Sufficient 2 and 10 cc glass and Hamilton syringes so that none have to be reused without first being cleaned.
2. Disposable lab supplies, where appropriate.
3. Glassware to prepare aqueous standards.
4. Miscellaneous laboratory supplies.



QA/QC PROCEDURES

I. Standards

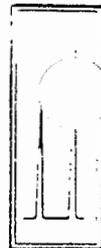
A) A fresh standard is prepared each day. The standards are made by serial dilution.

1) First, a stock solution containing the standard in methanol is prepared at TRC offices in Tucson. The stock solution is prepared by pipetting the pure chemical into 250 mL of methanol in a volumetric flask at room temperature. The absolute mass is determined from the product of volume and density calculated at room temperature. Hamilton microliter syringes, with a manufacturer's stated accuracy of + or - 1%, are used for pipetting. Information on density is obtained from the CRC Handbook of Physics and Chemistry. Once the stock solution is prepared, typically in concentration range of 50-1000 mg/L, a working standard is prepared in water each day. The solute in the stock solution has a strong affinity to remain in methanol so there is no need to refrigerate the stock solution. Additionally, the solute tends not to biodegrade or volatilize out of the stock solution.

2) The working standards are prepared in 40 mL VOA septum vials by diluting the appropriate ug/L quantity of the standard solution into 40 mL of water.

B) The standard water is analyzed for contamination before making the aqueous standard each day.

C) The aqueous standard is prepared in a clean vial using the same syringe each day. The syringe should only be used for that standard.



D) Final dilution of the calibration standards are made in water in a VOA vial having a Teflon coated septum cap instead of in a volumetric flask in order to have the standard in a container with no air exposure. The VOA bottle permits mixing of the standard solution and subsequent syringe sampling all day long without opening the bottle or exposing it to air. The measurement uncertainty inherent in the use of a VOA bottle instead of a volumetric flask is approximately - or - 1%.

E) The aqueous standard will contain the compounds of interest in the range of 5 to 100 ug/L depending on the detectability of the individual components. The standard will be analyzed at least three times at the beginning of each day to determine the mean response factor (RF) for each component (Figure 3). The standard will be injected again after every fifth sample to check detector response and chromatographic performance of the instrument throughout the day.

F) The RF allows conversion of peak areas into concentrations for the contaminants of interest. The RF used is changed if the standard response varies 25%. If the standard injections vary by more than 25% the standard injections are repeated. If the mean of the two standard injections represents greater than 25% difference then a third standard is injected and a new RF is calculated from the three standard injections. A new data sheet is started with the new RF's and calibration data.

$$\% \text{ difference} = \frac{A \text{ area} - B \text{ area}}{A \text{ area}}$$

Where ; A = mean peak area of standard injection from first calibration
 B = peak area of subsequent standard injection

G) The low ug/L aqueous standards that are made fresh daily need not be refrigerated during the day because they do not change significantly in a 24



hour period. On numerous occasions the unrefrigerated 24 hour old standards have been compared with fresh standards and no difference has been measurable. If the standards were made at high ppm levels in water, the problem of volatilization would probably be more pronounced in the absence of refrigeration.

- H) Primary standards are kept in the hotel room when on a project.
- I) A client may provide analytical standards for additional calibration and verification.

II. Syringe Blanks

- A) Each uL syringe is blanked before use.
- B) 2 cc (glass) syringes will each be blanked if ambient air concentrations are elevated (greater than or equal to 0.01 ug/L) for components of interest.
- C) If ambient air concentrations are <0.01 ug/L for components of interest, a representative sample of at least two syringes are blanked at the beginning of each day. If representative syringes have no detectable contamination remaining syringes need not be blanked. If any of representative syringes show contamination, all 2 cc syringes must be blanked prior to use.
- D) Syringe blanks are run with air or nitrogen.
- E) If it is necessary for any syringe to be used again before cleaning, it is blanked prior to its second use.

III. System Blanks

- A) System blanks are ambient air drawn through the probe and complete sampling apparatus (probe adaptor and 10 cc syringe) and analyzed by the same procedure as a soil gas sample. The probe is above the ground.
- B) One system blank is run at the beginning of each day and compared to a concurrently sampled air analyses.



C) A system blank is run before reusing any sampling system component.

IV. Ambient Air Samples

A) Ambient air samples are collected and analyzed a minimum of two times daily to monitor safety of the work environment and to establish site background concentrations, if any, for contaminants of interest.

B) All ambient air samples shall be documented (Figure 3).

V. Samples

A) All unknown samples will be analyzed at least twice.

B) More unknown samples will be run until reproducibility is within 25%, computed as follows:

$$\text{Difference} = \frac{A - B}{(A + B)/2}$$

Where; A is first measurement result

B is second measurement result

If the difference is greater than .25, a subsequent sample will be run until two measurements are made that have a difference of .25 or less. Those two measurements will be used in the final calculation for that sample.

C) The injection volume should be adjusted so that mass of analyte is as near as possible to that which is contained in the standard, at least within a factor of ten.

D) Whenever possible the attenuation for unknown samples is kept constant through the day (so as to provide a visual check of integrations).

E) A water plug is used as a gas seal in uL syringes

F) A seal is established between syringes when subsampling

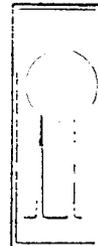
G) At very high concentrations air dilutions are acceptable once concentration of contaminants in air have been established.



- H) All sample analysis are documented (Figure 3).
- I) Separate data sheets are used if chromatographic conditions change
- J) Everything is labeled in ug/L, mg/L, etc. PPM and PPB notations are to be avoided.

VI. Daily System Preparation (Figure 4).

- A) Integrators parameters are initialized
 - 1. Pt. evaluation
 - 2. Attenuation
 - 3. Peak markers
 - 4. Auto zero
 - 5. Baseline offset (min. 10% of full scale)
- B) The baseline is checked for drift, noise, etc.
- C) System parameters are set.
 - 1. Gas flows (Note: N₂, air, H₂ tank pressure on Page 1 of chromatograms).
 - 2. Temperatures
 - a) Injector
 - b) Column
 - c) Detector
- D) After last analysis of the day conditioned septa are rotated into injection ports used during the day and replaced with fresh septa.
- E) Column and injector temperatures are run up to bake out residual contamination.
- F) Syringes are cleaned each day
 - 1. 2 and 10 cc syringes are cleaned with Alconox or equivalent detergent and brush



2. uL syringes are cleaned daily with IPA or MeOH and purged with N₂. Syringe Kleen is used to remove metal deposits in the barrel.
3. Syringes are baked out overnight in the oven of the gas chromatograph at a minimum temperature of 60°C.

VII. Sample Splits

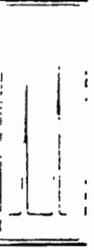
If desired, TRC's clients or any party, with the approval of TRC's client, may use sample splits to verify TRC's soil gas or groundwater sampling results.

A) Sample splits may be collected in two valve, flow through-type all-glass or internally electroplated stainless steel containers for analysis within 10 days of collection.

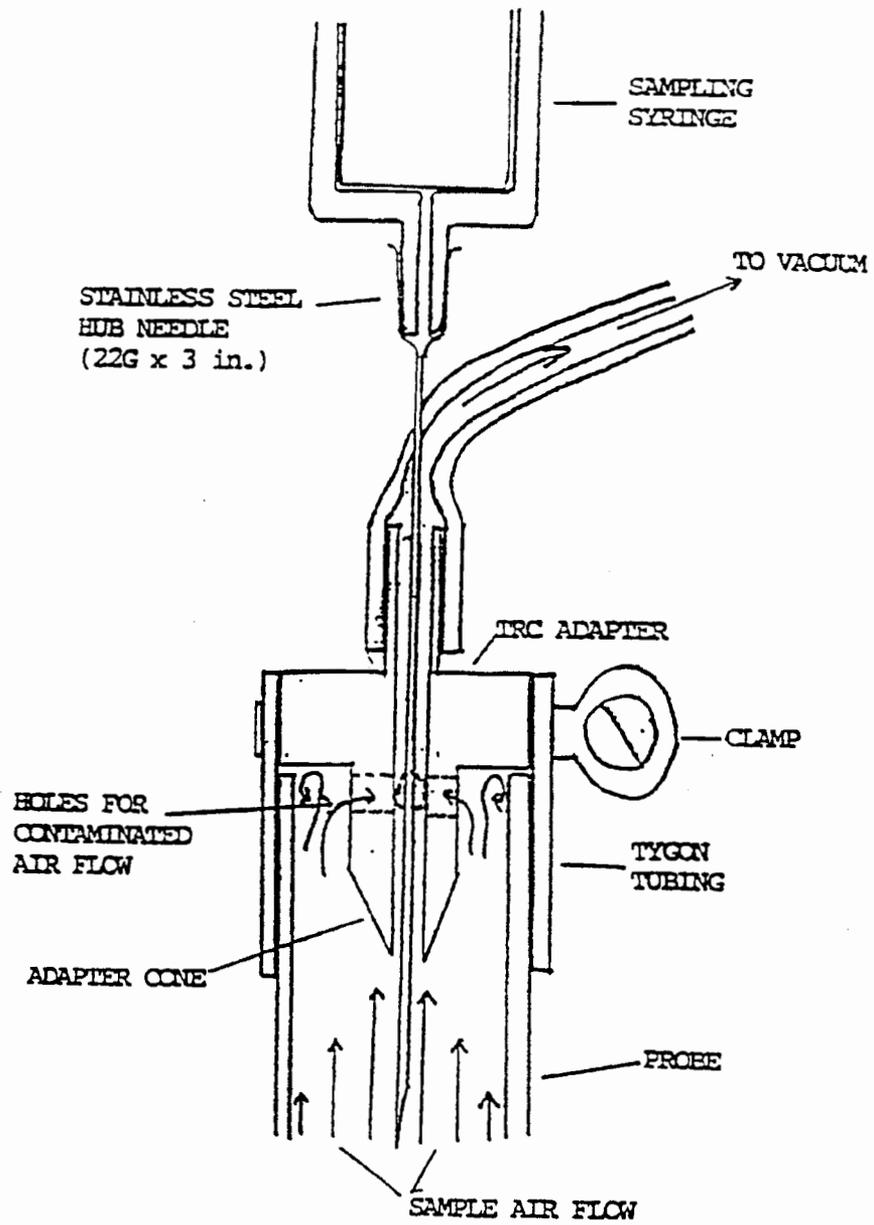
1. Flow through sample collection bottles should be cleaned by purging with nitrogen at 100°C for at least 30 minutes. Once clean, the bottles should be stored filled with nitrogen at ambient pressure.
2. Sample bottles are filled by placing them in the sample stream between the probe and the vacuum pump. Five sample bottle volumes should be drawn through the container before the final sample is collected. The sample should be at ambient pressure.

B) Sample splits can be provided in 10 cc glass syringes for immediate analysis in the field by the party requesting the sample splits.

C) Splits of the aqueous standards or the methanol standards used by TRC for instrument calibration may be analyzed by the party requesting sample splits.



Figures 1 through 4



SCHEMATIC CROSS SECTION OF THE NEW TRC PROBE ADAPTER.

FIGURE 1

VAN # /
PLATE # 43A-274

SOIL GAS INVESTIGATION BACKGROUND INFORMATION

SITE NAME: DAVIDSON CHEMICAL
LOCATION: 14600 WEST AVENUE N LITTLETON COLORADO
DATES OF INVESTIGATION: 2/16 - 2/18/99
CLIENT NAME & ADDRESS: RAMMENAUER ENVIRONMENTAL
502 HARRISON RD
LITTLETON CO 80120
FIELD REPRESENTATIVE(S) FOR CLIENT: JOE DANDELST
PERSON TO WHOM REPORT AND QUESTIONS
SHOULD BE DIRECTED: SARAH WENDEL
PHONE: (731) 972-1002
CREW: CHEMIST S CAUSLEY GEOLOGIST M. FIERONI

REPORT TO INCLUDE (CIRCLE):
 A. QA/QC-PROCEDURES-DATA ONLY or
 B. FULL REPORT WITH CONTOUR MAPS AND INTERPRETATION

PURPOSE OF INVESTIGATION

DETERMINE EXTENT OF CONTAMINATION FROM STORAGE TANK SOIL

SAMPLE

TARGET VOCs

<u>TC4</u>		
<u>ME</u>		
<u>PCE</u>		

GROUNDWATER INFORMATION:

DEPTH TO WATER: 12-16' DIRECTION: NE

SOURCES OF CONTAMINATION

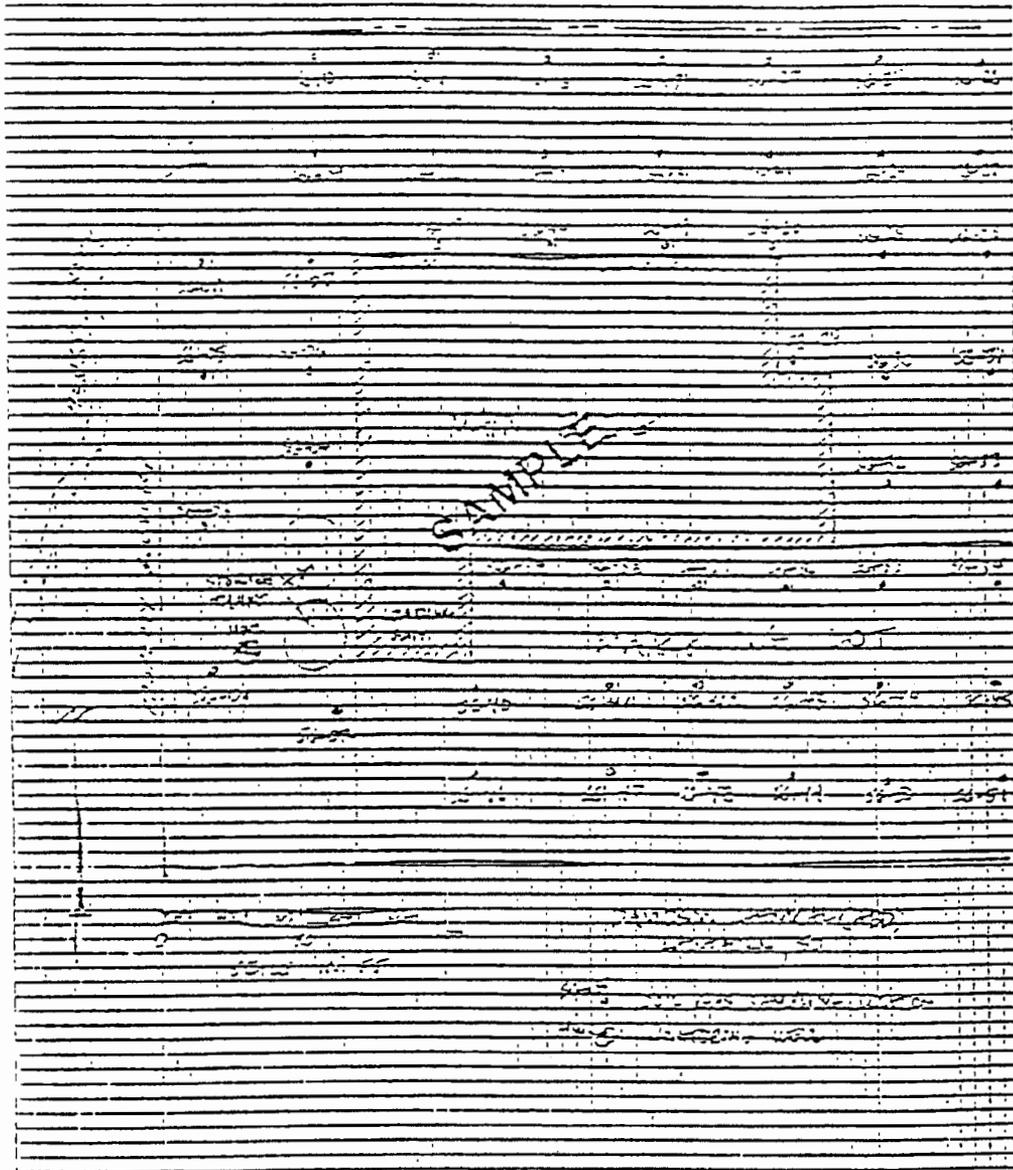
COMPANY USED SOLVENTS IN PAINT-STRIPPING PROCESS IN MANUFACTURE OF
REFRIGERANT CIRCUIT BOARD. STORAGE TANK RIPPED AND LEAKED FROM
APPROX 07-1072 WHEN COMPANY SHUT DOWN SOURCE WAS LOCATED
IN 1972

GEOLOGIC SETTING: (e.g. soil type, subsurface geology, etc.)

PORE & ALLUVIAL SAND (10-15'); FRACTURED ARGILLITE BELOW 15'

FIGURE 2A
FIELD LOGBOOK - BACKGROUND INFORMATION

SITE MAP



SITE MAPS TO INCLUDE: SITE NAME, SCALE, NORTH ARROW, SOIL GAS LOCATIONS & NUMBERS, CULTURAL AND NATURAL FEATURES TO IDENTIFY

FIGURE 13
FIELD LOGBOOK - SITE MAP

DATE : 2-16-89
LOCATION : DAVIDSON CHEMICAL, WINTHROP, SD
CLIENT : GRANDENAVILLE ENV.

GC Operator: S. CHARLES Field Assistant: M. FAVERONI
Weather : 12°F SNOW SQUALLS, COLD & WINDY

FIELD HOURS

Arrive on site : 0730 Lunch hours : 1
Leave off site : 1730 Downtime hours¹ : 0
Standby hours² : 0
Hours on site
(B - A) : 10

DECONTAMINATION

Probe Decontamination Syringe Decontamination
Total hours: 1/4 Total hours : 1/2
DCS M. Faveroni
Verified by GC operator Verified by field assistant

DAILY SUMMARY

Calibration	Sampling	Analysis
Time start : 0730	Max vacuum : 23 in Hg	Total system
Time end : 0830	Probes used : 13	blanks : 1
Total hours: 1	Points used : 20	Total air
	Soil gas samples collected : 18	samples : 3
	Water samples collected : 0	

Field data and gas standards checked by M. Faveroni
Data checking hours: 1/2

- 1 - Downtime includes time spent repairing sampling & analytic equipment; note times and explanation on following field data pages
- 2 - Standby includes time available for sampling but waiting for client; note times and explanation on following field data pages

DATE 2-10-87

LOCATION: JAVIGNON CHEMICAL, LUTHERAL, SD CLIENT: SLEMONVILLE ENV

SAMPLING DATA

TIME	SAMPLE NUMBER	DEPTH	PROBE #	ADAPT #	PROBE PUSH/POUND	VAC (in Hg)	EVAC TIME (s)	SAMPLE VOL (cc)	POINTS	NOTES/ADD'L DATA REQUESTED BY CLIENT
TIME ON SITE: 0730 BEGIN CALIBRATION: 0730										
0845	TESTED BLANK	4A	16	20	NA	5	30s	3	NA	
930	SC-01	6'	17	52	1000-15 200'	5	30s	9	1	TUB STUCK TO THE TOP OF SAMPLING POINT EVIDENCE OF LEAKS (GLASS IS DEAD, PNEUMATIC TIGHT O-RING AND SLIPRING ON LEADING END ALSO)
915	SC-02	6'	20	16	1000-15 200'	5	30s	7 1/2	1	NEARLY ASHMET (I DECIDED TO TAKE CONDITIONAL SOFT AND MUFFY-LIKE IN APPEARANCE & FEEL. NO NEED TO SEAL, PLEASE NIPED THROUGH EARLY; NIPED LATER 2240
941	SC-20	5 1/2'	15	10	1000-15 200'	4	30s	3	1	WIDE TAIL-PORE ASPHALT, CLIENT HAS INDICATED THAT PATCH WONT BE NECESSARY

SAMPLE

FIGURE 2D
FIELD LOGBOOK - SAMPLING DATA

TRACER RESEARCH CORPORATION
 1 JOB- DAVIDSON CHEMICAL, LAMOTHORH, SOUTH DAKOTA
 DATE- 16 FEBRUARY 1989
 CHEMIST- S CHRODLES
 GEOLOGIST- H FIVERDHI

DETECTOR A (0 or 1)	1	0	1	0
DETECTOR B (0 or 1)	0	0	0	0
RETENTION TIMES	1.1	1.1	1.7	1.7
SAMPLE INJECTOR (ul.)	5	5	5	5
STANDARD CONCENTRATION (ug/L):	3.10	3.10	10	10
AREA RESPONSE 1:	95310	2000456	1140076	1140076
IRON INJECTION 2:	103603	1936243	1114123	1114123
3:	107190	2150370	1126370	1126370
RESPONSE FACTOR:	5	4.90E-16	1.23E-17	4.13E-17
COMPONENT	F113	TCA	ICE	ICE
SAMPLE TIME (MIN)	11	14	15	15
BLANK	11	14	15	15
1120 BLANK	11	14	15	15
112 BLANK	11	14	15	15
OUR SAMPLE 0	11	14	15	15
SYSTEM BLANK 0	11	14	15	15
5001-3'	11	14	15	15
5001-3'	11	14	15	15
15-10	11	14	15	15
15-10	11	14	15	15

FIGURE 3.
 EXPLANATION OF FIELD DATA SHEET

- Site and staff information.
- Name of compound.
- Concentration of analyte in calibration standard.
- Peak area obtained from standard injections during calibration.
- Response factor (RF) for compound obtained from three calibration runs. The RF are used for calculation of actual concentrations and are listed on each data sheet.
- Factor blank verifies purity of standard water and cleanliness of injection system.
- Atrogen blank verifies decontamination of syringe and analytical equip.
- Site sample glass vial concentrations for comparison with system blank.
- System blank verifies decontamination of sampling equipment.
- Sample ID number: 001-3' (well geo sample 1 taken 6" below plastic, 81-18 (water sample).
- Site of analysis identifies the chromatogram from which the data are taken.
- Amount of sample injection - used for concentration calculation.
- Peak area - raw data produced by the computing integrator that is proportional to the area of analysis in the sample.
- Actual concentration present in the sample rounded to 1 significant figure.
- Mean concentration of duplicate injections.

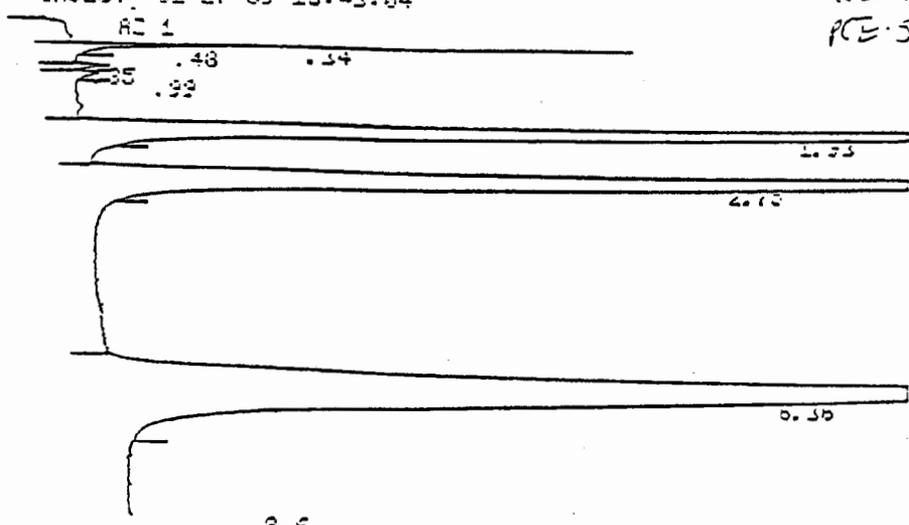
READY
 DATE " 01-27-89
 TIME " 15:06
 FI= 1. RE= 1. MH= 8.
 PRESS 'ENTER' TO SAIF ENTRY
 FILE NAME=" STD
 TIME FUNCTION VALUE
 TT= .01 TF=" SC TV= 1
 TT= .01 TF=" PH TV= 1
 TT=

Column <u>OV-171</u>	Detector <u>5</u>
Length <u>6'</u>	Voltage <u>200</u>
Dia. <u>1/8"</u>	Scrubt. _____
Liquid Phase <u>OV-171</u>	Flow Rates, ml/min _____
Wt. % <u>10</u>	Hydrogen _____ Air _____
Support <u>Chromasorb</u>	Carrier Gas _____
Mesh <u>60/80</u>	Split _____
Carrier Gas <u>N₂</u>	Temperature, °C _____
Rotameter <u>7</u>	Det. <u>500</u> <u>100</u> <u>200</u>
Inlet Press <u>25</u> psig	Column Initial <u>20</u> <u>150</u>
Rate <u>50</u> ml/min	Final _____
CHART SPEED <u>1</u>	Rate _____
SAMPLE _____	Solvent _____
Size _____	Concn. _____
Operator <u>MLC</u>	Date _____

METHOD NUMBER: MN=

END OF DIALOG
 AT= 32
 OF= 28
 PT= 1000

CHANNEL A INJECT 01-27-89 15:43:04



*50°C STG 2/ TC 1.5
 TC = 1.0 / 29/L
 PCE = 5*

STD 01-27-89 15:43:04 CH= "A" FS= 1.

FILE 1.	METHOD 0.	RUN 1	INDEX 1
PEAK#	AREA%	RT	AREA EC
1	0.377	0.34	13779 02
2	1.754	0.48	64194 03
3	0.164	0.85	6811 01
4	0.152	0.99	5547 01
5	25.881	1.93	917708 01
6	26.951	2.75	986147 01
7	45.521	6.36	1565628 01
TOTAL	100.		3659014

FIGURE 4
 CHROMATOGRAM DOCUMENTATION

APPENDIX B

TRACER RESEARCH CORPORATION
SHALLOW SOIL GAS INVESTIGATION
CALMAR, MAY 10-17, 1990



PREPARED FOR:

**Camp, Dresser & McKee Inc
18881 Von Karman
Suite 650
Irvine, California 92715
(714)752-5452**

SHALLOW SOIL GAS INVESTIGATION

CALMAR INDUSTRIES

CITY OF INDUSTRY, CALIFORNIA

MAY 1991

SUBMITTED BY:

Tracer Research Corporation

**191288S.REP
1-91-288-S**



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INTRODUCTION

A shallow soil gas investigation was performed by Tracer Research Corporation (TRC) at the Calmar Industries site located in City of Industry, California. The investigation was conducted on May 10-17, 1991 under contract to Camp, Dresser & McKee Inc. The purpose of the investigation was to delineate the extent of possible contamination in the subsurface.

During this survey, a total of 76 soil gas samples were collected from 38 locations and analyzed. Samples were analyzed for volatile organic compounds from the following suite:

<u>COMPOUND</u>	<u>DETECTOR</u>
1,1-dichloroethene (1,1-DCE)	ECD
methylene chloride (CH ₂ CL ₂)	ECD
1,1,2-trichlorotrifluoroethane (F-113)	ECD
chloroform (CHCL ₃)	ECD
1,1,1-trichloroethane (TCA)	ECD
carbon tetrachloride (CCL ₄)	ECD
trichloroethene (TCE)	ECD
1.1.2-trichloroethane (1.1.2-TCA)	ECD
1.1.1.2-tetrachloroethane (1.1.1.2-TCA)	ECD
tetrachloroethene (PCE)	ECD

The compounds in this suite were chosen as target compounds because of their suspected presence in the subsurface and amenability to soil gas technology. Soil gas samples were screened on a gas chromatograph equipped with an electron capture detector (ECD).



SHALLOW SOIL GAS INVESTIGATION - METHODOLOGY

Shallow soil gas investigation refers to a method developed by TRC for investigating underground contamination from volatile organic chemicals (VOCs) such as industrial solvents, cleaning fluids and petroleum products by looking for their vapors in the shallow soil gas. The method involves pumping a small amount of soil gas out of the ground through a hollow probe driven into the ground and analyzing the gas for the presence of volatile contaminants. The presence of VOCs in shallow soil gas indicates the observed compounds may either be in the vadose zone near the probe or in groundwater below the probe. The soil gas technology is most effective in mapping low molecular weight halogenated solvent chemicals and petroleum hydrocarbons possessing high vapor pressures and low aqueous solubilities. These compounds readily partition out of the groundwater and into the soil gas as a result of their high gas/liquid partitioning coefficients. Once in the soil gas, VOCs diffuse vertically and horizontally through the soil to the ground surface where they dissipate into the atmosphere. The contamination acts as a source and the above ground atmosphere acts as a sink, and typically a concentration gradient develops between the two. The concentration gradient in soil gas between the source and ground surface may be locally distorted by hydrologic and geologic anomalies (e.g. clays, perched water); however, soil gas mapping generally remains effective because distribution of the contamination is usually broader in areal extent than the local geologic barriers and is defined using a large database. The presence of geologic obstructions on a small scale tends to create anomalies in the soil gas-groundwater correlation, but generally does not obscure the broader areal picture of the contaminant distribution.

Soil gas contaminant mapping helps to reduce the time and cost required to delineate underground contamination by volatile contaminants. The soil gas investigation does this by outlining the general areal extent of contamination. Conventional bore holes or observation wells are used to verify both the presence and extent of the subsurface



contamination as indicated in the soil gas survey. In this manner, soil gas contaminant mapping can assist in determining the placement of monitoring wells. Thus the likelihood of drilling unnecessary monitoring wells is reduced. The soil gas survey is not intended to be substitute for conventional methodology, but rather to enable conventional methods to be used efficiently.

EQUIPMENT

Tracer Research Corporation utilized a one ton Ford analytical van that was equipped with one gas chromatograph and two Spectra Physics computing integrators. In addition, the van had two built-in gasoline powered generators that provide the electrical power (110 volts AC) to operate all of the gas chromatographic instruments and field equipment. A specialized hydraulic mechanism consisting of two cylinders and a set of jaws was used to drive and withdraw the sampling probes. A hydraulic hammer was used to assist in driving probes past cobbles and through unusually hard soil.

SOIL GAS SAMPLING PROCEDURES

Sampling probes consisted of 7 foot lengths of 3/4 inch diameter hollow steel pipe that were fitted with detachable drive tips. Soil gas probes were advanced 3-6 feet below grade. Once inserted into the ground, the above-ground end of the sampling probes were fitted with a steel reducer and a length of polyethylene tubing leading to a vacuum pump. Gas flow was monitored by a vacuum gauge to insure that an adequate flow was obtained.

To adequately purge the volume of air within the probe, 2 to 5 liters of gas was evacuated with a vacuum pump. During the soil gas evacuation, samples were collected in a glass syringe by inserting a syringe needle through a silicone rubber segment in the evacuation line and down into the steel probe. Ten milliliters of gas were collected for immediate analysis in the TRC analytical field van. Soil gas was subsampled (duplicate



injections) in volumes ranging from 1 uL to 2 mL, depending on the VOC concentration at any particular location.

Sample probe vacuums ranged from 3-18 inches Hg. The maximum pump vacuum was measured at 25 inches Hg.

ANALYTICAL PROCEDURES

A Varian 3300 gas chromatograph was used for the soil gas analyses. It was equipped with an electron capture detector (ECD). Compounds were separated on a 6' by 1/8" OD packed column with SP-1000 as the stationary phase in a temperature controlled oven. Nitrogen was used as the carrier gas.

Halocarbon compounds detected in the samples were identified by chromatographic retention time. Quantification of compounds was achieved by comparison of the detector response of the sample with the response measured for calibration standards (external standardization). Instrument calibration checks were run periodically throughout the day and system blanks were run at the beginning of the day to check for contamination in the soil gas sampling equipment. Air samples were also routinely analyzed to check for background levels in the atmosphere.

Detection limits for the compounds of interest were a function of the injection volume as well as the detector sensitivity for individual compounds. Thus the detection limit varied with the sample size. Generally, the larger the injection size the greater the sensitivity. However, peaks for compounds of interest were kept within the linear range of the analytical equipment. If any compound had a high concentration, it was necessary to use small injections, and in some cases to dilute the sample to keep it within linear range. This may have caused decreased detection limits for other compounds in the analyses.

The detection limits for the halocarbon compounds were approximately 0.0003 ug/L. Detection limits were dependant upon the conditions of the measurement, in particular,

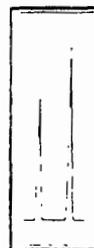


the sample size. If any component being analyzed was not detected, the detection limit for that compound in that analysis is given as a "less than" value (e. g. < 0.1 ug/L). Detection limits obtained from GC analyses were calculated from the current response factor, the sample size, and the estimated minimum peak size (area) that would have been visible under the conditions of the measurement.

QUALITY ASSURANCE/QUALITY CONTROL PROCEDURES

Tracer Research Corporation's normal quality assurance procedures were followed in order to prevent any cross-contamination of soil gas samples. These procedures are described below:

- . Steel probes are used only once during the day and then washed with high pressure soap and hot water spray or steam-cleaned to eliminate the possibility of cross-contamination. Enough probes are carried on each van to avoid the need to reuse any during the day.
- . Probe adaptors (TRC's patented design) are used to connect the sample probe to the vacuum pump. The adaptor is designed to eliminate the possibility of exposing the sample stream to any part of the adaptor. Associated tubing connecting the adaptor to the vacuum pump is replaced periodically as needed during the job to insure cleanliness and good fit. At the end of each day the adaptor is cleaned with soap and water and baked in the GC oven.
- . Silicone tubing (which acts as a septum for the syringe needle) is replaced as needed to insure proper sealing around the syringe needle. This tubing does not directly contact soil gas samples.
- . Glass syringes are usually used for only one sample per day and are washed and baked out at night. If they must be used twice, they are purged with carrier gas (nitrogen) and baked out between probe samplings.



- . Injector port septa through which soil gas samples are injected into the chromatograph are replaced on a daily basis to prevent possible gas leaks from the chromatographic column.
- . Analytical instruments are calibrated each day by analytical standards from Chem Service, Inc. Calibration checks are also run after approximately every five soil gas sampling locations.
- . Subsampling syringes are checked for contamination prior to sampling each day by injecting nitrogen carrier gas into the gas chromatograph.
- . Prior to sampling each day, system blanks are run to check the sampling apparatus (probe, adaptor, 10 cc syringe) for contamination by drawing ambient air from above ground through the system and comparing the analysis to concurrently sampled ambient air analysis.
- . All sampling and subsampling syringes are decontaminated each day and no such equipment is reused before being decontaminated. Microliter size subsampling syringes are reused only after a nitrogen carrier gas blank is run to insure it is not contaminated by the previous sample.
- . Soil gas pumping is monitored by a vacuum gauge to insure that an adequate gas flow from the vadose zone is maintained. A reliable gas sample can be obtained if the sample vacuum gauge reading is at least 2 inches Hg less than the maximum pump vacuum.



APPENDIX A: ANALYTICAL DATA

CDM/CALMAR INDUSTRIES/CITY OF INDUSTRY, CALIFORNIA JOB #01-91-288-S

05/10/91

CONDENSED DATA

SAMPLE	CH2CL2 ug/l	1,1-DCE ug/l	CHCL3 ug/l	F-113 ug/l	TCA ug/l	CCL4 ug/l	TCE ug/l	1.1.2 TCA ug/l	1.1.1.2 TCA ug/l	PCE ug/l
AIR	<0.01	<0.002	<0.002	<0.002	0.01	<0.0003	<0.002	<0.001	<0.0007	<0.002
SG-20-3'	<0.02	<0.005	<0.004	<0.003	0.07	<0.0005	0.3	<0.02	<0.001	0.7
SG-20-6'	<0.02	<0.005	<0.004	<0.003	0.02	<0.0005	0.3	<0.02	<0.001	0.05
SG-21-3'	<0.06	1	<0.01	<0.01	19	<0.002	15	<0.06	<0.004	4
SG-21-6'	<0.1	<0.03	<0.03	<0.02	1	<0.003	2	<0.01	<0.007	4
SG-22-3'	<0.06	0.03	<0.01	<0.01	8	<0.002	0.05	<0.06	<0.004	0.4
SG-22-6'	<0.06	<0.01	<0.01	<0.01	0.1	<0.002	1	<0.06	<0.004	<0.008
SG-23-3'	<0.06	<0.01	<0.01	<0.01	0.1	<0.002	1	<0.06	<0.004	<0.008
SG-23-6'	<0.06	<0.01	<0.01	<0.01	0.2	<0.001	2	<0.06	<0.004	1

Analyzed by: C Sullivan
 Proofed by: *KC*

CDM/CALMAR INDUSTRIES/CITY OF INDUSTRY, CALIFORNIA JOB #1-91-288-S

05/13/91

CONDENSED DATA

SAMPLE	CH2CL2 ug/l	1,1-DCE ug/l	CHCL3 ug/l	F-113 ug/l	TCA ug/l	CCL4 ug/l	TCE ug/l	1,1,2 TCA ug/l	1,1,1,2 TCA ug/l	PCE ug/l
AIR	<0.01	<0.02	<0.003	<0.003	0.1	<0.004	<0.003	<0.01	<0.0006	0.004
SG-24-3'	<0.02	<0.05	<0.008	<0.008	0.02	<0.001	<0.009	<0.03	<0.002	<0.004
SG-24-6'	<0.02	<0.05	<0.008	<0.008	0.04	<0.001	0.04	<0.03	<0.002	0.02
SG-25-3'	<0.02	<0.03	<0.005	<0.005	0.04	<0.0008	<0.006	<0.02	<0.001	<0.002
SG-25-6'	<0.02	<0.03	<0.005	<0.005	0.02	<0.0008	0.04	<0.02	<0.001	<0.002
SG-26-3'	<0.02	<0.03	<0.005	0.06	0.04	<0.0008	<0.006	<0.02	<0.001	0.5
AIR	<0.02	<0.02	<0.003	<0.003	0.006	<0.0005	<0.003	<0.01	<0.0006	0.006
SG-26-6'	<0.02	<0.03	<0.006	<0.005	0.04	<0.0008	0.9	<0.02	<0.001	0.02
SG-27-3'	<0.02	<0.03	<0.006	0.1	0.08	<0.0008	<0.006	<0.02	<0.001	0.01
SG-27-6'	<0.02	<0.03	<0.006	<0.005	0.02	<0.0008	0.4	<0.02	<0.001	0.007
SG-28-3'	<0.02	<0.03	<0.006	0.2	0.07	<0.0008	<0.006	<0.02	<0.001	0.01
SG-28-6'	<0.02	<0.03	<0.006	<0.005	0.07	<0.0008	<0.006	<0.02	<0.001	<0.002
SG-29-3'	<0.02	<0.03	<0.006	0.06	0.07	<0.0008	<0.006	<0.02	<0.001	<0.002
SG-29-6'	<0.02	<0.03	<0.006	<0.005	0.08	<0.0008	0.6	<0.02	<0.001	<0.002
AIR	<0.01	<0.02	<0.003	<0.003	0.03	<0.0004	<0.003	<0.01	<0.0006	<0.001

Analyzed by: C. Sullivan
 Proofed by: K.L.W.

CDM/CALMAR INDUSTRIES/CITY OF INDUSTRY, CALIFORNIA JOB #1-91-288-S

05/14/91

CONDENSED DATA

SAMPLE	CH2CL2 ug/l	1,1-DCE ug/l	CHCL3 ug/l	I-113 ug/l	TCA ug/l	CCL4 ug/l	TCE ug/l	11.2 TCA ug/l	11.12 TCA ug/l	PCE ug/l
AIR	<0.01	<0.03	<0.003	<0.009	0.07	<0.004	<0.003	<0.01	<0.0008	0.0009
SG-30-3'	<0.02	<0.05	<0.006	0.3	5	<0.0007	<0.006	<0.02	<0.001	0.03
SG-30-6'	<0.02	<0.05	<0.006	0.3	4	<0.0007	<0.006	<0.02	<0.001	0.01
SG-31-3'	<0.02	<0.05	<0.006	2	5	<0.0007	<0.006	<0.02	<0.001	0.08
SG-31-6'	<0.04	<0.07	<0.009	5	9	<0.001	<0.009	<0.04	<0.002	0.2
SG-32-3'	<0.04	<0.07	<0.009	2	6	<0.001	<0.009	<0.04	<0.002	0.02
SG-32-6'	<0.04	<0.07	<0.009	2	5	<0.001	<0.009	<0.04	<0.002	0.02
SG-33-3'	<0.04	<0.07	<0.009	0.7	8	<0.001	<0.009	<0.04	<0.002	0.02
AIR	<0.04	<0.07	<0.009	2	11	<0.001	<0.009	<0.04	<0.002	0.01
SG-33-6'	<0.04	<0.07	<0.009	1	10	<0.001	<0.009	<0.04	<0.002	0.03
SG-34-3'	<0.04	<0.07	<0.009	<0.02	12	<0.001	<0.009	<0.04	<0.002	0.02
SG-34-6'	<0.04	<0.07	<0.009	<0.02	0.5	<0.001	<0.009	<0.04	<0.002	<0.004
SG-35-3'	<0.04	<0.07	<0.009	0.4	10	<0.001	<0.009	<0.04	<0.002	0.03
SG-35-6'	<0.04	<0.07	<0.009	1	7	<0.001	<0.009	<0.04	<0.002	0.04
SG-36-3'	<0.04	<0.07	<0.009	<0.02	3	<0.001	<0.009	<0.04	<0.002	0.01
SG-36-6'	<0.04	<0.07	<0.009	<0.02	2	<0.001	<0.009	<0.04	<0.002	0.02
SG-37-3'	<0.04	<0.07	<0.009	0.04	5	<0.001	<0.009	<0.04	<0.002	0.01
SG-37-6'	<0.04	<0.07	<0.009	0.1	2	<0.001	<0.009	<0.04	<0.002	0.03
SG-38-3'	<0.04	<0.07	<0.009	<0.02	3	<0.001	<0.009	<0.04	<0.002	0.02
SG-38-6'	<0.04	<0.07	<0.009	<0.02	1	<0.001	<0.009	<0.04	<0.002	0.02

Analyzed by: C Sullivan
 Proofed by: KLK

CDM/CALMAR INDUSTRIES/CITY OF INDUSTRY, CALIFORNIA JOB #1-91-288-S

05/15/91

CONDENSED DATA

SAMPLE	CH2CL2 ug/l	1,1-DCE ug/l	CHCL3 ug/l	F-113 ug/l	TCA ug/l	CCL4 ug/l	TCE ug/l	1,1,2 TCA ug/l	1,1,1,2 TCA ug/l	PCE ug/l
AIR	<0.02	<0.05	<0.004	<0.005	<0.002	<0.005	<0.007	<0.02	<0.001	<0.002
SG-39-3'	<0.05	<0.1	<0.01	<0.01	0.5	<0.001	1	<0.05	<0.003	6
SG-39-6'	<0.05	0.5	<0.01	<0.01	0.7	<0.001	2	<0.05	<0.003	7
SG-40-3'	<0.05	1	<0.01	<0.01	4	<0.001	10	<0.05	<0.003	11
SG-40-6'	<0.1	<0.2	<0.02	<0.02	<0.01	<0.003	<0.03	<0.1	<0.007	0.6
SG-41-3'	<0.1	<0.2	<0.02	<0.02	0.9	<0.003	6	<0.1	<0.007	12
SG-41-6'	<0.1	0.9	<0.02	<0.02	3	<0.003	14	<0.1	<0.007	17
SG-42-3'	<0.1	<0.2	<0.02	<0.02	0.8	<0.003	5	<0.1	<0.007	15
SG-42-6'	<0.1	<0.2	<0.02	<0.02	<0.01	<0.003	<0.03	<0.1	<0.007	2
SG-43-3'	<0.1	<0.2	<0.02	<0.02	0.7	<0.003	2	<0.1	<0.007	11
SG-43-6'	<0.1	<0.2	<0.02	<0.02	0.03	<0.003	0.2	<0.1	<0.007	0.5

Analyzed by: C. Sullivan
 Proofed by: KLW

CIDM/CALMAR INDUSTRIES/CITY OF INDUSTRY, CALIFORNIA JOB #1-91-288-S

05/16/91

CONDENSED DATA

SAMPLE	CH2CL2 ug/l	1,1-DCE ug/l	CHCL3 ug/l	F-113 ug/l	TCA ug/l	CCLA ug/l	TCE ug/l	1.1.2 TCA ug/l	1.1.1.2 TCA ug/l	PCL ug/l
AIR	<0.02	<0.04	<0.004	<0.01	0.06	<0.0005	<0.005	<0.02	<0.001	0.02
SG-44-3'	<0.08	35	0.1	0.2	14	<0.003	31	<0.1	<0.006	590
SG-44-6'	<2	<39	<0.04	<1	<0.2	<0.06	<0.05	<2	<0.1	108
SG-45-3'	<2	<39	<0.04	<1	26	<0.06	20	<2	<0.1	820
SG-45-6'	<0.08	<2	<0.02	<0.06	<0.008	<0.003	<0.03	<0.1	<0.006	0.2
SG-46-3'	<0.02	<4	<0.04	<0.1	0.3	<0.06	<0.05	<0.2	<0.01	0.7
SG-46-6'	<0.08	<2	<0.02	<0.06	2	<0.003	0.4	<0.1	<0.006	12
SG-47-3'	<0.08	<2	<0.02	<0.06	0.2	<0.003	<0.03	<0.1	<0.006	5
SG-47-6'	<0.08	<2	<0.02	<0.06	<0.008	<0.003	<0.03	<0.1	<0.006	0.2
SG-48-3'	<0.08	<2	<0.02	<0.06	0.6	<0.003	<0.03	<0.1	<0.006	0.2
SG-48-6'	<0.08	<2	<0.02	<0.06	0.7	<0.003	0.1	<0.1	<0.006	0.4
SG-49-3'	<0.08	<2	<0.02	<0.06	<0.008	<0.003	<0.03	<0.1	<0.006	0.1
SG-49-6'	<0.08	250	<0.02	<0.06	30	<0.003	2	<0.1	<0.006	0.5
AIR	<0.06	<0.3	<0.003	<0.01	<0.001	1	<0.005	<0.1	<0.001	<0.002
SG-50-3'	<0.08	<2	<0.02	0.3	0.02	<0.003	<0.03	<0.1	<0.006	0.1
SG-50-6'	<0.08	<2	<0.02	0.9	0.2	<0.003	0.5	<0.1	<0.006	0.5

Analyzed by: C Sullivan

Printed by: KLR



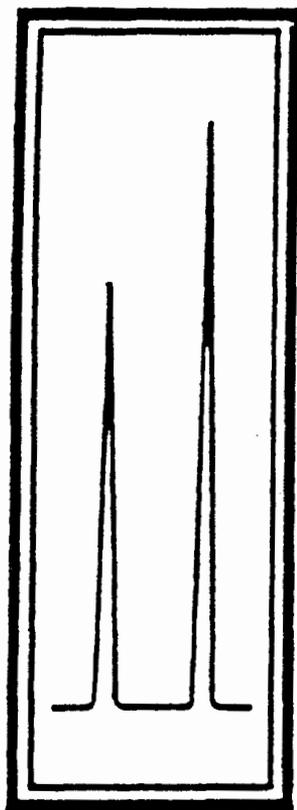
CDM/CALMAR INDUSTRIES/CITY OF INDUSTRY, CALIFORNIA JOB #1-91-288-S

05/17/91

CONDENSED DATA

SAMPLE	CH2CL2 ug/l	1,1-DCE ug/l	CHCL3 ug/l	F-113 ug/l	TCA ug/l	CCL4 ug/l	TCE ug/l	1.1.2 TCA ug/l	1.1.2 TCA ug/l	PCE ug/l
AIR	<0.01	<0.04	<0.004	<0.006	0.008	<0.0006	<0.005	<0.02	<0.001	0.006
SG-51-3'	<0.08	<0.2	<0.02	<0.02	0.02	<0.003	0.05	<0.1	<0.006	0.04
SG-51-6'	<0.08	<0.2	<0.02	0.2	0.03	<0.003	0.05	<0.1	<0.006	0.1
SG-52-3'	<0.08	<0.2	<0.02	0.09	0.02	<0.003	<0.03	<0.1	<0.006	0.1
SG-52-6'	<0.08	<0.2	<0.02	<0.03	<0.009	<0.003	<0.03	<0.1	<0.006	<0.01
SG-53-6'	<0.08	6	<0.02	0.4	3	<0.003	6	<0.1	<0.006	45
SG-53-3'	<0.08	<0.2	<0.02	<0.03	<0.009	<0.003	<0.03	<0.1	<0.006	0.2
SG-54-3'	<0.08	1	<0.02	<0.03	0.1	<0.003	0.3	<0.1	<0.006	2
SG-54-6'	<0.08	<0.2	<0.02	<0.03	<0.009	<0.003	<0.03	<0.1	<0.006	0.2
SG-55-3'	<0.08	<0.2	<0.02	<0.03	0.02	<0.003	0.08	<0.1	<0.006	0.1
SG-55-6'	<0.08	<0.2	<0.02	<0.03	0.1	<0.003	0.1	<0.1	<0.006	2
SG-56-3'	<0.08	<0.2	<0.02	<0.03	<0.009	<0.003	<0.03	<0.1	<0.006	<0.01
SG-56-6'	<0.08	0.5	<0.02	0.06	3	<0.003	0.8	<0.1	<0.006	17
SG-57-3'	<0.08	3	<0.02	<0.03	2	<0.003	0.5	<0.1	<0.006	0.8
SG-57-6'	<0.08	9	<0.02	<0.03	6	<0.003	2	<0.1	<0.006	2

Analyzed by: C. Sullivan
 Proofed by: *KLM*



**Tracer
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FIELD LOGBOOK #1

CLIENT CDM

SITE CALMAR

LOCATION C.D.I., CA

DATES 5/10 - 5/17/91

JOIND 1-91-288-5



VAN # 5
PLATE # 315 L13

SOIL GAS INVESTIGATION BACKGROUND INFORMATION

SITE NAME: CALMAR DISPERMITY SYSTEMS INC
LOCATION: 1-12-IT
DATES OF INVESTIGATION: 5/10/91
CLIENT NAME & ADDRESS: COM

18881 10N KARMAN SUITE 650
IRVINE CA 92715

FIELD REPRESENTATIVE(S) FOR CLIENT: STEVEN M. WATSON

PERSON TO WHOM REPORT AND QUESTIONS SHOULD BE DIRECTED: MIKE KAMRZGIT
PHONE: (714) 952-5452

CREW: CHEMIST C. SULLIVAN GEOLOGIST J. D. WILK

REPORT TO INCLUDE (CIRCLE):
 A. QA/QC-PROCEDURES-DATA ONLY or
 B. FULL REPORT WITH CONTOUR MAPS AND INTERPRETATION

PURPOSE OF INVESTIGATION
TO DETERMINE EXTENT OF POSSIBLE CONTAMINATION

TARGET VOCs	
<u>CH₄</u>	<u>CH₄ CCL₄</u>
<u>1,1,2,2-TCE</u>	<u>TCE</u>
<u>CH₂CL₂</u>	<u>1,1,2-TCF</u>
<u>F-113</u>	<u>1,1,1-TCF</u>
<u>TCA</u>	<u>DCM</u>

GROUNDWATER INFORMATION:
DEPTH TO WATER: 40' DIRECTION: EAST

SOURCES OF CONTAMINATION

GEOLOGIC SETTING: (e.g. soil type, subsurface geology, etc.)
CLAY



DATE : 5/10/91
 LOCATION : CAIMAR DISA.SYS INC
 CLIENT : COM

GC Operator: C. Sullivan
 Weather : PARTLY CLOUDY

Field Assistant: J. O'NEILL

F I E L D H O U R S

A Time on site : 0730	Lunch hours : -
B Time off site : 1530	Downtime hours ¹ :
Hours on site (B - A) :	Standby hours ² :

D E C O N T A M I N A T I O N

Probe Decontamination	Syringe Decontamination
Total hours:	Total hours :

Verified by GC operator

Verified by field assistant

D A I L Y S U M M A R Y

Calibration	Sampling	Analysis
Time start : 0800	Max vacuum : 20 in Hg	Total system
Time end : 1030	Probes used : 4	blanks :
Total hours: -----	Points used : 4	Total air
	Soil gas samples	samples : 3
	collected : 8	
	Water samples	
	collected : 0	

Field data and gas standards checked by _____

Verified by Client

Data checking hours:

- 1 - Downtime includes time spent repairing sampling & analytic equipment; note times and explanation on following field data pages
- 2 - Standby includes time available for sampling but waiting for client; note times and explanation on following field data pages



DATE :
LOCATION :
CLIENT :

GC Operator :
Weather :

Field Assistant :

F I E L D H O U R S

A Time on site :
B Time off site :
Hours on site (B - A) :
Lunch hours :
Downtime hours¹ :
Standby hours² :

D E C O N T A M I N A T I O N

Probe Decontamination Syringe Decontamination
Total hours: Total hours :
Verified by GC operator Verified by field assistant

D A I L Y S U M M A R Y

Calibration Sampling Analysis
Time start :
Time end :
Total hours:
Max vacuum : in Hg
Probes used :
Points used :
Soil gas samples collected :
Water samples collected :
Total system blanks :
Total air samples : 3

Field data and gas standards checked by

Verified by Client

Data checking hours:

- 1 - Downtime includes time spent repairing sampling & analytic equipment; note times and explanation on following field data pages
- 2 - Standby includes time available for sampling but waiting for client; note times and explanation on following field data pages



DATE :
LOCATION :
CLIENT :

GC Operator:
Weather :

Field Assistant:

F I E L D H O U R S

A Time on site	: 1:45	Lunch hours	: 0.5
B Time off site	: 1:45	Downtime hours ¹	: -
	-----	Standby hours ²	: -
Hours on site			
(B - A)	:		

D E C O N T A M I N A T I O N

Probe Decontamination	Syringe Decontamination
Total hours:	Total hours :
-----	-----
Verified by GC operator	Verified by field assistant

D A I L Y S U M M A R Y

Calibration	Sampling	Analysis
Time start :	Max vacuum : 27 in Hg	Total system
Time end : -----	Probes used : 7	blanks :
Total hours:	Points used : 1	Total air
	Soil gas samples	samples : 3
	collected : 8	
	Water samples	
	collected : 0	

Field data and gas standards checked by _____

Verified by Client

Data checking hours:

- 1 - Downtime includes time spent repairing sampling & analytic equipment; note times and explanation on following field data pages
- 2 - Standby includes time available for sampling but waiting for client; note times and explanation on following field data pages

DATE: 5/14/91
 LOCATION: CALMAR

CLIENT: *Jim*

SAMPLING DATA										
TIME	SAMPLE NUMBER	DEPTH	PROBE#	ADAPT#	PROBE PUSH/ POUND	VAC (in Hg)	EVAC TIME (s)	SAMPLE VOL (cc)	POINTS	NOTES/ADD'L DATA REQUESTED BY CLIENT
TIME ON SITE: BEGIN CALIBRATION:										
	SG-37	3	8		H/P 3	15	45	3	1	HAND FOUND UNDER LOWER
	SG-37	6			H/P 6	18	90	2	1	
	SG-38	3	9		H/P 3	18	90	2	1	HAND FOUND UNDER LOWER
	SG-38	6			H/P 6	18	90	2	1	



DATE : 5/15/91
LOCATION : CALMAR
CLIENT : CDM

GC Operator: C. SULLIVAN
Weather : CLEAR, 75°

Field Assistant: J. OLIVER

F I E L D H O U R S

A Time on site : 0745
B Time off site : 1645
Hours on site
(B - A) :

Lunch hours : .75
Downtime hours¹ : .504r
Standby hours² :

D E C O N T A M I N A T I O N

Probe Decontamination
Total hours:

Syringe Decontamination
Total hours :

Verified by GC operator

Verified by field assistant

D A I L Y S U M M A R Y

Calibration	Sampling	Analysis
Time start :	Max vacuum : 20 in Hg	Total system
Time end : -----	Probes used : 5	blanks :
Total hours:	Points used : 10	Total air
	Soil gas samples	samples : 3
	collected : 10	
	Water samples	
	collected : 0	

Field data and gas standards checked by _____

Verified by Client

Data checking hours:

- 1 - Downtime includes time spent repairing sampling & analytic equipment; note times and explanation on following field data pages
- 2 - Standby includes time available for sampling but waiting for client; note times and explanation on following field data pages



DATE : 5/16/91
LOCATION : CALMAR
CLIENT : CDM

GC Operator: C. SULLIVAN
Weather : CLEAR, WINDY, 75°

Field Assistant: F. J. R. R.

F I E L D H O U R S

A Time on site : 0730
B Time off site : 1645

Hours on site
(B - A) :

Lunch hours : .5
Downtime hours¹ :
Standby hours² :

D E C O N T A M I N A T I O N

Probe Decontamination

Syringe Decontamination

Total hours:

Total hours :

Verified by GC operator

Verified by field assistant

D A I L Y S U M M A R Y

Calibration

Sampling

Analysis

Time start :
Time end : -----
Total hours:

Max vacuum : 20 in Hg
Probes used : 7
Points used : 14
Soil gas samples
collected : 14
Water samples
collected : 0

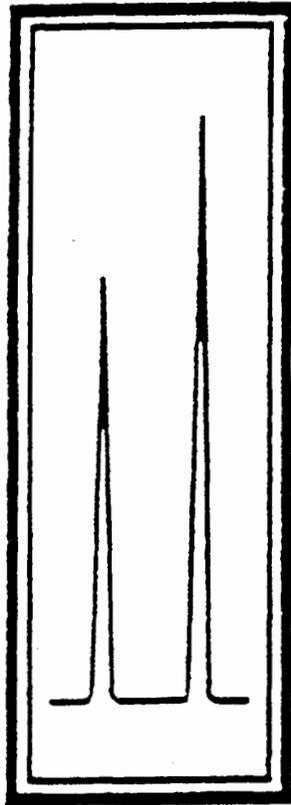
Total system
blanks :
Total air
samples : 3

Field data and gas
standards checked by _____

Verified by Client

Data checking hours:

- 1 - Downtime includes time spent repairing sampling & analytic equipment; note times and explanation on following field data pages
- 2 - Standby includes time available for sampling but waiting for client; note times and explanation on following field data pages



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FIELD LOGBOOK #2

JOB No: 1-91-288-5

CLIENT: CDM

SITE: CALMAR DISPENSING SYSTEMS

LOCATION: C.O.I. LA

DATES: 5/10 - 5/17/91

DAILY SUMMARY

DATE: 5/17/91 CLIENT: CDM JOB # 1-91-288-5
WEATHER: CLEAR, WINDY, 70-75°



FIELD HOURS

TIME ON SITE: 0800 LUNCH HOURS: -
TIME OFF SITE: 1530 DOWNTIME HOURS¹: -
STANDBY HOURS²: -

CLIENT'S SIGNATURE VERIFYING TIME ON & OFF SITE: _____

BILLABLE HOURS: _____ (office use only)

DECONTAMINATION

PROBE DECONTAMINATION
HOURS: _____

SYRINGE DECONTAMINATION
HOURS: .5

Verified by Crew Leader

Verified by Field Asst

SAMPLING & ANALYSIS

CALIBRATION: TIME START: _____ TIME END: _____ TOTAL HOURS: _____

ANALYSIS: TOTAL SYSTEM BLANKS: 1 TOTAL AIR SAMPLES: 3

SAMPLING: VACUUM PUMP USED (circle): DIAPHRAM or TRANSDUCER
MAXIMUM PUMP VACUUM: 20 in Hg
PROBES USED: 7 POINTS USED: 14
SOIL GAS SAMPLES COLLECTED: 14
WATER SAMPLES COLLECTED: 0

¹ Downtime is time spent repairing equipment; note times and explain in SAMPLING DATA log.
² Standby is time available for sampling but waiting at client's request; note times and explain in SAMPLING DATA log.

SAMPLING DATA

DATE 5/1/91 CLIENT: CDM JOB # 71-989-1

TIME	SAMPLE NUMBER	DEPTH (FT)	PROBE #	PROBE PUSH/ POUND	VACUUM (in Hg)	EVACUATION TIME (SEC)	SAMPLE VOLUME (CC)	POINTS USED	NOTES AND ADDITIONAL INFORMATION REQUESTED BY CLIENT
0845	SG-51 57-3	3	1	PUSH 3	17	90	2	1	
0855	SG-51	6	1	PUSH 6	15	90	2	1	
0920	SG-52	3	2	PUSH 3	18	90	2	1	
0930	SG-52	6	2	PUSH 6	18	90	2	1	
1015	SG-53	3	3	PUSH 3	15	45	3	1	
1025	SG-53	6	3	PUSH 6	18	90	2	1	
1055	SG-54	3	4	PUSH 3	16	45	3	1	
1105	SG-54	6	4	PUSH 6	16	45	3	1	
1120	SG-55	2 2	5	PUSH 2	18	90	2	1	
1130	SG-55	4 5	5	PUSH 5	18	90	2	1	
1245	SG-56	3	6	HAND POUND 3	12	30	7	1	
1300	SG-56	6	6	H/P 6	10	30	7	1	
1330	SG-57	3	7	H/P 3	12	30	7	1	
1350	SG-57	5	7	H/P 5	18	90	2	1	