



Shallow
Groundwater Investigation

2020 SHERMAN
Alameda, California

January 24, 1994



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1.0 2020 SHERMAN SITE INVESTIGATION

Tracer Research Corporation (Tracer Research) performed a shallow groundwater investigation at 2020 Sherman in Alameda, California. The investigation was conducted January 24, 1994 for Geomatrix Consultants of San Francisco, California.

1.1 Objective

The purpose of the investigation was to evaluate and delineate possible subsurface contamination by screening shallow groundwater for the presence of volatile organic compounds (VOCs). Groundwater samples were collected and analyzed for the following analyte classes and compounds:

Analyte Class: Hydrocarbon

benzene, toluene, ethylbenzene, and xylenes (BTEX)

Analyte Class: Halocarbon

1,1 dichloroethene (1,1 DCE)

1,1, dichloroethane (1,1 DCA)

total 1,2 dichloroethene (1,2 DCE)

1,2 dichloroethane (1,2 DCA)

1,1,1 trichloroethane (TCA)

trichloroethene (TCE)

tetrachloroethene (PCE)

1.2 Overview of Results

For this investigation, nine groundwater samples were collected from nine locations. Also, one water sample was collected by the client from a monitoring well and analyzed on site by Tracer Research. Samples were collected at depths of 5 to 7 feet below ground surface (bgs). A summary of the results of the investigation is presented in Table 1.



Table 1. Water Sample Summary

Compound	# of samples in which compound was detected	Low conc. $\mu\text{g/L}$	High conc. $\mu\text{g/L}$	Sample(s) with high conc.
Benzene	0	NA	NA	NA
Toluene	1	NA	8	GW-3-6'
Ethylbenzene	0	NA	NA	NA
Xylenes	0	NA	NA	NA
1,1 DCE	8	1	160	GW-3-6'
1,1 DCA	9	20	1,800	GW-3-6'
1,2 DCE	0	NA	NA	NA
1,2 DCA	0	NA	NA	NA
TCA	2	6	74	GW-3-6'
TCE	1	NA	0.7	GW-4-7'
PCE	2	0.05	2	GW-3-6'

NA = Not Applicable

2.0 SITE DESCRIPTION

Samples were collected near the southwest corner of the warehouse. Sample GW-4 was collected inside the building. Samples were collected through asphalt and grass cover. The geologic setting at this site was not reported. The depth to groundwater was 5 to 7 feet bgs. The direction of groundwater flow was not reported.



3.0 GROUNDWATER SAMPLING PROCEDURES

Sampling probes consisted of 7-foot lengths of 3/4-inch diameter hollow steel pipe. Groundwater samples were collected at depths of approximately 5 to 7 feet bgs.

The hollow probes with detachable drive points were advanced below the water table by hydraulically pushing and/or pounding the probes to the desired depths. Probes were hand pounded to depth in areas which were not accessible with the van. An electric rotary hammer was used to drill through the asphalt.

Once at the desired depth, the probes were withdrawn several inches to permit water to flow into the resulting hole. The aboveground end of the sampling probes were fitted with a vacuum adaptor (metal reducer) and a length of polyethylene tubing leading to a vacuum pump. A vacuum of up to 22 inches Hg was applied to the interior of the probe for 10 to 15 minutes or until water was drawn up the probe. The water accumulated in the hole was removed by vacuum through a 1/4-inch polyethylene tube inserted down into the probe to the bottom of the hole. Because the water is induced to flow into a very narrow hole, it can be sampled with little exposure to air and, consequently, the loss of volatile compounds by evaporation is reduced. The polyethylene tubing was used only once and discarded to avoid cross contamination.

Groundwater samples were collected in 40 milliliter (mL) VOA vials that were filled to exclude air and capped with Teflon-lined septa caps. Approximately half of the liquid in the bottle was decanted, the vials were shaken vigorously, and a sample of the headspace from the container was injected into the gas chromatograph (GC).

Indirect (headspace) analysis is the preferred technique when a large number of water samples are to be performed daily. The method is more time efficient for the measurement of volatile organics than direct injection of the water sample into the GC because there is less chance of semi-volatile and non-volatile organics contaminating the system. Depending upon the partitioning coefficient of a given compound, the indirect analysis method may be more sensitive than the direct injection method. The precision and accuracy of both methods are similar.



4.0 ANALYTICAL PARAMETERS

During this investigation, 40 milliliters (mL) of groundwater were collected for each sample and immediately analyzed in the Tracer Research analytical van. Groundwater samples were injected into the gas chromatograph (GC) in volumes of 200 to 1,000 microliters (μL).

Analytical instruments were calibrated daily using fresh working standards made from National Institute of Sciences and Technology traceable standards and reagent blanked solvents.

The GC was calibrated for indirect analysis by decanting 20 ml of the known standard, leaving approximately the same amount of headspace as in the water headspace samples. The standard bottle was resealed and shaken vigorously for 30 seconds. An analysis of the headspace in the vial determined the Response Factor (RF) which was then used to calculate the sample concentrations.

4.1 Chromatographic System

A Varian 3300 gas chromatograph, equipped with a flame ionization detector (FID), electron capture detector (ECD) and two computing integrators, was used for the groundwater analyses. The hydrocarbon compounds, detected on the FID, were separated in the GC on a 4 foot by 1/8 inch outer diameter (OD) packed analytical column (10% TCEP stationary phase bonded to 80/100 mesh Chromosorb PAW support). The halocarbons, detected on the ECD, were separated in the GC on a 6 foot by 1/8 inch OD packed analytical column (1% SP1000 stationary phase bonded to 60/80 mesh Carbopack B support). Both columns were in a temperature controlled oven. Nitrogen was used as the carrier gas. The following paragraphs explain the GC, FID, and ECD processes.



GC Process

The sample is injected into the GC where it is swept through the analytical column by the carrier gas. The detector senses the presence of a component different from the carrier gas and converts that information to an electrical signal. The components of the sample pass through the column at different rates, according to their individual properties, and are detected by the detector. Compounds are identified by the time it takes them to pass through the column (retention time).

FID Process

The FID utilizes a flame produced by the combustion of hydrogen and air. When a component, which has been separated on the GC analytical column, is introduced into the flame, a large increase in ions occurs. A collector with a polarizing voltage is applied near the flame and the ions are attracted and produce a current, which is proportional to the amount of the sample compound in the flame. The electrical current causes the computing integrator to record a peak on a chromatogram. By measuring the area of the peak and comparing that area to the integrator response of a known aqueous standard, the concentration of the analyte in the sample is determined.

ECD Process

The ECD captures low energy thermal electrons that have been ionized by beta particles. The flow of these captured electrons into an electrode produces a small current, which is collected and measured. When the halogen atoms (halocarbons) are introduced into the detector, electrons that would otherwise be collected at the electrode are captured by the sample, resulting in decreased current. The current causes the computing integrator to record a peak on a chromatogram. The area of the peak is compared to the peak generated by a known standard to determine the concentration of the analyte.

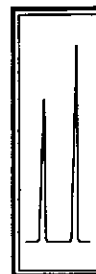


4.2 Analyses

The detection limits for target compounds depend on the sensitivity of the detector to the individual compound as well as the volume of the injection. The detection limits of the target compounds were calculated from the response factor, the sample size, and the calculated minimum peak size (area) observed under the conditions of the analyses. If any compound was not detected in an analysis, the detection limit is given as a "less than" value, e.g., <0.1 micrograms per liter ($\mu\text{g/L}$). The approximate detection limits for the target compounds are presented in Table 2.

Table 2. Detection Limits for Groundwater Compounds

Compound	Detection Limits ($\mu\text{g/L}$)
Benzene	0.2
Toluene	0.4
Ethyl benzene	0.7
Xylenes	2
1,1 DCE	0.07
1,1 DCA	0.2
1,2 DCE	3
1,2 DCA	0.4
TCA	0.01
TCE	0.03
PCE	0.01



5.0 QUALITY ASSURANCE AND QUALITY CONTROL

Tracer Research's Quality Assurance (QA) and Quality Control (QC) program was followed to maintain data that was reproducible through the investigation. An overview presenting the significant aspects of this program is presented below.

Groundwater Sampling Quality Assurance

To ensure consistent collection of samples, the following procedures are performed:

-Sampling Probes

Steel probes are used only once each day. To eliminate the possibility of cross contamination, they are washed with high pressure soap and hot water spray, or steam-cleaned. Enough sampling probes are carried on each van to avoid the need to re-use any during the day.

-Glass Syringes

Glass syringes are used for only one sample a 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.

- Polyethylene Tubing and VOA Vials

Polyethylene tubing and VOA vials used for the collection of groundwater samples are used only once and then discarded to avoid cross contamination.

Analytical Quality Assurance Samples

Quality assurance samples are performed at the minimum frequencies listed in Table 3. The actual frequency depends on the number of samples analyzed each day and the length of time of the survey.



Table 3. Quality Assurance Samples

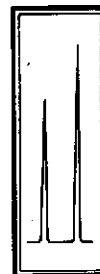
Sample type	Frequency
Ambient Air Samples	3 per day or 1 per site
Analytical Method Blanks	5% (1 per 20 samples or 1 a day)
Continuing Calibration Check	20% (1 every 5 samples)
Field System Blank	1 per day
Reagent Blank	1 per set of working standards
Replicate Samples	10 to 100 % of all samples

The ambient air samples are obtained on site by sampling the air immediately outside the mobile analytical van and directly injecting it into the GC. Analytical method blanks are taken to demonstrate that the analytical instrumentation is not contaminated. These are performed by injecting carrier gas (nitrogen) into the GC with the sampling syringe. Subsampling syringes are also checked in this fashion.

The injector port septa through which samples are injected into the GC are replaced daily to prevent possible gas leaks from the chromatographic column. All sampling and subsampling syringes are decontaminated after use and are not used again until they have been decontaminated by washing in anionic detergent and baking at 90°C.

Continuing calibration checks are analyzed to verify the detector response for the target VOCs. If the response changes by more than twenty percent, the GC is recalibrated and new response factors are calculated.

Field system blanks are analyzed to check for contamination of the sampling apparatus, e.g., probe and sampling syringe. A sample is collected using standard soil gas sampling procedures, but without putting the probe into the ground. The results are compared to those obtained from a concurrently sampled ambient air analysis.



If the blanks detect compounds of interest at concentrations that indicate equipment contamination or concentrations that exceed normal background levels (ambient air analysis), corrective actions are performed. If the problem cannot be corrected, an out-of-control event is documented and reported.

A reagent blank is performed to ensure the solvent used to dilute the stock standards is not contaminated. Analytical instruments are calibrated daily using fresh working standards made from National Institute of Sciences and Technology (NIST) traceable standards and reagent blanked solvents.

Quantitative precision is assured by replicating analysis of 10 to 100 percent of the groundwater samples. Replicate analyses are performed by subsampling groundwater from the original VOA.

6.0 RESULTS

The analytical results from this groundwater investigation are condensed in Appendix A. The data are presented by location and by analyte concentration. When the compound was not detected, the detection limit is presented as a "less than" value, e.g., <0.1 ug/L.

Samples are identified by sample location and sampling depth. For example, GW-7-6.5' represents a groundwater sample collected from location 7 at a depth of 6.5 feet bgs. Sample HSP-1 was collected from the monitoring well located at this site.



APPENDIX A Condensed Data

TRACER RESEARCH CORPORATION - ANALYTICAL RESULTS
 GEOMATRIX/ 2020 SHERMAN/ ALAMEDA, CALIFORNIA/ 114-0025-S
 01/24/94

SAMPLE	1,1 DCE µg/L	1,1 DCA µg/L	1,2 DCE µg/L	1,2 DCA µg/L	TCA µg/L	TCE µg/L	PCE µg/L
HSP-1	4	390	<6	<0.9	<0.02	<0.07	<0.02
GW-7-6.5'	1	200	<6	<0.9	<0.02	<0.07	<0.02
GW-6-5.5'	1	230	<6	<0.9	<0.02	<0.07	<0.02
GS-1-6.5'	3	54	<6	<0.9	<0.02	<0.07	<0.02
GW-2-7.5'	<0.07	<0.2	<3	<0.4	<0.01	<0.03	<0.01
GW-3-6'	160	1800	<14	<2	74	<0.6	2
GW-5-6'	4	240	<3	<0.4	<0.01	<0.03	<0.01
GW-4-7'	2	110	<3	<0.4	6	0.7	0.05
GW-8-6'	11	140	<3	<0.4	<0.01	<0.03	<0.01
GW-9-5'	<0.07	20	<3	<0.4	<0.01	<0.03	<0.01

Analyzed by: A. Koch
 Proofed by: J. Maisel (ms)

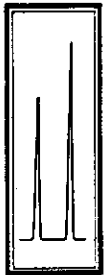


TRACER RESEARCH CORPORATION - ANALYTICAL RESULTS
 GEOMATRIX/ 2020 SHERMAN/ ALAMEDA, CALIFORNIA/ 114-0025-S
 01/24/94

SAMPLE	BENZENE μg/L	TOLUENE μg/L	ETHYL BENZENE μg/L	XYLENES μg/L
HSP-1	<0.5	<0.8	<1	<3
GW-7-6.5'	<0.5	<0.8	<1	<3
GW-6-5.5'	<0.5	<0.8	<1	<3
GW-1-6.5'	<0.5	<0.8	<1	<3
GW-2-7.5'	<0.2	<0.4	<0.7	<2
GW-3-6'	<1	8	<3	<8
GW-5-6'	<0.2	<0.4	<0.7	<2
GW-4-7'	<0.2	<0.4	<0.7	<2
GW-8-6'	<0.2	<0.4	<0.7	<2
GW-9-5'	<0.2	<0.4	<0.7	<2

Analyzed by: A. Koch
 Proofed by: J. Maisch (MS)





Tracer Research Corporation appreciates the opportunity of being of service to your organization. Because we are constantly striving to improve our service to you, we welcome any comments or suggestions you may have about how we can be more responsive to the needs of your organization. If you have any questions about the field work, analytical results, or this report, please give Marty Favero a call at (602) 888-9400.