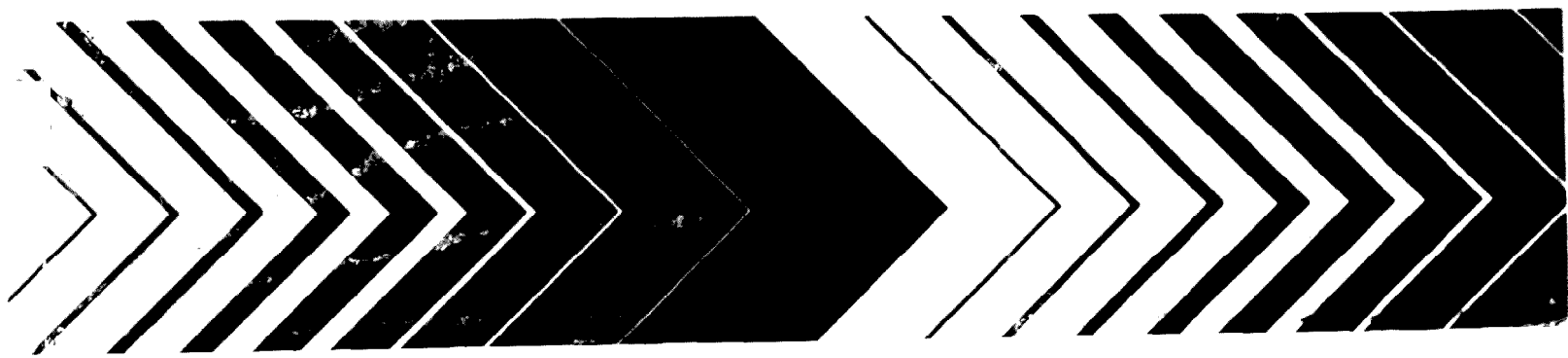
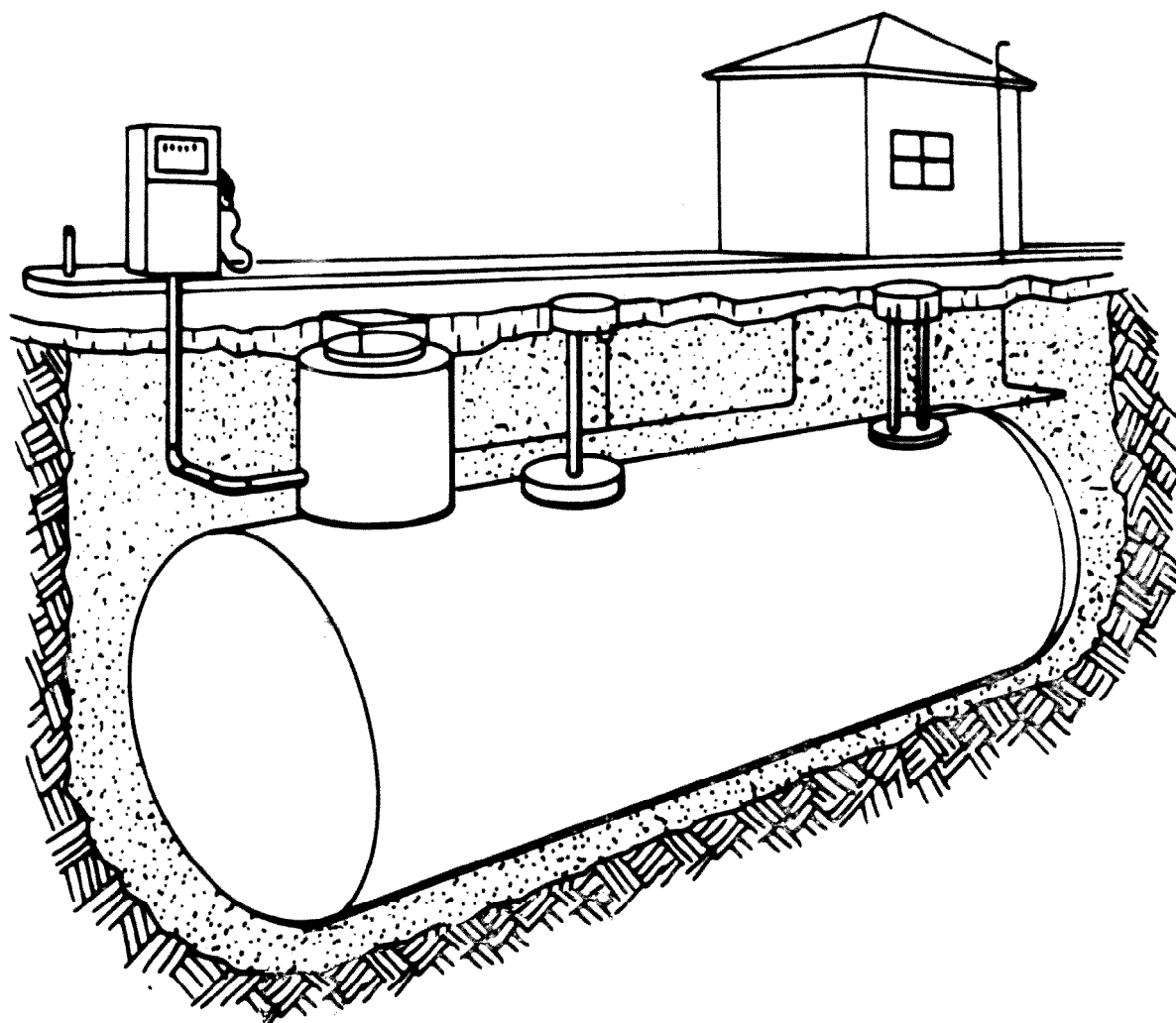




Background Hydrocarbon Vapor Concentration Study for Underground Fuel Storage Tanks



**BACKGROUND HYDROCARBON VAPOR CONCENTRATION STUDY
FOR UNDERGROUND FUEL STORAGE TANKS**

by

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NOTICE

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ABSTRACT

The Environmental Monitoring Systems Laboratory (EMSL) of the USEPA awarded Contract No. 68-03-3409 to Camp, Dresser and McKee (CDM) to conduct a study to determine the background hydrocarbon concentrations in soil vapor in the backfill of representative underground fuel storage tank (UST) sites across the country. CDM designated Geoscience Consultants, Ltd. (GCL) to select sampling sites, prepare sampling strategies, review data collection, analyze the data, and prepare a final report. Field data on clean UST sites were collected from September 14 to December 13, 1987. Data on UST sites with documented releases were obtained from Tracer Research Corporation (TRC) files.

Since no data base for soil vapor information at nonleaking UST sites was known to exist, a field sampling program was undertaken to establish a baselinedata set of hydrocarbon vapor concentrations. Data were collected from 27 gasoline service stations selected as nonleaking sites in 3 diverse geographic regions: Central Texas (Austin, Texas); areas surrounding Long Island Sound (Suffolk County, New York; Providence, Rhode Island; Storrs, Connecticut); and Southern California (San Diego, California). The three regions were selected for their active UST regulatory programs, as well as their differences in geology, hydrology, and climate. A site was considered to be nonleaking if it had good inventory and maintenance records, or had recently passed a tank tightness test. The nonleaking data base consists of 279 soil vapor samples from 25 service stations. At the other two stations, observed or suspected leaks prevented their data from being used in the non-leaking data base.

At each location, soil was sampled at varying distances and depths from UST appurtenances (such as submersible pumps, vents, and product flow lines) to determine if a particular pattern of hydrocarbon concentration existed. Samples were collected by driving a hollow steel probe into the ground and evacuating 5 to 10 liters of soil vapors with a vacuum pump. Volatile hydrocarbon species were identified and quantified the site by utilizing gas chromatograph/flame ionization detection (GC/FID) equipment. Ten to fifteen samples were collected and analyzed at each site.

The types of compound groups that were studied were aliphatics, aromatics, and total hydrocarbons. The concentrations of volatile aliphatics that elute from the gas chromatograph (GC) column before benzene were reported as a group called light aliphatics. At 18 of the sites, the light aliphatics represent aliphatic compounds such as methane, ethane, propanes, butanes, and pentanes. At seven of the sites where butanes and pentanes could be quantified and reported, the concentration of light aliphatics represent only methane, ethane, and propanes. The aromatics reported were benzene, toluene, ethylbenzene, and the xylenes (BTEX).

Hydrocarbon concentrations in soil gas are reported in micrograms per liter ($\mu\text{g/L}$). These concentrations were calculated directly from the GC/FID using calibration gas response factors (RF) and sample volumes. The concentration of total hydrocarbons (less light aliphatics) were estimated using an average RF from the gas standards benzene, toluene, ethylbenzene, and ortho-xylene (BTEX). The concentrations in milligrams per liter (mg/L) were converted to parts per million by volume (ppmv), using average molecular weights of BTEX at each site, and the ambient temperatures and pressures.

Hydrocarbon vapor concentrations from the nonleaking sites range from detection limit levels of $0.02 \mu\text{g/L}$ to maximum values of $1,500,000 \mu\text{g/L}$ of light aliphatics, $110,000 \mu\text{g/L}$ of benzene, $160,000 \mu\text{g/L}$ of toluene, $25,000 \mu\text{g/L}$ of ethylbenzene, and $110,000 \mu\text{g/L}$ of xylenes. The maximum concentration of total hydrocarbons (less light aliphatics) is $1,100,000 \mu\text{g/L}$. Determination of total hydrocarbon concentrations exclude the light aliphatic peaks in order to elevate the compounds most representative of gasoline. Additionally, subtraction of the light aliphatics peaks precludes the inclusion of methane concentrations caused by naturally-occurring organic decomposition.

The statistical distribution of total hydrocarbons (less light aliphatics) indicates that a majority of the concentration values are in the lower concentration ranges. The relative frequency distribution shows 53.2 percent of the samples below $1,500 \mu\text{g/L}$ (500 ppmv) and 93.1 percent below $100,000 \mu\text{g/L}$ (27,000 ppmv). The median is $800 \mu\text{g/L}$ and the mean is $23,300 \mu\text{g/L}$.

Contaminated site data were obtained from TRC's historical records. The contaminated site data consists of 60 soil vapor samples taken from 9 sites having known contamination from a petroleum fuel leak or spill. These sites were all active gasoline service stations or fueling facilities. The contaminated site data also show much variability. The statistical distribution of total hydrocarbons (less light aliphatics) shows a majority of sample values to be in the lower concentration ranges. The relative frequency distribution shows 35 percent of the samples below $1,500 \mu\text{g/L}$ (500 ppmv) and 66.7 percent below $100,000 \mu\text{g/L}$ (27,000 ppmv). The median is $9,000 \mu\text{g/L}$ and the mean is $160,000 \mu\text{g/L}$.

Although much variability exists in both the nonleaking and contaminated site data, significant differences can be seen between the two distributions. A 10-fold difference exists between the means and the medians of each data set. This 10-fold difference also exists between the numbers of samples with concentrations above $10,000 \mu\text{g/L}$ (3,000 ppmv) for the two data sets. For example, 29.6 percent of the nonleaking samples occurred in the range of $10,000 \mu\text{g/L}$ to $100,000 \mu\text{g/L}$ while 33.3 percent of the contaminated samples concentrations occurred in the range of $100,000 \mu\text{g/L}$ to $1,000,000 \mu\text{g/L}$.

Statistical data patterns associated with site location and sample depth were delineated using non-parametric statistical methods. Statistically significant differences were found to exist between the total hydrocarbon (less light aliphatics) vapor concentrations among the five locations studied for

steel tank systems, whereas these differences were not significant for fiberglass tank systems. Statistically significant differences also occurred between the total hydrocarbon (less light aliphatics) vapor concentrations among the sample depths of 2, 6, and 10 feet for both steel and fiberglass tank systems. Higher concentrations were found at the lower depths.

A fresh spill at one station in Austin provided an opportunity to add butane to the list of analytes under study. The butane concentration in 15 soil gas samples taken during the first 4 days after the spill occurred ranged from 530 $\mu\text{g/L}$ to 300,000 $\mu\text{g/L}$. Butane was also sampled at sites in Storrs, Connecticut, and Providence, Rhode Island, both of which had no evidence of recent leaks or spills. At these two sites, butane concentrations in 65 soil gas samples ranged from the minimum detection limit of 0.02 $\mu\text{g/L}$ to 930 $\mu\text{g/L}$. The large difference between the butane concentrations at the fresh spill site in Austin and the nonleaking sites in Connecticut and Rhode Island suggests that butane may be a good indicator of a fresh spill or leak.

Because there are no standard procedures for estimating and reporting total hydrocarbon concentration data, GCL evaluated different estimation methods. It was determined that the best approximation of total hydrocarbon (less light aliphatics) concentrations, based on available calibration data, was achieved using an average RF calculated from the daily RFs of benzene, toluene, ethylbenzene, and ortho-xylene.

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SECTION 1

PURPOSE OF STUDY

Proposed Federal regulations to monitor ground-water contamination around UST systems require the development of effective external and internal leak detection methods. Soil gas sampling is an external detection method which could prove useful in determining whether an UST is leaking.

In order to determine the effectiveness of soil gas surveys in leak detection, a study was designed with the following goals:

- collection of soil gas data from sites where the tank system was tested and found to be tight, providing background soil gas data, and,
- comparison of these background data to soil gas data from sites known to be contaminated by spills or leaks in order to identify a data pattern which may be indicative of a leaking system.

To fulfill these goals, soil gas surveys were performed at 27 active gasoline service stations in 3 diverse geographic regions. Hydrocarbon vapor concentrations in the backfill surrounding the USTs were sampled and analyzed.

The term soil gas refers to vapors found in the interstitial area between particles of sand or gravel (pores). Soil gas and soil vapor are used interchangeably in this report. These vapors, often loaded with hydrocarbons when a UST is leaking, escape into the gravel or sand which is used to surround the tank during installation. This surrounding tank medium is called backfill. Typically pea gravel is used for backfill around fiberglass tanks, and sand around steel tanks. An overview of a typical UST arrangement is shown in Figure 1.

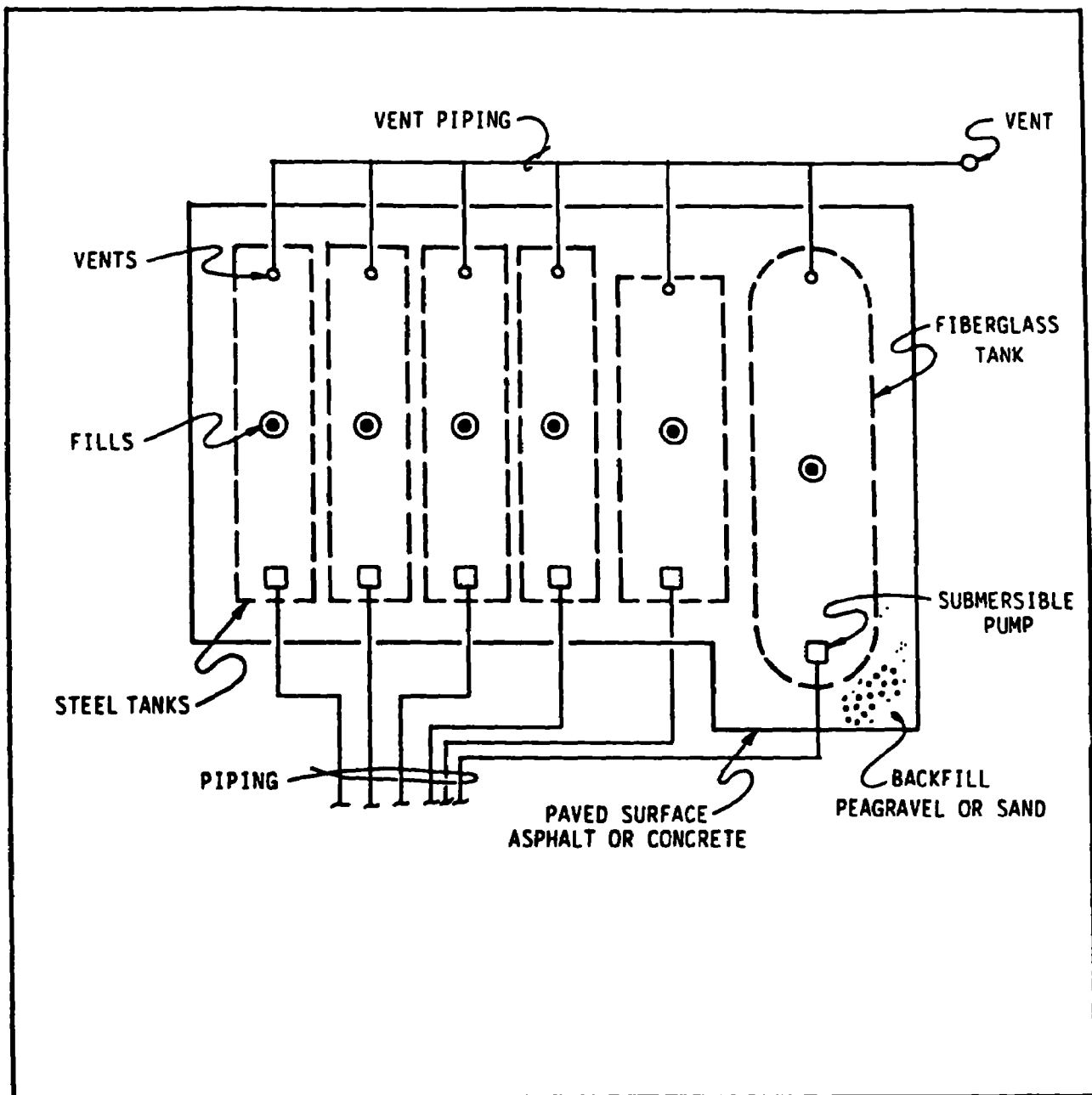


Figure 1. Typical UST arrangement.

SECTION 2

SITE SELECTION

LOCATIONS

Soil-gas surveys were conducted at the following locations:

- Austin, Texas
- San Diego, California
- Long Island Sound area
- Suffolk County, New York
- Providence, Rhode Island
- Storrs, Connecticut

Austin, San Diego, and Suffolk County, New York were originally selected as the locations for the study because they were recognized as having exemplary local UST regulatory programs, and they represented different geographical situations. Stations in Providence and Storrs were added to provide a broader data base from the Long Island Sound area, and to interact with the UST evaluation program at the University of Connecticut.

Active regulatory programs were desired in order to assure that accurate information would be available for the stations to be studied. Since a major purpose of the study was to determine background soil vapor levels at clean, well-managed stations, it was necessary to determine if leaks or spills had previously occurred at the stations being tested. Records at Austin, San Diego, and Suffolk County were carefully reviewed and all available information was obtained concerning the specific stations to be studied.

Different geographical locations were desired for the study in order to eliminate possible data bias that could occur if sampling were done at one location. The selected locations represent a wide range of temperature, humidity, geology, and topography. Although soil gas samples were taken primarily from the backfill areas of the tanks, the surrounding geology and climatic conditions can affect the concentration of vapors existing in the backfill material.

SERVICE STATIONS

Three oil companies cooperated in the study by offering several of their service stations as candidates for field testing. Twenty-seven stations were selected which represent a variety of tank ages, tank materials, products

stored, and backfill materials. The stations were selected according to the following screening criteria:

- The stations were to be clean, well-managed businesses with no major environmental problems.
- Existing tanks were required to meet the appropriate operation specifications.
- The tanks must have been in the ground and operational for at least 6 months prior to the site sampling.
- The stations were required to have relatively large total throughputs of product since beginning operation and relatively large throughputs on a monthly basis.
- The stations were required to have good inventory control.

Twenty-seven service stations with 10 to 15 sample points at each station were selected, providing a broad database with a variety of tanks, backfills, and field conditions. There were a total of 100 USTs involved in this study, of which 63 were made of steel and 37 of fiberglass. Tank installation dates ranged from 1940 to 1984 for steel tanks, and 1978 to 1984 for fiberglass tanks. A listing of all of the tanks is shown in Appendix A.

SECTION 3

GEOLOGY, HYDROLOGY, AND CLIMATE

This section briefly describes the geologic, hydrologic, and climatic characteristics which may effect hydrocarbon soil gas concentrations within the three study regions.

AUSTIN, TEXAS

Geology and Hydrology

Bedrock in the Austin area consists dominantly of limestones, marls, and shales, all of Cretaceous age. Terrace deposits and alluvium locally overlie the bedrock units in the present valley of the Colorado River and on terraces representing older Quaternary drainage levels.

Station sites AU-2, AU-4, AU-5, and AU-6 all lie in outcrop areas of the Upper Cretaceous Austin Group, which consists of chalk, limestone, and marly limestone. A very thin (less than 5 feet) cover of sand and gravel terrace deposits may be present at site AU-4. Site AU-5 lies within 100 feet of a fault which exposes Cretaceous clay at the land surface on the side of the fault opposite the station.

Sites AU-1 and AU-7 are located in areas of alluvial sand and gravel comprising terrace deposits, but these deposits are probably less than 10 feet thick at both sites. The alluvium is underlain by Lower Cretaceous clay of the Del Rio Formation, a pyritic, gypsiferous, and calcareous shale unit which may represent a barrier to ground water or soil gas movement.

Site AU-3 lies within a small exposure of altered volcanic tuff of Cretaceous age, in an area consisting dominantly of Austin Group limestones. A very thin cover of terrace deposits similar to those at AU-4 may also be present at AU-3. As at site AU-5, a Cretaceous clay unit crops out within 100 feet of the AU-3 site, on the opposite side of a fault passing near the station.

The Edwards aquifer underlying the Austin area is contained within limestones of Cretaceous age. Depth to water in the Edwards aquifer is highly dependent on topography, ranging from the land surface in river valleys to over 250 feet below it in upland areas.

Elevation of the water table varies by as much as 50 feet over time, depending on recharge and pumpage. Local zones of perched water occur above

the Edwards aquifer in areas where impermeable lithologic units are present. Ground water was encountered at a depth of 7 feet at sites AU-4 and AU-6, at a depth of 9 feet at site AU-7, and at a depth of 10 feet at site AU-5.

Climate

The climate of Austin, Texas is humid subtropical with an average rainfall of 20 to 40 inches per year which is evenly distributed throughout the year. During the first sampling period, September 28 through October 2, the weather was partly cloudy to clear with temperatures ranging from 62°F to 92°F. The barometric pressure during this period ranged from 29.49 inches Hg to 30.09 inches Hg. The second sampling period was October 26 to October 30. The same weather patterns were seen with temperatures ranging from 70°F to 96°F and barometric pressures ranging from 29.84 inches Hg to 30.12 inches Hg. Appendix B contains a summary of the actual field conditions.

LONG ISLAND SOUND AREA, NEW YORK, RHODE ISLAND, AND CONNECTICUT

Geology and Hydrology - Long Island, New York

Long Island consists dominantly of glacial till and outwash deposits representing a terminal moraine formed during the Quaternary Period. Cretaceous and Tertiary rocks crop out locally in western Suffolk County, but are not a really significant. All station sites examined for this project are located in areas of glacial till.

Ground water on Long Island is contained within the glacial till and local alluvial deposits of reworked glacial material. Depth to water varies from about 10 to 100 feet on the Island. At site NY-2, ground water is about 22 feet below the surface. At all other Long Island sites, ground water is between 60 and 90 feet below the surface.

Geology and Hydrology - Providence, Rhode Island

In the Providence area, Quaternary glacial deposits of varying thickness overlie bedrock of Cambrian and Precambrian age. As on Long Island, ground water is found at depths up to about 50 feet in the Rhode Island glacial deposits. Ground-water conditions are not well known in many areas because most public water supply is derived from surface sources. The depth to water at the station sites is not known.

Geology and Hydrology - Storrs, Connecticut

In the Storrs area, Quaternary glacial deposits of varying thickness, up to about 100 feet, overlie crystalline and metamorphic bedrock of Cambrian and Ordovician age. Limited quantities of ground water are found in the glacial fill, but water supply wells generally tap more extensive reserves in fractures of the Paleozoic rocks. Depth to water at the Connecticut station sites is 10 feet.

Climate

The three Long Island Sound locations included in the study have similar climatic conditions which are influenced by the continental and oceanic weather systems. The average rainfall for these locations is from 40 to 60 inches per year. During the sampling period, September 22 to September 25 in Suffolk County, the temperature ranged from 61°F to 75°F with the barometric pressure ranging from 29.70 inches Hg to 29.94 inches Hg. During the sampling visit to Storrs, Connecticut from November 11 to November 13, the temperatures ranged from 29°F to 51°F with snow and rain occurring on November 11 and November 12. The barometric pressure during this time ranged from 29.65 inches Hg to 29.99 inches Hg. The sampling visit to Rhode Island during the period of December 9 to December 11, experienced 1 day of rain, December 11, with temperatures ranging from 40°F to 58°F and the barometric pressure ranging from 29.32 inches Hg to 29.83 inches Hg. Appendix B contains a summary of actual field conditions at the time of sampling.

SAN DIEGO REGION, CALIFORNIA

Geology and Hydrology

The San Diego area of southern California contains two distinct physiographic sections, a coastal plain section and a mountain-valley section. The coastal plain section consists of Tertiary marine sediments, in many parts of which wave-cut terraces are apparent, and through which alluvial valleys have been cut between inland watersheds and the sea. The mountain-valley section includes alluvium-filled valleys dissecting mountain ranges which are comprised of a wide variety of volcanic, sedimentary, and igneous rocks.

Station sites SD-1, SD-4, and SD-6 are located in Quaternary coastal sediments overlain by a thin veneer of recent alluvium. All three of these sites are at elevations within a few feet above sea level. Water was encountered 7 feet below the land surface at site SD-1 and 12 feet below the land surface at site SD-6. Ground water probably exists at a shallow depth at site SD-4, but was not encountered during the study.

Stations SD-3 and SD-7 are on a terrace of Tertiary sediments elevated about 200 feet above sea level, and are located about 3 to 5 miles inland from the sea. Depth to water at stations SD-3 and SD-7 is not known.

Stations SD-2 and SD-9 are located in valleys near the eastern margin of the coastal plain section. At these locations alluvium of unknown but probably shallow depth overlies volcanic or metamorphic bedrock. Ground water was encountered at a depth of 8 feet at site SD-2. Depth to water at site SD-9 is unknown.

Sites SD-5 and SD-8 are in a broad valley within the mountain-valley physiographic section. These sites are located on the residuum produced by in-situ weathering of underlying volcanic bedrock. Based on information from wells in the vicinity, depth to water at sites SD-5 and SD-8 is probably between 10 and 25 feet.

Climate

The coastal location of San Diego, California tempers the climate of this city. Rainfall in San Diego ranges from 10 inches to 20 inches per year, with 85 percent of this precipitation occurring during the months of November through March. During the sampling period, September 15 through September 24, the temperature ranged from 70°F to 86°F with 1 day of slight rain (September 22). The barometric pressure during the sampling period ranged from 29.90 inches Hg to 30.10 inches Hg. Appendix B contains a summary of actual field conditions at the time of sampling.

SECTION 4

FIELD METHODS

The field investigation consisted of on-site sampling and analysis of soil gas at a total of 27 service stations in the 3 regional areas. TRC performed the soil-gas sampling and the on-site analysis of the samples. TRC also performed on-site analysis of backfill samples for each site to determine soil moisture content. GCL was responsible for overall sampling strategy and data quality assurance.

The field work began on September 14, 1987, in San Diego, California and was completed on December 13, 1987, in Rhode Island. The field schedule was as follows:

San Diego, CA	9 Stations	September 14 - 24, 1987
Suffolk County, NY	5 Stations	September 21 - 25, 1987
Austin, TX	4 Stations	September 28 - Oct. 2, 1987
	3 Stations	October 26 - Oct. 30, 1987
Storrs, CT	2 Stations	November 10 - 13, 1987
Providence, RI	4 Stations	December 10 - 13, 1987

SAMPLING STRATEGY

The sampling strategy was designed to determine the range and spatial distribution of hydrocarbons within the backfill of the USTs. The sampling points were very close to the tanks because excavation and backfill typically extended only 1 to 3 feet laterally from the edges of the tanks.

Soil-gas samples were collected only from the backfill areas of the tank excavations. The specific sample sites were located at varying distances from tank fill ports, pump chambers, and product and vent piping, all of which can be sources of leaks. A typical sampling grid consisted of four or five sample holes with samples collected at depths of 2, 6, and 10 feet in each hole. Typically, 10 to 15 samples were collected at each service station.

Soil samples to determine moisture content of the backfill material were taken from 50 percent of the sample points. These samples were analyzed on-site by TRC personnel utilizing a portable oven and balance. Two soil samples were collected at each station by GCL personnel. These samples were sent to an independent certified laboratory, Professional Service Industries, Inc. (PSI), for the determination of moisture content and particle size distribution (sieve analysis).

Some additional sampling other than for soil gas was performed at five stations where some unusual conditions existed. This consisted of: 1) vapor sampling from U-Tube monitoring systems at Stations 4 and 6 in Suffolk County, New York, and 2) water sampling from shallow ground water at Stations 1 and 2 in Storrs, Connecticut, and Station 6 in Austin, Texas. The results of these sampling and analyses are presented in Section 8 in U-Tube Sampling and Ground-water Sampling, respectively.

SAMPLING METHODS

Soil-gas samples were collected by driving a hollow probe into the ground to an appropriate depth and evacuating a small amount of soil gas (5 to 10 L) using a vacuum pump. A hydraulic hammer was used to assist in driving probes past cobbles and through unusually hard soil.

Probes consisted of 7-foot lengths of 3/4-inch diameter steel pipe which were fitted with a detachable drive point. The above ground end of the sampling probe was fitted with a steel reducer, a silicone rubber tube, and polyethylene tubing leading to the vacuum pump. Samples were collected in a syringe during evacuation by inserting the syringe needle into the silicone rubber evacuation line and drawing a sample from the gas stream.

A split spoon device was used to collect soil samples of backfill material utilizing the probe holes that were used to collect the soil gas samples. The soil samples were stored in sealed plastic bags prior to analysis.

Promptly upon completion of the sampling program at each site, all holes made in the concrete or asphalt apron were patched to restore the integrity of the apron.

ANALYTICAL PROCEDURES

TRC used a mobile field laboratory which was equipped with GCs and computing integrators. A flame ionization detector (FID) was used to measure aliphatics, aromatics, and total hydrocarbons. The volatile aliphatics that elute from the GC column before benzene were reported as a group called light aliphatics. At 18 of the sites, the light aliphatics represent compounds such as methane, ethane, propanes, butanes, and pentanes. These compounds were reported as a group since it was difficult to identify individual peaks within this range. At seven of the sites where butanes and pentanes could be quantified, the concentration of light aliphatics represent methane, ethane, and propanes. At these sites, a variation in the temperature program in the GC was used to help clarify these peaks; however, some interference in peaks was still observed.

Typically, three samples were analyzed from each sampling point and operator judgement was used in the field to determine which of the various results could be considered as reliable. Mean values were calculated in the field based upon experienced operator judgement, and these averages were considered to be representative of the actual soil gas concentration at the individual sample locations. This type of field judgement is generally used in soil gas surveys because of the variability of the soil gas analysis technique

and the skill required to achieve reproducible results. Means derived in this manner were used in this study in order to provide data that is comparable to existing soil gas data and to data that can be expected to be obtained in future soil gas surveys.

SECTION 5

QUALITY ASSURANCE AND QUALITY CONTROL

QA OBJECTIVES FOR MEASUREMENT DATA

GC Analyses

The GC was calibrated daily by measuring the instrumental area count for each analyte against the known concentration of that analyte in a standard gas mixture. The gases, which were traceable to those of the U.S. National Bureau of Standards (NBS), were obtained from Scott Specialty Gases. The calibration procedure is described in Section 5 in the Calibration Procedures and Frequency paragraph of this report.

Because calibration was performed directly from the BTEX gas standard, the independent accuracy check against another standard was not feasible. Accuracy checks during the field day were performed against the same gas standard used for initial calibration. These accuracy checks, generally two or three per field day, were performed at the discretion of the analyst. All RFs determined by the accuracy checks were within ± 30 percent of those established at the beginning of the field day, so no recalibrations during any field day were required.

In order to assess analytical precision, analyses at each sample point were done in triplicate, by injecting three separate aliquots of the sample into the GC for analysis. In a few cases, where one of the injections clearly produced anomalous results, additional injections were made as necessary to yield three valid analytical runs. For each set of three analyses for each component at each sample point, Tracer determined a mean value concentration which is presented in Appendix C. The standard deviation exceeded 25 percent of the mean value in 58 out of the 950 triplicate analyses (or 6.1 percent) in which all three results exceeded the detection limit. Of this 6.1 percent, the standard deviation exceeded 50 percent of the mean in only 11 cases, of which 7 included analyses in which concentrations were so low as to be near the analytical detection limit for the constituent of interest.

At sites where low total hydrocarbon and light aliphatic concentrations were encountered, the detection limits for analytes of interest were normally less than 0.10 $\mu\text{g/L}$, and in many cases were less than 0.05 $\mu\text{g/L}$. As anticipated, detection limits for all analytes were much higher in locations where high hydrocarbon concentrations were encountered. Detection limits for all non-detected compounds are reported in the accompanying data sets in Appendix C.

The detection limits were determined by the GC chemist for each compound in each sample. To determine the detection limit, the chemist must estimate what the smallest quantifiable peak for each analyte would be, based on other peaks in the chromatogram. The chemist's judgment is important in estimating detection limits, since they are influenced by several factors, not all of which are quantifiable. These factors include the volume of sample injection, the concentration of the compound of interest relative to other constituents present, chromatographic interference from other compounds (adjacent peaks), and the presence of background noise.

Soil Moisture Content Analyses

Due to sampling and analytical problems encountered in the field, Tracer reported fewer soil moisture analytical results than were originally anticipated. Sample splits, and in some locations the majority of soil samples, were sealed in air-tight containers and submitted by GCL to PSI in Albuquerque, New Mexico for moisture content analysis. PSI submitted results for 42 soil samples, and Tracer submitted results for 26 samples. Because of inconsistent sample identification, particularly in New York and Rhode Island, it was not always possible to identify which Tracer samples were in fact splits of PSI samples.

Table 1 lists and compares all soil moisture replicate analyses identified in a review of the Tracer and PSI data. In most cases, the laboratory values agree well with those obtained in the field, but significant discrepancies exist for the data at sites AU-2 and SD-2.

TABLE 1. RESULTS OF REPLICATE ANALYSES FOR SOIL MOISTURE CONTENT

(All analytical values in percent by weight)				
Site	Tracer Sample Number	PSI Sample Number	Tracer Analytical Value	PSI Analytical Value
AU-1	8709291807	8709301819	14.7	13
		8709301825		11
AU-2	8709300935	8709300940	12.4	4
		8709300946		3
SD-2	8709161636	8709161637	11.3	20
NY-2	NY2-SG4-10	8709231230	10.0	7
NY-4	NY4-SG4-10	8709241545	5.0	3
		8709241600		5
NY-5	NY5-SG4-10	8709251310	6.9	8
NY-6	NY6-SG2-10	8709251800	5.7	5
		8709251830		6

There is good internal consistency among the values reported for replicate samples which were both sent to the PSI lab.

SAMPLING PROCEDURES

Soil gas sampling was performed at each site. At the request of EPA EMSL, sample points were confined to the area of the backfill immediately adjacent to the USTs at each site, and in a few cases to soil just outside the backfill. There were generally no more than six sample points per site, and samples were normally taken from three depths at each point.

A total of 78 soil samples, mostly backfill material, were analyzed for moisture content. The samples were not uniformly distributed among the sites because of difficulties encountered in obtaining soil samples at some locations and the realization that moisture content was of little use in others,

such as sites where the backfill material consisted of pea gravel. The values reported in this document represent only samples that were properly packaged, transported, and analyzed.

SAMPLE CUSTODY

Chain-of-custody procedures were followed for all soil samples sent to PSI for moisture content or sieve analysis. Chain-of-custody forms for these samples are on file at the GCL office in Albuquerque.

CALIBRATION PROCEDURES AND FREQUENCY

The GC was calibrated daily, using gas standards obtained from Scott Specialty Gases. These standards are traceable to those of the NBS. Two separate three-point calibration curves were established, one for light aliphatic hydrocarbons C_1-C_5 and one for the aromatic hydrocarbons C_6-C_9 . However, the curve used to quantify hydrocarbons C_6-C_9 was established using the BTEX gas standard rather than an aqueous standard. It was found that this procedure yielded accurate and replicable results. An aqueous standard was also used which produced a RF that did not accurately quantify the gaseous BTEX standard; these results were not used in the analyses. Additional calibration and accuracy checks were made periodically during each field day, and RF's were then revised as necessary. Recalculation of RF's during the field day was not found to be necessary at any site.

Isopentane was not originally included among the compounds to be specifically isolated under the original Work Plan. However, GCL and Tracer were subsequently requested by the EPA to attempt a determination of isopentane concentrations at selected locations. Since no standard for isopentane had been provided in the field, isopentane values were determined after field work was complete by reanalyzing the chromatograms to identify the isopentane peak. A RF for isopentane was defined by comparison with the known RF for benzene, a gas which had been included among the standards available in the field.

To assure the cleanliness of sampling equipment, syringe blanks and system blanks (air samples) were taken and analyzed each morning and periodically during the day.

ANALYTICAL PROCEDURES

Analytical procedures are described in Section 4 in the Analytical Procedures paragraph of this report. All soil gas analyses for BTEX and for total hydrocarbons were performed by Tracer personnel in accordance with the procedures described in Section 2, except for the treatment of samples yielding total hydrocarbon values greater than 500 $\mu\text{g/L}$. Experience during the first day of field work indicated that reducing the injection size for such samples resulted in obscuration of the chromatogram peaks for hydrocarbons C_6-C_9 (gasoline constituents), while not significantly improving the accuracy of lighter aliphatic measurements. Since the use of smaller injection sizes resulted in a great loss of data, the practice was discontinued.

DATA REDUCTION, VALIDATION, AND REPORTING

Data presented to GCL by Tracer were recorded and analyzed. The results of the analyses performed are described in Section 10 of this report.

Some extreme values (outliers) identified in the original data recorded on-site were discarded from the data set by Tracer because the on-site chemist, based on his field experience, believed them not to be representative of actual hydrocarbon concentrations in the sample analyzed (see Section 5 in the Assessment of Data Precision, Accuracy, and Completeness paragraph of this report). Consequently, GCL has made no attempt to identify or explain the few outliers remaining in the data set, which would require excessive time and yield little information.

The data presented in this report have been subjected to Tracer's internal review process, and have been spot-checked for accuracy by GCL personnel. Although a few minor errors were detected and corrected during the GCL review, and a few others undoubtedly remain in the large data set, GCL is confident that such errors represent a very minor portion of the total body of data.

INTERNAL QUALITY CONTROL CHECKS

GC calibration procedures and frequency were described in Section 5 in the Calibration Procedures and Frequency paragraph of this report. As a standard part of Tracer's analytical procedure, daily blanks consisting of pure nitrogen, of air, and of air drawn through a soil gas probe and adapter (system blank) were analyzed. These blanks were repeated as necessary during the field day, and specifically after any event which was suspected to affect analytical results. Soil gas samples at each point were analyzed in triplicate, as described in Section 5 in the GC Analyses paragraph of this report, and duplicate soil samples for moisture content analysis were taken at selected points, as described in Section 5 in the Soil Moisture Content Analyses paragraph of this report.

Triplicate soil gas analyses were performed to assess the replicability of concentration data. This replicability was measured by computing a standard deviation for each triplicate analyses. Duplicate soil samples were taken only as check samples and did not require three values for statistical computations.

PERFORMANCE AND SYSTEM AUDITS

A field system audit and evaluation of operational procedures was performed in San Diego on September 17, 1987, by the GCL QA Officer. Minor modifications to field sampling and analytical procedures were discussed with project field personnel and approved by the QA Officer at that time.

PREVENTIVE MAINTENANCE

All equipment was maintained in operable condition during the field work. Spare parts and new equipment were obtained as necessary to complete field work in a timely manner.

ASSESSMENT OF DATA PRECISION, ACCURACY, AND COMPLETENESS

The data presented in this report are complete in the sense that all values believed to represent valid analyses have been included. GC analysis as a procedure is subject to interpretation by the GC operator, who must evaluate each run on the basis of his experience to determine its validity. Volume of sample injection, concentrations of the analytes of interest, and possible residual effects of previous sample runs must be considered by the operator in deciding whether to accept the concentrations indicated for any given sample injection. Concentration values which were clearly in error, were rejected by the GC operator in the field, and are not included in the data set. Some other values which appear to be outliers inconsistent with the rest of the data set have been included in the tabulated analytical results, but were not used in determining the mean values of the triplicate analyses reported in Appendix C. In some of these cases, the outlying values were excluded by Tracer in calculation of the mean concentration, but were included in calculation of the standard deviation. GCL and Tracer have attempted to indicate such points where such operator judgment was exercised. These undoubtedly represent far less than one percent of the total data set.

During the course of the project, Tracer was asked to recalculate the total hydrocarbon concentrations to show them relative to the BTEX total, rather than as benzene. Consequently, the mean values used in the data analysis (Section 10) for total hydrocarbons (less light aliphatics) differ from the means of the values taken from individual GC/FID injections. The standard deviations for the total hydrocarbon data were calculated on the basis of the values reported as benzene, and consequently should not be applied directly to the total hydrocarbons (less light aliphatics) data calculated from average daily RFs for BTEX.

Concentration values reported in $\mu\text{g/L}$ for analytes of interest in this report are normally given to two significant figures if greater than $10 \mu\text{g/L}$, and to one significant figure if less than $10 \mu\text{g/L}$. As illustrated by the standard deviations presented with this data set, and based on Tracer's experience in soil gas analyses, instrumental precision does not normally justify greater precision in the reporting of results.

Further information regarding analytical accuracy, precision and replicability was presented in Section 5 in the QA Objectives for Measurement Data paragraph of this report.

CORRECTIVE ACTIONS

During the field system audit, the requirements for proper chain-of-custody procedures were explained to some site personnel who were not fully aware of them. Samples previously taken for soil moisture content analysis had been properly handled, but the QA Officer felt that additional explanation was necessary to prevent the possibility of future problems.

No other corrective actions were found to be necessary during field work. Problems with Tracer's handling procedure of the soil moisture samples were discovered too late to be remedied by GCL personnel.

QUALITY ASSURANCE REPORTS TO MANAGEMENT

Monthly quality assurance reports were submitted during the course of the project.

SECTION 6

REPORTING METHODS

One of the problems encountered in this study concerned the calculation and reporting of the total hydrocarbon concentration data. Different practices in calculating and reporting these data were discovered within the environmental industry and among those who collect and analyze soil gas data. For example, some leak detection devices were found to report total hydrocarbons in ppmv as hexane, and others in ppmv as butane (Radian). Additionally, laboratories using GC/FID equipment to analyze soil gas, report total hydrocarbon concentrations in $\mu\text{g/L}$ (Tracer). The method of determining total hydrocarbon concentration values using a GC/FID also vary. A GC/FID must use a RF based on the calibration of a known gas to determine the concentration of an unknown gas. This calibration gas, or gas standard may be benzene, toluene, or some other hydrocarbon compound.

Because of these variations, GCL evaluated different estimation methods to determine the most appropriate method for reporting total hydrocarbon concentrations. In this method evaluation, both the calculations and their accuracy were examined. Since these data may be used in developing threshold limits between nonleaking and contaminated sites, they must be comparable to soil gas data determined by different methods.

The evaluation consisted of two parts:

- Calculation of total hydrocarbon concentrations in $\mu\text{g/L}$ from the calibration of the GC/FID, reported both as benzene and according to an average RF, and
- Calculation of total hydrocarbon concentrations in parts per million (ppm).

DETERMINATION OF TOTAL HYDROCARBON CONCENTRATIONS IN $\mu\text{g/L}$

The field investigation phase of this study required that soil gas samples be collected and analyzed at nonleaking sites. Recall that nonleaking sites were determined according to current tank testing procedures which report tightness at less than 0.05 gallons per hour (gph). These samples were analyzed on-site using a portable GC/FID. The results of these analyses yield concentration values in $\mu\text{g/L}$. Section 6 in the GC/FID Operation paragraph of this report, contains a brief discussion on the function of a GC/FID and the procedure used to calculate the total hydrocarbon concentrations from the GC/FID in the field. This procedure uses benzene as the calibration gas. Section 6 in the Calculation of Total Hydrocarbons as Benzene

paragraph of this report, discusses a more accurate method used to calculate total hydrocarbon concentrations in $\mu\text{g/L}$ using data from all the calibration gases.

GC/FID Operation

A GC is an analytical instrument that can be used to separate volatile organic compounds for analysis (EPA Methods 8000). A GC equipped with a FID can be used to generate a chromatogram that consists of peaks corresponding to different compounds. The complete analytical system used in the field investigation of this study consisted of a chromatographic packed column containing Alltech OV101, a hydrogen FID, an integrator-recorder, calibration gases, and glass syringes (Tracer).

Calibration gases were used to generate a chromatogram that formed a baseline or standard of peaks in the chromatogram. RFs, defined as the ratio of the mass of each gas standard injected to the integrated area of the peak produced by that mass, were determined for each gas standard. Individual hydrocarbon compounds in the soil gas samples were identified by a comparison of sample chromatograms to the standard chromatogram. Concentrations of individual compounds were calculated from the RFs for the corresponding gas standard.

Concentrations of individual compounds were determined in $\mu\text{g/L}$. This is based on the principal of operation of the FID in which pyrolysis of organic compounds produces ionic intermediate compounds that can carry an electric current. The resulting current flows through the flame, and the ions are collected and measured. The current responds linearly to the mass of carbon in the sample, and consequently, RFs and concentrations are measured in mass units (Tracer).

The calibration gas standards used were methane, benzene, toluene, ethylbenzene, and ortho-xylene. Concentrations of each of these compounds in each sample were calculated directly using the corresponding calibration gas RF and the sample injection size. However, concentrations for total hydrocarbons (less light aliphatics) were required to be approximated.

Calculation of Total Hydrocarbons as Benzene

During the field investigation, total hydrocarbon (less light aliphatics) concentrations were approximated by using the RF for benzene to compute the concentrations. During the data analysis, it was discovered that this approximation yielded a low estimate of total hydrocarbons (less light aliphatics) concentrations. This discovery was made by a comparison of the combined concentrations of BTEX to the total hydrocarbon concentration (less light aliphatics). This comparison, shown in Appendix D, indicates that the concentration of BTEX was greater than the concentration of total hydrocarbons (less light aliphatics) in 30 percent of the samples.

A possible cause for the discrepancy between the concentrations of total hydrocarbons (less light aliphatics) and BTEX could have been an erroneous

interpretation of the chromatogram peaks. However, a reexamination of the chromatograms showed that no interpretation errors had occurred.

The discrepancy was determined to be the result of using the benzene RFs for the approximation of total hydrocarbon (less light aliphatics) concentrations. By an examination of the RFs for all of the gas standards (Appendix C), it was found that the benzene RF was usually lower when compared to RFs for toluene, ethylbenzene, and ortho-xylene. In theory, RFs for similar hydrocarbon compounds should be similar. However, in practice, RFs vary because of chemical and instrument effects.

Because of the discrepancies between the total hydrocarbon (less light aliphatics) concentrations and the combined BTEX concentrations, a better approximation of total hydrocarbon (less light aliphatics) concentrations was needed. This was considered important because these values obtained from non-leaking sites may affect the development of threshold limits to be used to distinguish between contaminated and nonleaking sites.

Calculation of Total Hydrocarbon Concentrations Using Average RFs

The total hydrocarbon concentration in a soil gas sample is actually the summation of all the hydrocarbon compounds that can be detected from the GC/FID analysis. To accurately determine this concentration would require that a gas standard be analyzed in the GC/FID for every compound that existed in the soil gas. This comprehensive type of analysis was considered impractical since an enormous amount of GC/FID calibration work would have been necessary to quantitatively analyze all the peaks in the soil gas samples.

The best approximation, based on the available calibration data, was to determine total hydrocarbons (less light aliphatics) using the average of the RFs for all the calibration gases (less light aliphatics). Therefore, total hydrocarbon (less light aliphatics) concentrations were calculated from an average of the daily RFs for benzene, toluene, ethylbenzene, and ortho-xylene.

This approximation resulted in new total hydrocarbon (less light aliphatics) concentrations that were generally higher. A comparison of total hydrocarbon (less light aliphatics) concentrations calculated from average BTEX RFs and as benzene is shown below.

<u>Total Hydrocarbon (less light aliphatics) Concentrations</u>	<u>Percentage of Samples</u>
As Benzene > As BTEX Average	8.6 percent
As Benzene = As BTEX Average	15.1 percent
As Benzene < As BTEX Average	76.3 percent

In the case where the new values (as BTEX average) were greater than the old values (as benzene), these new values ranged from 7 percent to about 100 percent higher. A comparison of the old values and new values for each sample is provided in Appendix D.

The new concentrations also result in values that are larger than the combined BTEX concentrations which indicates a more reasonable approximation of total hydrocarbon concentration. A comparison of the BTEX and the new total hydrocarbon (less light aliphatics) concentrations are shown in Appendix D.

The calculation of total hydrocarbon (less light aliphatics) concentrations using the average BTEX RFs was found to be a better approximation than when using only benzene because it accounted for variations in the RFs. However, it is understood that some error still exists in this method because several peaks in the chromatograms and their corresponding compounds were not identified and quantified.

To better understand the extent that compounds other than BTEX are contained in total hydrocarbons, a comparison of the combined BTEX concentrations to total hydrocarbons (less light aliphatics) concentrations (calculated from average BTEX RFs) was made. These results are shown in Figure 2. The tabular data used to generate this figure is included in Appendix D. The percentage of samples where the BTEX concentrations were less than 50 percent of total hydrocarbons (less light aliphatics) was about 59 percent of the total samples. This means that in about 59 percent of the samples, compounds other than BTEX make up the majority of the total hydrocarbon concentrations.

The result that compounds other than BTEX make up the majority of the total hydrocarbon concentration in most of the samples is not surprising when the composition of gasoline is considered. A typical gasoline contains several hundred hydrocarbon compounds, each falling into one of four chemical groups: paraffins, olefins, naphthenes, or aromatics (NM EID). The aromatics, which includes BTEX, are considered most important because they are relatively soluble in water, and therefore, present a risk of ground-water contamination. Table 2 shows a list of major components of an API PS-6 Gasoline, some of which can be expected to be present in soil gas. These compounds represent C₄ to C₁₀ molecules (API 1985).

Some selected sample chromatograms from Suffolk County, New York, San Diego, California, and Austin, Texas, were qualitatively analyzed for a wide range of compounds where BTEX was found to represent less than 10 percent of the total hydrocarbon concentration. These qualitative analyses identified some additional compounds: methane, butane, isopentane, 2-methylhexane, isooctane, and octane. These chromatograms are shown in Appendix D.

DETERMINATION OF TOTAL HYDROCARBON CONCENTRATIONS IN PPM

The concentration of extremely dilute solutions are expressed in ppm. Typically, liquid solutions are expressed in parts per million by weight (ppmw) and gaseous solutions are expressed in ppmv, (Himmelblau 1974).

PPMV is a measurement unit that is commonly used in the environmental industry for reporting air pollutant concentrations (Wark and Warner 1981). Many leak detection systems report hydrocarbon contamination in soil gas in ppmv (Radian 1980). Therefore, ppmv was considered appropriate rather than ppmw.

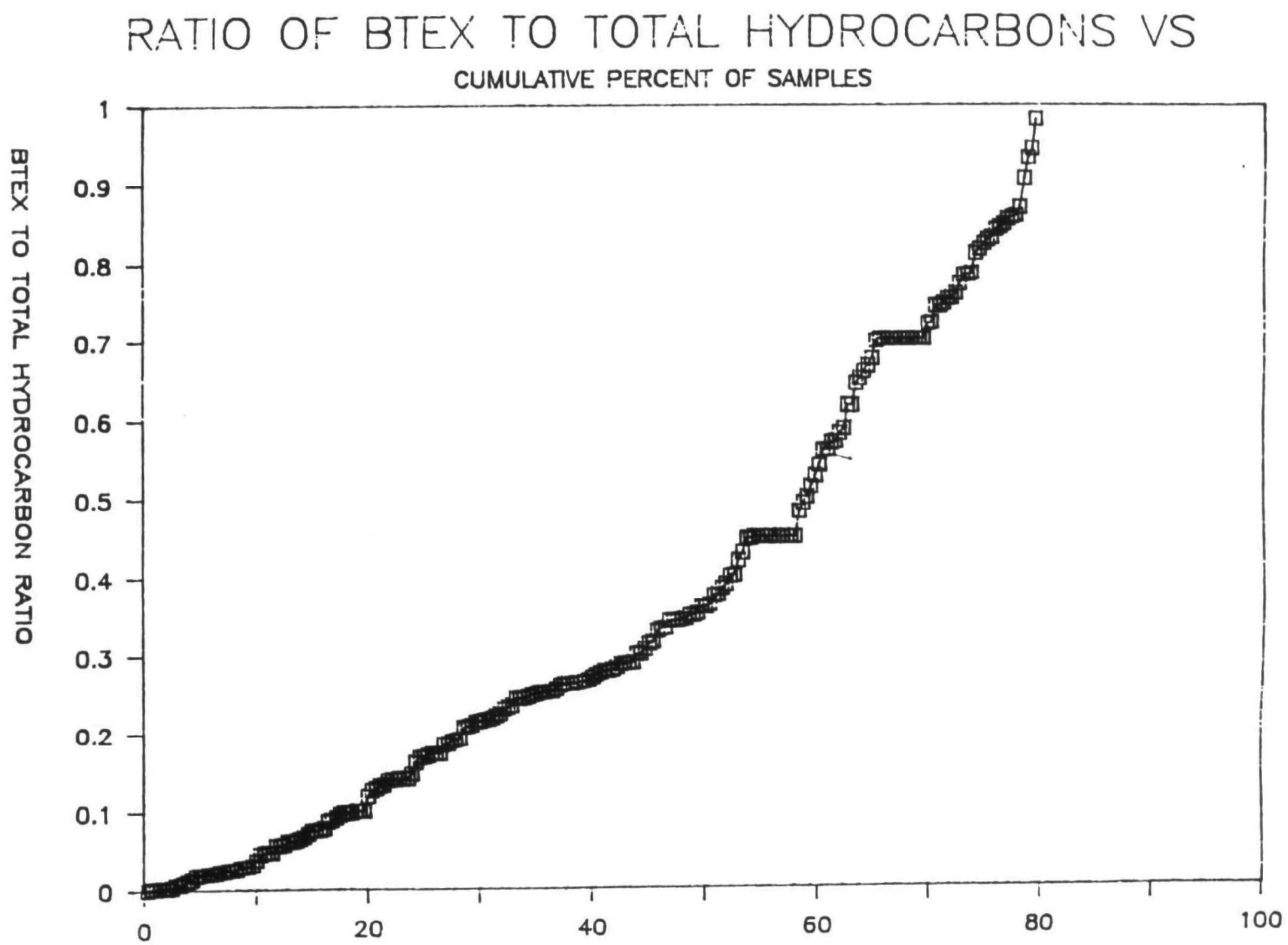


Figure 2. Ratio of BTEX to Total Hydrocarbons as Cumulative Percent of Samples.

TABLE 2. MAJOR COMPONENTS OF API PS-6 GASOLINE

<u>Compound</u>	<u>Percent Weight</u>
2-Methylbutane	8.72
M-Xylene	5.66
2,2,4-Trimethylpentane	5.22
Toluene	4.73
2-Methylpentane	3.93
N-Butane	3.83
1,2,4-Trimethylbenzene	3.26
N-Pentane	3.11
2,3,4-Trimethylpentane	2.99
2,3,3-Trimethylpentane	2.85
3-methylpentane	2.36
O-Xylene	2.27
Ethylbenzene	2.00
Benzene	1.94
P-Xylene	1.72
2,3-Dimethylbutane	1.66
N-Hexane	1.58
1-Methyl, 3-Ethylbenzene	1.54
1-Methyl, 4-Ethylbenzene	1.54
3-Methylhexane	1.30

ppmv is defined as:

$$1 \text{ ppmv} = \frac{1 \text{ volume of gaseous pollutant}}{10^6 \text{ volumes of pollutant \& air}} \quad \text{Equation 1}$$

The data in $\mu\text{g/L}$ can be converted to ppmv by the following equation:

$$\text{ppmv} = \frac{\mu\text{g}}{1} \times \frac{RT}{P (\text{Mol Wt})} \quad \text{Equation 2}$$

where:

ppmv = parts per million by volume
 $\mu\text{g/L}$ = micrograms per liter
 R = gas constant = $0.08205 \frac{\text{atm liter}}{\text{gmole} \cdot \text{K}}$
 P = pressure in atmosphere
 T = temperature in K
Mol Wt = molecular weight of hydrocarbon

This equation was derived from the ideal gas equation (Wark and Warner 1981). The temperature and pressure used in these calculations represented the ambient conditions measured in the field at each site.

The assumption of an ideal gas was justified by examining a mean compressibility factor. The mean compressibility factor is a factor that is

introduced into the ideal gas equation to account for non-ideal or real gas relationships. Therefore, the ideal gas equation becomes:

$$PV = Z_m nRT$$

Equation 3

where:

Z_m = mean compressibility factor

If calculations can show that Z_m is approximately equal to one for the soil gas mixtures, then the assumption that the soil gas samples in this study can be approximated to an ideal gas is valid one (Himmelblau 1974).

Two cases were examined in testing this assumption. Because the complete composition of soil gas is not known, Case 1 assumed soil gas contains 80 percent air and Case 2 assumed soil gas contains 20 percent air. The mean compressibility factor was determined to be 0.99 for Case 1 and 0.85 for Case 2. Therefore, the ideal gas assumption introduces about 1 to 15 percent error in calculating hydrocarbon concentrations in soil gas. This small deviation (1 to 15 percent) from the ideal gas assumption is reasonable since the pressure conditions are low, and the hydrocarbons in the mixture are similar in their chemical nature. These temperatures and pressure effects are considered when converting from mg/L to ppmv.

The conversion calculations from $\mu\text{g/L}$ to ppmv were made for each sample and each compound within that sample. The molecular weight of each compound was used in the conversion calculation. However, for total hydrocarbons (less light aliphatics), an average molecular weight was used. This average molecular weight was based on the average of the BTEX concentrations at each sample.

To compute total hydrocarbons (with light aliphatics), the light aliphatics concentration was converted to ppmv and then added to total hydrocarbons (less light aliphatics) in ppmv. In these calculations, the detection limits were divided by two to approximate the actual concentration. A sample calculation is shown in Appendix D. An actual concentration below the detection limit could be a value of zero up to the detection limit. Dividing the detection limit by two approximates the concentration within this range.

The average of the BTEX concentrations was used to compute the average molecular weight of each sample since BTEX concentrations were known at all sample points. It is recognized that some error is introduced by using only BTEX concentrations. However, this is considered to be the best approximation possible from the available data. Reporting hydrocarbon concentrations in ppm may be useful for some purposes, however, reporting them in $\mu\text{g/L}$ provides more accurate values based on fewer assumptions.

SECTION 7

RESULTS

SOIL GAS DATA

The maximum soil gas concentration values determined in this study are presented in Table 3 for the sites in Austin, Table 4, for the sites in the Long Island Sound area, and Table 5 for those in the San Diego area.

Average hydrocarbon vapor concentration data for all 27 gasoline service stations are presented in Appendix C. The average hydrocarbon vapor concentration data, in most cases, represent mean values for each set of three GC/FID analyses for each sample. These data are presented in two formats: 1) concentration values listed by sample number and depth, and 2) concentration values listed by depth and sample number. In the second format, computed average concentrations for all samples at each depth are shown. Additionally, each site map contains an average total hydrocarbon concentration computed from concentrations at each depth within each hole. In computing these average concentrations, the concentrations reported at detection limits were divided by two to approximate the actual concentration.

A pipeline was accidentally punctured during the investigations at Station 6 in Austin, Texas. Data were collected during 4 consecutive days at this station to study soil gas migration under dynamic conditions. These data are also included in Appendix C.

Data in Appendix C is presented both in $\mu\text{g/L}$ and ppmv.

CONTAMINATED SITE DATA

Soil gas surveys were previously conducted at a number of UST sites in which product spills were known to have occurred. Data from 27 sites were examined as candidates. Of these sites, eight were selected as being appropriate for comparison purposes because site maps were available and contamination was known to exist. Data collected from Austin Station 6 was included as Site 9 since data from this station represents a fresh spill.

TABLE 3. MAXIMUM CONCENTRATIONS AT AUSTIN, TEXAS

(All concentration values in µg/L)							
	Light Aliphatics C ₁ -C ₅ (as Methane)	Benzene	Toluene	Ethyl- benzene	Xylenes	Total Hydrocarbons (less light aliphatics)	Tank Tightness Test Results
Station 1	790,000	7,400	5,300	<310	2,300	21,000	Tight
Station 2	210,000	16,000	17,000	160	21,000	63,000	Tight
Station 3	120,000	3,300	1,700	<63	410	5,700	NR
Station 4	870,000	97,000	85,000	<680	83,000	210,000	NR
Station 5	1,500,000	24,000	26,000	25,000	8,200	1,100,000	Tight
Station 6							
10/27/87	710,000	110,000	90,000	<220	<240	960,000	
10/28/87	8,600	27,000	83,000	<250	70,000	790,000	
10/29/87	13,000	<250	<290	<270	<260	690,000	
10/30/87	4,800	53,000	1,600	<20	<31	290,000	
Station 7	59,000	<42	<48	<50	<58	55,000	Tight

Notations:

NAZ = Not analyzed

NR = No records available showing tank tightness results.

Notes:

- (1) Total hydrocarbons are reported as less light aliphatics to reflect a profile of compounds similar to gasoline, and to exclude products of naturally-occurring degradation.
- (2) Total hydrocarbons are calculated from average Rf's for benzene, toluene, ethylbenzene, and ortho-xylene.
- (3) <310 means the compound was analyzed but not detected within this detection limit. The detection limit varies according to sample injection size and compound.
- (4) Spill occurred at 9:00 a.m. on 10/27/87. These data were collected after the spill.
- (5) At Stations 6 and 7, the light aliphatics' concentrations represent C₁-C₃ peaks.
- (6) Tight means tightness test results were <0.05 gph.

TABLE 4. MAXIMUM CONCENTRATIONS AT LONG ISLAND SOUND AREA

(All concentration values in µg/L)							
	Light Aliphatics C ₁ -C ₅ (as Methane)	Benzene	Toluene	Ethyl- benzene	Xylenes	Total Hydrocarbons (less light aliphatics)	Tank Tightness Test Results
SUFFOLK COUNTY, NY							
Station 1	<40	2,700	11,000	12,000	10,000	270,000	NR
Station 2	140	<29	420	130	<41	2,100	Tight
Station 4	<24	3,700	1,000	<37	<42	69,000	NR
Station 5	4	2,300	13,000	2,900	91	110,000	NR
Station 6	15	<0.6	55	<0.7	<0.8	1,500	NR
STORRS, CT							
Station 1	25,000	<10	840	<6	<8	3,700	Leak
Station 2	11,000	<6	<6	<7	2,300	49,000	NR
PROVIDENCE, RI							
Station 1	8	<0.1	110	130	110	590	NR
Station 2	72	23	230	<0.1	130	1,400	Tight
Station 3	9	<0.08	0.8	<0.1	<0.2	0.3	NR
Station 4	2,800	670	1,400	4007	840	24,000	Leak

Notations:

NAZ = Not analyzed.

NR = No records available showing tank tightness results.

Notes:

- (1) Total hydrocarbons are reported as less light aliphatics to reflect a profile of compounds similar to gasoline, and to exclude products of naturally-occurring degradation.
- (2) <310 means the compound was analyzed but not detected within this detection limit. The detection limit varies according to sample injection size and compound.
- (3) Total hydrocarbons are calculated from average RFs for benzene, toluene, ethylbenzene, and ortho-xylene.
- (4) At stations in Storrs, CT and Providence, RI, the light aliphatics' concentrations represent C₁-C₃ peaks.
- (5) Tight means tightness test results were <0.05 gph.

TABLE 5. MAXIMUM CONCENTRATIONS AT SAN DIEGO, CALIFORNIA

(All concentration values in µg/L)							
	Light Aliphatics C ₁ -C ₅ (as Methane)	Benzene	Toluene	Ethyl- benzene	Xylenes	Total Hydrocarbons (less light aliphatics)	Tank Tightness Test Results
Station 1	48,000	<89	11,000	<120	4,900	31,000	Tight
Station 2	110,000	<89	11,000	<120	5,100	77,000	Tight
Station 3	22	<0.1	17	<0.05	0.8	62	Tight
Station 4	420,000	<90	17,000	<0.1	1,800	110,000	Tight
Station 5	55,000	<86	2,600	<0.1	1,600	7,700	Tight
Station 6	33,000	<83	23,000	<0.1	10,000	58,000	Tight
Station 7	390,000	<90	31,000	<0.1	8,800	210,000	Tight
Station 8	21,000	<91	22,000	<0.1	8,600	120,000	Tight
Station 9	280,000	<98	32,000	<0.1	8,200	110,000	NR

Notations:

NAZ = Not analyzed.

NR = No records available showing tank tightness results.

Notes:

- (1) Total hydrocarbons are reported as less light aliphatics to reflect a profile of compounds similar to gasoline, and to exclude products of naturally-occurring degradation.
- (2) Total hydrocarbons are calculated from average Rf's for benzene, toluene, ethylbenzene, and ortho-xylene.
- (3) <310 means the compound was analyzed but not detected within this detection limit. The detection limit varies according to sample injection size and compound.
- (4) Tight means tightness test results were <0.05 gph.

Table 6 gives a brief description of these sites and Table 7 presents the maximum concentration data for them. These sites include active service stations or fueling facilities. Site data are presented in Appendix E. Specific sample locations at these sites were selected for use in the contaminated site database because of their close proximity to the tanks or contamination source. It was desirable to use sampling points close to the tanks so that the data would be comparable to the clean site data collected from the tank backfill areas under this study. A summary of the soil gas data is included in Appendix E. Total hydrocarbon values are reported less light aliphatics, and as benzene.

EXPANDED AUSTIN STUDY

A 4-day study was conducted at Austin Station 6 to take advantage of a spill that occurred when a product line was punctured during the field investigations. Approximately 15 gallons of super unleaded gas were spilled. Soil gas samples were taken from the same holes each day and the results are included in Appendix C. Figure 3 shows the concentration of total hydrocarbons for each of the 4 days at 2-foot and 6-foot depths, and Figure 4 shows the corresponding concentrations of C_4 - C_6 components.

This intensified study provided the following basic information:

- Total hydrocarbon concentrations increased initially to >100,000 ug/L near the spill site and higher concentrations migrated into the entire backfill area.
- Total hydrocarbon concentrations decreased after peaking 1 day after the spill.
- High concentrations of C_4 - C_6 components were found to parallel the total hydrocarbon concentrations.
- Since high concentrations of C_4 - C_6 components were not usually encountered in the field sampling at nonleaking stations, it may be possible to use C_4 - C_6 concentrations, as compared to those of total hydrocarbons, to detect fresh leaking conditions. More study is required to confirm this preliminary indication.

CHARACTERIZATION OF BACKFILL MATERIAL

Soil moisture and particle size of the backfill materials impacts hydrocarbon vapor concentrations because of liquid/vapor partitioning and porosity effects. Consequently, soil moistures and sieve analyses were performed on soil samples collected from the backfill of the nonleaking sites. A summary of the results of these sample analyses are presented in Table 8.

Backfill soil material at steel tank installations included fine, medium, and silty sands while the backfill at fiberglass tank installations were of

TABLE 6. DESCRIPTION OF CONTAMINATED SITES

Site 1	New Service Station. Tanks were tested tight, but found floating product in ground water. Ground-water depth = 8'.
Site 2	Active Service Station.
Site 3	Active Service Station. Floating product in ground water. Ground-water depth = 15' - 20'.
Site 4	Active Fueling Facility. Pipeline leak. No ground-water contamination. Ground-water depth = >20'.
Site 5	Active Fueling Facility. Ground-water depth = 12'.
Site 6	Active Service Station. No ground-water contamination. Ground-water depth = 15'.
Site 7	Active Fueling Facility.
Site 8	Active Service Station. Floating product on ground water. Ground-water depth = 25' - 35'.
Site 9	Active Service Station (Austin 6). Spill resulting from product like puncture.

Note: These sites were selected from TRC files to develop database of hydrocarbon vapor concentrations for sites with known hydrocarbon contaminated.

TABLE 7. MAXIMUM CONCENTRATIONS AT CONTAMINATED SITES

(All concentration values in µg/L)						
	Light Aliphatics C ₁ -C ₅ (as Methane)	Benzene	Toluene	Ethylbenzene	Xylenes	Total Hydrocarbons (less light aliphatics)
Station 1	1,200,000	100,000	68,000	61,000	NAZ	2,200,000
Station 2	NAZ	<10	1,200	120	140	19,000
Station 3	NAZ	NAZ	31,000	NAZ	NAZ	400,000
Station 4	NAZ	780	620	50	<4.5	15,000
Station 5	NAZ	26,000	11,000	<850	<900	280,000
Station 6	NAZ	<230	4,000	<58	<61	210,000
Station 7	NAZ	<55	1,700	<80	<80	9,500
Station 8	100,000	60,000	40,000	NAZ	NAZ	800,000

Notations:

NAZ = Not analyzed.

Notes:

- (1) Total hydrocarbons are reported as less light aliphatics to reflect a profile of compounds similar to gasoline, and to exclude products of naturally-occurring degradation.
- (2) Total hydrocarbons are calculated from average RFs for benzene, toluene, ethylbenzene, and ortho-xylene.

AUSTIN 6 MEDIAN TOTAL HYDROCARBON DATA

OVER TIME

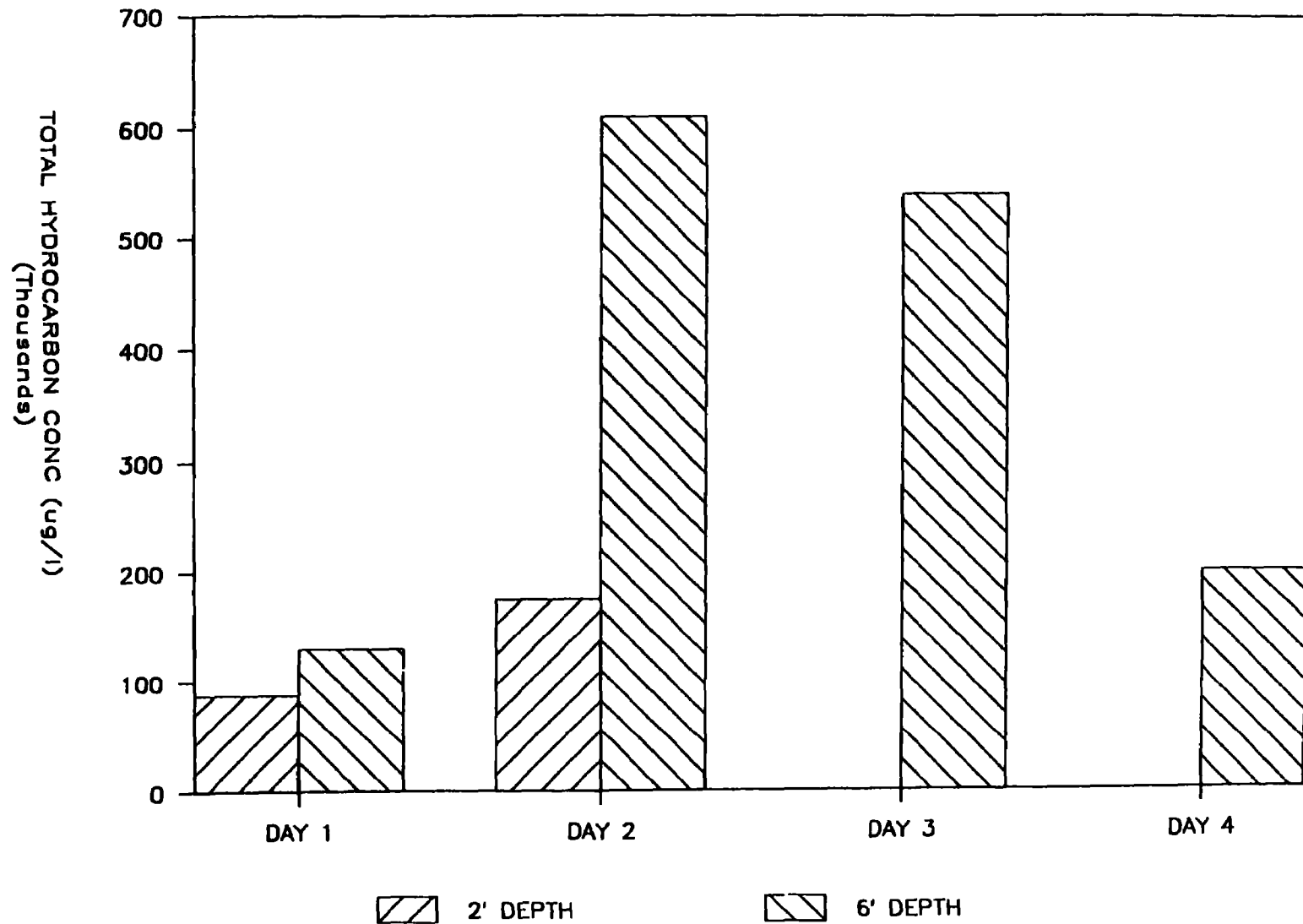


Figure 3. Austin 6 median total hydrocarbon data.

AUSTIN 6 MEDIAN C₄-C₆ HYDROCARBON DATA OVER TIME

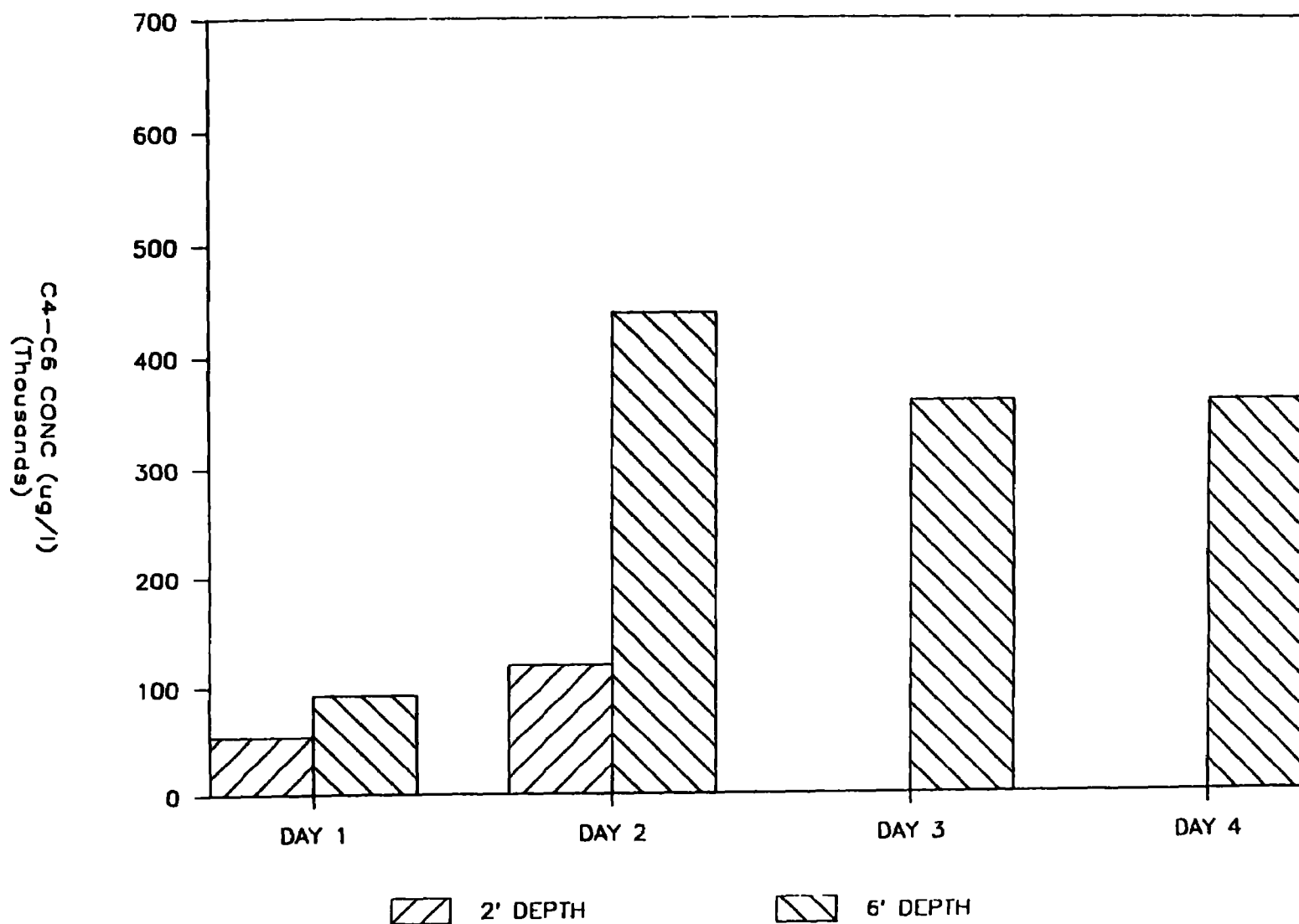


Figure 4. Austin 6 median C₄-C₆ hydrocarbon data.

fine gravel, gravelly sand, and coarse sand mixed with gravel. Moisture contents were higher in the sands than in the gravels and the porosities of the sands were less than those of the gravels.

Because gravel is more porous and less moist, hydrocarbons will likely move more quickly through gravel backfill than through sand. Also, moisture will tend to inhibit the movement of hydrocarbons and will absorb hydrocarbons through liquid/vapor partitioning.

U-TUBE SAMPLING

Leak detection methods are classified into four groups: Volumetric, Nonvolumetric, Inventory Control, and Leak Effects methods (EPA). Methods within the Leak Effects classification are those that identify leaks by examining the environmental effects of the leak. Those methods usually require the installation of monitor wells and chemical analysis.

Since soil gas contamination is an environmental effect that can result from a leaking UST system, then soil gas sampling, as performed in the field investigation of this study, would be classified as a Leak Effects method.

Another method for monitoring leaks within the Leak Effects classification utilizes a U-Tube device. The U-Tube consists of a 4-inch diameter, schedule 40, PVC pipe installed as shown in Figure 5.

These tubes were installed under each tank within the backfill material at Stations 4 and 6 in Suffolk County, New York.

A comprehensive comparison of leak detection methods was not within the scope of this project. However, two stations with U-Tubes were included in the study in order to make a comparison of hydrocarbon vapor concentrations from U-Tubes versus hydrocarbon vapor concentrations in soil gas.

The method of collecting soil gas samples from the backfill areas was presented in Section 4 in the Sampling Methods paragraph of this report. Briefly, soil gas samples were collected by inserting a hollow probe into the backfill and evacuating a soil gas sample using a vacuum pump. Vapor samples from the U-Tubes were also collected by inserting a hollow probe to the desired depth in the U-Tube and evacuating a sample using a vacuum pump. Samples were collected near the bottom of the U-Tubes to minimize the effects of dilution from the outside air.

Since vapor samples from the U-Tubes were collected near the bottom of the U-Tubes, these data were compared to soil gas samples collected from the backfill at the 10-foot depth. The U-Tube samples and soil gas samples (at 10 feet) are shown in Table 9.

At Station 4 in Suffolk County, New York, the U-Tube sample contained 90,000 µg/L of total hydrocarbons (less light aliphatics) while the soil gas samples ranged from 42,000 to 69,000 µg/L of total hydrocarbons (less light

TABLE 8. MOISTURE RANGES OF SOIL AND BACKFILL SAMPLES

(Values in percent by weight. Moisture content analyzed by PSI, Albuquerque, NM)					
Location/Station	Tank Type	Moisture Content			Sieve Analysis Results
		Sand	Gravel	Native Soil	
AUSTIN, TX					
AU1	Steel	11-13	-	10	Silty sand
AU2	Steel	3-4	-	11	-
AU3	FRP	-	6	79 *	Sandy gravel
AU4	FRP	-	5	-	Gravelly sand
AU5	Steel	4-13	-	-	Medium sand
AU6	FRP	-	1-15	-	Fine gravel
AU7	FRP	-	-	-	-
STORRS, CT					
CONN1	Steel	-	-	-	-
CONN2	Steel	-	-	-	-
PROVIDENCE, RI					
RI1	Steel	15	-	-	Fine sand
RI2	Steel	10	-	-	Medium sand with silt
RI3	Steel	4	-	-	Fine sand
RI4	Steel	4	-	-	Medium to fine sand
SUFFOLK COUNTY, NY					
NY1	FRP	-	-	-	-
NY2	Steel	-	-	-	-
NY4	FRP	-	-	-	-
NY5	Steel	8	-	-	-
NY6	FRP	5-6	-	3-6	Fine sand
SAN DIEGO COUNTY, CA					
SD1	Steel	-	-	-	-
SD2	Steel	13-20	-	-	Fine sand with silt
SD3	FRP	-	-	-	-
SD4	Steel	15-17	-	-	Fine sand with silt
SD5	FRP	-	1	-	-
SD6	FRP	-	1	11	Crs sand with gravel
SD7	Steel	7-9	-	-	Medium sand with silt
SD8	Steel	6-7	-	-	Medium sand with silt
SD9	Steel	3-10	-	-	Silty sand

NOTE: All Sieve Analysis results from backfill samples.

*Native Soil Sample taken from saturated zone in bottom of monitor well.

aliphatics). Benzene and toluene were found in both the U-Tube and soil gas samples while methane, ethylbenzene and the xylenes were not found at detection limits for either the U-Tubes or soil gas samples.

At Station 6 in Suffolk County, New York, the U-Tube sample contained 47 µg/L of total hydrocarbons (less light aliphatics) while the soil gas sample contained 1,500 µg/L of total hydrocarbons (less light aliphatics). Only toluene was identified in both the U-Tube and soil gas samples.

GROUND-WATER SAMPLING

Shallow ground water was encountered at several locations which prevented soil gas samples from being taken at the 10-foot levels. In these cases, samples of the ground water were taken and analyzed by the GC/FID using the same procedures as were used for the soil gas. These results are shown in Table 10.

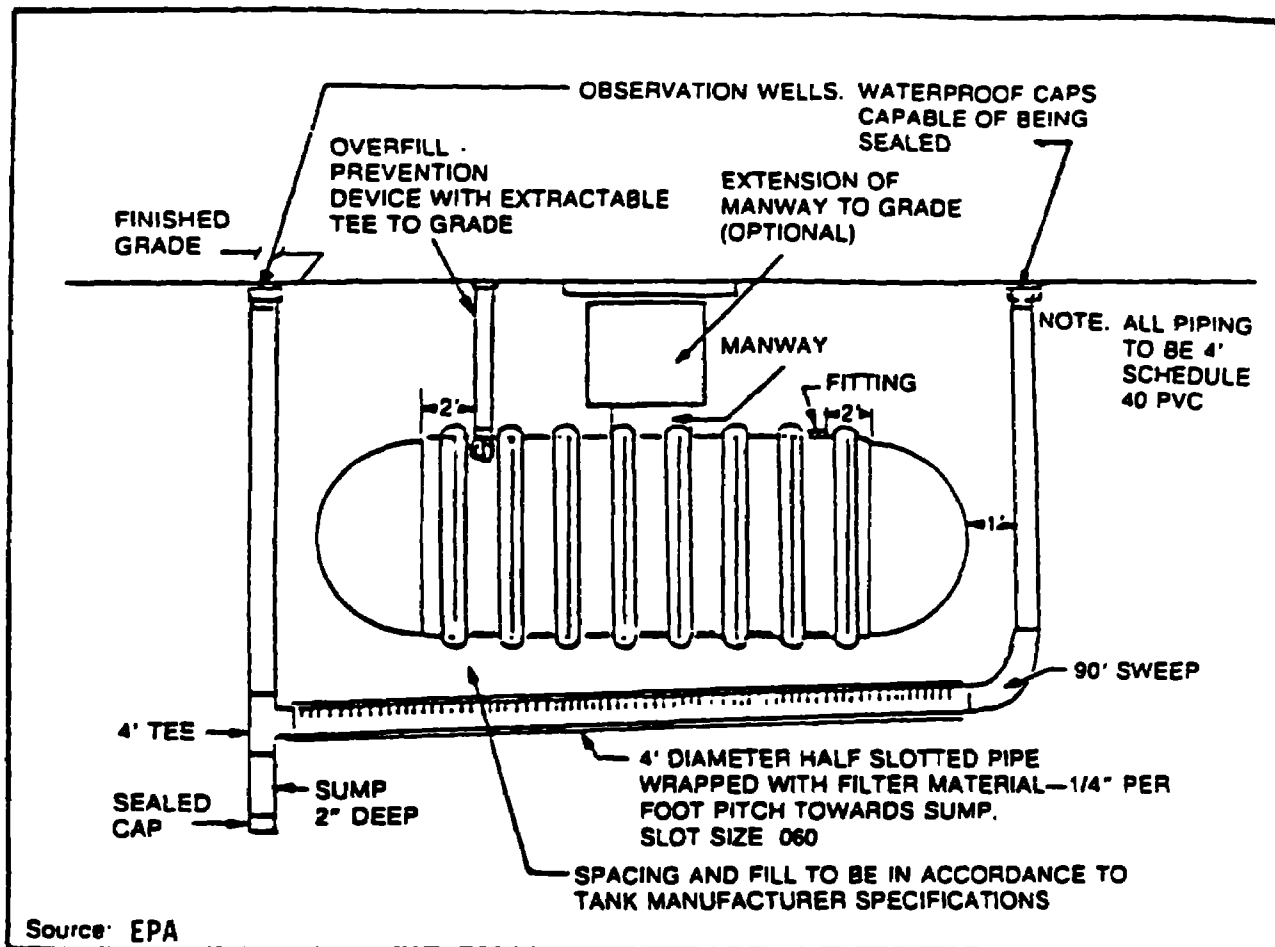


Figure 5. U-Tube leak detection system.

TABLE 9. U-TUBE VAPOR SAMPLES
SUFFOLK COUNTY, NEW YORK

(All Concentration Values in $\mu\text{g/L}$)

	Methane ($\text{C}_1\text{-C}_5$)	Benzene	Toluene	Ethylbenzene	Xylenes	Total Hydrocarbons (less light aliphatics)
<u>Station 4</u>						
U-Tube-11'	<24	2,800	950	<37	<42	90,000
SG1-10'	<24	730	120	<37	<42	42,000
SG2-10'	<24	980	300	<37	<42	42,000
SG3-10'	<24	3,300	1,000	<37	<42	69,000
SG4-10'	<24	1,800	930	<37	<42	58,000
<u>Station 6</u>						
U-Tube-14'	<0.02	<0.03	2	<0.04	<0.04	47
SG2-10'	<0.4	<0.6	55	<0.7	<0.8	1,500

Notes:

- (1) Total hydrocarbons are calculated from the average Rf's for BTEX.
- (2) <24 indicates that the concentration is less than the detection limit of 24 $\mu\text{g/L}$.

TABLE 10. HYDROCARBON CONCENTRATIONS FROM GROUND-WATER SAMPLES

(All concentration values in $\mu\text{g/L}$)

Station	Sample Number	Date	Depth (FT)	Methane	Butane	Isopentane	Benzene	Toluene	Ethyl-benzene	Xylenes	Total Hydrocarbons
AU6	MW/H ₂ O	10/29	7.	4,000	5,700.	NA	77,000.	150,000.	<140.	80,000.	380,000.
AU6	MW/H ₂ O/P	10/29	8.	5,400	5,000.	NA	52,000.	130,000.	<140.	110,000.	410,000.
AU6	MW/H ₂ O	10/30	8.	6,700	8,900.	NA	50,000.	16,000.	<49.	<79.	100,000.
AU6	MW/H ₂ O/S	10/29	8.	6,600	6,200.	NA	71,000.	18,000.	<140.	110,000.	480,000.
AU6	MW/H ₂ O	10/29	9.	4,200	4,900.	NA	67,000.	120,000.	<140.	51,000.	290,000.
AU6	SG4/H ₂ O	10/28	10.	2,100	4,300.	NA	27,000.	83,000.	<25.	70,000.	200,000.
AU6	SG5/H ₂ O	10/28	10.	4,700	2,400.	NA	5,600.	10,000.	<12.	12,000.	37,000.
AU6	SG2/H ₂ O	10/28	10.	1,800	2,100.	NA	5,600.	15,000.	<49.	17,000.	42,000.
AU6	MW/H ₂ O	10/29	11.	9,300	5,700.	NA	67,000.	160,000.	<140.	93,000.	400,000.
AU6	MW/H ₂ O/P	10/29	11.	10,000	1,000.	NA	7,300.	15,000.	<140.	17,000.	53,000.
AU6	MW/H ₂ O/S	10/29	11.	13,000	690.	NA	7,500.	15,000.	<140.	<130.	36,000.
AU6	MW/H ₂ O	10/30	11.	4,200	2,400.	NA	4,500.	1,300.	<49.	<79.	18,000.
AU6	MW/H ₂ O	10/28	NA	8,600	8,500.	NA	10,000.	25,000.	<250.	21,000.	86,000.
CONN1	GW-04	11/12	10.	62	<7.	<6	<6.	<8.	<4.	<8.	<7.
CONN2	GW-04	11/13	6.	18	<4.	<4	<6.	<6.	<7.	<10.	<6.
CONN2	GW-03	11/13	10.	18	<4.	<4	<6.	<6.	<8.	<10.	<6.
CONN2	GW-05	11/13	10.	4,400	1,700.	<6	<30.	-31.	<37.	48,000.	240,000.

Notes.

- (1) Total hydrocarbons are less light aliphatics, as benzene in $\mu\text{g/L}$.
- (2) NA refers to Not Analyzed.
- (3) Samples noted as MW/H₂O/P indicate values immediately after pumping.
- (4) Samples noted as MW/H₂O/S indicate values gathered 1.5 hours after pumping.
- (5) GW refers to ground-water samples.
- (6) Values less than detection limits are indicated by <.

SECTION 8
UST REGULATIONS

AUSTIN, TEXAS

USTs at existing facilities in Austin must have a permit to operate and are required to be tested or monitored for leaks on a regular basis. If tank testing is conducted, a precision tank test, as defined in the NFPA National Fires Codes, Section 329, is performed on each tank according to the following schedule:

<u>Tank Age</u> <u>(as of 6/18/85)</u>	<u>Test Frequency</u>
0 to 5 years	0
6 to 10 years	Within 12 months of 6/18/85 and then every 2 years until over 10 years old.
over 10 years	Annually, beginning within 12 months of 6/18/85.

The Department of Environmental Protection (DEP) assumed the UST responsibility from the fire department on January 14, 1987. At the present time, the DEP has approved seven tests for tank tightness testing: Petro-tite (Kent-Moore), Hunter, Horner, Acutest, Massney, Tanty-Tech, and Tank Auditor. Companies who perform these tests are registered by the DEP.

Monitoring wells may be used as an alternative to precision tank testing for leak detection of USTs. For existing facilities, leak detection monitoring by surface geophysical methods such as ground penetrating radar, electromagnetic induction, resistivity, magnetometers, and X-ray fluorescence or by tracer analysis may be permitted only by approval from the DEP.

SUFFOLK COUNTY, NEW YORK

Suffolk County began regulating USTs in 1980 when a law was passed stating that all new tank installations except underground petroleum tanks had to be double-walled with leak detection between the walls. The law further stated that all tanks had to be replaced with double-walled tanks by 1990. Underground petroleum tanks could remain single-walled up to 1985 in critical aquifer recharge areas at which time they had to be replaced with double-walled tanks with leak detection between walls. The main aquifer recharge area is inland and encompasses 75 percent of the island. The coastal areas do

not affect the recharge of the aquifer and tanks in this area can remain single-walled with external leak detection.

Testing of USTs is performed by county licensed testing companies. Tests are performed every 2 years on older tanks and every 5 years on newer tanks (since 1975). The only test recognized by the county is the Petro-Tite Tank Tester (formerly Kent-Moore) system.

SAN DIEGO, CALIFORNIA

California state law regarding the monitoring and testing of USTs allows for implementation of these regulations to be carried out at the local level. Counties implement the regulations through the issuance of permits to UST owners. A city may, by ordinance, assume such responsibilities within its boundaries.

All owners of existing USTs are required to implement a visual monitoring or alternative monitoring system. Visual monitoring should be used as the principal leak detection monitoring method, where feasible. When visual monitoring is not possible, an alternative method should be implemented. The alternative methods are:

- UST Testing,
- Vapor or Other Vadose Zone Monitoring and Ground-Water Monitoring with Soil Sampling,
- Vadose Zone Monitoring, Soil Sampling, and UST Testing,
- Ground Water and Soil Testing,
- Inventory Reconciliation, UST Testing, and Pipeline Leak Detectors,
- Inventory Reconciliation, UST Testing, Pipeline Leak Detectors, Vadose Zone, or Ground-Water Monitoring and Soil Testing,
- UST Gauging and Testing, and
- Interim Monitoring.

Most tank owners select the first alternative - UST testing method. In the past, initial testing was required on all tanks within 12 months but subsequent testing on nonleaking tanks less than 10 years old was authorized to be done in 30 months rather than annually. Following the expiration of the 30 month period, all USTs operating under the option will require annual testing. The specific test is not designated, but it must comply with the NFPA National Fire Codes, Section 329.

SECTION 9

TANK TIGHTNESS TESTING RECORDS

Tank tightness test records were available for most of the study sites. Two commercially available systems were used to test the tanks - the Petro-Tite Tester (formerly Kent-Moore) and the Hunter Leak Lokater. The Petro-Tite Tester has been a recognized standard for accurate tank testing within the industry for many years. This system works on the principle of applying a hydraulic pressure head to the tank by an externally connected, graduated standpipe which is filled with product to approximately four feet above ground level. Product level in the standpipe is monitored for rise and fall and measured amounts of product are added or removed. Readings are taken every 15 minutes for 6 hours.

The Hunter Leak Lokater measures tank leakage by sensing weight changes in a sensor which is suspended in the liquid of the tank. Changes in weight are transmitted to a recorder that registers these changes as leaks in or out. The only station in this study to use the Hunter Leak Lokater was RI-4.

The manufacturers of the Petro-Tite Tank Tester and the Hunter Leak Lokater both report that these systems can detect leaks as low as 0.05 gph in tanks and pipes. The accuracy of these tests is currently being examined in other EPA-related studies. Both tests do not have the capability of detecting spills.

Some records of tank tightness tests were obtained from the oil companies who owned the various sites. In addition, San Diego County provided test results for several of the San Diego sites (SD-1 and SD-3 through SD-7). A government agency provided tightness data for CONN-1. These records have been modified to protect the confidentiality of the site locations and operators.

Table 11 presents the Tank Tightness Test Results of the study sites. Tanks with absolute leak rates of less than 0.05 gph are labeled **TIGHT**.

Tanks with leak rates greater than 0.05 gph are labeled **LEAK** and an explanation of the leak and the surrounding circumstances is provided in the accompanying footnote. Several sites had no available records or had not been tested due to recent tank installations and are labeled **NA** and **NT**, respectively, in the table.

TABLE 11. TANK TIGHTNESS TEST RESULTS

Site/Station	Tank Material	Number of Tanks	Tank Installation Date	Date of Test	Test Results
AU-1	Steel	3	1961	04/09/86	TIGHT
	FRP	1	1981	04/09/86	TIGHT
AU-2	Steel	3	1973	05/01/86	TIGHT
AU-3	FRP	4	1984	NT	
AU-4	FRP	4	1981	NT ¹	
AU-5	Steel	3	1984	04/15/86	TIGHT
AU-6	FRP	4	1984	NT ²	
AU-7	FRP	4	1984	NT	
NY-1	FRP	3	1982	T	
NY-2	Steel	6	1968	12/30/85	TIGHT
NY-4	FRP	3	1980	NT	
NY-5	Steel	3	1972	NA	NA
NY-6	FRP	3	1980	NT	

(continued)

FRP = Fiberglass Reinforced Plastic

NA = Not Available

NT = Tank Tightness Tests Not Required

¹1980-1987 maintenance records indicate station had several small spills in dispensing areas, and possibly some pipeline spills.

²Spill occurred from product line during testing. Corrective action was taken.

TABLE 11. (Continued)

Site/Station	Tank Material	Number of Tanks	Tank Installation Date	Date of Test	Test Results
RI-1	Steel	3	1973	NA	NA
RI-2	Steel	3	1976	09/25/87	TIGHT
RI-3	Steel	6	1965	NA	NA
RI-4	Steel	1	1966	01/22/86 (Hunter)	LEAK ¹
	Steel	1	1966	01/22/86 (Hunter)	TIGHT
	Steel	1	1966	01/22/86 (Hunter)	LEAK ²
	Steel	1	1966	01/22/86 (Hunter)	TIGHT
	Steel	1	1966	01/22/86 (Hunter)	TIGHT
	FRP	1	1984	01/22/86 (Hunter)	TIGHT
CONN-1	Steel	1	1984	01/22/87	TIGHT
	Steel	1	1966	01/21/87	TIGHT
	Steel	1	1978	01/21/87	TIGHT
	Steel	1	1966	01/21/87	LEAK ³
	Steel	1	1966	01/21/87	TIGHT
CONN-2	Steel	1	1985	NA	NA ⁴
	Steel	2	1940	NA	NA

(continued)

¹Failed tightness test on 01/22/86 due to a leak in system line. No records on further testing.

²Failed tightness test on 01/22/86. No records on further testing.

³Failed tightness test on 01/21/87 due to leak in suction piping under pump. Tank has been out of service since 01/87.

⁴H₂O was discovered in super unleaded tank in 01/85. Tank was excavated and replaced with new steel tank.

TABLE 11. (Continued)

Site/Station	Tank Material	Number of Tanks	Tank Installation Date	Date of Test	Test Results
SD-1	Steel	2	1971	11/11/86	TIGHT
	Steel	1	1971	11/21/86	TIGHT ¹
	FRP	1	1978	11/21/86	TIGHT ²
SD-2	Steel	3	1972	06/17/87	TIGHT
SD-3	FRP	2	1982	12/10/86	TIGHT
	FRP	1	1982	12/22/86	TIGHT ³
SD-4	Steel	4	1965	11/05/86	TIGHT
SD-5	FRP	3	1983	05/07/86	TIGHT
SD-6	FRP	3	1983	05/18/87	TIGHT
SD-7	Steel	1	1972	04/16/86	TIGHT
	Steel	1	1965	04/16/86	TIGHT
	Steel	1	1965	04/17/86	TIGHT
SD-8	Steel	4	1965	01/21/86	TIGHT
SD-9	Steel	3	1967	NA	NA

¹Failed tightness test on 11/11/86 due to a leak in diesel vent line. Retested on 11/21/86 and passed.

²Failed tightness test on 11/11/86 due to tank leak of -0.5 gph. Retested on 11/21/86 and passed.

³Failed tightness test on 12/10/86 due to leak in the vapor line. Retested on 12/22/86 and passed.

There are a total of 100 USTs at the 27 gasoline stations that were studied. Of this total, 63 tanks are fabricated from steel and were installed between 1940 and 1984. The remaining 37 are made of fiberglass reinforced plastic (FRP) and were installed between 1978 and 1984.

Of the 63 steel tanks, 42 were determined tight in recent tests. Three steel tanks, two from RI-4 and one from CONN-1, were found to be leaking. No further records are available to indicate repair and/or subsequent testing of these tanks. No tank tightness test records are available on the remaining 18 steel tanks.

Tank tightness tests were conducted on 12 of the FRP tanks; all tested tight. Tests on the remaining 25 were not required by the regulating government agency due to the relatively new age of the tanks.

Seven gas stations had histories of leaks: AU-4 and 6; RI-4; CONN-1 and 2; and SD-1 and 3. Maintenance records from AU-4 for the period of 1980 to 1987 indicate that numerous surface spills occurred from vandalized split hoses and dispensers. Records also exist of low or slow flow which might indicate pipeline leaks. AU-4 was removed from the database as a clean site because of its history of high maintenance and its unusually high soil gas concentrations. AU-6 was also removed from the database because of a known spill that occurred from a product line break. The five other stations remained in the database as background data because the soil gas concentrations were not excessive.

SECTION 10

DATA ANALYSIS

GCL investigated hydrocarbon vapor concentrations in the backfill of UST in two phases: a field investigation phase and a data analysis phase.

Since no data base for soil gas information in nonleaking UST sites was known to exist, it was necessary to conduct field investigations to establish a baseline of hydrocarbon vapor concentrations. Data were collected from 27 gasoline service stations selected as nonleaking sites. Selection criteria (Section 2) were used to develop a data set which included a variety of tank ages, tank materials, stored products, and backfill materials. The USTs selected were believed to be nonleaking, or tight. UST systems were considered to be tight if:

- Tightness testing within the previous 2 years indicated the system to be without leaks, or
- In cases where test records were not available, the environmental and maintenance personnel of the oil company had no knowledge of contamination due to leakage at the site.

Two stations sampled (Stations 6 and 4 in Austin, Texas) were determined to be inappropriate as nonleaking sites, and their data were not included in the data set. Station 6 had a fresh gasoline spill from a product line puncture that occurred during the field investigation. Station 4 had a history of frequent product line and dispenser problems, according to maintenance records, and no test records were available.

The nonleaking site data, therefore, consisted of 279 soil gas samples taken from 25 service stations.

Contaminated site data were obtained from TRC historical records. The contaminated site data was selected from 60 soil gas samples taken from 9 sites having known contamination from a petroleum fuel leak or spill. These sites were all active gasoline service stations or fueling facilities.

The strategy for data analysis was determined by the fact that no usable data for nonleaking sites were known to exist. Therefore, analyses were employed which could delineate patterns in the data, if they existed, and which could prove useful in establishing contamination thresholds.

Data analysis was broken down into three parts:

- Analysis of total hydrocarbon concentrations (less light aliphatics and including light aliphatics) in soil gas at nonleaking sites with the objective of establishing a descriptive statistical baseline.
- Comparison of the nonleaking site baseline information to data from sites where petroleum fuel contamination was known to exist. This comparison examined the appropriateness of establishing an upper limit for total hydrocarbon (less light aliphatics) vapor concentrations at nonleaking sites that could provide a threshold concentration value between nonleaking and contaminated sites.
- Non-parametric statistical testing of each data set (nonleaking and contaminated) in order to substantiate observed differences and identify significant trends among total hydrocarbon vapor concentrations, sample depth, location, backfill materials, tank age, and tank material.

Analyses focused on concentrations of total hydrocarbons (less light aliphatics) in soil gas, as the presence of total hydrocarbons is indicative of contamination from a petroleum leak or spill. Light aliphatics were excluded from the reported concentrations in order to present a profile of compounds similar to that of gasoline, and to exclude methane concentrations which may have been present due to naturally-occurring decomposition of organic matter.

The use of total hydrocarbon concentrations in soil gas as a contamination index is consistent with current EPA ground-water and soil monitoring proposals. An analysis of total hydrocarbon data (including light aliphatics) is presented [Section 10, in the Empirical Distribution of Total Hydrocarbon Concentrations (Including Light Aliphatics) of Nonleaking Sites paragraph of this report] to show how these data are distributed as compared to total hydrocarbon concentrations (less light aliphatics). This comparison may be useful in evaluating total hydrocarbon concentrations from leak detection devices which include light aliphatics.

Accuracy in the data analysis was essential because the results may be used to provide direction for future leak detection methods. Towards this goal, the soil gas data were reported in $\mu\text{g/L}$ because this provided a better approximation of the total hydrocarbon vapor concentrations than ppmv (Section 6). Also, three GC/FID analyses were generally performed on each sample, and the arithmetic mean of the usable samples, as judged by the GC/FID operator, was used in the analyses. The replicability of analytical results were within 25 percent of the average concentration value for each sample.

EMPIRICAL DISTRIBUTION OF TOTAL HYDROCARBON CONCENTRATIONS (LESS LIGHT ALIPHATICS) FOR NONLEAKING SITES

An empirical distribution of the total hydrocarbon (less light aliphatics) vapor concentrations in soil gas surrounding nonleaking UST systems is useful for two reasons:

- It shows what concentrations can be considered as **background** concentrations in a UST system, and
- The distribution can be compared to similar concentration distributions from contaminated sites.

Even at sites with no known contamination, a level of total hydrocarbon vapor concentrations is present resulting from surface spills or small undetected leaks of petroleum fuels. These concentrations are defined as the total hydrocarbon background level of the soil gas at the site.

The best way to describe the distribution of total hydrocarbon concentration data is by using the relative frequency distribution. The relative frequency distribution is obtained by grouping the data into concentration classes and determining the proportion of samples in each of the classes. This distribution for total hydrocarbon (less light aliphatics) concentrations is shown in Table 12 in $\mu\text{g/L}$ and in Table 13 in ppmv.

The classes in these distributions were chosen to show the overall distribution of samples, as well as the percentage of samples below $1500 \mu\text{g/L}$ (approximately 500 ppmv). The $1500 \mu\text{g/L}$ concentration class was chosen because proposed EPA regulations concerning leaking UST systems have considered 500 ppmv as a possible threshold value to differentiate nonleaking from contaminated sites. The relative frequency distribution shows that 53.2 percent of the samples were below $1500 \mu\text{g/L}$. The overall distribution shows that 93.1 percent of the samples were less than $100,000 \mu\text{g/L}$.

There are 19 samples (6.8 percent of the total) that have average concentration values greater than $100,000 \mu\text{g/L}$. Site and sample data were examined to explore causes for these high values. Table 14 shows the site and sample location of the data points. The 19 samples came from 7 service stations studied. Tightness test results showed the UST systems at four of these stations to be tight, while no test records were available for the other three.

A possible source for the high total hydrocarbon (less light aliphatics) concentrations at the seven sites is from surface spills. Interviews with the participating oil companies revealed that underground fuel storage tanks are occasionally overfilled by the transporter. Since there is no system for monitoring these surface spills, the frequency of this event is unknown.

Another possible source for the high concentrations could be related to the age of the tanks. Six of the stations contained steel tanks installed between the years 1965 and 1971. One station contained a fiberglass tank installed in 1982. The possibility of undetected leaks could be greater in older tanks.

TABLE 12. DISTRIBUTION OF NONLEAKING SITE DATA FOR
TOTAL HYDROCARBONS LESS LIGHT ALIPHATICS

Concentration Ranges (µg/L)	Number of Samples	Relative Frequency Distribution (%)	Cumulative Relative Frequency Distribution (%)
Not Detected	65	23.3	23.2
< 1,500	84	30.1	53.4
1,501 - 5,000	16	5.7	59.1
5,000 - 10,000	12	4.3	63.4
10,000 - 50,000	56	20.1	83.5
50,000 - 100,000	27	9.7	93.2
100,000 - 270,000	18	6.4	99.6
1,100,000	1	0.4	100.0
	<u>279</u>	<u>100.0</u>	

Mean 23,300
Median 800
Upper Quartile 33,000

TABLE 13. DISTRIBUTION OF NONLEAKING SITE DATA FOR
TOTAL HYDROCARBONS LESS LIGHT ALIPHATICS

Concentration Ranges (ppmv)	Number of Samples	Relative Frequency Distribution (%)	Cumulative Relative Frequency Distribution (%)
Not Detected	65	23.3	23.3
< 500	87	31.2	54.5
501 - 1,350	14	5.0	59.5
1,351 - 2,700	11	3.9	63.4
2,701 - 13,500	57	20.4	83.8
13,501 - 27,000	27	9.7	93.5
27,001 - 72,900	17	6.1	99.6
> 72,900	1	0.4	100.0
	<u>279</u>	<u>100.0</u>	

Mean 7,200
Median 220
Upper Quartile 9,200

TABLE 14. TOTAL HYDROCARBON CONCENTRATIONS LESS LIGHT ALIPHATICS
GREATER THAN 100,000 µg/L

Station	Tank Age and Material	Petrotite Test Results	Sample Number- Depth	Total Hydrocarbons Concentration Less Light Aliphatics (ug/L)
<u>Austin, TX</u>				
Station 5	1971-Steel	Tight	SG1-2	150,000
			SG1-6	110,000
			SG1-10	1,100,000
			SG2-10	120,000
			SG3-2	190,000
			SG4-2	140,000
<u>Suffolk County, NY</u>				
Station 1*	1982- Fiberglass	NR	SG2-2	170,000
			SG2-6	210,000
			SG2-8	270,000
Station 5	1972-Steel	NR	SG4-10	110,000
<u>San Diego, CA</u>				
Station 4	1965-Steel	Tight	SG4-2	110,000
Station 7*	1965-Steel	Tight	SG1-10	120,000
			SG2-2	120,000
			SG2-6	130,000
			SG2-10	210,000
Station 8**	1965-Steel	Tight	SG2-10	110,000
			SG3-10	104,000
			SG4-10	120,000
Station 9*	1967-Steel	NR	SG2-6	110,000

*SG2 is located near a tank fill cap.

**Station 8 is an inactive service station.

Notations:

NR = No records available showing tank tightness results.

EMPIRICAL DISTRIBUTION OF TOTAL HYDROCARBON CONCENTRATIONS (INCLUDING LIGHT ALIPHATICS) OF NONLEAKING SITES

It may be useful to report total hydrocarbons as including light aliphatics for two reasons:

- Methane can also occur by the natural decomposition of petroleum fuel in soil, and
- Some UST leak detection methods are based on detection equipment that is sensitive to any hydrocarbon compound. Therefore, these detection devices will detect the presence of methane in soil gas in addition to other hydrocarbon compounds.

The empirical distribution of average total hydrocarbon vapor concentrations (including light aliphatics) is compared to the distribution of average total hydrocarbon vapor concentrations (less light aliphatics) in $\mu\text{g/L}$ in Table 15, and in ppmv in Table 16.

The distribution of total hydrocarbons including light aliphatics are similar to total hydrocarbons less light aliphatics in two class ranges: 5,001 - 10,000 $\mu\text{g/L}$ and 50,001 - 100,000 $\mu\text{g/L}$. However, differences exist in the other class ranges. These differences can best be shown by summarizing the distributions into two classes as follows:

<u>Concentration Ranges ($\mu\text{g/L}$)</u>	<u>Relative Frequency Percent</u>	
	<u>Less Light Aliphatics</u>	<u>Including Light Aliphatics</u>
$\leq 100,000$	93.2	73.8
$> 100,000$	6.8	26.2
	<u>100.0</u>	<u>100.0</u>

The effect of including light aliphatics in the total hydrocarbon concentration is to lower the percentage of samples with concentrations equal to or less than 100,000 $\mu\text{g/L}$ (or 30,000 ppmv) by 21 percent. This effect was expected since the soil gas data showed high concentrations of light aliphatics at many of the sites. This was probably due to naturally-occurring methane as well as methane which occurs from the decomposition of hydrocarbon compounds.

COMPARISON OF TOTAL HYDROCARBON CONCENTRATIONS FOR NONLEAKING SITE AND CONTAMINATED SITE DATA SETS

The data distribution in Section 10, in the Empirical Distribution of Total Hydrocarbon Concentrations (Less Light Aliphatics) for Nonleaking Sites paragraph of this report, has shown that a wide range of background hydrocarbon vapor concentrations exist in the soil gas in backfill at nonleaking UST sites. These concentrations ranged from the lower detection limits of 0.02 $\mu\text{g/L}$ to 1,100,000 $\mu\text{g/L}$ for total hydrocarbons (less light aliphatics). Although much variability exists in these data, a comparison of these data to

TABLE 15. COMPARISON OF TOTAL HYDROCARBONS INCLUDING LIGHT ALIPHATICS AND LESS LIGHT ALIPHATICS AT NONLEAKING SITES

Concentration Ranges (ug/L)	Relative Frequency Percent	
	Less Light Aliphatics	Including Light Aliphatics
< 5,000*	59.2	48.9
5,001 - 10,000	4.3	4.3
10,001 - 50,000	20.0	11.0
50,001 - 100,000	9.6	9.6
100,001 - 400,000	6.4	21.8
400,000 - 1,000,000	-	3.9
1,100,000	0.5	-
1,250,000	-	0.5
	<u>100.0</u>	<u>100.0</u>

*Includes non-detected values.

TABLE 16. COMPARISON OF TOTAL HYDROCARBONS INCLUDING LIGHT ALIPHATICS AND LESS LIGHT ALIPHATICS AT NONLEAKING SITES

Concentration Ranges (ppmv)	Relative Frequency Percent	
	Less Light Aliphatics	Including Light Aliphatics
< 500*	54.6	45
501 - 1,350	5.0	2.1
1,351 - 2,700	3.9	2.5
2,701 - 13,500	20.4	8.9
13,501 - 27,000	9.6	5.0
27,001 - 72,900	6.1	11.1
72,901 - 250,000	0.4	15.0
250,001 - 600,000	-	6.4
> 600,000	-	4.0
	<u>100.0</u>	<u>100.0</u>

*Includes non-detected values.

data from known contaminated sites is required to determine if background vapor concentrations differ from vapor concentrations at sites with known contamination. If statistically significant differences exist between these data

distributions, then the results of this comparison could be useful to UST regulators, service station owners and others who must interpret soil gas data to determine if contamination exists at a UST site.

An evaluation of these differences could also determine the appropriateness of establishing a threshold concentration for total hydrocarbons (less light aliphatics). Statistical testing was performed (Section 10 in the Non-parametric Statistical Testing paragraph of this report) to determine if observed differences concluded from the descriptive statistics are significant differences.

In order for the data sets to be comparable, the data in each set must be collected in a similar fashion. Since the contaminated site data set was obtained from historical records, data for this set were selectively chosen to be consistent with the samples taken at nonleaking sites during the field investigation.

The sampling strategy for nonleaking sites, as outlined in the Field Methods (Section 4) was to collect samples from the backfill of the tanks and at depths of 2, 6, and 10 feet. Although samples at contaminated sites were usually not in backfill, data were chosen that were within approximately 50 feet of the USTs, and at 2, 6, and 10-foot depths. The method of sampling was similar for both data sets since soil gas samples were collected by TRC using similar procedures.

In this comparison, total hydrocarbons are reported less light aliphatics and in $\mu\text{g/L}$ for both data sets. The total hydrocarbon (less light aliphatics) concentrations in the nonleaking data set were calculated from average RFs for BTEX. However, in the contaminated data set, total hydrocarbon concentrations (less light aliphatics) were calculated from the RF for benzene. Therefore, contaminated site data could be as much as 50 to 100 percent higher if it were reported on the basis of an average BTEX RF. A comparison of calculation methods and their effects on total hydrocarbon concentrations was presented in Section 6.

The sample size for the nonleaking data set was 279 samples from 25 sites. The sample size for the contaminated data set was 60 samples from 9 sites.

The descriptive statistics used to compare the nonleaking and contaminated data sets were: mean, median, upper quartile, and the relative frequency distribution percentages. These statistics are useful because they show the distribution of each data set and these distributions can be compared even though the sample sizes in each data set are different. The descriptive statistics for the nonleaking sites were shown in Table 12 and those for the contaminated sites are shown in Table 17. A comparison of these descriptive statistics are shown in Table 18 in $\mu\text{g/L}$ for total hydrocarbons (less light aliphatics). The relative frequency distribution for the nonleaking site data was shown in Figure 6 and that for the contaminated site data is shown in Figure 7.

TABLE 17. DISTRIBUTION OF CONTAMINATED SITE DATA FOR TOTAL HYDROCARBONS LESS LIGHT ALIPHATICS

Concentration Ranges (µg/L)	Number of Samples	Relative Frequency Distribution (%)	Cumulative Relative Frequency Distribution (%)
Not Detected	2	3.3	3.3
< 1,500	19	31.7	35.0
1,501 - 5,000	6	10.0	45.0
5,000 - 10,000	5	8.3	53.3
10,000 - 50,000	7	10.0	65.0
50,000 - 100,000	1	1.7	66.7
100,000 - 270,000	6	10.0	76.7
270,000 - 1,100,000	13	21.7	98.4
> 1,000,000	1	1.7	100.0
		100.0	100.0

Mean 160,000
Median 9,000
Upper Quartile 22,000

TABLE 18. COMPARISON OF NONLEAKING AND CONTAMINATED SITE DATA DISTRIBUTIONS FOR HYDROCARBONS LESS LIGHT ALIPHATICS

Concentration Ranges (µg/L)	Relative Frequency Percent Contaminated	Relative Frequency Percent NonLeaking
Not Detected	3.3	23.2
< 1,500	31.7	30.0
1,501 - 5,000	10.0	6.0
5,001 - 10,000	10.0	4.3
10,001 - 50,000	10.0	20.0
50,001 - 100,000	1.7	9.6
100,001 - 270,000	10.0	6.4
270,001 - 1,100,000	21.6	0.4
2,200,000	1.7	0.0
	100.0	100.0
Mean	160,000	23,300
Median	9,000	800
Upper Quartile	220,000	33,000

NON-CONTAMINATED SITE DATA DISTRIBUTION

TOTAL HYDROCARBONS LESS METHANE

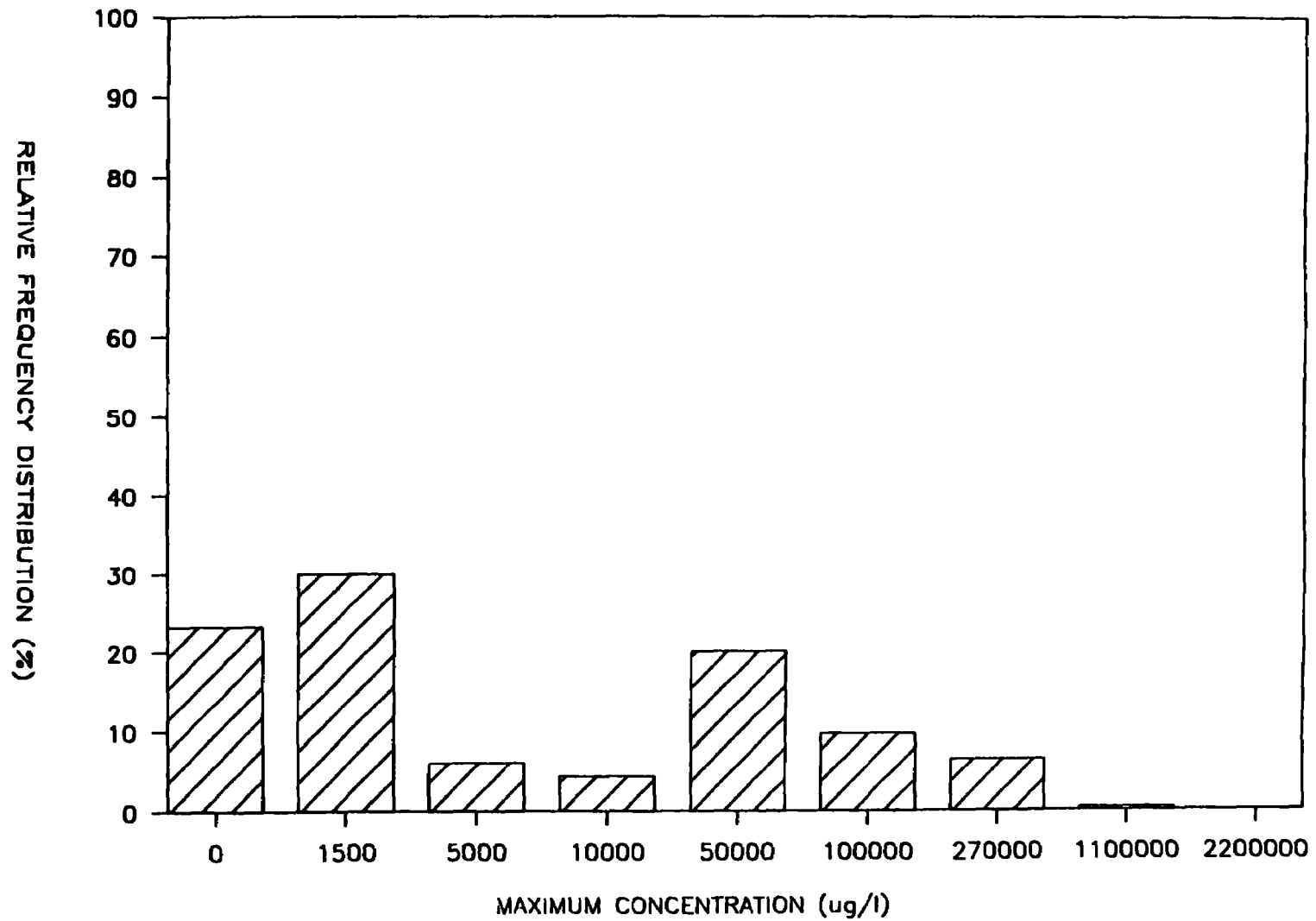


Figure 6. Non-contaminated site data distribution.

CONTAMINATED SITE DATA DISTRIBUTION

TOTAL HYDROCARBONS LESS METHANE

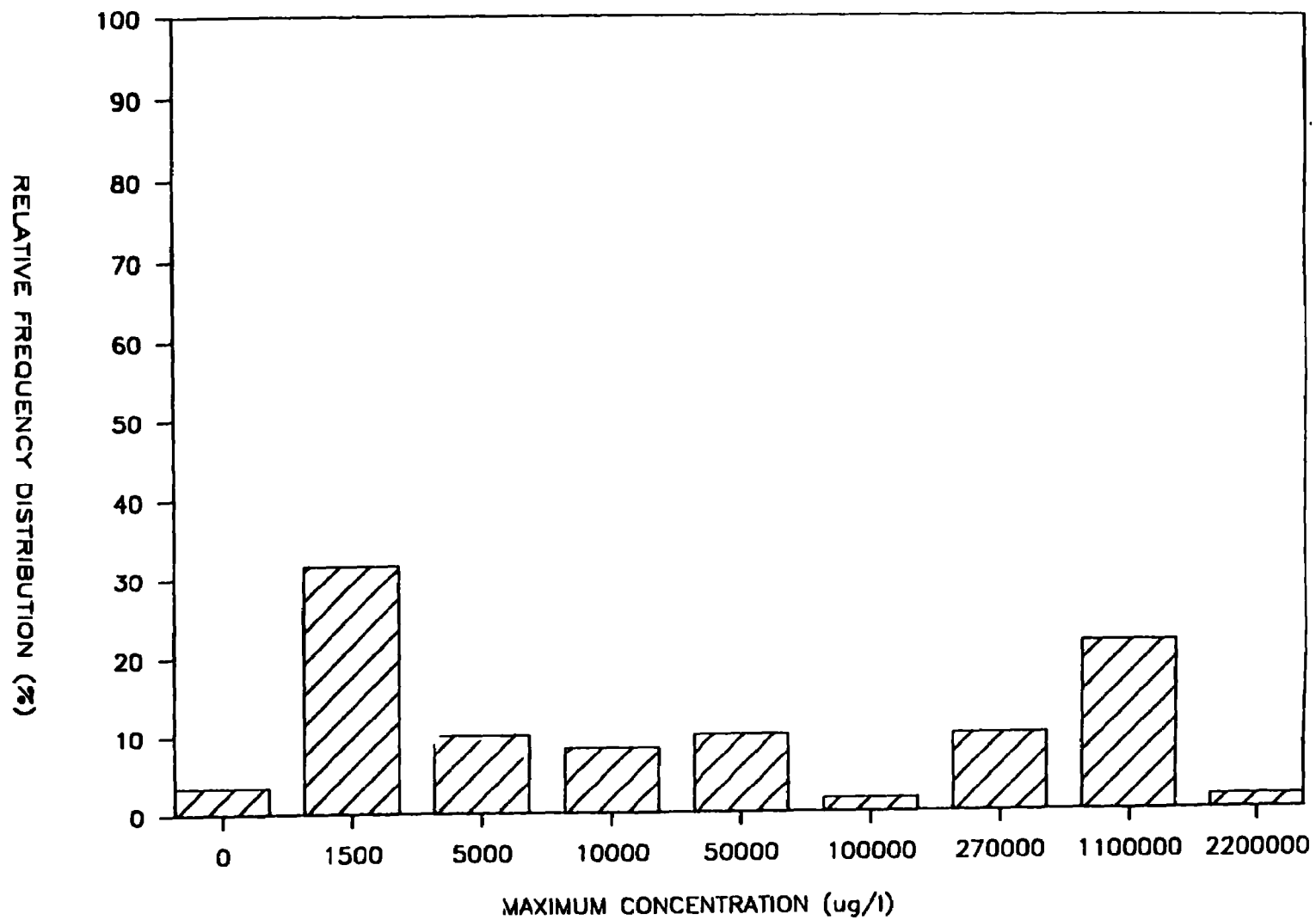


Figure 7. Contaminated site data distribution.

The relative frequency distributions show much variability in both data sets. Nine concentration ranges were selected to show this variability.

An evaluation of the means and medians gives additional information about these data sets. The mean is an arithmetic average that is computed by summing the concentration values and dividing by the total number of samples. The median is defined as the middle value after the samples have been arranged in order of magnitude (Hoel 1967).

In both data sets, the medians are much lower than the means. These differences show that both data distributions are skewed to the right with a majority of samples in the lower concentration ranges. The high mean values show the effect of a few high concentration values that exist in both data distributions.

Although similarities exist in the distribution of these data sets, some differences can also be seen. An order of magnitude difference exists between the mean of each data set, and between the medians of each data set. This suggests that although similarities exist in how these data sets are skewed, that an order of magnitude difference exists for much of the data.

The order of magnitude can best be seen in the concentration ranges above 10,000 $\mu\text{g/L}$. The relative frequency percentages from Table 18 are summarized below for concentrations above 10,000 $\mu\text{g/L}$, or about 3000 ppmv.

Concentration Ranges ($\mu\text{g/L}$)	Relative Frequency Percent	
	Nonleaking	Contaminated
10,000 - 100,000	29.6	13.4
100,000 - 2,200,000	6.9	33.3
	<u>36.5</u>	<u>46.7</u>

Most of the nonleaking samples occur in the 10,000 to 100,000 $\mu\text{g/L}$ range, while most of the contaminated samples occur above 100,000 $\mu\text{g/L}$.

The order of magnitude difference between the data sets can also be seen by comparing the upper quartiles of each data set. The definition of upper quartile is that 75 percent of the samples occur below the upper quartile (Hoel 1967).

The upper quartile for the nonleaking and contaminated data sets are 33,000 $\mu\text{g/L}$ and 220,000 $\mu\text{g/L}$, respectively.

The observed conclusions from these descriptive statistics is that both data sets contain much variability and both are skewed to the right. An order of magnitude difference exists between the data sets for concentrations above 10,000 $\mu\text{g/L}$. Statistical testing in Section 10, in the Non-Parametric Statistical Testing paragraph of this report, confirms the significance of these differences between the data sets.

NON-PARAMETRIC STATISTICAL TESTING

The purpose of statistical methods is to describe data quantitatively, and to draw inferences for decision-making (Kilpatrick 1987). The descriptive statistics have been examined in the previous sections, and these described the means, medians, upper quartiles, and relative frequency distributions for the data sets.

In this section, statistical methods are employed to determine what inferences can be made about the nonleaking site and contaminated site data sets.

The statistical testing in this data analysis served two purposes:

- The testing determined the significance of the observed statistical differences between the data sets (nonleaking and contaminated) noted in the descriptive statistics, and
- The testing delineated data patterns that existed among such parameters as location of site, depth of sample, tank material, tank age, and backfill material.

The types of statistical tests chosen were dictated by the characteristics of the data set distributions. These distributions, as described previously, did not appear to correspond to any known statistical distribution such as a normal distribution. Non-parametric statistical methods were used since these methods did not require that the sample data correspond to a known statistical distribution (Harval).

These statistical methods also introduce the element of probability as related to the drawing of conclusions. Probability was considered important in developing conclusions about these data sets because these data sets do not contain complete information about the entire data set of USTs that exist. Therefore, a probability must be attached to any conclusions made about the data sets. A discussion of the risks associated with statistical testing, and how these risks were controlled is given in Section 10 in the Risks Associated with Hypothesis Testing paragraph of this report.

The Risks Associated with Hypothesis Testing

There is always the possibility of making an incorrect decision when testing a hypothesis. This is because inferences about a particular distribution are based upon random samples from that distribution. A statistical hypothesis is simply an assumption or statement, which may or may not be true, concerning one or more populations.

There are two types of error or risk associated with the testing of any hypothesis. Type 1 error is the probability of rejecting a true null hypothesis, while Type 2 error is the probability of rejecting a true alternative hypothesis. A null hypothesis indicates that no differences exist between distributions. An alternate hypothesis indicates that differences do exist between distributions.

Type 1 error is usually controlled by setting the significance level of the test to a small value. This significance level, designated as p , numerically describes the probability that a particular hypothesis is true. Typically this value is set at 0.05. This corresponds to a confidence level (probability) of 95 percent. The significance level becomes a specification of the Type 1 error rate of probability.

Type 2 error is usually controlled by taking a properly-sized sample. This study did not consider the control of Type 2 error as a criteria for determining sample size. However, when large discrepancies exist between the information contained in the samples and the specification of the null hypothesis with respect to the samples, then the Type 2 error will generally be small.

When testing more than one hypothesis, the Type 1 error rate must be controlled. A simple example will demonstrate what happens to the Type 1 error rate when testing several hypotheses.

Suppose that each of 10 independent hypotheses are to be tested at a significance level of 0.05. If the null hypothesis is true in all 10 cases, the probability of detecting this is only 0.60. Therefore, the Type 1 error rate is 0.40, which is totally unacceptable. One way to control the Type 1 error rate when testing several hypotheses is to test each hypothesis at a reduced significance level. A good conservative procedure for determining the significance level in a multiple testing situation is the Bonferroni procedure. This procedure is described below.

If an overall Type 1 error rate of 0.05 is to be attained, the significance level for each hypothesis tested is computed by dividing 0.05 by the number of hypotheses to be tested.

In the example above, the significance level of each hypothesis should be:

$$0.05/10 = 0.005$$

Thus, if each hypothesis is tested at a Type 1 error rate of 0.005, then an overall Type 1 error rate of 0.05 will be maintained. There were 16 statistical tests performed in this study. Therefore, in order to maintain an overall Type 1 error rate of 0.05 for this study, each hypothesis was tested at a Type 1 error rate of 0.003.

Comparison of Nonleaking Site and Contaminated Site Data Distributions

The descriptive statistics showed some similarities in how the nonleaking and contaminated site data were distributed. The distribution of both data sets were skewed to the right with a majority of samples in the lower concentration ranges. However, an order of magnitude difference existed in the data above 10,000 $\mu\text{g/L}$. This difference was seen by a comparison of the means, medians, and upper quartiles of each data set. In this section of the report, a non-parametric test is used to compare these data sets. This test

will determine if the distributions of these data sets are significantly different.

The non-parametric test used for this comparison is the Two-Sample Wilcoxon Rank Sum Procedure (Siegel 1956). This test is designed to determine if two independent samples are from different distributions. Since the sample values within each data set contain much variability, the question is whether the differences observed between the data sets signify genuine differences in distributions or whether they represent differences that can be expected between two random samples from the same distribution.

The Wilcoxon technique tests the null hypothesis that two independent samples come from identical distributions. This is called a null hypothesis because it assumes that there is no difference between distributions. If the outcome of the test rejects the null hypothesis (that is, $p < 0.003$), then it can be concluded that the samples came from two different distributions.

This test was computed using a computer software package called Stat-graph. In most cases, the data used in this test represent the mean of three GC/FID injections for each sample. The concentrations at non-detection levels were approximated by dividing the detection limit in half.

The outcome of this test is show below.

<u>Distribution</u>	<u>Sample Size</u>	<u>Average Rank</u>	<u>Level of Significance</u>
Nonleaking	279	160	0.00008
Contaminated	60	215	

This test result shows that there is a significant difference ($p < 0.003$) between the distributions of the nonleaking and contaminated site data. This test result confirms that the distributions of nonleaking and contaminated data, as shown in Table 18, actually represent two different distributions.

Non-Parametric Testing for Data Patterns Within the Nonleaking Data

Non-parametric techniques can be used to identify patterns in the non-leaking data set if they exist. The results of non-parametric testing can be used to draw inferences about the data.

The purpose of this testing was to examine the effects that different parameters had on the data. These parameters included site location sample depth, tank material, tank age, and backfill material. The testing was designed so that independent effects from each parameter could be seen. However, insufficient data were available to delineate the individual effect of tank material, tank age, and backfill material.

The determination of insufficient data was made from observations about the data at a time when further data could not be collected (i.e., the field investigation had been completed). Two observations were made:

- All the fiberglass tanks used pea gravel backfill and corresponded to newer tank ages (1978 to 1984), and
- All the steel tanks used sand backfill and corresponded to older tank ages (1940 to 1984).

The data could not be separated to distinguish between tank materials, tank age, and backfill material. In this analysis, these three parameters are combined and referred to as either a steel tank system or a fiberglass tank system. The presentation of test results are organized according to the parameters of location, sample depth, and steel or fiberglass tank systems. Test results that involve fiberglass tank systems are only shown for the locations of Austin, Texas, Suffolk County, New York and San Diego, California, since no fiberglass tank systems were sampled in Providence, Rhode Island or Storrs, Connecticut.

Location--

The first parameter examined was site location. The Kruskal-Wallis One-Way Analysis of Variance by Ranks (Siegel 1956) was chosen to test the null hypothesis that samples from different locations come from the same distribution.

This testing was again accomplished by the use of the Statgraph computer software package. In order to test only for the effect of location, the data set was broken down into subsets corresponding to sample depth and the combined group of tank material, tank age, and backfill material. The above breakdown yields six subsets as follows:

- fiberglass tank systems at sample depths of 2, 6, and 10 feet, and
- steel tank systems at sample depths of 2, 6, and 10 feet.

The mean concentrations for each sample were used as data. The concentrations below detection limits were set to positive values at the detection limits to represent the worst case for concentrations at these sample points.

The results of these tests are shown in Table 19 for the steel tank systems and Table 20 for the fiberglass tank systems.

The subsets consisting of steel tank systems at 2, 6, and 10 foot sample depths show significance at $p < 0.003$. The interpretation of these results is that the null hypothesis, which states that these subset samples are from the same distribution set, must be rejected. It is concluded that significant differences do exist among the total hydrocarbon (less light aliphatics) vapor concentrations from the five locations studied for steel tank systems. The differences were significant at all three sample depths (2, 6, and 10 feet).

The average rank is an indication of how these concentrations were ranked. The total hydrocarbon concentrations in Austin, Texas and San Diego, California, were greater than in Providence, Rhode Island, Suffolk County, New York, and Storrs, Connecticut.

The subsets consisting of fiberglass tank systems at each of the 2, 6, and 10 foot sample depths do not show significance ($p > 0.003$) at any of the sample depths. The interpretation is that the null hypothesis, which states that these subset samples are from the same distribution, is accepted. It is concluded that no significant differences exist among the total hydrocarbons (less light aliphatics) vapor concentrations from the three locations studied for fiberglass tank systems. This conclusion can also be seen by examining the average ranks. The value of these ranks are similar within each sample depth subset.

Sample Depth--

The second parameter examined was sample depth. The analysis was designed to determine if differences existed among samples taken at different depths. This analysis is based on the assumption that samples taken from different depths within a hole are related, and the tests determine if data at different sample depths have been drawn from the same distribution.

Two non-parametric tests were chosen. These were the Page L Test for Ordered Alternatives based on Friedman Rank Sums, and the Wilcoxon Matched-Pairs Signed-Ranks Test (Siegel 1956).

The Page L Test was chosen to test the null hypothesis that data at different sample depths have been drawn from the same distribution. If differences do exist, this test also reveals how these data are ordered. Specifically, this test will determine if one of the following trends exist for total hydrocarbon (less light aliphatics) vapor concentrations taken from nonleaking sites:

$$2' < 6' = 10'$$

$$2' = 6' < 10'$$

$$2' < 6' < 10'$$

$$2' = 10' < 6'$$

If test results show a level of significance ($p < 0.003$) then the null hypothesis is rejected and one of these conditions exist.

In cases where these test results showed a level of significance for a particular data subset, the Wilcoxon Matched-Pairs Signed-Ranks Test was employed to further test the following hypotheses for total hydrocarbon (less light aliphatics) vapor concentrations at nonleaking sites:

$$2' < 6'$$

$$6' < 10'$$

$$2' < 10'$$

A separate calculation was required to test for each of these conditions.

TABLE 19.. RESULTS OF KRUSKAL-WALLIS TESTS FOR LOCATIONS WITH
STEEL TANK SYSTEMS USING NONLEAKING DATA

Steel Tank Systems Sample Depth	Location	Sample Size	Average Rank	Significance Level
= 2 Foot	Austin, TX	14	51	0.000003
	San Diego, CA	29	49	
	Providence, RI	14	30	
	Suffolk County, NY	8	20	
	Storrs, CT	10	15	
= 6 Foot	San Diego, CA	28	48	0.00002
	Austin, TX	13	43	
	Suffolk County, NY	6	28	
	Providence, RI	15	22	
	Storrs, CT	9	17	
= 10 Foot	San Diego, CA	17	33	0.0006
	Austin, TX	11	27	
	Suffolk County, NY	5	18	
	Providence, RI	11	14	
	Storrs, CT	3	7	

TABLE 20. RESULTS OF KRUSKAL-WALLIS TESTS FOR LOCATIONS WITH
FIBERGLASS TANK SYSTEMS USING NONLEAKING DATA

Fiberglass Tank Systems Sample Depth	Location	Sample Size	Average Rank	Significance Level
= 2 Foot	Suffolk County, NY	10	21	0.06
	Austin, TX	9	20	
	San Diego, CA	14	12	
= 6 Foot	Suffolk County, NY	11	18	0.4
	Austin, TX	8	14	
	San Diego, CA	11	14	
= 10 Foot	San Diego, CA	8	13	0.5
	Suffolk County, NY	9	12	
	Austin, TX	5	9	

The benefits in using the Wilcoxon Test as a supplement to the Page L test are not only to determine exactly how the data at different depths are ordered, but also to utilize more data from the nonleaking data set. There were service stations in San Diego and Austin in which shallow perched water zones were encountered that precluded taking samples at 10 feet. Therefore, soil gas samples were only collected at 2- and 6-foot depths. By using the Wilcoxon Test, these data could also be utilized. The computations for both techniques (Page L and Wilcoxon) were done by hand, under the direction of a qualified statistician.

The results of the Page L Tests and the Wilcoxon Tests are shown in Tables 21 and 22, respectively. These test results show variations in significance levels at individual locations in both the steel and fiberglass tank systems. A summary of the significant test results is given below.

- 1) Two significant test results were shown from the Page L Test for the overall data. The significant differences were among total hydrocarbon (less light aliphatics) vapor concentrations at the different sample depths (2, 6, and 10 feet) for both steel and fiberglass tank systems. The overall test represents data that are combined from the different locations.
- 2) Significant test results were also shown from the Page L Test for individual locations. There were significant differences among total hydrocarbon (less light aliphatics) vapor concentrations at the different sample depths (2, 6, and 10 feet) for steel tank systems in San Diego, California and for fiberglass tank systems in San Diego, California and Suffolk County, New York.
- 3) One significant test result was shown from the Wilcoxon Test for San Diego, California. The significant difference was shown in the test of 2' < 6'. Therefore, total hydrocarbon (less light aliphatics) concentrations are greater at 6 feet than at 2 feet for the steel tank system in San Diego, California.

The variations in significance at the different locations could be due to two factors: 1) the differences in the locations, such as geology, hydrology, backfill material, etc., and 2) insufficient data to detect significant differences using the statistical methods.

Unfortunately, the paired-sample Wilcoxon Test is not as sensitive as the Page L Test for detecting significant differences. This is due to the nature of the null distribution of the paired-sample Wilcoxon Test for small samples. Thus, even though the Page L Test may have detected significant differences in total hydrocarbon concentrations between the three sample depths, the paired-sample Wilcoxon may not uncover the nature of these differences. Also, the Wilcoxon could only be applied in cases where the sample size was greater than nine samples.

TABLE 21. RESULTS OF PAGE L TEST FOR DIFFERENCES IN DATA
ACCORDING TO SAMPLE DEPTH

	Location	Sample Size	Significance Level
<u>Steel Tank Systems</u>			
	Austin, TX	11	<0.05
	Suffolk County, NY	3	>0.05
	San Diego, CA	15	<0.001
	Providence, RI	5	>0.05
	Overall	34	<0.0002
<u>Fiberglass Tank Systems</u>			
	Austin, TX	6	<0.05
	Suffolk County, NY	7	<0.001
	San Diego, CA	8	<0.001
	Overall	21	<0.0002

TABLE 22. RESULTS OF WILCOXON TESTS FOR DIFFERENCES IN DATA
ACCORDING TO SAMPLE DEPTH

	Location	Test	Sample Size	Significance Level
<u>Steel Tank Systems</u>				
	San Diego, CA	2'<6'	24	<0.001
	San Diego, CA	6'<10'	16	0.004
	San Diego, CA	2'<10'	11	0.0012

Each of the paired-sample Wilcoxon Tests were tested at individual significance levels of 0.0015. This was derived by dividing 0.003 by two, since two independent test cases (2'<6' and 6'<10') were performed.

Conclusions from Non-Parametric Tests Within the Nonleaking Data--

The data patterns associated with site location and sample depth were delineated by the use of Kruskal-Wallis, Page L and Wilcoxon non-parametric statistical methods. The Kruskal-Wallis method, used to delineate patterns according to location, revealed that significant differences in total hydrocarbon (less light aliphatics) vapor concentrations among the five locations studied for steel tank systems. The differences were significant at all three sample depths (2, 6, and 10 feet). There were no significant differences between the total hydrocarbon (less light aliphatics) vapor concentrations at the three locations studied for fiberglass tank systems.

The Page L method, used to delineate patterns according to sample depths, revealed that significant differences exist between the total hydrocarbon (less light aliphatics) vapor concentrations among the different sample depths (2, 6, and 10 feet) for both steel and fiberglass tank systems.

The results of these tests indicate that data from steel tank systems at different locations and sample depths represent significantly different data distributions. Also, data from fiberglass tank systems from all locations, but at different sample depths, represent significantly different distributions.

The means, medians, lower, and upper quartiles are shown in Table 23 for the steel tank systems and Table 24 for the fiberglass tank systems for total hydrocarbon (less light aliphatics) vapor concentrations in $\mu\text{g/L}$.

The difference in total hydrocarbon (less light aliphatics) vapor concentrations at different sample depths can be seen in these tables. The steel tank systems in Austin, Texas, San Diego, California, and Suffolk County, New York show increasing concentrations with depths in the means, medians, and lower and upper quartiles. The differences in concentrations at the different locations can also be seen.

RESULTS AND CONCLUSIONS OF DATA ANALYSIS

The distribution of total hydrocarbon (less light aliphatics) vapor concentrations was skewed to the right with a majority of samples in the lower concentration ranges. The relative frequency distribution showed 53.2 percent of the samples below 1,500 $\mu\text{g/L}$ and 93.1 percent below 100,000 $\mu\text{g/L}$. The median was 800 $\mu\text{g/L}$ and the mean was 23,300 $\mu\text{g/L}$. The difference between the mean and the median is because of a few high concentration values.

The distribution of total hydrocarbon (including light aliphatics) vapor concentrations showed that 21 percent more samples existed above 100,000 $\mu\text{g/L}$ as compared to total hydrocarbons (less light aliphatics). High concentrations of methane were seen at many of the sites. These concentrations are probably due to decomposition of the background hydrocarbons as well as naturally occurring methane.

TABLE 23. DESCRIPTIVE STATISTICS FOR TOTAL HYDROCARBON LESS
LIGHT ALIPHATICS CONCENTRATIONS IN STEEL TANK SYSTEMS
AT DIFFERENT LOCATIONS AND SAMPLE DEPTHS ($\mu\text{g/L}$)

	Sample Depth		
	2 Foot	6 Foot	10 Foot
Austin, TX			
Mean	41000	24000	120000
Median	15000	16500	12000
Lower Quartile	570	380	160
Upper Quartile	36000	35000	36000
Providence, RI			
Mean	1700	1200	1300
Median	1	0.3	0.1
Lower Quartile	Detection Limit	Detection Limit	Detection Limit
Upper Quartile	0.1	450	350
San Diego, CA			
Mean	30000	44000	72000
Median	27000	41000	71000
Lower Quartile	5100	2400	39000
Upper Quartile	37000	70000	104000
Storrs, CT			
Mean	270	5300	1.0
Median	Detection Limit	0.3	0.06
Lower Quartile	Detection Limit	Detection Limit	Detection Limit
Upper Quartile	1.0	11.0	3.0
Suffolk County, NY			
Mean	5300	16000	27000
Median	1.6	1100	110
Lower Quartile	Detection Limit	Detection Limit	Detection Limit
Upper Quartile	2100	39000	36000

TABLE 24. DESCRIPTIVE STATISTICS FOR TOTAL HYDROCARBON LESS
LIGHT ALIPHATICS CONCENTRATIONS IN FIBERGLASS TANK
SYSTEMS AT DIFFERENT DEPTHS ($\mu\text{g/L}$)

	Sample Depth		
	2 Foot	6 Foot	10 Foot
Mean	16143	21689	49133
Median	28	780	5850
Lower Quartile	0.1	2	27
Upper Quartile	21000	38500	58000

Although much variability existed in both the nonleaking and contaminated data, significant differences could be seen between the two distributions. Both distributions were skewed to the right with a majority of samples in the lower concentration ranges. However, an order of magnitude difference existed between the mean of each data set, and between the median of each data set. The order of magnitude was best seen in concentrations above 10,000 $\mu\text{g/L}$. Of the nonleaking samples, 29.6 percent occurred in the range of 10,000 to 100,000 $\mu\text{g/L}$ while 33.3 percent of the contaminated samples occurred in the range above 100,000 $\mu\text{g/L}$.

SECTION 11

CONCLUSIONS AND RECOMMENDATIONS FOR FURTHER STUDY

CONCLUSIONS

The following conclusions are derived from the results of this study:

- UST sites evaluated in this study where total hydrocarbon (less light aliphatics) concentrations in soil vapor exceeded 100,000 µg/L (27,000 ppmv) were generally considered contaminated, whereas sites that exhibited vapor values less than 100,000 µg/L typically had not had a release and were considered nonleaking. This apparent threshold value of 100,000 µg/L (27,000 ppmv) of total hydrocarbon (less light aliphatics) vapors may be used to help differentiate between nonleaking and contaminated sites.
- Calculation of total hydrocarbon values as **BTEX** based on the average of the RFs for benzene, toluene, ethylbenzene, and ortho-xylene provides a more accurate representation than when calculated as benzene.
- Because of the regional variability of the data collected in this study, any soil vapor concentration limits that are to be utilized to differentiate between contaminated and nonleaking sites may best be established on a regional or local basis.
- Soil gas techniques can effectively be used to evaluate the backfill areas of underground gasoline storage tanks to determine if significant leaks exist, especially if appropriate regional or local threshold levels are established.
- Limited analysis of butane vapor concentrations indicates that butane analysis may be useful in detecting recent leaks or spills.

RECOMMENDATIONS FOR FURTHER STUDY

Analysis of the data collected in this study revealed several areas where additional study would be useful in developing a more complete understanding of the occurrence and characteristics of soil gas at both clean and contaminated underground gasoline storage tank sites. Recommendations for further study are:

- Develop a standardized method for reporting soil gas concentrations in the backfill areas of USTs. This can be done by a more thorough

analysis of soil gas in each of the three geographical areas used in this study. The objectives would be to measure the concentrations, develop simplified calculations to be used in reporting the concentration values and determine the appropriate assumptions and approximations.

- Determine the minimum amount of data required to decide if a site is contaminated by a leak. The objectives would be to determine the required number and locations of sampling points, the number of samples above a specified threshold limit that would be acceptable, and whether butane concentrations can be used to distinguish between a leak and a spill.
- Determine the effects of geology, backfill material, tank age, and tank material on soil gas concentrations. A sufficient amount of data was not collected in this study to determine the effects of these parameters.
- Examine the dispersion and decomposition of contamination by additional sampling at Austin 6, taking advantage of the recent documented spill.
- Determine the effects of a leaking pipeline on an UST system as compared to the effects of only a leaking tank.

SECTION 12

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APPENDIX A

TANK SUMMARY

FIBERGLASS TANKS

Installation Date	Type of product	Capacity in gallons
1978	Diesel	12000
1980	Super Unleaded	10000
1980	Unleaded	10000
1980	Unleaded	10000
1980	Regular	10000
1980	Super Unleaded	10000
1980	Regular	10000
1981	Unleaded	10000
1981	Super Unleaded	10000
1981	Diesel	10000
1981	Regular	10000
1981	Diesel	10000
1982	Unleaded	10000
1982	Unleaded	10000
1982	Regular	10000
1982	Regular	10000
1982	Super Unleaded	10000
1982	Super Unleaded	10000
1983	Unleaded	10000
1983	Super Unleaded	6000
1983	Super Unleaded	6000
1983	Regular	8000
1983	Unleaded	10000
1983	Regular	8000
1984	Unleaded	10000
1984	Diesel	10000
1984	Regular	10000
1984	Unleaded	12000
1984	Super Unleaded	10000
1984	Regular	10000
1984	Diesel	10000
1984	Super Unleaded	10000
1984	Diesel	10000
1984	Regular	10000
1984	Unleaded	10000
1984	Super Unleaded	12000
1984	Kerosene	6000

Total No. of FRP Tanks = 37

STEEL TANKS

Installation Date	Type of product	Capacity in gallons
1940	Regular	5000
1940	Unleaded	5000
1961	Regular	4000
1961	Unleaded	4000
1961	Super Unleaded	6000
1965	Not Known	6000
1965	Not Known	6000
1965	Unleaded	4000
1965	Unleaded	4000
1965	Regular	8000
1965	Unleaded	10000
1965	Not Known	6000
1965	Unleaded	6000
1965	Super Unleaded	6000
1965	Unleaded	6000
1965	Regular	6000
1965	Super Unleaded	4000
1965	Regular	4000
1965	Super Unleaded	4000
1965	Super Unleaded	4000
1965	Super Unleaded	4000
1965	Not Known	6000
1966	Super Unleaded	4000
1966	Regular	4000
1966	Regular	5000
1966	Unleaded	1500
1966	Super Unleaded	4000
1966	Unleaded	4000
1966	Unleaded	4000
1966	Unleaded	4000
1966	Regular	5000
1967	Unleaded	10000
1967	Regular	8000
1967	Super Unleaded	6000
1968	Unleaded	4000
1968	Diesel	4000
1968	Regular	4000
1968	Super Unleaded	4000
1968	Super Unleaded	4000
1968	Unleaded	4000
1971	Super Unleaded	10000
1971	Regular	10000
1971	Unleaded	10000
1972	Unleaded	8000
1972	Regular	8000
1972	Unleaded	8000
1972	Super Unleaded	6000
1972	Regular	8000

(continued)

STEEL TANKS (Continued)

Installation Date	Type of product	Capacity in gallons
1972	Super Unleaded	8000
1972	Super Unleaded	8000
1973	Super Unleaded	8000
1973	Regular	8000
1973	Unleaded	8000
1973	Regular	8000
1973	Unleaded	8000
1973	Super Unleaded	8000
1976	Unleaded	8000
1976	Regular	8000
1976	Super Unleaded	8000
1978	Diesel	2000
1984	Unleaded	5000
1984	Unleaded	8000
1984	Regular	8000
1984	Super Unleaded	8000
1985	Super Unleaded	5000

Total No. of Steel Tanks = 63

APPENDIX B
SUMMARY OF FIELD NOTES AND CONDITIONS

NOTE: 999 = Not Analyzed

Sta- tion	Sample No.	Sample		Evacuation		Hydro- carbon Odor	Temp. (F)	Barometric		Soil Type	Fill Material	Probe Penetration	Use of Hammer	Depth to Water (ft)
		Depth (ft)	Vacuum (in. Hg)	Duration (sec.)				Pressure (in. Hg)						
AU1	SG1-02	2.	3.	30.	None	78.	29.57	Native	Sand	Soft	No	A		
AU1	SG1-06	6.	13.	120.	None	83.	29.57	Native	Sand	Hard	Yes	A		
AU1	SG1-10	10.	6.	90.	None	83.	29.57	Native	Sand	Hard	Yes	A		
AU1	SG2-02	2.	3.	30.	Strong	79.	29.57	Native	Sand	Soft	No	A		
AU1	SG2-06	6.	2.	30.	Strong	81.	29.57	Native	Sand	Hard	Yes	A		
AU1	SG2-10	10.	2.	30.	Strong	80.	29.57	Native	Sand	Hard	Yes	A		
AU1	SG3-02	2.	2.	30.	Strong	84.	29.56	Backfill	Sand	Soft	No	A		
AU1	SG3-06	6.	2.	30.	Strong	84.	29.56	Backfill	Sand	Soft	No	A		
AU1	SG3-10	10.	7.	90.	Strong	84.	29.56	Backfill	Sand	Soft	No	A		
AU1	SG4-02	2.	2.	30.	None	88.	29.53	Backfill	Gravel	Soft	No	A		
AU1	SG4-06	6.	2.	30.	None	89.	29.53	Backfill	Gravel	Soft	No	A		
AU1	SG4-10	10.	2.	60.	None	89.	29.53	Backfill	Gravel	Soft	No	A		
AU1	SG5-02	2.	2.	30.	Strong	87.	29.49	Backfill	Sand	Soft	No	A		
AU1	SG5-06	6.	18.	120.	Strong	87.	29.49	Backfill	Sand	Soft	No	A		
AU1	SG5-10	10.	9.	120.	Strong	86.	29.49	Backfill	Sand	Hard	Yes	A		
AU2	SG1-02	2.	2.	30.	Strong	69.	29.52	Backfill	Sand	Soft	No	A		
AU2	SG1-06	6.	2.	30.	Strong	69.	29.52	Backfill	Sand	Soft	No	A		
AU2	SG1-10	10.	2.	60.	Strong	70.	29.52	Backfill	Sand	Soft	No	A		
AU2	SG2-02	2.	2.	30.	Strong	73.	29.54	Backfill	Sand	Soft	No	A		
AU2	SG2-06	6.	2.	30.	Strong	74.	29.54	Backfill	Sand	Soft	No	A		
AU2	SG2-08	8.	2.	60.	Strong	73.	29.54	Native	Sand	Hard	Yes	A		
AU2	SG3-02	2.	7.	60.	Strong	78.	29.49	Backfill	Sand	Soft	No	A		
AU2	SG3-06	6.	2.	30.	Strong	78.	29.49	Backfill	Sand	Soft	No	A		
AU2	SG3-10	10.	2.	60.	Strong	80.	29.49	Backfill	Sand	Soft	No	A		
AU2	SG4-02	2.	2.	30.	Strong	84.	29.48	Backfill	Sand	Soft	No	A		
AU2	SG4-06	6.	3.	40.	Strong	84.	29.48	Backfill	Sand	Soft	No	A		
AU2	SG4-10	10.	2.	60.	Strong	85.	29.48	Backfill	Sand	Soft	No	A		
AU2	SG5-02	2.	2.	30.	Strong	85.	29.41	Backfill	Sand	Soft	No	A		
AU2	SG5-06	6.	2.	30.	Strong	85.	29.41	Backfill	Sand	Soft	No	A		
AU2	SG5-10	10.	2.	60.	Strong	85.	29.41	Backfill	Sand	Soft	No	A		
AU3	SG1-02	2.	2.	30.	None	67.	29.62	Backfill	Gravel	Soft	No	A		
AU3	SG1-06	6.	2.	30.	Slight	67.	29.62	Backfill	Gravel	Soft	No	A		

(Continued)

Sta- tion	Sample No.	Sample		Evacuation		Hydro- carbon Odor	Temp. (F)	Barometric		Soil Type	Fill Material	Probe Penetration	Use of Hammer	Depth to Water (ft)
		Depth (ft)	Vacuum (in. Hg)	Duration (sec.)				Pressure (in. Hg)						
AU3	SG1-10	10.	2.	60.		Strong	67.	29.62		Backfill	Gravel	Soft	No	A
AU3	SG2-02	2.	2.	30.		Strong	72.	29.63		Backfill	Gravel	Soft	No	A
AU3	SG2-06	6.	2.	30.		Strong	72.	29.63		Backfill	Gravel	Soft	No	A
AU3	SG2-10	10.	2.	60.		Strong	78.	29.63		Backfill	Gravel	Soft	No	A
AU3	SG3-02	2.	2.	30.		Slight	84.	29.59		Backfill	Gravel	Soft	No	A
AU3	SG3-06	6.	2.	30.		Strong	84.	29.59		Backfill	Gravel	Soft	No	A
AU3	SG4-02	2.	2.	30.		Slight	82.	29.57		Backfill	Gravel	Soft	No	A
AU3	SG4-06	6.	2.	85.		Strong	85.	29.57		Backfill	Gravel	Soft	No	A
AU3	SG4-10	10.	2.	60.		Strong	85.	29.57		Backfill	Gravel	Soft	No	A
AU3	SG5-02	2.	2.	30.		Slight	85.	29.57		Backfill	Gravel	Soft	No	A
AU3	SG5-06	6.	2.	30.		Strong	85.	29.57		Backfill	Gravel	Soft	No	A
AU3	SG5-10	10.	2.	60.		Strong	85.	29.57		Backfill	Gravel	Soft	No	A
AU4	SG1-02	2.	2.	30.		Strong	62.	29.55		Backfill	Gravel	Soft	No	A
AU4	SG1-06	6.	2.	30.		Strong	63.	29.55		Backfill	Gravel	Soft	No	A
AU4	SG1-10	10.	999.			Strong	63.	29.55		Backfill	Gravel	Soft	No	10.
AU4	SG2-02	2.	2.	30.		None	71.	29.56		Backfill	Gravel	Soft	No	A
AU4	SG2-06	6.	2.	30.		None	72.	29.56		Backfill	Gravel	Soft	No	A
AU4	SG2-10	10.	0.	0.		None	72.	29.56		Backfill	Gravel	Soft	No	10.
AU4	SG3-02	2.	2.	30.		Strong	72.	29.56		Backfill	Gravel	Soft	No	A
AU4	SG3-06	6.	2.	30.		Strong	72.	29.56		Backfill	Gravel	Soft	No	A
AU5	SG1-02	2.	3.	30.		Slight	85.	29.89		Backfill	Sand	Soft	No	A
AU5	SG1-06	6.	2.	30.		Strong	85.	29.89		Backfill	Sand	Soft	No	A
AU5	SG1-10	10.	15.	60.		Strong	90.	29.84		Backfill	Sand	Soft	No	A
AU5	SG2-02	2.	2.	30.		Strong	999.	999.		Backfill	Sand	Soft	No	A
AU5	SG2-06	6.	2.	30.		Strong	999.	999.		Backfill	Sand	Soft	No	A
AU5	SG2-10	10.	15.	60.		Strong	999.	999.		Backfill	Sand	Soft	No	10.
AU5	SG3-02	2.	2.	30.		Strong	90.	29.83		Backfill	Sand	Soft	No	A
AU5	SG3-06	6.	999.			Strong	999.	999.		Backfill	Sand	Not	No	6.
AU5	SG4-02	2.	2.	30.		Strong	999.	999.		Backfill	Sand	Soft	No	A
AU5	SG4-10	10.	999.			Not	999.	999.		Backfill	Sand	Not	Not	10.
AU5	SG5-1 5	1.5	2.	30.		Strong	999.	999.		Backfill	Sand	Soft	No	A
AU6	SG1-02	2.	4.	30.		Strong	999.	999.		Backfill	Gravel	Soft	No	A

(Continued)

Sta- tion	Sample No.	Sample		Evacuation Duration (sec.)	Hydro- carbon Odor	Temp. (F)	Barometric		Soil Type	Fill Material	Probe Penetration	Use of Hammer	Depth to Water (ft)
		Depth (ft)	Vacuum (in. Hg)				Pressure (in. Hg)						
AU6	SG1-06	6.	4.	30.	Strong	999.	999.	Backfill	Gravel	Soft	No	A	
AU6	SG2-02	2.	4.	30.	Strong	65.	29.96	Backfill	Gravel	Soft	No	A	
AU6	SG2-02	2.	2.	30.	Strong	81.	29.90	Backfill	Gravel	Soft	No	A	
AU6	SG2-06	6.	3.	30.	Strong	69.	29.96	Backfill	Gravel	Soft	No	A	
AU6	SG2-06	6.	2.	30.	Strong	81.	29.90	Backfill	Gravel	Soft	No	A	
AU6	SG3-02	2.	8.	45.	Slight	79.	29.96	Backfill	Gravel	Soft	No	A	
AU6	SG3-02	2.	13.	60.	Slight	71.	29.97	Backfill	Gravel	Soft	No	A	
AU6	SG3-06	6.	8.	45.	Strong	80.	29.96	Backfill	Gravel	Soft	No	A	
AU6	SG3-06	6.	3.	30.	Strong	72.	29.98	Backfill	Gravel	Soft	No	A	
AU6	SG4-02	2.	4.	30.	Strong	72.	29.97	Backfill	Gravel	Soft	No	A	
AU6	SG4-02	2.	3.	30.	Strong	73.	29.89	Backfill	Gravel	Soft	No	A	
AU6	SG4-06	6.	2.	30.	Strong	72.	29.96	Backfill	Gravel	Soft	No	A	
AU6	SG4-06	6.	3.	30.	Strong	70.	29.88	Backfill	Gravel	Soft	No	A	
AU6	SG5-02	2.	3.	30.	Strong	78.	29.89	Backfill	Gravel	Soft	No	A	
AU6	SG5-02	2.	5.	30.	Strong	78.	29.96	Backfill	Gravel	Soft	No	A	
AU6	SG5-06	6.	3.	30.	Strong	75.	29.89	Backfill	Gravel	Soft	No	A	
AU6	SG5-06	6.	5.	30.	Strong	79.	29.96	Backfill	Gravel	Soft	No	A	
AU7	SG1-02	2.	2.	30.	None	77.	29.96	Backfill	Gravel	Soft	No	A	
AU7	SG1-06	6.	2.	30.	None	79.	29.96	Backfill	Gravel	Soft	No	A	
AU7	SG2-02	2.	3.	30.	Slight	64.	30.12	Backfill	Gravel	Soft	No	A	
AU7	SG2-06	6.	3.	30.	Strong	61.	30.12	Backfill	Gravel	Soft	No	A	
AU7	SG3-02	2.	3.	30.	Slight	62.	30.12	Backfill	Gravel	Soft	No	A	
AU7	SG3-06	6.	4.	30.	Strong	64.	30.11	Backfill	Gravel	Soft	No	A	
AU7	SG4-02	2.	2.	30.	Slight	64.	30.12	Backfill	Gravel	Soft	No	A	
AU7	SG4-06	6.	3.	30.	Strong	66.	30.12	Backfill	Gravel	Soft	No	A	
CONN1	SG1-02	2.	13.	90.	None	34.	29.99	Native	Sand	Hard	Yes	A	
CONN1	SG1-06	6.	19.	135.	None	32.	29.98	Native	Sand	Hard	Yes	A	
CONN1	SG1-10	10.	13.	90.	None	29.	29.91	Native	Sand	Hard	Yes	A	
CONN1	SG2-02	2.	7.	90.	None	33.	29.86	Backfill	Sand	Medium	Yes	A	
CONN1	SG2-06	6.	17.	150.	None	30.	29.87	Backfill	Sand	Soft	No	A	
CONN1	SG2-10	10.	20.	240.	None	31.	29.83	Backfill	Sand	Soft	No	10.	
CONN1	SG3-02	2.	18.	120.	Slight	32.	29.82	Native	Sand	Hard	Yes	A	

(Continued)

Sta- tion	Sample No.	Sample Depth (ft)	Evacuation Vacuum (in. Hg)	Duration (sec.)	Hydro- carbon Odor	Temp. (F)	Barometric Pressure (in. Hg)	Soil Type	Fill Material	Probe Penetration	Use of Hammer	Depth to Water (ft)
CONN1	SG3-06	6.	18.	120.	Slight	999.	999.	Native	Sand	Hard	Yes	A
CONN1	SG3-10	10.	20.	60.	None	41.	29.65	Native	Sand	Hard	Yes	10.
CONN1	SG4-02	2.	12.	75.	None	41.	29.72	Native	Sand	Soft	Yes	A
CONN1	SG4-06	6.	9.	45.	None	40.	29.74	Native	Sand	Medium	Yes	A
CONN1	SG4-10	10.	11.	30.	None	37.	29.78	Native	Sand	Hard	Yes	10.
CONN1	SG5-02	2.	12.	65.	None	36.	29.78	Native	Sand	Medium	Yes	A
CONN1	SG5-06	6.	15.	75.	None	36.	29.78	Native	Sand	Hard	Yes	A
CONN1	SG5-10	10.	3.	30.	None	36.	29.78	Native	Sand	Hard	Yes	A
CONN2	SG1-02	2.	3.	20.	None	53.	29.88	Native	Sand	Hard	Yes	A
CONN2	SG1-06	6.	1.	30.	None	51.	29.89	Native	Sand	Hard	Yes	A
CONN2	SG2-02	2.	2.	30.	None	55.	29.90	Backfill	Sand	Soft	No	A
CONN2	SG2-06	6.	19.	110.	None	61.	29.90	Backfill	Sand	Soft	No	A
CONN2	SG2-09	9.	3.	30.	None	62.	29.90	Backfill	Sand	Soft	Yes	A
CONN2	SG3-02	2.	2.	20.	None	53.	29.90	Backfill	Sand	Soft	No	A
CONN2	SG3-06	6.	17.	90.	None	51.	29.89	Backfill	Sand	Soft	No	A
CONN2	SG3-10	10.	20.	110.	None	51.	29.89	Backfill	Sand	Soft	No	10.
CONN2	SG4-02	2.	14.	90.	None	47.	29.94	Native	Sand	Hard	Yes	A
CONN2	SG4-06	6.	14.	75.	None	46.	29.95	Native	Sand	Hard	Yes	10.
CONN2	SG5-02	2.	2.	30.	None	46.	29.91	Backfill	Sand	Soft	No	A
CONN2	SG5-06	6.	7.	30.	Strong	48.	29.94	Backfill	Sand	Soft	No	A
CONN2	SG5-10	10.	20.	30.	Strong	48.	29.91	Backfill	Sand	Hard	Yes	10.
NY1	SG1-02	2.	2.	30.	Not	69.	29.95	Not	Sand	Hard	No	A
NY1	SG1-06	6.	2.	30.	Not	70.	29.95	Not	Sand	Hard	No	A
NY1	SG1-10	10.	2.	30.	Not	72.	29.95	Not	Sand	Hard	No	A
NY1	SG2-02	2.	2.	30.	Not	73.	29.95	Not	Sand	Soft	No	A
NY1	SG2-06	6.	2.	60.	Not	73.	29.94	Not	Sand	Hard	No	A
NY1	SG2-08	8.	2.	60.	Not	74.	29.89	Not	Sand	Hard	No	A
NY1	SG3-02	2.	2.	60.	Not	75.	29.88	Not	Sand	Soft	No	A
NY1	SG3-06	6.	2.	60.	Not	74.	29.88	Not	Sand	Soft	No	A
NY1	SG3-10	10.	5.	45.	Not	75.	29.87	Not	Sand	Soft	No	A
NY1	SG4-03	3.	3.	60.	Not	67.	29.86	Not	Sand	Hard	No	A
NY1	SG4-06	6.	3.	60.	Not	67.	29.86	Not	Sand	Hard	No	A

(Continued)

Sta- tion	Sample No.	Sample		Evacuation Duration (sec.)	Hydro- carbon Odor	Temp. (F)	Barometric		Soil Type	Fill Material	Probe Penetration	Use of Hammer	Depth to Water (ft)
		Depth (ft)	Vacuum (in. Hg)				Pressure (in. Hg)						
NY1	SG4-10	10.	5.	60.	Not	67.	29.87	Not	Sand	Hard	No	A	
NY2	SG1-02	2.	2.	60.	Not	61.	29.87	Not	Sand	Soft	No	A	
NY2	SG1-06	6.	2.	60.	Not	61.	29.87	Not	Sand	Soft	No	A	
NY2	SG1-10	10.	2.	60.	Not	61.	29.88	Not	Sand	Soft	No	A	
NY2	SG2-02	2.	2.	60.	Not	64.	29.88	Not	Sand	Soft	No	A	
NY2	SG2-06	6.	2.	60.	Not	64.	29.87	Not	Sand	Soft	No	A	
NY2	SG2-10	10.	2.	60.	Not	64.	29.87	Not	Sand	Soft	No	A	
NY2	SG3-02	2.	2.	60.	Not	66.	29.87	Not	Sand	Soft	No	A	
NY2	SG4-02	2.	2.	60.	Not	66.	29.87	Not	Sand	Soft	No	A	
NY2	SG4-07	7.	2.	60.	Not	66.	29.87	Not	Sand	Soft	No	A	
NY2	SG4-10	10.	2.	90.	Not	67.	29.87	Not	Sand	Soft	No	A	
NY2	SG5-02	2.	2.	60.	Not	68.	29.87	Not	Sand	Soft	No	A	
NY4	SG1-02	2.	2.	60.	Not	62.	29.78	Not	Sand	Soft	No	A	
NY4	SG1-06	6.	2.	60	Not	63.	29.79	Not	Sand	Soft	No	A	
NY4	SG1-10	10.	2.	60.	Not	64.	29.79	Not	Sand	Soft	No	A	
NY4	SG2-02	2.	2.	60.	Not	66.	29.79	Not	Sand	Soft	No	A	
NY4	SG2-06	6.	2.	60.	Not	66.	29.79	Not	Sand	Soft	No	A	
NY4	SG2-10	10.	2.	60.	Not	67.	29.78	Not	Sand	Soft	No	A	
NY4	SG3-02	2.	2.	60.	Not	67.	29.78	Not	Sand	Soft	No	A	
NY4	SG3-06	6.	2.	60.	Not	67.	29.79	Not	Sand	Soft	No	A	
NY4	SG3-10	10.	2.	60.	Not	67.	29.78	Not	Sand	Soft	No	A	
NY4	SG4-02	2.	2.	60.	Not	68.	29.78	Not	Sand	Soft	No	A	
NY4	SG4-06	6.	2.	60.	Not	67.	29.77	Not	Sand	Soft	No	A	
NY4	SG4-10	10.	2.	60.	Not	67.	29.77	Not	Sand	Soft	No	A	
NY5	SG1-02	2.	2.	60.	Not	73.	29.70	Not	Not	Soft	Yes	A	
NY5	SG1-06	6.	2.	60.	Not	71.	29.71	Not	Not	Hard	Yes	A	
NY5	SG1-09	9.	2.	60.	Not	71.	29.71	Not	Not	Hard	Yes	A	
NY5	SG2-02	2.	2.	60.	Not	70.	29.71	Not	Not	Soft	No	A	
NY5	SG2-06	6.	10.	60.	Not	60.	29.71	Not	Not	Soft	No	A	
NY5	SG3-02	2.	3.	60.	Not	57.	29.87	Not	Not	Soft	No	A	
NY5	SG3-05	5.	20.	180.	Not	57.	29.87	Not	Not	Hard	Yes	A	

(Continued)

Station	Sample No.	Sample Depth (ft)	Vacuum (in. Hg)	Evacuation Duration (sec.)	Hydro-carbon Odor	Temp. (F)	Barometric Pressure (in. Hg)	Soil Type	Fill Material	Probe Penetration	Use of Hammer	Depth to Water (ft)
NY5	SG4-02	2.	1.	60.	Not	59.	29.85	Not	Not	Hard	Yes	A
NY5	SG4-06	6.	1.	60.	Not	59.	29.85	Not	Not	Hard	Yes	A
NY5	SG4-10	10.	1.	60.	Not	59.	29.85	Not	Not	Soft	Yes	A
NY6	SG1-02	2.	1.	30.	Not	60.	29.87	Not	Not	Hard	Yes	A
NY6	SG1-06	6.	1.	30.	Not	61.	29.88	Not	Not	Hard	Yes	A
NY6	SG2-02	2.	9.	60.	Not	61.	29.88	Not	Not	Hard	Yes	A
NY6	SG2-06	6.	7.	60.	Not	61.	29.88	Not	Not	Hard	Yes	A
NY6	SG2-10	10.	12.	90.	Not	60.	29.88	Not	Not	Hard	Yes	A
NY6	SG3-02	2.	1.	30.	Not	60.	29.92	Not	Not	Soft	No	A
NY6	SG3-06	6.	1.	30.	Not	59.	29.94	Not	Not	Soft	No	A
RI1	SG1-02	2.	3.	30.	Not	40.	29.32	Native	Not	Soft	No	A
RI1	SG1-06	6.	3.	30.	Not	40.	29.39	Native	Not	Not	Yes	A
RI1	SG2-02	2.	4.	30.	Not	41.	29.33	Native	Not	Mod/Hard	Yes	A
RI1	SG2-06	6.	5.	30.	Not	41.	29.35	Native	Not	Hard	Yes	A
RI1	SG3-02	2.	5.	30.	Not	41.	29.32	Native	Not	Hard	Yes	A
RI1	SG3-06	6.	4.	30.	None	43.	29.37	Backfill	Not	Soft	Yes	A
RI2	SG1-02	2.	4.	30.	None	54.	29.72	Backfill	Not	Mod	Yes	A
RI2	SG1-06	6.	4.	30.	Slight	57.	29.72	Backfill	Not	Soft	No	A
RI2	SG1-10	10.	4.	30.	Slight	53.	29.72	Backfill	Not	Hard	Yes	A
RI2	SG2-02	2.	7.	30.	Not	41.	29.47	Backfill	Not	Soft	Yes	A
RI2	SG2-06	6.	4.	30.	Not	43.	29.47	Backfill	Not	Soft	No	A
RI2	SG2-10	10.	2.	30.	Not	43.	29.47	Backfill	Not	Mod	No	A
RI2	SG3-02	2.	4.	30.	Not	41.	29.47	Backfill	Not	Soft	No	A
RI2	SG3-06	6.	999.	30.	Not	41.	29.45	Backfill	Not	Mod	No	A
RI2	SG3-09	9.	8.	60.	Not	41.	29.39	Backfill	Not	Hard	No	A
RI2	SG4-02	2.	5.	30.	Not	41.	29.38	Backfill	Not	Hard	Yes	A
RI2	SG4-06	6.	2.	30.	Not	41.	29.39	Backfill	Not	Not	No	A
RI2	SG4-10	10.	3.	30.	Not	40.	29.39	Backfill	Not	Soft	No	A
RI3	SG1-02	2.	8.	30.	None	60.	29.49	Backfill	Sand	Soft\Mod	No	A
RI3	SG1-06	6.	3.	30.	None	65.	29.49	Backfill	Sand	Mod\Hard	Yes	A
RI3	SG1-10	10.	3.	30.	Not	58.	29.49	Backfill	Sand	Mod	Yes	A
RI3	SG2-02	2.	5.	30.	Not	57.	29.49	Backfill	Sand	Mod	Yes	A

(Continued)

Sta- tion	Sample No.	Sample Depth (ft)	Vacuum (in. Hg)	Evacuation Duration (sec.)	Hydro- carbon Odor	Temp. (F)	Barometric Pressure (in. Hg)	Soil Type	Fill Material	Probe Penetration	Use of Hammer	Depth to Water (ft)
RI3	SG2-06	6.	3.	30.	None	57.	29.50	Backfill	Sand	Mod	Yes	A
RI3	SG2-10	10.	3.	30.	None	58.	29.51	Native	Sand	Mod\Hard	Yes	A
RI3	SG3-02	2.	4.	30.	None	57.	29.51	Backfill	Sand	Mod	Yes	A
RI3	SG3-06	6.	6.	45.	None	55.	29.50	Backfill	Sand	Mod	Yes	A
RI3	SG3-10	10.	6.	30.	None	49.	29.52	Native	Sand	Mod	Not	A
RI3	SG4-02	2.	4.	30.	None	48.	29.54	Backfill	Sand	Hard	Yes	A
RI3	SG4-06	6.	3.	30.	None	46.	29.55	Backfill	Sand	Hard	Yes	A
RI4	SG1-02	2.	2.	30.	None	58.	29.82	Backfill	Sand	Soft	No	A
RI4	SG1-06	6.	3.	30.	Mod	60.	29.83	Backfill	Sand	Soft	No	A
RI4	SG1-10	10.	3.	30.	Mod	60.	29.80	Backfill	Sand	Soft	No	A
RI4	SG2-02	2.	9.	30.	None	53.	29.80	Backfill	Sand	Soft	No	A
RI4	SG2-06	6.	9.	30.	Not	50.	29.80	Native	Sand	Soft	No	A
RI4	SG2-10	10.	6.	30.	None	50.	29.80	Native	Sand	Mod	Yes	A
RI4	SG3-02	2.	3.	30.	None	54.	29.79	Native	Sand	Soft	No	A
RI4	SG3-06	6.	4.	30.	None	54.	29.78	Native	Sand	Soft	No	A
RI4	SG3-10	10.	9.	30.	None	55.	29.78	Native	Sand	Soft	No	A
RI4	SG4-02	2.	3.		Mod-Stng	61.	29.72	Backfill	Sand	Soft	No	A
RI4	SG4-06	6.	4.	30.	Strong	62.	29.73	Backfill	Sand	Soft	No	A
SD1	SG1-02	2.	9.	90.	None	79.	29.97	Backfill	Sand	Soft	No	A
SD1	SG1-06	6.	4.	30.	None	77.	29.97	Backfill	Sand	Soft	No	A
SD1	SG1-10	10.	20.		None	77.	29.97	Backfill	Sand	Soft	No	10.
SD1	SG2-02	2.	7.	70.	None	76.	29.97	Backfill	Sand	Soft	No	A
SD1	SG2-06	6.	2.	30.	None	75.	29.97	Backfill	Sand	Soft	No	A
SD1	SG2-10	10.	999.		None	75.	29.97	Backfill	Sand	Soft	No	10.
SD1	SG3-02	2.	2.	30.	None	72.	29.97	Backfill	Sand	Soft	No	A
SD1	SG3-06	6.	2.	30.	None	73.	29.97	Backfill	Sand	Soft	No	A
SD1	SG3-10	10.	999.		None	73.	29.97	Backfill	Sand	Soft	No	10.
SD1	SG4-02	2.	9.	30.	None	72.	29.97	Backfill	Sand	Soft	No	A
SD1	SG4-06	6.	9.	30.	None	72.	29.97	Backfill	Sand	Soft	No	A
SD1	SG4-10	10.	999.		None	72.	29.97	Backfill	Sand	Soft	No	10.
SD1	SG5-06	6.	2.	30.	Strong	73.	29.97	Backfill	Sand	Soft	No	A
SD2	SG1-02	2.	2.	30.	None	73.	29.00	Backfill	Sand	Soft	No	A

(Continued)

Sta- tion	Sample No.	Sample		Evacuation		Hydro- carbon Odor	Temp. (F)	Barometric		Soil Type	Fill Material	Probe Penetration	Use of Hammer	Depth to Water (ft)
		Depth (ft)	Vacuum (in. Hg)	Duration (sec.)				Pressure (in. Hg)						
SD2	SG1-06	6.	4.	30.		None	77.	29.00		Backfill	Sand	Soft	No	A
SD2	SG1-06	6.	2.	30.		None	78.	29.00		Backfill	Sand	Soft	No	A
SD2	SG1-10	10.	999.			None	79.	29.00		Backfill	Sand	Soft	No	10.
SD2	SG2-02	2.	2.	30.		None	78.	29.00		Backfill	Sand	Soft	No	A
SD2	SG2-06	6.	2.	30.		None	80.	29.00		Backfill	Sand	Soft	No	A
SD2	SG2-10	10.	999.			None	81.	29.00		Backfill	Sand	Soft	No	10.
SD2	SG3-02	2.	2.	30.		None	80.	29.00		Backfill	Sand	Soft	No	A
SD2	SG3-06	6.	2.	30.		None	79.	29.00		Backfill	Sand	Soft	No	A
SD2	SG3-10	10.	999.			None	79.	29.00		Backfill	Sand	Soft	No	10.
SD2	SG4-02	2.	2.	30.		None	80.	29.00		Backfill	Sand	Soft	No	A
SD2	SG4-06	6.	2.	30.		None	78.	29.00		Backfill	Sand	Soft	No	A
SD2	SG4-10	10.	999.			None	78.	29.00		Backfill	Sand	Soft	No	10.
SD3	SG1-02	2.	8.	75.		None	999.	30.23		Backfill	Crushed	Hard	No	A
SD3	SG1-06	6.	999.			None	999.	30.23		Native	Not	Hard	Yes	A
SD3	SG1-10	10.	999.			None	999.	30.23		Native	Not	Hard	No	A
SD3	SG2-02	2.	2.	30.		None	74.	30.23		Backfill	Gravel	Moderate	No	A
SD3	SG2-06	6.	2.	30.		None	74.	30.23		Backfill	Gravel	Moderate	No	A
SD3	SG2-10	10.	999.			None	74.	30.23		Backfill	Gravel	Moderate	No	10.
SD3	SG3-02	2.	2.	30.		None	77.	30.23		Backfill	Gravel	Soft	No	A
SD3	SG3-06	6.	2.	30.		None	77.	30.23		Backfill	Gravel	Soft	No	A
SD3	SG3-10	10.	999.			None	77.	30.23		Backfill	Gravel	Soft	No	10s
SD3	SG4-02	2.	2.	30.		None	79.	30.23		Native	Clays	Hard	No	A
SD3	SG4-06	6.	999.			None	79.	30.23		Native	Clays	Hard	Yes	A
SD3	SG4-10	10.	999.			None	79.	30.23		Native	Clays	Hard	Yes	A
SD3	SG5-02	2.	7.	45.		None	79.	30.23		Backfill	Gravel	Moderate	No	A
SD3	SG5-06	6.	2.	30.		None	79.	30.23		Backfill	Gravel	Moderate	No	A
SD3	SG5-10	10.	999.			None	79.	30.23		Backfill	Gravel	Moderate	No	10.
SD4	SG1-02	2.	2.	30.		None	75.	29.99		Backfill	Sand	Soft	No	A
SD4	SG1-06	6.	2.	30.		None	75.	29.99		Backfill	Sand	Soft	No	A
SD4	SG1-10	10.	2.	60.		None	75.	29.99		Backfill	Sand	Soft	No	A
SD4	SG2-02	2.	2.	30.		Strong	75.	29.99		Backfill	Sand	Soft	No	A
SD4	SG2-06	6.	2.	30.		Strong	75.	29.99		Backfill	Sand	Soft	No	A

(Continued)

Sta- tion	Sample No.	Sample		Evacuation Duration (sec.)	Hydro- carbon Odor	Temp. (F)	Barometric		Soil Type	Fill Material	Probe Penetration	Use of Hammer	Depth to Water (ft)
		Depth (ft)	Vacuum (in. Hg)				Pressure (in. Hg)						
SD4	SG2-10	10.	2.	60.	Strong	75.	29.99	Backfill	Sand	Soft	No	A	
SD4	SG3-02	2.	2.	30.	Moderate	76.	29.99	Backfill	Sand	Soft	No	A	
SD4	SG3-06	6.	2.	30.	Moderate	76.	29.99	Backfill	Sand	Soft	No	A	
SD4	SG3-10	10.	2.	60.	Moderate	76.	29.99	Backfill	Sand	Soft	No	A	
SD4	SG4-02	2.	2.	30.	Strong	76.	29.99	Backfill	Sand	Soft	No	A	
SD4	SG4-06	6.	2.	30.	Strong	76.	29.99	Backfill	Sand	Soft	No	A	
SD4	SG4-10	10.	10.	180.	Strong	76.	29.99	Backfill	Sand	Soft	No	A	
SD4	SG5-06	6.	10.	60.	Strong	76.	29.99	Backfill	Sand	Soft	No	A	
SD5	SG1-02	2.	2.	30.	Slight	79.	999.	Backfill	Gravel	Soft	No	A	
SD5	SG1-06	6.	2.	30.	Slight	79.	999.	Backfill	Gravel	Soft	No	A	
SD5	SG1-10	10.	2.	60.	Moderate	80.	999.	Backfill	Gravel	Soft	No	A	
SD5	SG2-02	2.	2.	30.	Moderate	80.	999.	Backfill	Gravel	Soft	No	A	
SD5	SG2-06	6.	2.	30.	Strong	80.	999.	Backfill	Gravel	Soft	No	A	
SD5	SG2-10	10.	2.	60.	Strong	80.	999.	Backfill	Gravel	Soft	No	A	
SD5	SG3-02	2.	2.	30.	Moderate	80.	999.	Backfill	Gravel	Soft	No	A	
SD5	SG3-06	6.	2.	30.	Moderate	80.	999.	Backfill	Gravel	Soft	No	A	
SD5	SG3-10	10.	2.	60.	Moderate	80.	999.	Backfill	Gravel	Soft	No	A	
SD5	SG4-02	2.	2.	30.	Slight	80.	999.	Backfill	Gravel	Soft	No	A	
SD5	SG4-06	6.	4.	35.	Slight	83.	999.	Backfill	Gravel	Soft	No	A	
SD5	SG4-10	10.	2.	60.	Slight	81.	999.	Backfill	Gravel	Soft	No	A	
SD6	SG1-02	2.	2.	30.	None	72.	29.90	Backfill	Gravel	Hard	Yes	A	
SD6	SG1-06	6.	2.	30.	Slight	72.	29.90	Backfill	Gravel	Soft	No	A	
SD6	SG1-10	10.	2.	30.	Strong	77.	29.90	backfill	Gravel	Soft	No	A	
SD6	SG2-02	2.	2.	30.	Moderate	78.	29.91	Backfill	Gravel	Soft	No	A	
SD6	SG2-06	6.	2.	90.	Moderate	78.	29.91	Backfill	Gravel	Soft	No	A	
SD6	SG2-10	10.	2.	60.	Moderate	76.	29.91	Backfill	Gravel	Hard	Yes	A	
SD6	SG3-02	2.	2.	30.	Slight	80.	29.92	Backfill	Gravel	Soft	No	A	
SD6	SG3-06	6.	2.	30.	Slight	80.	29.92	Backfill	Gravel	Soft	No	A	
SD6	SG3-10	10.	2.	60.	Slight	80.	29.92	Backfill	Gravel	Soft	No	A	
SD6	SG4-02	2.	2.	30.	Slight	76.	29.92	Backfill	Gravel	Soft	No	A	
SD6	SG4-06	6.	6.	30.	Slight	74.	29.92	Backfill	Gravel	Soft	No	A	
SD6	SG4-08	8.	2.	30.	Slight	74.	29.92	Backfill	Gravel	Soft	No	A	

(Continued)

Sta- tion	Sample No.	Sample Depth (ft)	Vacuum (in. Hg)	Evacuation Duration (sec.)	Hydro- carbon Odor	Temp. (F)	Barometric Pressure (in. Hg)	Soil Type	Fill Material	Probe Penetration	Use of Hammer	Depth to Water (ft)
SD6	SG5-02	2.	13.	95.	None	74.	999.	Native	Native Soil	Hard	No	A
SD6	SG5-06	6.	999.		Not	74.	999.	Native	Native Soil	Hard	Not	A
SD6	SG5-10	10.	999.		Not	74.	999.	Native	Native Soil	Hard	Not	A
SD7	SG1-02	2.	2.	30.	Slight	73.	29.93	Backfill	Sand	Soft	No	A
SD7	SG1-06	6.	2.	30.	Strong	72.	29.93	Backfill	Sand	Soft	No	A
SD7	SG1-10	10.	2.	60.	Strong	72.	29.93	Backfill	Sand	Soft	No	A
SD7	SG2-02	2.	2.	30.	Strong	72.	29.93	Backfill	Sand	Soft	No	A
SD7	SG2-06	6.	2.	30.	Strong	72.	29.93	Backfill	Sand	Soft	No	A
SD7	SG2-10	10.	2.	60.	Strong	76.	29.93	Backfill	Sand	Soft	No	A
SD7	SG3-02	2.	2.	30.	Strong	76.	31.00	Backfill	Sand	Soft	No	A
SD7	SG3-06	6.	2.	30.	Strong	76.	31.00	Backfill	Sand	Soft	No	A
SD7	SG3-10	10.	2.	60.	Strong	76.	31.00	Backfill	Sand	Soft	No	A
SD7	SG4-02	2.	2.	30.	Strong	75.	31.00	Backfill	Sand	Soft	No	A
SD7	SG4-06	6.	2.	30.	Strong	77.	31.00	Backfill	Sand	Soft	No	A
SD7	SG4-10	10.	2.	30.	Strong	76.	31.00	Backfill	Sand	Soft	No	A
SD7	SG5-02	2.	2.	45.	Slight	74.	31.00	Backfill	Sand	Soft	No	A
SD7	SG5-06	6.	2.	30.	Slight	74.	31.00	Backfill	Sand	Soft	No	A
SD7	SG5-10	10.	2.	60.	Slight	74.	31.00	Backfill	Sand	Soft	No	A
SD8	SG1-02	2.	3.	30.	Moderate	80.	30.10	Backfill	Sand	Soft	No	A
SD8	SG1-06	6.	7.	60.	Strong	80.	30.10	Backfill	Sand	Soft	No	A
SD8	SG1-10	10.	0.	60.	Strong	76.	30.10	Backfill	Sand	Soft	No	A
SD8	SG2-02	2.	2.	30.	Strong	78.	30.10	Backfill	Sand	Soft	No	A
SD8	SG2-06	6.	2.	30.	Strong	78.	30.10	Backfill	Sand	Soft	No	A
SD8	SG2-10	10.	2.	60.	Strong	77.	30.10	Backfill	Sand	Soft	No	A
SD8	SG3-02	2.	2.	30.	Strong	87.	30.10	Backfill	Sand	Soft	No	A
SD8	SG3-06	6.	2.	30.	Strong	87.	30.10	Backfill	Sand	Soft	No	A
SD8	SG3-10	10.	2.	30.	Strong	83.	30.10	Backfill	Sand	Soft	No	A
SD8	SG4-02	2.	2.	30.	Strong	79.	30.10	Backfill	Sand	Soft	No	A
SD8	SG4-06	6.	2.	30.	Strong	80.	30.10	Backfill	Sand	Soft	No	A
SD8	SG4-10	10.	3.	30.	Strong	84.	30.10	Backfill	Sand	Soft	No	A
SD9	SG1-02	2.	2.	30.	None	70.	30.26	Backfill	Sand	Hard	Yes	A
SD9	SG1-06	6.	2.	30.	Slight	74.	30.26	Backfill	Sand	Hard	Yes	A

(Continued)

Sta- tion	Sample No.	Sample		Evacuation		Hydro- carbon Odor	Temp. (F)	Barometric		Soil Type	Fill Material	Probe Penetration	Use of Hammer	Depth to Water (ft)
		Depth (ft)	Vacuum (in. Hg)	Duration (sec.)				Pressure (in. Hg)						
SD9	SG1-10	10.	999.			Not	74.	30.26		Backfill	Sand	Not	Not	A
SD9	SG2-02	2.	2.	30.		Strong	74.	30.26		Backfill	Sand	Soft	No	A
SD9	SG2-06	6.	2.	30.		Strong	73.	30.26		Backfill	Sand	Soft	No	A
SD9	SG2-10	10.	2.	30.		Strong	72.	30.26		Backfill	Sand	Soft	No	A
SD9	SG3-02	2.	2.	30.		Strong	76.	30.26		Backfill	Sand	Soft	No	A
SD9	SG3-06	6.	2.	30.		Strong	73.	30.26		Backfill	Sand	Soft	No	A
SD9	SG3-10	10.	12.	30.		Strong	83.	30.26		Backfill	Sand	Hard	Yes	A
SD9	SG4-02	2.	2.	30.		Slight	85.	30.26		Backfill	Sand	Soft	No	A
SD9	SG4-06	6.	2.	30.		Slight	84.	30.26		Backfill	Sand	Soft	No	A
SD9	SG4-10	10.	2.	60.		Strong	86.	30.26		Backfill	Sand	Soft	No	A
SD9	SG5-02	2.	2.	30.		Slight	82.	30.26		Backfill	Sand	Soft	No	A
SD9	SG5-06	6.	2.	30.		Slight	82.	30.26		Backfill	Sand	Soft	No	A
SD9	SG5-10	10.	2.	60.		Slight	80.	30.26		Backfill	Sand	Soft	No	A

APPENDIX C

SOIL GAS DATA AND SITE MAPS

(NOTE: Methane as it appears in Appendix C represents light aliphatics. For an explanation, refer to Section 4, Analytical Procedures of the text.)

SOIL GAS DATA

(Data Arranged by Sample Number)

Austin
Station 1

($\mu\text{g/L}$)

Sample	Methane $\text{C}_1\text{-C}_5$ (as Methane)	Benzene	Toluene	Ethylbenzene	Xylenes	Total Hydrocarbons (less light aliphatics)
SG1-02	760000.00	7400.00	5300.00	<310.00	2300.00	21000.00
SG1A-06	550000.00	<8.00	<9.00	<12.00	<12.00	210.00
SG1A-09	560000.00	<40.00	<46.00	<63.00	<59.00	160.00
SG2-02	56000.00	<8.00	<9.00	<12.00	120.00	110.00
SG2-06	440000.00	<0.80	<46.00	<1.00	86.00	79.00
SG2-10	8900.00	<0.08	10.00	<0.10	18.00	27.00
SG3-02	670000.00	<40.00	<46.00	<63.00	520.00	570.00
SG3-06	790000.00	<40.00	<46.00	<63.00	360.00	460.00
SG3-10	450000.00	<40.00	<46.00	<63.00	<58.00	<52.00
SG4-02	370000.00	300.00	<23.00	<31.00	<29.00	490.00
SG4-06	140000.00	220.00	<46.00	<63.00	<59.00	310.00
SG4-10	98000.00	93.00	<23.00	<31.00	<29.00	160.00
SG5-02	150000.00	160.00	150.00	<31.00	430.00	810.00
SG5-06	460000.00	370.00	140.00	<31.00	120.00	780.00
SG5-10	670000.00	5900.00	1400.00	<31.00	590.00	12000.00

(ppmv)

Sample	Methane $\text{C}_1\text{-C}_5$ (as Methane)	Benzene	Toluene	Ethylbenzene	Xylenes	Total Hydrocarbons (less light aliphatics)
SG1-02	1177786	2352	1428	36	538	6035
SG1A-06	860275	1	1	1	1	55
SG1A-09	875917	6	6	7	7	42
SG2-02	86946	1	1	1	28	26
SG2-06	685683	0	6	0	20	19
SG2-10	13844	0	3	0	4	7
SG3-02	1050259	6	6	7	123	137
SG3-06	1238365	6	6	7	85	112
SG3-10	705398	6	6	7	7	7
SG4-02	584857	97	3	4	3	154
SG4-06	221701	71	6	8	7	94
SG4-10	155191	30	3	4	3	48
SG5-02	236992	52	41	4	103	214
SG5-06	726775	120	38	4	29	230
SG5-10	1056627	1909	384	4	140	3699

Concentrations in $\mu\text{g/L}$ represent the mean values of three GC/FID analyses per sample. Concentrations at or below detection limits are noted with a less than symbol. Concentrations in ppmv are calculated as discussed in Section 6, and rounded to the nearest whole number. Concentrations at detection limits were approximated by dividing the detection limit value by 2. This procedure resulted in some values being reported as zero.

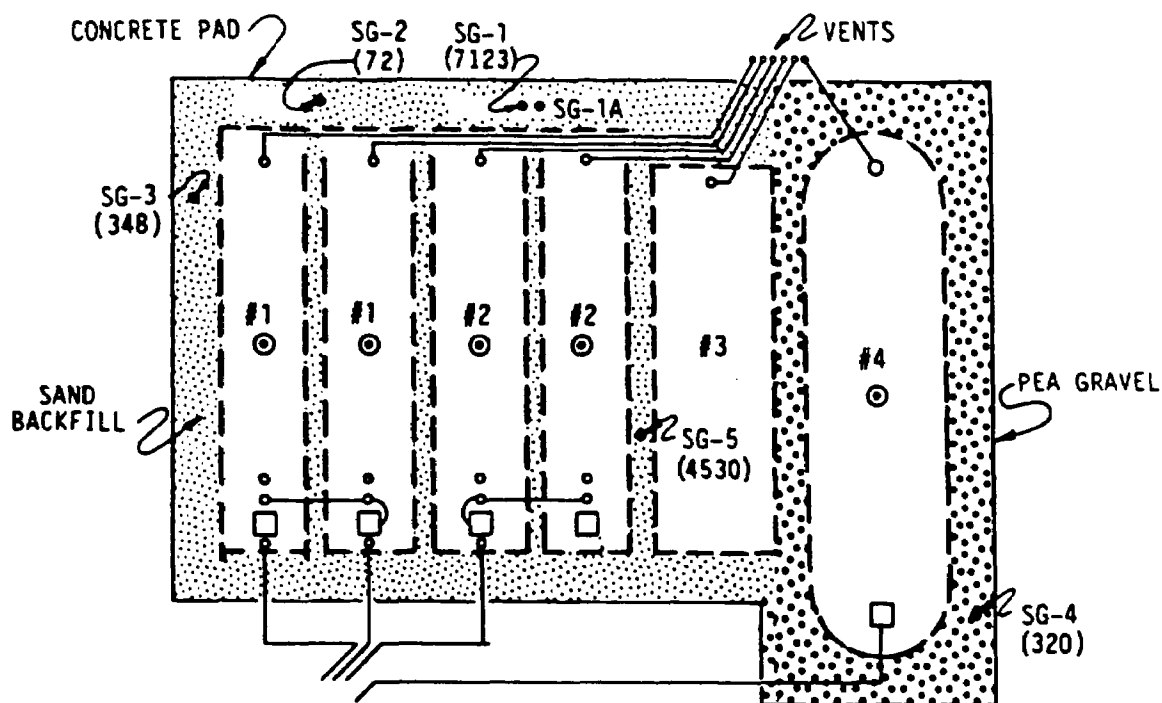
SOIL GAS DATA
($\mu\text{g/L}$)

(Data Arranged by Depth with Averages)

Austin
Station 1

Sample	Methane $\text{C}_1\text{-C}_5$ (as Methane)	Benzene	Toluene	Ethylbenzene	Xylenes	Total Hydrocarbons (less light aliphatics)
Depth - 02 Feet						
SG1-02	760000.00	7400.00	5300.00	<310.00	2300.00	21000.00
SG2-02	560000.00	<8.00	<9.00	<12.00	120.00	110.00
SG3-02	670000.00	<40.00	<46.00	<63.00	520.00	570.00
SG4-02	370000.00	300.00	<23.00	<31.00	<29.00	490.00
SG5-02	150000.00	160.00	150.00	<31.00	430.00	810.00
Averages	401200.00	1576.80	1097.80	44.70	676.90	4596.00
Depth - 06 Feet						
SG1A-06	550000.00	<8.00	<9.00	<12.00	<12.00	210.00
SG2-06	440000.00	<0.80	<46.00	<1.00	86.00	79.00
SG3-06	790000.00	<40.00	<46.00	<63.00	360.00	460.00
SG4-06	140000.00	220.00	<46.00	<63.00	<59.00	310.00
SG5-06	460000.00	370.00	140.00	<31.00	120.00	780.00
Averages	476000.00	122.88	42.70	17.00	120.30	367.80
Depth - 10 Feet						
SG1A-09	560000.00	<40.00	<46.00	<63.00	<59.00	160.00
SG2-10	8900.00	<0.08	10.00	<0.10	18.00	27.00
SG3-10	450000.00	<40.00	<46.00	<63.00	<58.00	<52.00
SG4-10	98000.00	93.00	<23.00	<31.00	<29.00	160.00
SG5-10	670000.00	5900.00	1400.00	<31.00	590.00	12000.00
Averages	357380.00	1206.61	293.50	18.81	136.20	2474.60

Concentration at detection limits were approximated by dividing the detection limit by 2. The approximations were in computing the averages.



#1 UNLEADED

INSTALLED 1961
COVER DEPTH 4'-2"
TANK BOTTOM 9'-8"
TANK TYPE STEEL
CAP. 4000 GAL.
SIZE 5'-6"x23'-6"

#2 REGULAR

INSTALLED 1961
COVER DEPTH 2'-10"
TANK BOTTOM 9'-10"
TANK TYPE STEEL
CAP. 4000 GAL.
SIZE 5'-6"x23'-6"

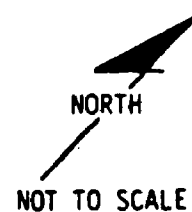
#3 SUPER

INSTALLED 1961
COVER DEPTH 4'-2"
TANK BOTTOM 9'-8"
TANK TYPE STEEL
CAP. 6000 GAL.
SIZE 8'-0"x16'-10"

#4 DIESEL

INSTALLED 1981
COVER DEPTH 4'-2"
TANK BOTTOM 10'-9"
TANK TYPE FIBERGLASS
CAP. 10,000 GAL.
SIZE 8'-0"x32'-0"

Austin Station 1



NOT TO SCALE

SOIL GAS DATA

(Data Arranged by Sample Number)

Austin
Station 2

($\mu\text{g/L}$)

Sample	Methane $\text{C}_1\text{-C}_5$ (as Methane)	Benzene	Toluene	Ethylbenzene	Xylenes	Total Hydrocarbons (less light aliphatics)
SG1-02	110000.00	5200.00	3900.00	<80.00	3100.00	15000.00
SG1-06	150000.00	8600.00	6300.00	<80.00	9400.00	28000.00
SG1-10	120000.00	8200.00	7200.00	<80.00	10000.00	30000.00
SG2-02	20000.00	1100.00	990.00	<40.00	300.00	3200.00
SG2-06	56000.00	3600.00	2500.00	<40.00	1800.00	11000.00
SG2-08	45000.00	2900.00	2100.00	<40.00	1700.00	9000.00
SG3-02	420.00	26.00	24.00	<2.00	<2.00	70.00
SG3-06	71000.00	6600.00	4800.00	<80.00	8500.00	22000.00
SG3-10	130000.00	11000.00	7200.00	160.00	9200.00	34000.00
SG4-02	120000.00	6600.00	4700.00	<40.00	2000.00	20000.00
SG4-06	200000.00	12000.00	9900.00	<80.00	8700.00	39000.00
SG4-10	200000.00	12000.00	8600.00	<160.00	6400.00	36000.00
SG5-02	180000.00	10000.00	6300.00	<80.00	9500.00	33000.00
SG5-06	180000.00	12000.00	9400.00	<80.00	14000.00	42000.00
SG5-10	210000.00	16000.00	17000.00	<160.00	21000.00	63000.00

(ppmv)

Sample	Methane $\text{C}_1\text{-C}_5$ (as Methane)	Benzene	Toluene	Ethylbenzene	Xylenes	Total Hydrocarbons (less light aliphatics)
SG1-02	167898	1628	1035	9	714	4150
SG1-06	228952	2693	1672	9	2166	7523
SG1-10	183508	2572	1915	9	2308	8024
SG2-02	30737	347	265	5	70	910
SG2-06	86226	1137	669	5	418	3097
SG2-08	69159	914	561	5	394	2511
SG3-02	653	8	6	0	0	21
SG3-06	110329	2104	1297	9	1994	5962
SG3-10	202762	3519	1953	38	2166	9470
SG4-02	188617	2128	1285	5	475	5844
SG4-06	314361	3869	2706	9	2064	11009
SG4-10	314939	3876	2355	19	1521	10332
SG5-02	284120	3238	1729	10	2263	9246
SG5-06	284120	3885	2580	10	3336	11627
SG5-10	331474	5181	4667	19	5003	17322

Concentrations in $\mu\text{g/L}$ represent the mean values of three GC/FID analyses per sample. Concentrations at or below detection limits are noted with a less than symbol. Concentrations in ppmv are calculated as discussed in Section 6, and rounded to the nearest whole number. Concentrations at detection limits were approximated by dividing the detection limit value by 2. This procedure resulted in some values being reported as zero.

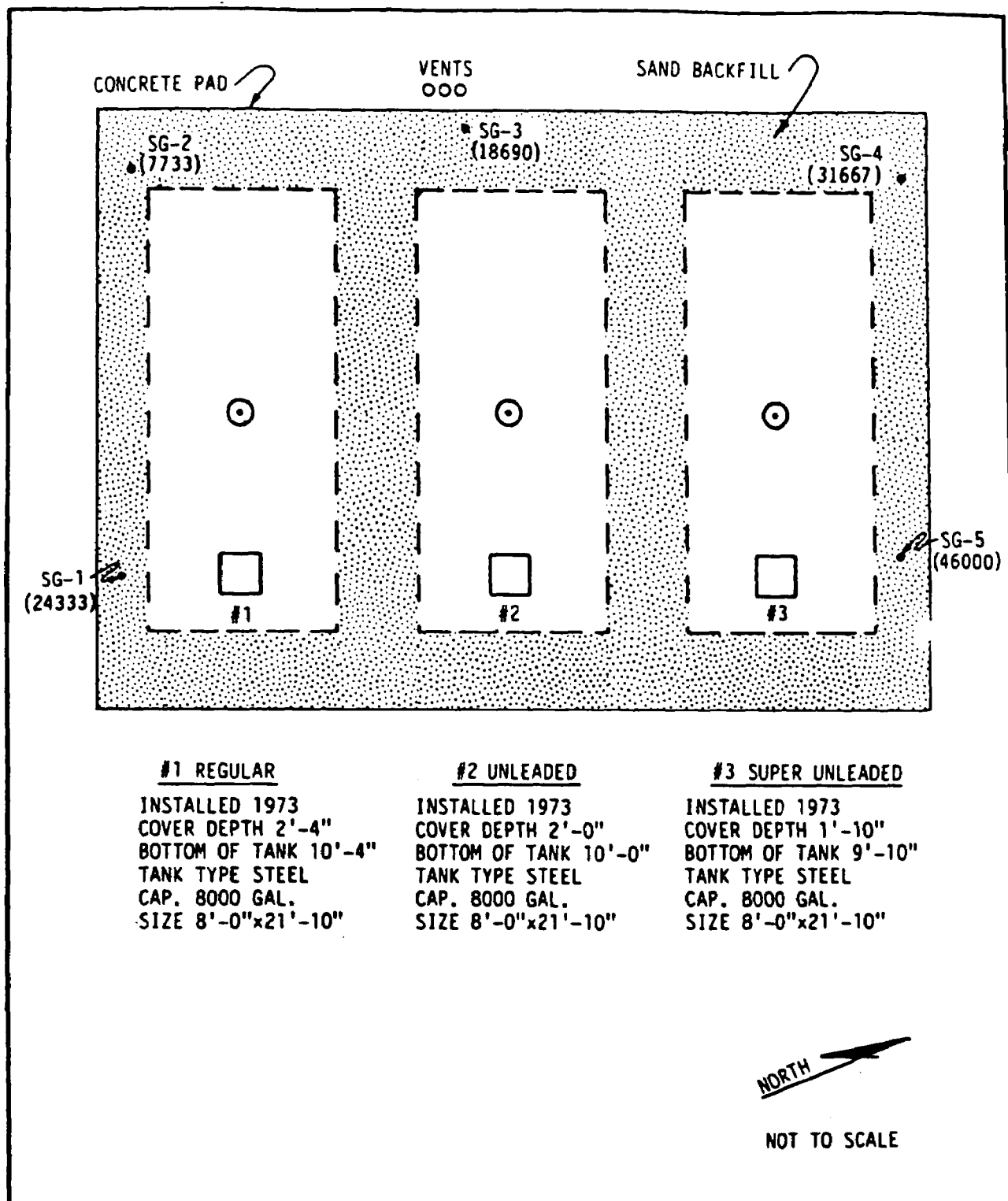
SOIL GAS DATA
($\mu\text{g/L}$)

(Data Arranged by Depth with Averages)

Austin
Station 2

Sample	Methane $\text{C}_1\text{-C}_5$ (as Methane)	Benzene	Toluene	Ethylbenzene	Xylenes	Total Hydrocarbons (less light aliphatics)
<u>Depth - 02 Feet</u>						
SG1-02	110000.00	5200.00	3900.00	<80.00	3100.00	15000.00
SG2-02	20000.00	1100.00	990.00	<40.00	300.00	3200.00
SG3-02	420.00	26.00	24.00	<2.00	<2.00	70.00
SG4-02	120000.00	6600.00	4700.00	<40.00	2000.00	20000.00
SG5-02	180000.00	10000.00	6300.00	<80.00	9500.00	33000.00
Averages	86084.00	4585.20	3182.80	<24.20	2980.20	14254.00
<u>Depth - 06 Feet</u>						
SG1-06	150000.00	8600.00	6300.00	<80.00	9400.00	28000.00
SG2-06	56000.00	3600.00	2500.00	<40.00	1800.00	11000.00
SG3-06	71000.00	6600.00	4800.00	<80.00	8500.00	22000.00
SG4-06	200000.00	12000.00	9900.00	<80.00	8700.00	39000.00
SG5-06	180000.00	12000.00	9400.00	<80.00	14000.00	42000.00
Averages	131400.00	8560.00	6580.00	36.00	8480.00	28400.00
<u>Depth - 10 Feet</u>						
SG1A-09	120000.00	8200.00	7200.00	<80.00	10000.00	30000.00
SG2-08	45000.00	2900.00	2100.00	<40.00	1700.00	9000.00
SG3-10	130000.00	11000.00	7200.00	160.00	9200.00	34000.00
SG4-10	200000.00	12000.00	8600.00	<160.00	6400.00	36000.00
SG5-10	210000.00	16000.00	17000.00	<160.00	21000.00	63000.00
Averages	141000.00	10020.00	8420.00	76.00	9660.00	34400.00

Concentration at detection limits were approximated by dividing the detection limit by 2.
The approximations were in computing the averages.



Austin Station 2

SOIL GAS DATA
(Data Arranged by Sample Number)

Austin
Station 3

($\mu\text{g/L}$)

Sample	Methane $\text{C}_1\text{-C}_5$ (as Methane)	Benzene	Toluene	Ethylbenzene	Xylenes	Total Hydrocarbons (less light aliphatics)
SG1-02	0.08	<0.04	<0.04	<0.06	0.20	0.10
SG1-06	24.00	<0.04	0.02	<0.06	0.10	0.50
SG1-10	37000.00	1200.00	370.00	<31.00	34.00	2100.00
SG2-02	0.50	<0.04	<0.04	<0.06	0.10	0.10
SG2-06	24.00	0.70	1.00	<0.06	0.03	3.00
SG2-10	60000.00	1900.00	510.00	<63.00	7.97	3000.00
SG3-02	2.00	<0.04	0.09	<0.06	<56.00	0.10
SG3-06	25000.00	800.00	250.00	<31.00	<28.00	1300.00
SG3-10	120000.00	3300.00	1100.00	<63.00	<56.00	5700.00
SG4-02	0.10	<0.04	<0.04	<0.06	<0.06	<0.06
SG4-06	32.00	1.00	1.00	<0.06	0.20	3.00
SG4-10	110000.00	3000.00	840.00	<31.00	<28.00	5100.00
SG5-02	0.60	<0.04	<0.04	<0.06	0.20	0.10
SG5-06	5.00	0.06	0.30	<0.06	<0.06	1.00
SG5-10	35000.00	1900.00	1700.00	<31.00	410.00	4700.00

(ppmv)

Sample	Methane $\text{C}_1\text{-C}_5$ (as Methane)	Benzene	Toluene	Ethylbenzene	Xylenes	Total Hydrocarbons (less light aliphatics)
SG1-02	0	0	0	0	0	0
SG1-06	36	0	0	0	0	0
SG1-10	56071	373	98	4	8	625
SG2-02	1	0	0	0	0	0
SG2-06	37	0	0	0	0	1
SG2-10	92795	603	137	7	2	916
SG3-02	3	0	0	0	7	0
SG3-06	39149	257	68	4	3	400
SG3-10	187911	1060	300	7	7	1756
SG4-02	0	0	0	0	0	0
SG4-06	50	0	0	0	0	1
SG4-10	172690	966	229	4	3	1585
SG5-02	1	0	0	0	0	0
SG5-06	8	0	0	0	0	0
SG5-10	54947	612	464	4	97	1374

Concentrations in $\mu\text{g/L}$ represent the mean values of three GC/FID analyses per sample. Concentrations at or below detection limits are noted with a less than symbol. Concentrations in ppmv are calculated as discussed in Section 6, and rounded to the nearest whole number. Concentrations at detection limits were approximated by dividing the detection limit value by 2. This procedure resulted in some values being reported as zero.

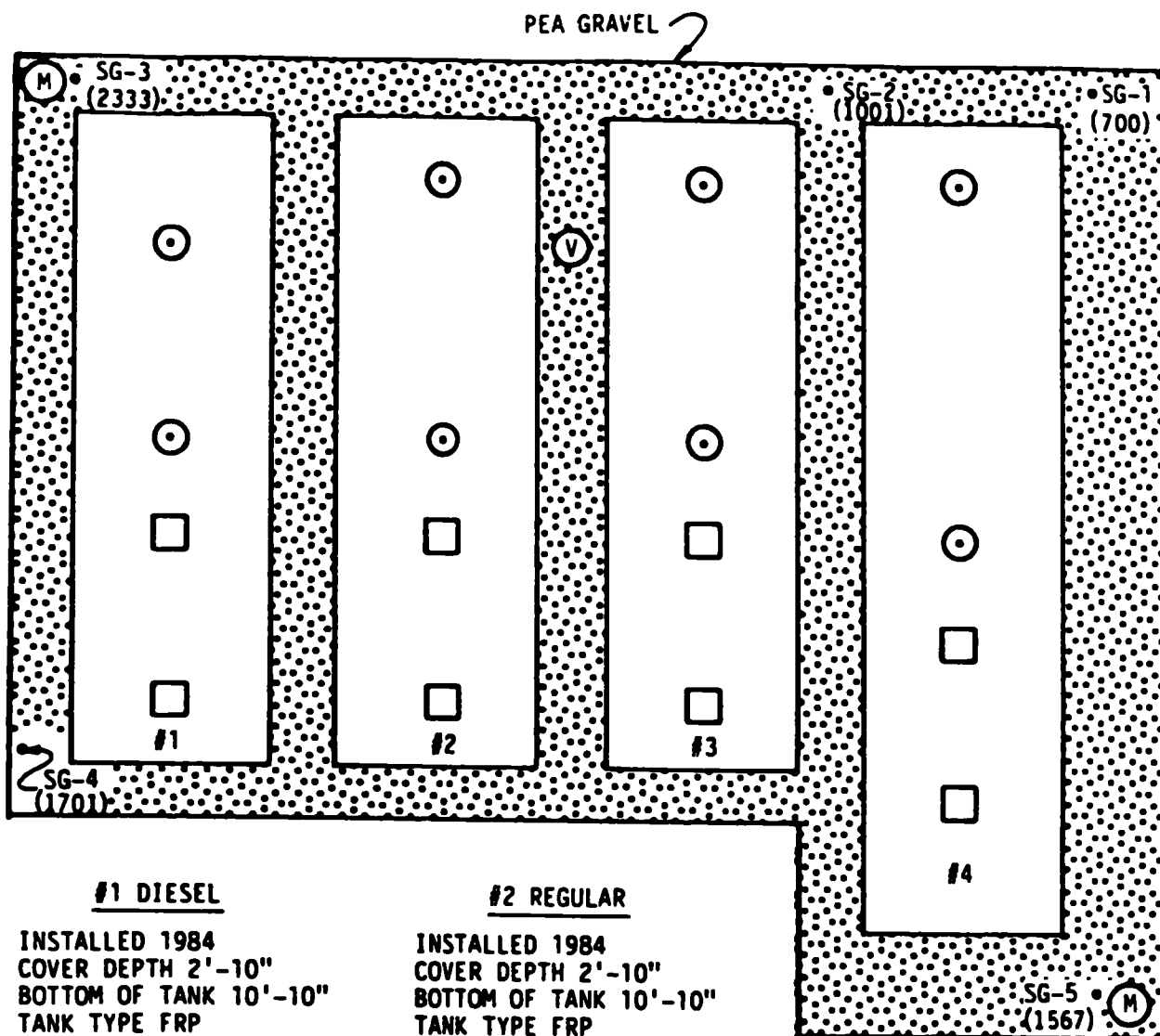
SOIL GAS DATA
($\mu\text{g/L}$)

(Data Arranged by Depth with Averages)

Austin
Station 3

Sample	Methane $\text{C}_1\text{-C}_5$ (as Methane)	Benzene	Toluene	Ethylbenzene	Xylenes	Total Hydrocarbons (less light aliphatics)
Depth - 02 Feet						
SG1-02	0.08	<0.04	<0.04	<0.06	0.20	0.10
SG2-02	0.50	<0.04	<0.04	<0.06	0.10	0.10
SG3-02	2.00	<0.04	0.09	<0.06	<56.00	0.10
SG4-02	0.10	<0.04	<0.04	<0.06	<0.06	<0.06
SG5-02	0.60	<0.04	<0.04	<0.06	0.20	0.10
Averages	0.66	0.02	0.03	0.03	5.71	0.09
Depth - 06 Feet						
SG1-06	24.00	<0.04	0.20	<0.06	0.10	0.50
SG2-06	24.00	0.70	1.00	<0.06	0.03	3.00
SG3-06	25000.00	800.00	250.00	<31.00	<28.00	1300.00
SG4-06	32.00	1.00	1.00	<0.06	0.20	3.00
SG5-06	5.00	0.06	0.30	<0.06	<0.06	1.00
Averages	5017.00	160.36	50.50	3.12	2.87	261.50
Depth - 10 Feet						
SG1-10	37000.00	1200.00	370.00	<31.00	34.00	2100.00
SG2-10	60000.00	1900.00	510.00	<63.00	7.97	3000.00
SG3-10	120000.00	3300.00	1100.00	<63.00	<56.00	5700.00
SG4-10	110000.00	3000.00	840.00	<31.00	<28.00	5100.00
SG5-10	35000.00	1900.00	1700.00	<31.00	410.00	4700.00
Averages	72400.00	2260.00	904.00	21.90	98.79	4120.00

Concentration at detection limits were approximated by dividing the detection limit by 2.
The approximations were in computing the averages.



#1 DIESEL

INSTALLED 1984
COVER DEPTH 2'-10"
BOTTOM OF TANK 10'-10"
TANK TYPE FRP
CAP. 10,000 GAL.
SIZE 8'-0"x32'-0"

#2 REGULAR

INSTALLED 1984
COVER DEPTH 2'-10"
BOTTOM OF TANK 10'-10"
TANK TYPE FRP
CAP. 10,000 GAL.
SIZE 8'-0"x32'-0"

#3 UNLEADED

INSTALLED 1984
COVER DEPTH 2'-10"
BOTTOM OF TANK 10'-10"
TANK TYPE FRP
CAP. 10,000 GAL.
SIZE 8'-0"x32'-0"

#4 SUPER UNLEADED

INSTALLED 1984
COVER DEPTH 2'-10"
BOTTOM OF TANK 10'-10"
TANK TYPE FRP
CAP. 12,000 GAL.
SIZE 8'-0"x36'-0"



NORTH

NOT TO SCALE

SOIL GAS DATA

(Data Arranged by Sample Number)

Austin
Station 4

($\mu\text{g/L}$)

Sample	Methane $\text{C}_1\text{-C}_5$ (as Methane)	Benzene	Toluene	Ethylbenzene	Xylenes	Total Hydrocarbons (less light aliphatics)
SG1-02	540000.00	43000.00	25000.00	<680.00	26000.00	120000.00
SG1-06	870000.00	58000.00	68000.00	<680.00	62000.00	220000.00
SG2-02	500000.00	41000.00	26000.00	<680.00	21000.00	110000.00
SG2-06	520000.00	41000.00	50000.00	<680.00	51000.00	160000.00
SG3-02	600000.00	64000.00	39000.00	<680.00	41000.00	180000.00
SG3-06	780000.00	97000.00	85000.00	<680.00	83000.00	320000.00
SG4-02	630000.00	78000.00	27000.00	<680.00	52000.00	200000.00
SG4-06	580000.00	78000.00	63000.00	<680.00	58000.00	240000.00
SG5-02	470000.00	37000.00	16000.00	<34.00	12000.00	87000.00
SG5-06	630000.00	51000.00	35000.00	<680.00	47000.00	160000.00

(ppmv)

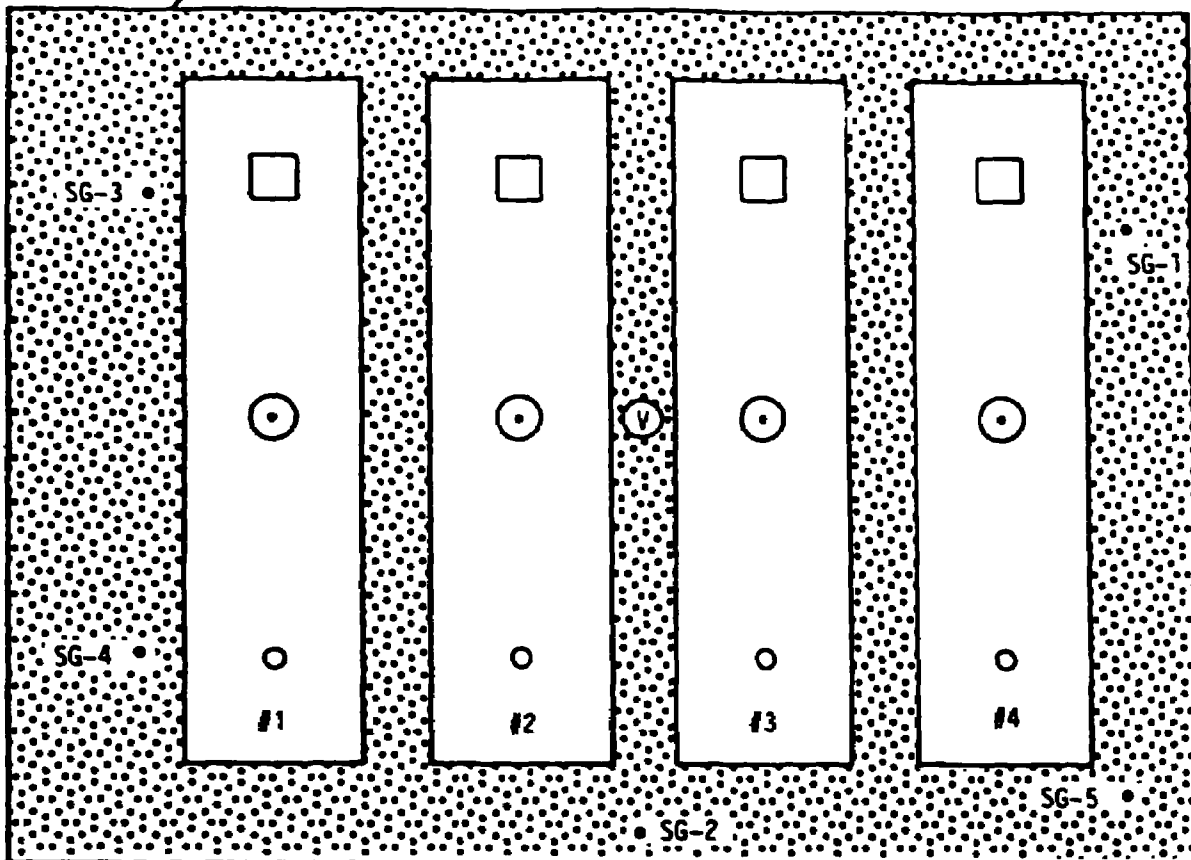
Sample	Methane $\text{C}_1\text{-C}_5$ (as Methane)	Benzene	Toluene	Ethylbenzene	Xylenes	Total Hydrocarbons (less light aliphatics)
SG1-02	812482	13271	6542	77	5905	32811
SG1-06	1311509	17935	17828	77	14108	58344
SG2-02	763025	12868	6918	79	4850	30775
SG2-06	797126	12892	13330	79	11801	42829
SG3-02	919761	20125	10397	79	9487	49991
SG3-06	1195689	30501	22661	79	19205	87370
SG4-02	965749	24527	7198	79	12032	55721
SG4-06	889102	24527	16796	79	13420	66004
SG5-02	720479	11635	4266	4	2777	24997
SG5-06	965749	16037	9331	79	10875	43584

Concentrations in $\mu\text{g/L}$ represent the mean values of three GC/FID analyses per sample.

Concentrations at or below detection limits are noted with a less than symbol.

Concentrations in ppmv are calculated as discussed in Section 6, and rounded to the nearest whole number. Concentrations at detection limits were approximated by dividing the detection limit value by 2. This procedure resulted in some values being reported as zero.

PEAGRAVEL



#1 DIESEL

INSTALLED 1981
COVER DEPTH 3'-0"
BOTTOM OF TANK 11'-0"
TANK TYPE FRP
CAP. 10,000 GAL.
SIZE 8'-0"x32'-0"

#2 REGULAR

INSTALLED 1981
COVER DEPTH 3'-0"
BOTTOM OF TANK 11'-0"
TANK TYPE FRP
CAP. 10,000 GAL.
SIZE 8'-0"x32'-0"

#3 UNLEADED

INSTALLED 1981
COVER DEPTH 3'-0"
BOTTOM OF TANK 11'-0"
TANK TYPE FRP
CAP. 10,000 GAL.
SIZE 8'-0"x32'-0"

#4 SUPER

INSTALLED 1981
COVER DEPTH 3'-0"
BOTTOM OF TANK 11'-0"
TANK TYPE FRP
CAP. 10,000 GAL.
SIZE 8'-0"x32'-0"

Austin Station 4

100



NOT TO SCALE

SOIL GAS DATA

(Data Arranged by Sample Number)

Austin
Station 5

($\mu\text{g/L}$)

Sample	Methane $\text{C}_1\text{-C}_5$ (as Methane)	Butanes Pentanes and Hexanes	Benzene	Toluene	Ethyl- benzene	Xylenes	Total Hydrocarbons less methane
SG1-02	72000.00	110000.00	13000.00	3800.00	950.00	<32.00	150000.00
SG1-06	240000.00	68000.00	24000.00	13000.00	2800.00	690.00	110000.00
SG1-10	1500000.00	160000.00	17000.00	6300.00	1800.00	<32.00	1100000.00
SG2-02	120000.00	26000.00	8000.00	2700.00	550.00	<32.00	36000.00
SG2-06	110000.00	22000.00	7400.00	2200.00	400.00	<32.00	30000.00
SG2-10	1500.00	24000.00	5600.00	26000.00	25000.00	8200.00	120000.00
SG3-02	10000.00	110000.00	16000.00	18000.00	5100.00	6000.00	190000.00
SG4-02	120000.00	100000.00	6300.00	5400.00	2300.00	<32.00	140000.00
SG5-1.5	9500.00	10000.00	660.00	220.00	33.00	<2.00	12000.00

(ppmv)

Sample	Methane $\text{C}_1\text{-C}_5$ (as Methane)	Butanes Pentanes and Hexanes	Benzene	Toluene	Ethyl- benzene	Xylenes	Total Hydrocarbons less methane
SG1-02	111823	37965	4142	1026	223	4	45546
SG1-06	372743	23469	7646	3511	656	162	32607
SG1-10	2354982	55822	5475	1720	427	4	333966
SG2-02	188399	9071	2576	737	130	4	11017
SG2-06	172699	7676	2383	601	95	4	9233
SG2-10	2355	8373	1803	7099	5924	1943	31056
SG3-02	15705	38390	5155	4916	1209	1422	52285
SG4-02	188462	34900	2030	1475	545	4	40489
SG5-1.5	14920	3490	213	60	8	0	3686

Concentrations in $\mu\text{g/L}$ represent the mean values of three GC/FID analyses per sample.

Concentrations at or below detection limits are noted with a less than symbol.

Concentrations in ppmv are calculated as discussed in Section 6, and rounded to the nearest whole number. Concentrations at detection limits were approximated by dividing the detection limit value by 2. This procedure resulted in some values being reported as zero.

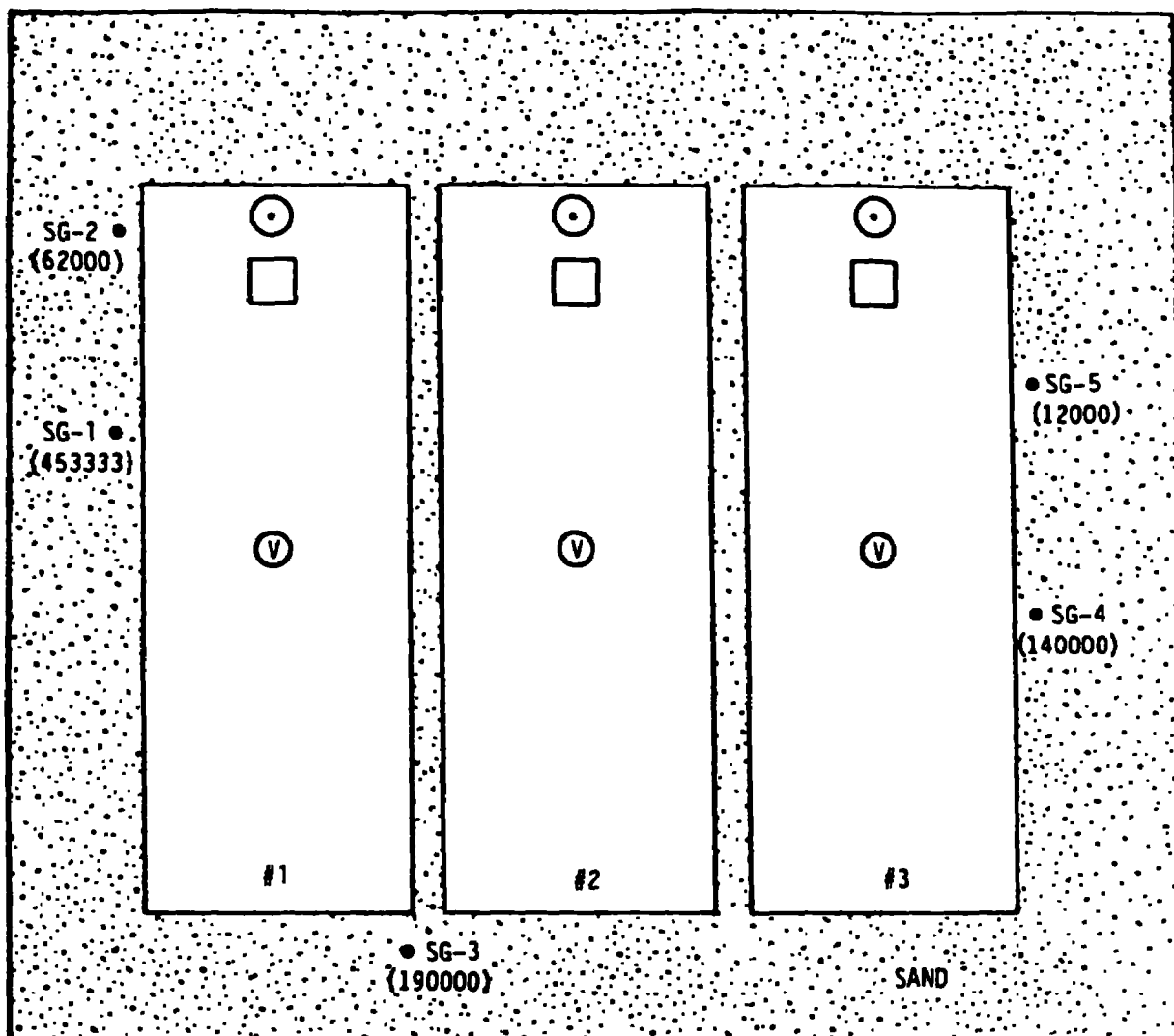
SOIL GAS DATA
($\mu\text{g/L}$)

(Data Arranged by Sample Number)

Austin
Station 5

Sample	Methane $\text{C}_1\text{-C}_5$ (as Methane)	Butanes Pentanes and Hexanes	Benzene	Toluene	Ethyl- benzene	Xylenes	Total Hydrocarbons less methane
<u>Depth - 02 Feet</u>							
SG1-02	72000.00	110000.00	13000.00	3800.00	950.00	<32.00	150000.00
SG2-02	120000.00	26000.00	8000.00	2700.00	550.00	<32.00	36000.00
SG3-02	10000.00	110000.00	16000.00	18000.00	5100.00	6000.00	190000.00
SG4-02	120000.00	100000.00	6300.00	5400.00	2300.00	<32.00	140000.00
SG5-1.5	9500.00	10000.00	660.00	220.00	33.00	<2.00	12000.00
Averages	66300.00	71200.00	8792.00	6024.00	1786.60	1209.80	105600.00
<u>Depth - 06 Feet</u>							
SG1-06	240000.00	68000.00	24000.00	13000.00	2800.00	690.00	110000.00
SG2-06	110000.00	22000.00	7400.00	2200.00	400.00	<32.00	30000.00
Averages	175000.00	45000.00	15700.00	7600.00	1600.00	353.00	70000.00
<u>Depth - 10 Feet</u>							
SG1-10	1500000.00	160000.00	17000.00	6300.00	1800.00	<32.00	1100000.00
SG2-10	1500.00	24000.00	5600.00	26000.00	25000.00	8200.00	120000.00
Averages	750750.00	92000.00	11300.00	16150.00	13400.00	4108.00	610000.00

Concentration at detection limits were approximated by dividing the detection limit by 2. The approximations were used in computing the averages.



SPECS. TYPICAL ALL TANKS.

INSTALLED 1984
COVER DEPTH 3'-0"
BOTTOM DEPTH 11'-0"
TANK TYPE STEEL
CAP. 8000 GAL.
SIZE 8'-0"x21'-4"

#1 UNLEADED

#2 SUPER UNLEADED

#3 REGULAR

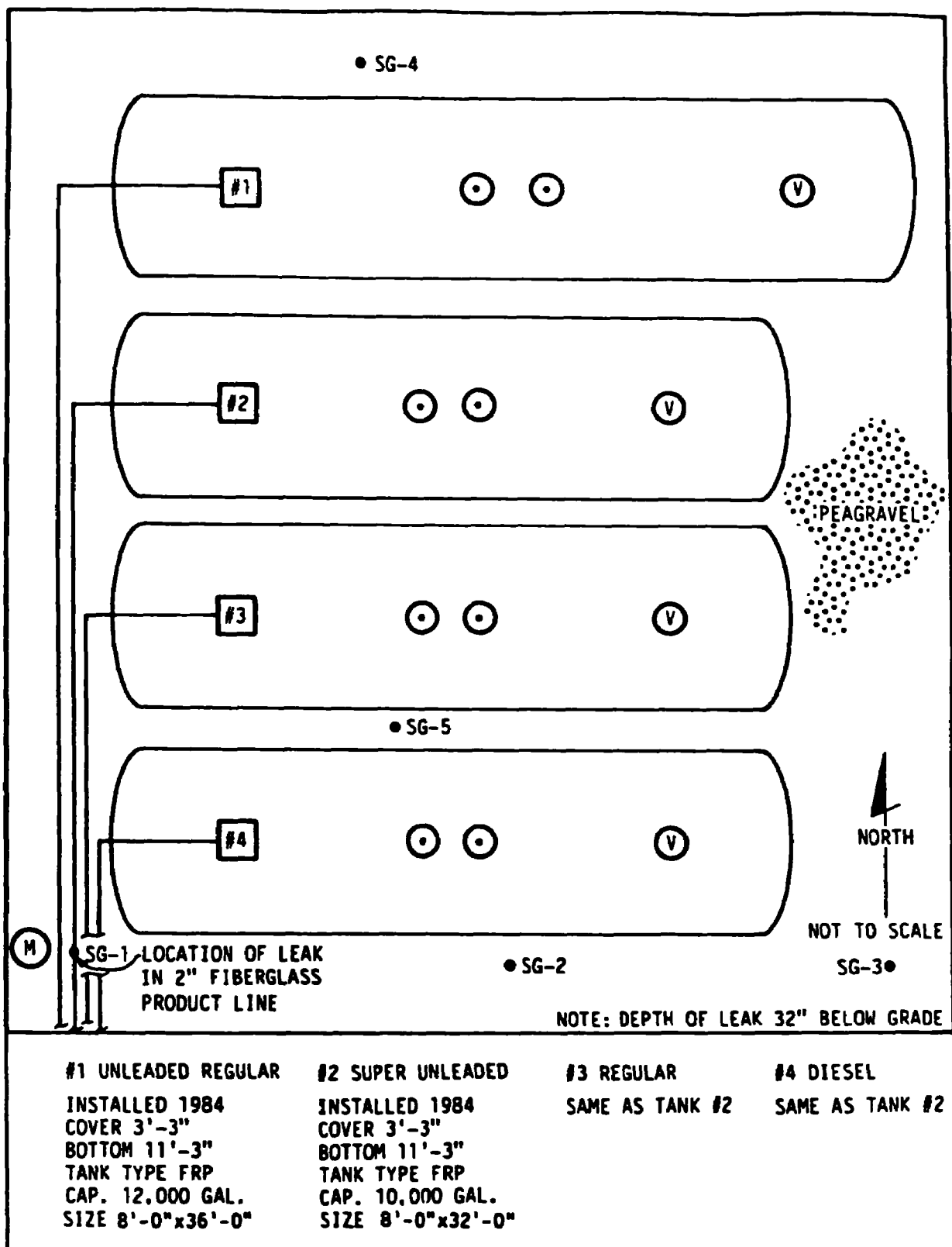


Austin Station 5

Austin Station 6

(All concentration values in µg/L)

Station	Sample Number	Depth (ft)	Sample Date	Sample Time	Methane (C ₁ - C ₅)	Butane	Benzene	Toluene	Ethylbenzene	Xylenes	Total Hydrocarbons
AU6	SG-01	2.	10/27/87	8:54:00	4500.0	NA	<38.0	3100.0	<44.0	-48.0	71000.0
AU6	SG-01	6.	10/27/87	9:02:00	710,000	NA	110000	90000.0	<220.0	-240.0	960000.0
AU6	SG-02	6.	10/27/87	9:15:00	4500.0	NA	<38.0	<43.0	<44.0	-48.0	8700.0
AU6	SG-02	2.	10/27/87	9:40:00	6100.0	NA	<190.0	<220.0	<220.0	-240.0	13000.0
AU6	SG-03	2.	10/27/87	10:12:00	0.3	NA	<0.2	<0.2	<0.2	-0.2	-0.2
AU6	SG-03	6.	10/27/87	10:38:00	14000.0	NA	<190.0	<220.0	<220.0	-240.0	180000.0
AU6	SG-04	2.	10/27/87	11:14:00	6700.0	NA	<190.0	<220.0	<220.0	-240.0	150000.0
AU6	SG-04	6.	10/27/87	11:38:00	6300.0	NA	<190.0	<220.0	<220.0	-240.0	130000.0
AU6	SG-05	2.	10/27/87	12:49:00	4800.0	NA	<190.0	<220.0	<220.0	-240.0	88000.0
AU6	SG-05	6.	10/27/87	13:13:00	3600.0	NA	<190.0	<220.0	<220.0	-240.0	90000.0
AU6	SG-03	2.	10/28/87	13:48:00	200.0	620.0	<4.2	<4.8	<4.9	-5.8	1900.0
AU6	SG-03	6.	10/28/87	14:17:00	200.0	530.0	<4.2	<4.8	<4.9	-5.8	2100.0
AU6	SG-02	2.	10/28/87	14:50:00	5493.0	58000	<42.0	<48.0	<49.0	-58.0	190000.0
AU6	SG-02	6.	10/28/87	15:31:00	4100.0	210000	8300.0	8100.0	<49.0	-58.0	610000.0
AU6	SG-05	2.	10/28/87	16:20:00	2400.0	57000	<42.0	1800.0	<49.0	-58.0	150000.0
AU6	SG-05	6.	10/28/87	16:50:00	4400.0	300000	5600.0	5600.0	<49.0	-58.0	740000.0
AU6	SG-04	2.	10/28/87	18:03:00	5000.0	64000	<42.0	<48.0	<49.0	-58.0	200000.0
AU6	SG-03	6.	10/29/87	16:30:00	5600.0	13000	<250.0	<290.0	-270.0	-260.0	180000.0
AU6	SG-02	6.	10/29/87	17:07:00	8500.0	41000	<250.0	<290.0	-270.0	-260.0	420000.0
AU6	SG-05	6.	10/29/87	17:32:00	10000.0	71000	<250.0	<290.0	-270.0	-260.0	690000.0
AU6	SG-04	6.	10/29/87	17:53:00	13000.0	55000	<250.0	<290.0	-270.0	-260.0	660000.0
AU6	SG-04	6.	10/30/87	11:48:00	3600.0	250000	76000.0	700.0	-20.0	-31.0	250000.0
AU6	SG-05	6.	10/30/87	12:20:00	4800.0	270000	4500.0	1200.0	-20.0	-31.0	290000.0
AU6	SG-02	6.	10/30/87	12:45:00	3400.0	150000	38000.0	7600.0	-20.0	-31.0	160000.0
AU6	SG-03	6.	10/30/87	13:15:00	4600.0	140000	<78.0	<15.0	-20.0	-31.0	150000.0



Austin Station 6

SOIL GAS DATA

(Data Arranged by Sample Number)

Austin
Station 7

($\mu\text{g/L}$)

Sample	Methane $\text{C}_1\text{-C}_5$ (as Methane)	Butanes Pentanes and Hexanes	Benzene	Toluene	Ethyl- benzene	Xylenes	Total Hydrocarbons less methane
SG2-02	560.00	12.00	<0.04	<0.04	<0.06	<0.06	16.00
SG2-06	31000.00	31000.00	<42.00	<48.00	<50.00	<58.00	42000.00
SG3-02	340.00	100.00	<0.40	<0.50	<0.50	<0.06	150.00
SG3-06	59000.00	39000.00	<42.00	<48.00	<50.00	<58.00	55000.00
SG4-02	26.00	11.00	<0.20	5.00	<0.20	<0.30	32000.00

(ppmv)

Sample	Methane $\text{C}_1\text{-C}_5$ (as Methane)	Butanes Pentanes and Hexanes	Benzene	Toluene	Ethyl- benzene	Xylenes	Total Hydrocarbons less methane
SG2-02	830	4	0	0	0	0	4
SG2-06	45672	10149	6	6	6	6	10396
SG3-02	502	33	0	0	0	0	37
SG3-06	87454	12846	6	6	6	6	13697
SG4-02	39	4	0	1	0	0	8224

Concentrations in $\mu\text{g/L}$ represent the mean values of three GC/FID analyses per sample. Concentrations at or below detection limits are noted with a less than symbol. Concentrations in ppmv are calculated as discussed in Section 6, and rounded to the nearest whole number. Concentrations at detection limits were approximated by dividing the detection limit value by 2. This procedure resulted in some values being reported as zero.

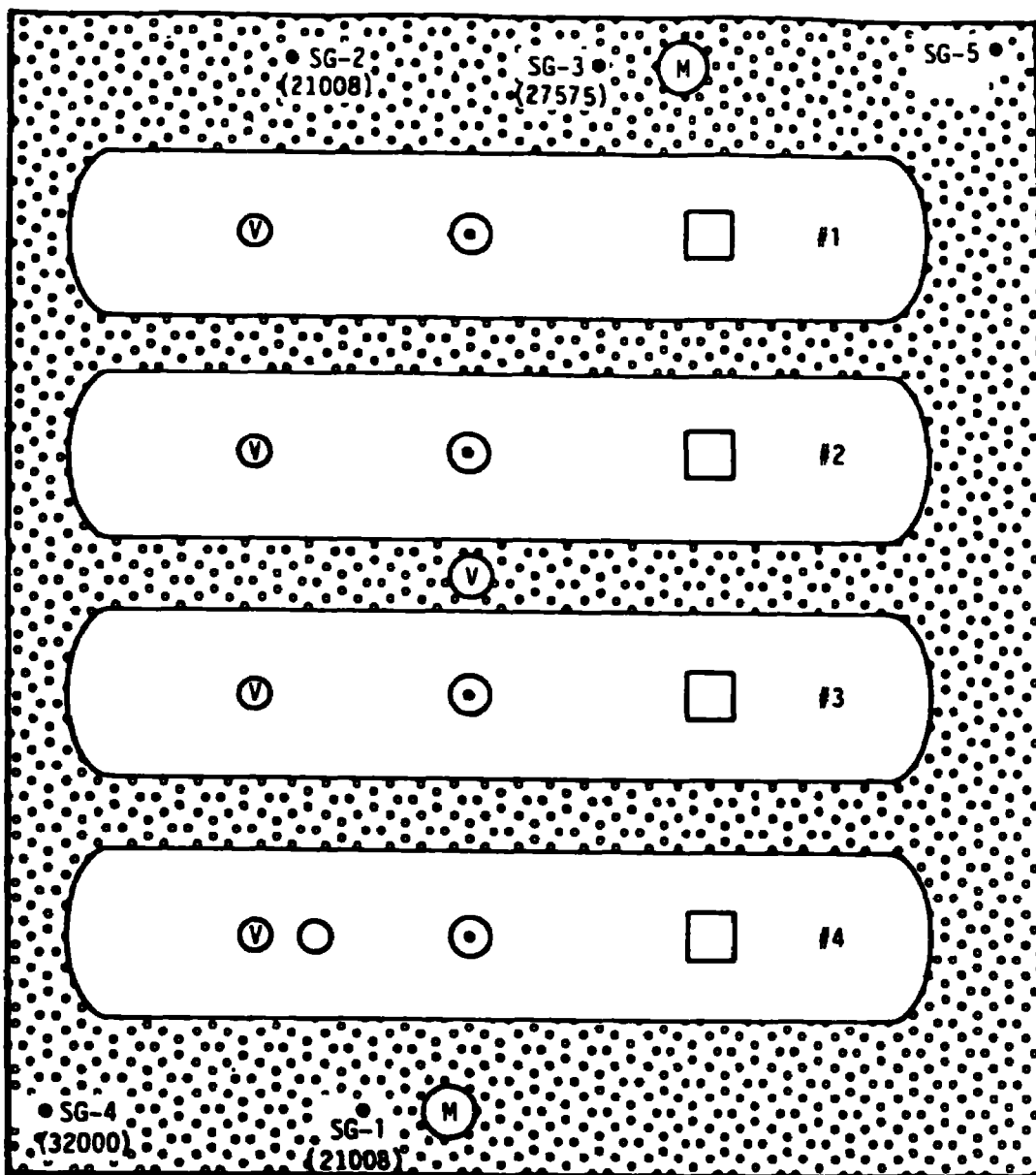
SOIL GAS DATA
($\mu\text{g/L}$)

(Data Arranged by Sample Number)

Austin
Station 7

Sample	Methane C ₁ -C ₅ (as Methane)	Butanes Pentanes and Hexanes	Benzene	Toluene	Ethyl- benzene	Xylenes	Total Hydrocarbons less methane
<u>Depth - 02 Feet</u>							
SG2-02	560.00	12.00	<0.04	<0.04	<0.06	<0.06	16.00
SG3-02	340.00	100.00	<0.40	<0.50	<0.50	<0.06	150.00
SG4-02	26.00	11.00	<0.20	5.00	<0.20	<0.30	32000.00
Averages	308.67	41.00	0.11	1.76	0.13	0.07	10722.00
<u>Depth - 06 Feet</u>							
SG2-06	31000.00	31000.00	<42.00	<48.00	<50.00	<58.00	42000.00
SG2-06	59000.00	39000.00	<42.00	<48.00	<50.00	<58.00	55000.00
Averages	45000.00	35000.00	21.00	24.00	25.00	29.00	48500.00

Concentration at detection limits were approximated by dividing the detection limit by 2. The approximations were used in computing the averages.



PEAGRAVEL

SPECS. TYPICAL ALL TANKS.

INSTALLED 1984
COVER DEPTH 3'-5"
BOTTOM DEPTH 11'-5"
TANK TYPE FRP
CAP. 10,000 GAL.
SIZE 8'-0"x30'-6"

#1 SUPER UNLEADED
#2 UNLEADED
#3 REGULAR
#4 DIESEL



NOT TO SCALE

Austin Station 7

SOIL GAS DATA

(Data Arranged by Sample Number)

Connecticut
Station 1

($\mu\text{g/L}$)

Sample	Methane $\text{C}_1\text{-C}_5$ (as Methane)	Butanes Pentanes and Hexanes	Benzene	Toluene	Ethyl- benzene	Xylenes	Total Hydrocarbons less methane
SG1-02	2.00	20.00	<0.04	<0.04	<0.02	<0.04	28.00
SG1-06	0.40	<0.02	<0.08	<0.04	<0.04	<0.06	<0.20
SG1-10	1.00	0.30	<0.06	<0.04	<0.04	<0.04	3.00
SG2-02	0.30	0.10	<0.04	<0.04	<0.02	<0.02	0.30
SG2-06	0.80	<0.02	<0.04	<0.04	<0.02	<0.04	0.70
SG3-02	13000.00	280.00	<10.00	250.00	<6.00	<8.00	2700.00
SG3-06	25000.00	350.00	<10.00	840.00	<6.00	<8.00	3700.00
SG4-02	2.00	<0.04	<0.04	<0.06	<0.04	<0.06	<0.04
SG4-06	2.00	<0.02	<0.04	<0.04	<0.02	<0.04	<0.04
SG5-02	3.00	0.60	<0.06	<0.08	<0.04	<0.08	2.00
SG5-06	2.00	3.00	<0.06	<0.08	<0.04	<0.08	11.00
SG5-10	6.00	0.50	<0.06	<0.08	<0.04	<0.08	0.50

(ppmv)

Sample	Methane $\text{C}_1\text{-C}_5$ (as Methane)	Butanes Pentanes and Hexanes	Benzene	Toluene	Ethyl- benzene	Xylenes	Total Hydrocarbons less methane
SG1-02	3	6	0	0	0	0	7
SG1-06	1	0	0	0	0	0	0
SG1-10	1	0	0	0	0	0	1
SG2-02	0	0	0	0	0	0	0
SG2-06	1	0	0	0	0	0	0
SG3-02	18267	87	1	61	1	1	660
SG3-06	35130	109	1	205	1	1	904
SG4-02	3	0	0	0	0	0	0
SG4-06	3	0	0	0	0	0	0
SG5-02	4	0	0	0	0	0	0
SG5-06	3	1	0	0	0	0	3
SG5-10	9	0	0	0	0	0	0

Concentrations in $\mu\text{g/L}$ represent the mean values of three GC/FID analyses per sample. Concentrations at or below detection limits are noted with a less than symbol. Concentrations in ppmv are calculated as discussed in Section 6, and rounded to the nearest whole number. Concentrations at detection limits were approximated by dividing the detection limit value by 2. This procedure resulted in some values being reported as zero.

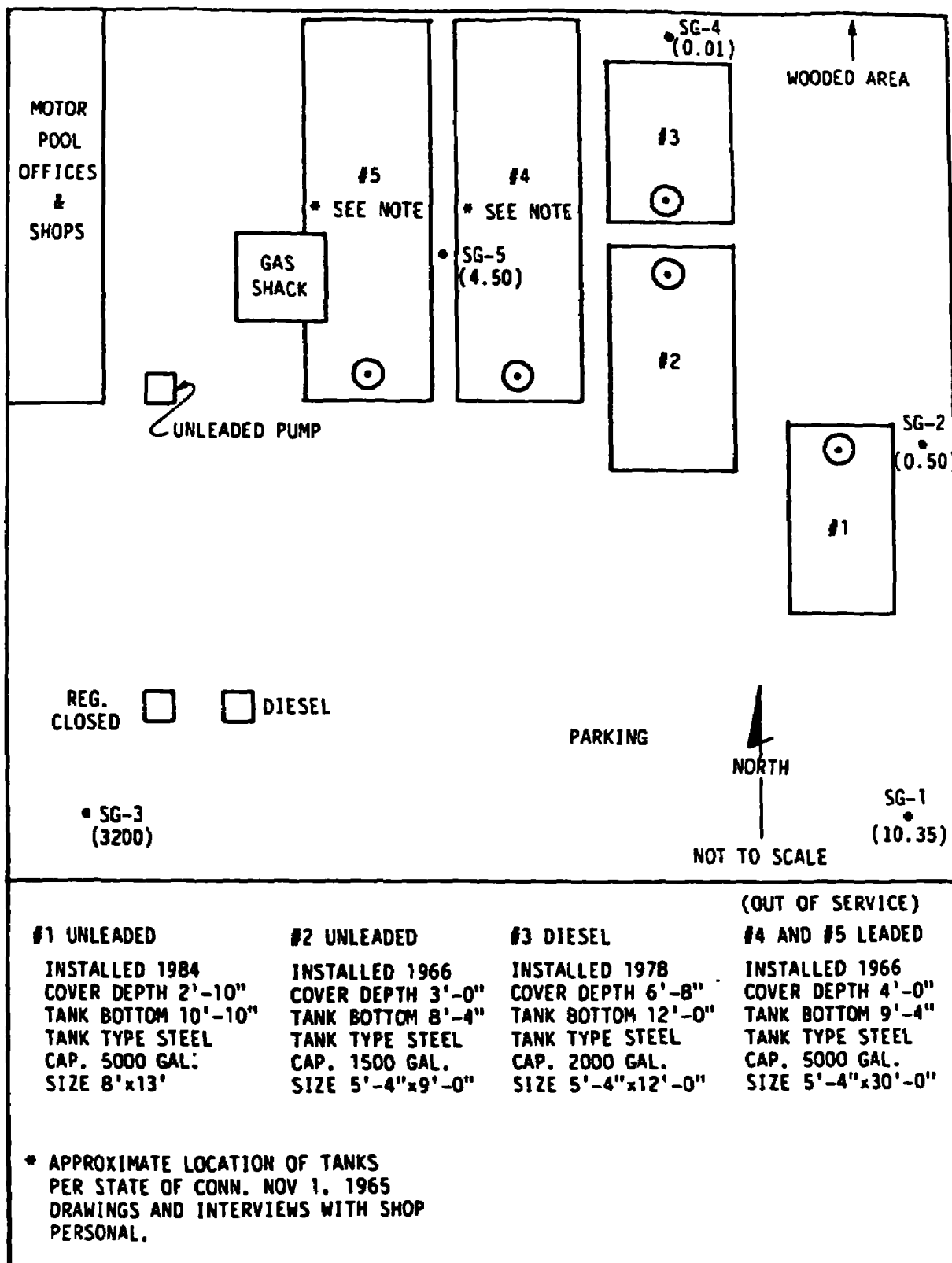
SOIL GAS DATA
($\mu\text{g/L}$)

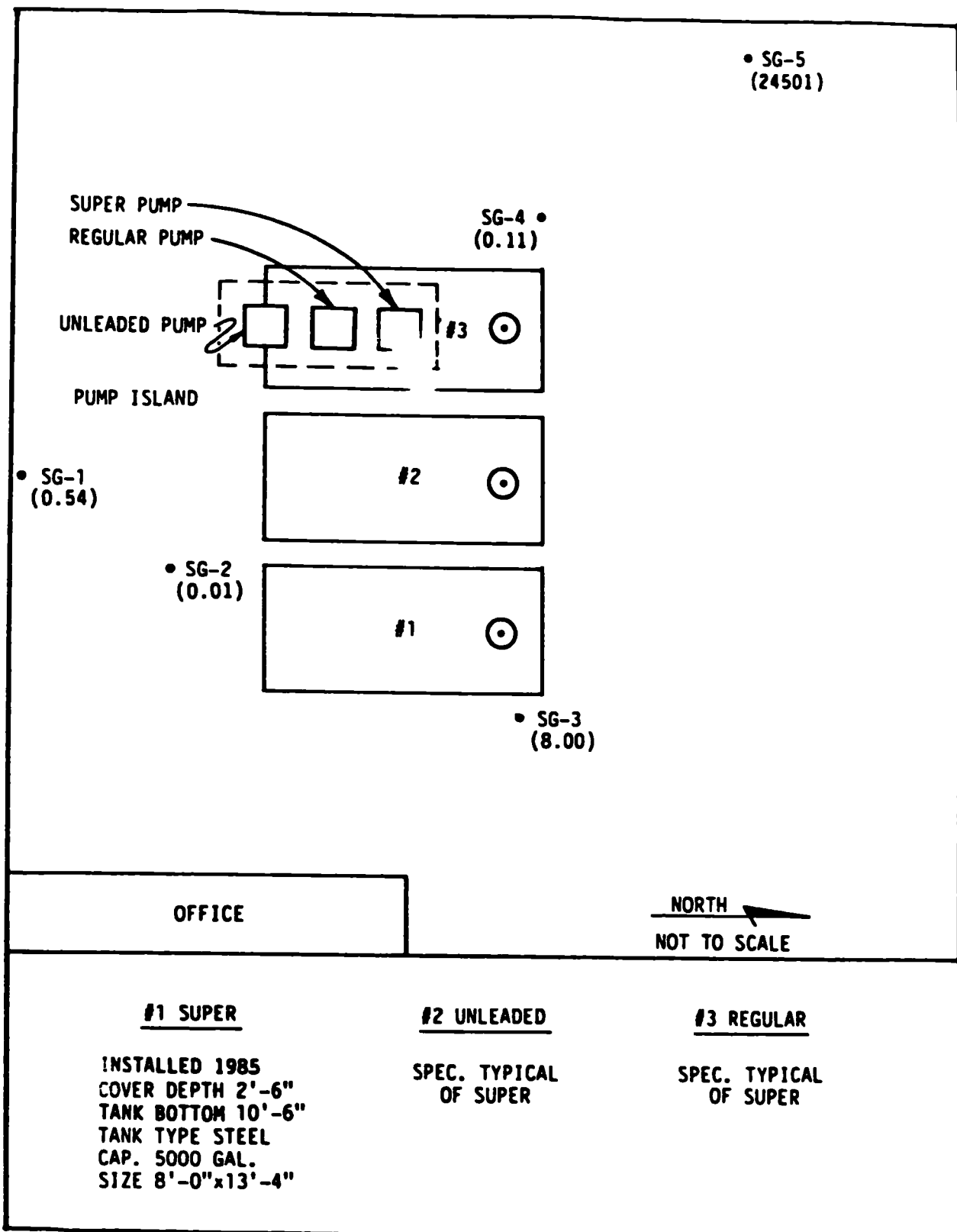
(Data Arranged by Sample Number)

Connecticut
Station 1

Sample	Methane $\text{C}_1\text{-C}_5$ (as Methane)	Butanes Pentanes and Hexanes	Benzene	Toluene	Ethyl- benzene	Xylenes	Total Hydrocarbons less methane
<u>Depth - 02 Feet</u>							
SG1-02	2.00	20.00	<0.04	<0.04	<0.02	<0.04	28.00
SG2-02	0.30	0.10	<0.04	<0.04	<0.02	<0.02	0.30
SG3-02	13000.00	280.00	<10.00	250.00	<6.00	<8.00	2700.00
SG4-02	2.00	<0.04	<0.04	<0.06	<0.04	<0.06	<0.04
SG5-02	3.00	0.60	<0.06	<0.08	<0.04	<0.08	2.00
Averages	2601.46	60.14	1.02	50.02	0.61	0.82	546.06
<u>Depth - 06 Feet</u>							
SG1-06	0.40	<0.02	<0.08	<0.04	<0.04	<0.06	<0.20
SG2-06	0.80	<0.02	<0.04	<0.04	<0.02	<0.04	0.70
SG3-06	25000.00	350.00	<10.00	840.00	<6.00	<8.00	3700.00
SG4-06	2.00	<0.02	<0.04	<0.04	<0.02	<0.04	<0.04
SG5-06	2.00	3.00	<0.06	<0.08	<0.04	<0.08	11.00
Averages	5001.04	70.61	1.02	168.02	0.61	0.82	742.36
<u>Depth - 10 Feet</u>							
SG1-10	1.00	0.30	<0.06	<0.04	<0.04	<0.04	3.00
SG3-10	6.00	0.50	<0.06	<0.08	<0.04	<0.08	0.50
Averages	3.50	0.40	0.03	0.03	0.02	0.03	1.75

Concentration at detection limits were approximated by dividing the detection limit by 2. The approximations were used in computing the averages.





SOIL GAS DATA

(Data Arranged by Sample Number)

New York
Station 1

($\mu\text{g/L}$)

Sample	Methane $\text{C}_1\text{-C}_5$ (as Methane)	Benzene	Toluene	Ethylbenzene	Xylenes	Total Hydrocarbons (less light aliphatics)
SG1-02	2.00	<0.08	<0.10	<0.20	<0.02	<0.10
SG1-06	2.00	<0.08	<0.10	<0.20	<0.02	<0.10
SG1-10	2.00	<0.08	<0.10	<0.20	<0.02	<0.10
SG2-02	<40.00	<150.00	<210.00	<360.00	<410.00	170000.00
SG2-06	<40.00	1400.00	1300.00	1100.00	<410.00	210000.00
SG2-08	<40.00	2700.00	11000.00	12000.00	10000.00	270000.00
SG3-02	0.80	<0.08	<0.10	<0.20	<0.20	<0.10
SG3-06	0.60	<0.08	<0.10	<0.20	<0.20	<0.10
SG3-10	1.00	<0.08	<0.10	<0.20	<0.20	<0.10
SG4-02	0.80	<0.08	<0.10	<0.20	<0.20	<0.10
SG4-06	<0.40	<1.00	140.00	<4.00	<4.00	1900.00
SG4-09	<0.40	<1.00	110.00	<4.00	<4.00	1300.00

(ppmv)

Sample	Methane $\text{C}_1\text{-C}_5$ (as Methane)	Benzene	Toluene	Ethylbenzene	Xylenes	Total Hydrocarbons (less light aliphatics)
SG1-02	3	0	0	0	0	0
SG1-06	3	0	0	0	0	0
SG1-10	3	0	0	0	0	0
SG2-02	30	23	28	41	47	41850
SG2-06	30	435	343	252	47	56470
SG2-08	30	843	2911	2756	2297	66609
SG3-02	1	0	0	0	0	0
SG3-06	1	0	0	0	0	0
SG3-10	2	0	0	0	0	0
SG4-02	1	0	0	0	0	0
SG4-06	0	0	37	0	0	495
SG4-09	0	0	29	0	0	338

Concentrations in $\mu\text{g/L}$ represent the mean values of three GC/FID analyses per sample. Concentrations at or below detection limits are noted with a less than symbol. Concentrations in ppmv are calculated as discussed in Section 6, and rounded to the nearest whole number. Concentrations at detection limits were approximated by dividing the detection limit value by 2. This procedure resulted in some values being reported as zero.

SOIL GAS DATA

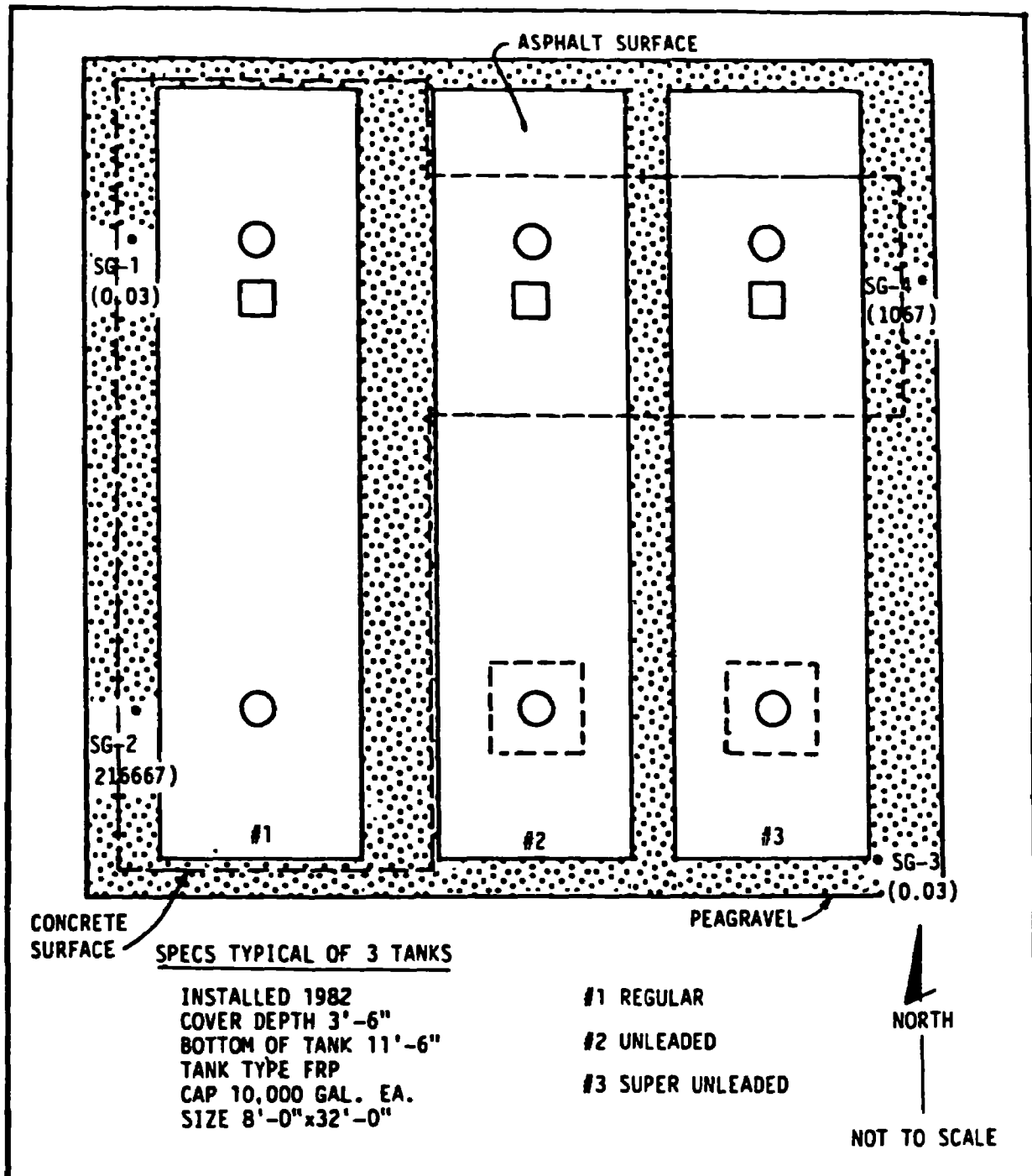
(Data Arranged by Sample Number)

New York
Station 1

(µg/L)

Sample	Methane C ₁ -C ₅ (as Methane)	Benzene	Toluene	Ethylbenzene	Xylenes	Total Hydrocarbons (less light aliphatics)
<u>Depth - 02 Feet</u>						
SG1-02	2.00	<0.08	<0.10	<0.20	<0.02	<0.10
SG2-02	<40.00	<150.00	<210.00	<360.00	<410.00	170000.00
SG3-02	0.80	<0.08	<0.10	<0.20	<0.20	<0.10
SG4-02	0.80	<0.08	<0.10	<0.20	<0.20	<0.10
Averages	5.90	18.78	26.29	45.07	51.30	42500.04
<u>Depth - 06 Feet</u>						
SG1-06	2.00	<0.08	<0.10	<0.20	<0.02	<0.10
SG2-06	<40.00	1400.00	1300.00	1100.00	<410.00	210000.00
SG3-06	0.60	<0.08	<0.10	<0.20	<0.20	<0.10
SG4-06	<0.40	<1.00	140.00	<4.00	<4.00	1900.00
Averages	5.70	350.14	360.02	275.55	51.78	52975.02
<u>Depth - 10 Feet</u>						
SG1-10	2.00	<0.08	<0.10	<0.20	<0.02	<0.10
SG2-08	<40.00	2700.00	11000.00	12000.00	10000.00	270000.00
SG3-10	1.00	<0.08	<0.10	<0.20	<0.20	<0.10
SG4-09	<0.40	<1.00	110.00	<4.00	<4.00	1300.00
Averages	5.80	675.14	2777.52	3000.55	2500.53	67825.02

Concentrations at detection limits were approximated by dividing the detection limit by 2.
The approximations were used in computing the averages.



Suffolk County, New York Station 1

SOIL GAS DATA

(Data Arranged by Sample Number)

New York
Station 2

(µg/L)

Sample	Methane C ₁ -C ₅ (as Methane)	Benzene	Toluene	Ethylbenzene	Xylenes	Total Hydrocarbons (less light aliphatics)
SG1-02	0.30	<0.04	<0.04	<0.04	<0.04	<0.04
SG1-06	0.20	<0.04	<0.04	<0.04	<0.04	<0.04
SG1-10	0.20	<0.04	<0.04	<0.04	<0.04	<0.04
SG2-02	140.00	<29.00	420.00	130.00	<41.00	2100.00
SG2-06	75.00	<3.00	410.00	28.00	<4.00	1100.00
SG2-10	18.00	<0.30	38.00	<0.40	<0.40	110.00
SG3-02	0.20	<0.04	<0.04	<0.04	<0.04	<0.04
SG4-02	0.20	<0.04	<0.04	<0.04	<0.04	<0.04
SG4-06	0.08	<0.04	0.30	<0.04	<0.04	0.30
SG4-10	0.06	<0.04	<0.04	<0.04	<0.04	<0.04
SG5-02	0.60	<0.04	0.10	<0.04	<0.04	0.10

(ppmv)

Sample	Methane C ₁ -C ₅ (as Methane)	Benzene	Toluene	Ethylbenzene	Xylenes	Total Hydrocarbons (less light aliphatics)
SG1-02	0	0	0	0	0	0
SG1-06	0	0	0	0	0	0
SG1-10	0	0	0	0	0	0
SG2-02	209	4	109	29	5	529
SG2-06	112	0	107	6	0	283
SG2-10	27	0	10	0	0	29
SG3-02	0	0	0	0	0	0
SG4-02	0	0	0	0	0	0
SG4-06	0	0	0	0	0	0
SG4-10	0	0	0	0	0	0
SG5-02	1	0	0	0	0	0

Concentrations in µg/L represent the mean values of three GC/FID analyses per sample. Concentrations at or below detection limits are noted with a less than symbol. Concentrations in ppmv are calculated as discussed in Section 6, and rounded to the nearest whole number. Concentrations at detection limits were approximated by dividing the detection limit value by 2. This procedure resulted in some values being reported as zero.

SOIL GAS DATA

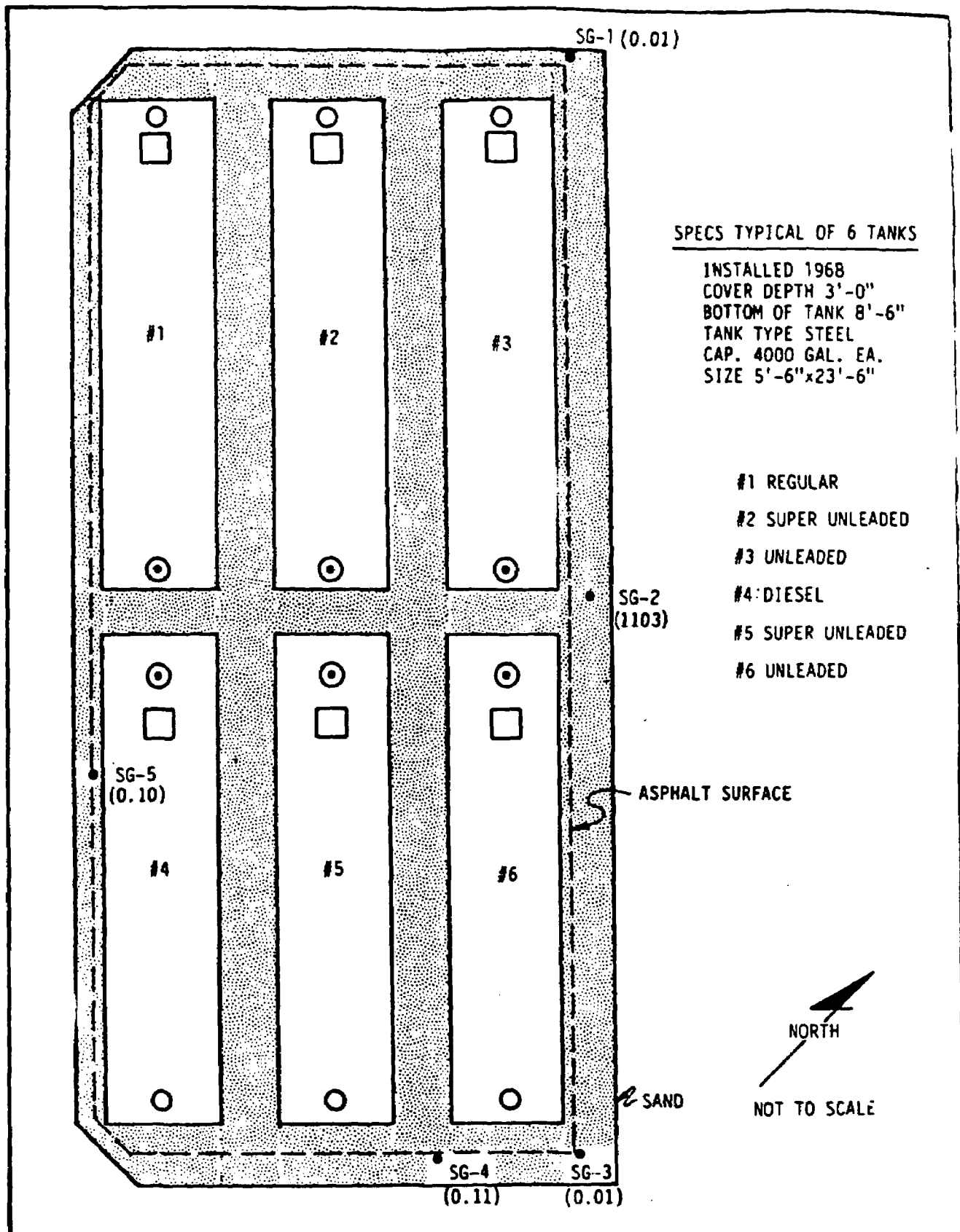
(Data Arranged by Sample Number)

New York
Station 2

($\mu\text{g/L}$)

Sample	Methane $\text{C}_1\text{-C}_5$ (as Methane)	Benzene	Toluene	Ethylbenzene	Xylenes	Total Hydrocarbons (less light aliphatics)
Depth - 02 Feet						
SG1-02	0.30	<0.04	<0.04	<0.04	<0.04	<0.04
SG2-02	140.00	<29.00	420.00	130.00	<41.00	2100.00
SG3-02	0.20	<0.04	<0.04	<0.04	<0.04	<0.04
SG4-02	0.20	<0.04	<0.04	<0.04	<0.04	<0.04
SG5-02	0.60	<0.04	0.10	<0.04	<0.04	0.10
Averages	28.26	2.92	84.03	26.02	4.12	420.03
Depth - 06 Feet						
SG1-06	0.20	<0.04	<0.04	<0.04	<0.04	<0.04
SG2-06	75.00	<3.00	410.00	28.00	<4.00	1100.00
SG4-06	0.08	<0.04	0.30	<0.04	<0.04	0.30
Averages	25.09	0.51	136.77	9.35	0.68	366.77
Depth - 10 Feet						
SG1-10	0.20	<0.04	<0.04	<0.04	<0.04	<0.04
SG2-10	18.00	<0.30	38.00	<0.40	<0.40	110.00
SG4-10	0.06	<0.04	<0.04	<0.04	<0.04	<0.04
Averages	6.09	0.06	12.68	0.08	0.08	36.68

Concentrations at detection limits were approximated by dividing the detection limit by 2.
The approximations were used in computing the averages.



Suffolk County, New York Station 2

SOIL GAS DATA

(Data Arranged by Sample Number)

New York
Station 4

(µg/L)

Sample	Methane C ₁ -C ₅ (as Methane)	Benzene	Toluene	Ethylbenzene	Xylenes	Total Hydrocarbons (less light aliphatics)
SG1-02	<0.50	0.25	14.00	<0.70	<0.80	1100.00
SG1-06	<24.00	620.00	<30.00	<37.00	<42.00	26000.00
SG1-10	<24.00	730.00	120.00	<37.00	<42.00	42000.00
SG2-02	<0.50	<0.50	46.00	<0.70	<0.80	1600.00
SG2-06	<24.00	480.00	120.00	<37.00	<42.00	31000.00
SG2-10	<24.00	980.00	300.00	<37.00	<42.00	42000.00
SG3-02	<24.00	1300.00	<30.00	<37.00	<42.00	54000.00
SG3-06	<24.00	3700.00	<30.00	<37.00	<42.00	61000.00
SG3-10	<24.00	3300.00	1000.00	<37.00	<42.00	69000.00
SG4-02	<24.00	<27.00	120.00	<37.00	<42.00	25000.00
SG4-06	<24.00	860.00	220.00	<37.00	<42.00	44000.00
SG4-10	<24.00	1800.00	930.00	<37.00	<42.00	58000.00

(ppmv)

Sample	Methane C ₁ -C ₅ (as Methane)	Benzene	Toluene	Ethylbenzene	Xylenes	Total Hydrocarbons (less light aliphatics)
SG1-02	0	0	4	0	0	285
SG1-06	18	190	4	4	5	7825
SG1-10	18	224	31	4	5	12491
SG2-02	0	0	12	0	0	418
SG2-06	18	148	31	4	5	9134
SG2-10	18	303	79	4	5	12434
SG3-02	18	402	4	4	5	16539
SG3-06	18	1144	4	4	5	18790
SG3-10	18	1020	262	4	5	20535
SG4-02	18	4	32	4	5	6460
SG4-06	18	266	58	4	5	13075
SG4-10	18	557	244	4	5	16955

Concentrations in µg/L represent the mean values of three GC/FID analyses per sample. Concentrations at or below detection limits are noted with a less than symbol. Concentrations in ppmv are calculated as discussed in Section 6, and rounded to the nearest whole number. Concentrations at detection limits were approximated by dividing the detection limit value by 2. This procedure resulted in some values being reported as zero.

SOIL GAS DATA

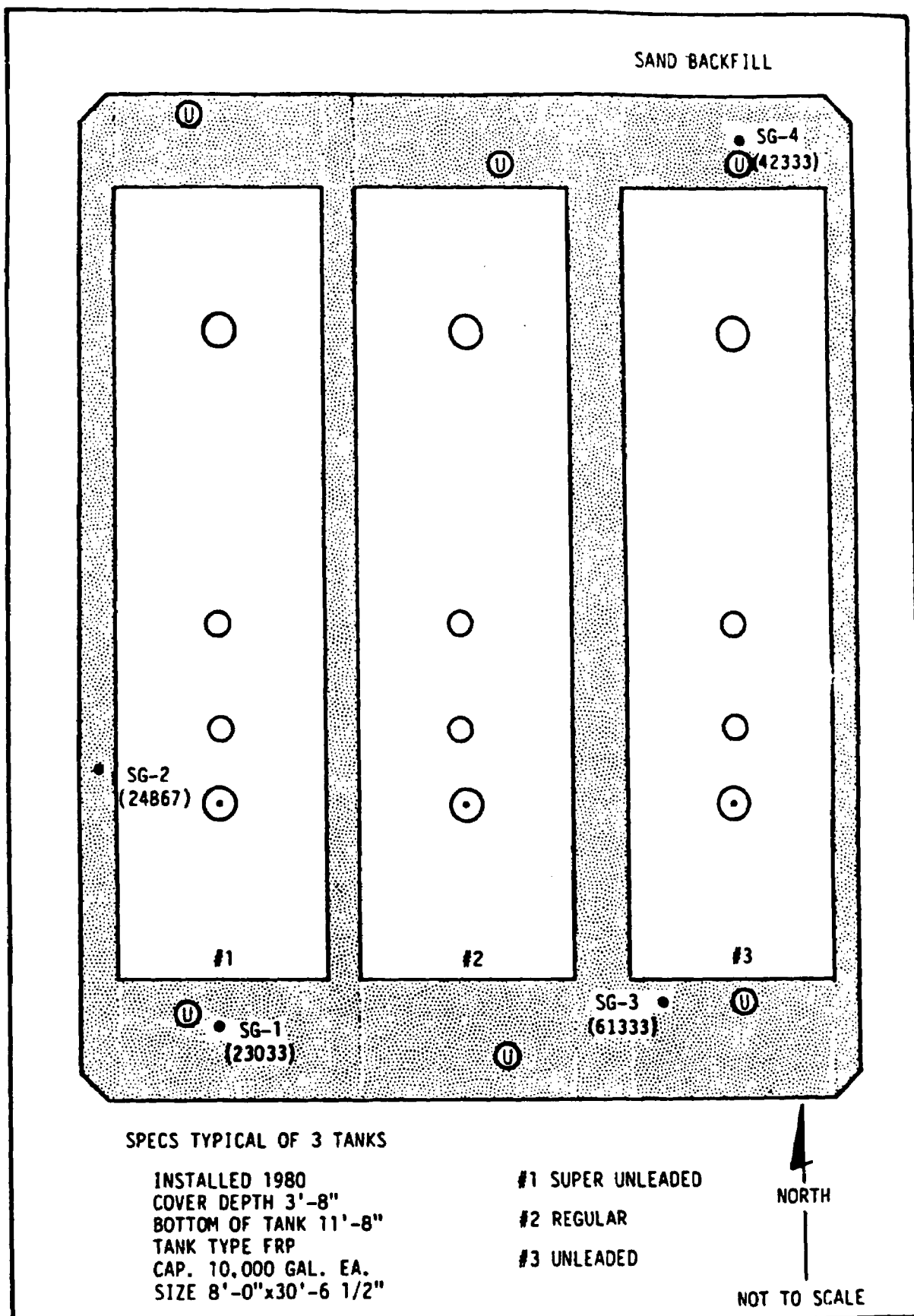
(Data Arranged by Sample Number)

New York
Station 4

($\mu\text{g/L}$)

Sample	Methane $\text{C}_1\text{-C}_5$ (as Methane)	Benzene	Toluene	Ethylbenzene	Xylenes	Total Hydrocarbons (less light aliphatics)
<u>Depth - 02 Feet</u>						
SG1-02	<0.50	0.25	14.00	<0.70	<0.80	1100.00
SG2-02	<0.50	<0.50	46.00	<0.70	<0.80	1600.00
SG3-02	<24.00	1300.00	<30.00	<37.00	<42.00	54000.00
SG4-02	<24.00	<27.00	120.00	<37.00	<42.00	25000.00
Averages	6.12	328.50	48.75	9.43	10.70	20425.00
<u>Depth - 06 Feet</u>						
SG1-06	<24.00	620.00	<30.00	<37.00	<42.00	26000.00
SG2-06	<24.00	480.00	120.00	<37.00	<42.00	31000.00
SG3-06	<24.00	3700.00	<30.00	<37.00	<42.00	61000.00
SG4-06	<24.00	860.00	220.00	<37.00	<42.00	44000.00
Averages	12.00	1415.00	92.50	18.50	21.00	40500.00
<u>Depth - 10 Feet</u>						
SG1-10	<24.00	730.00	120.00	<37.00	<42.00	42000.00
SG2-10	<24.00	980.00	300.00	<37.00	<42.00	42000.00
SG3-10	<24.00	3300.00	1000.00	<37.00	<42.00	69000.00
SG4-10	<24.00	1800.00	930.00	<37.00	<42.00	58000.00
Averages	12.00	1702.50	587.50	18.50	21.00	52750.00

Concentrations at detection limits were approximated by dividing the detection limit by 2.
The approximations were used in computing the averages.



Suffolk County, New York Station 4

SOIL GAS DATA

(Data Arranged by Sample Number)

New York
Station 5

($\mu\text{g/L}$)

Sample	Methane $\text{C}_1\text{-C}_5$ (as Methane)	Benzene	Toluene	Ethylbenzene	Xylenes	Total Hydrocarbons (less light aliphatics)
SG1-02	0.40	<0.04	0.04	<0.04	<0.04	3.00
SG1-06	3.00	<0.04	<0.04	<0.04	<0.04	<0.04
SG1-10	<24.00	<27.00	1700.00	<37.00	<42.00	26000.00
SG2-02	<5.00	290.00	360.00	<7.00	<8.00	7200.00
SG2-06	<24.00	2000.00	2800.00	620.00	<42.00	39000.00
SG3-02	2.00	<0.04	0.08	<0.04	<0.04	0.20
SG4-02	<20.00	1100.00	960.00	<37.00	<38.00	44000.00
SG4-06	<39.00	2300.00	1500.00	130.00	<76.00	64000.00
SG4-10	<39.00	1	13000.00	2900.00	91.00	110000.00
SG5-02	4.00	<0.04	3.00	<0.04	<0.04	13.00
SG5-05	<20.00	250.00	360.00	<37.00	<38.00	7500.00

(ppmv)

Sample	Methane $\text{C}_1\text{-C}_5$ (as Methane)	Benzene	Toluene	Ethylbenzene	Xylenes	Total Hydrocarbons (less light aliphatics)
SG1-02	1	0	0	0	0	1
SG1-06	5	0	0	0	0	0
SG1-10	18	4	450	4	5	6873
SG2-02	4	90	95	1	1	2050
SG2-06	18	612	726	140	5	10621
SG3-02	3	0	0	0	0	0
SG4-02	15	334	247	4	4	12372
SG4-06	29	699	386	29	8	18106
SG4-10	29	0	3348	648	20	29008
SG5-02	6	0	1	0	0	3
SG5-05	15	76	93	4	4	2051

Concentrations in $\mu\text{g/L}$ represent the mean values of three GC/FID analyses per sample. Concentrations at or below detection limits are noted with a less than symbol. Concentrations in ppmv are calculated as discussed in Section 6, and rounded to the nearest whole number. Concentrations at detection limits were approximated by dividing the detection limit value by 2. This procedure resulted in some values being reported as zero.

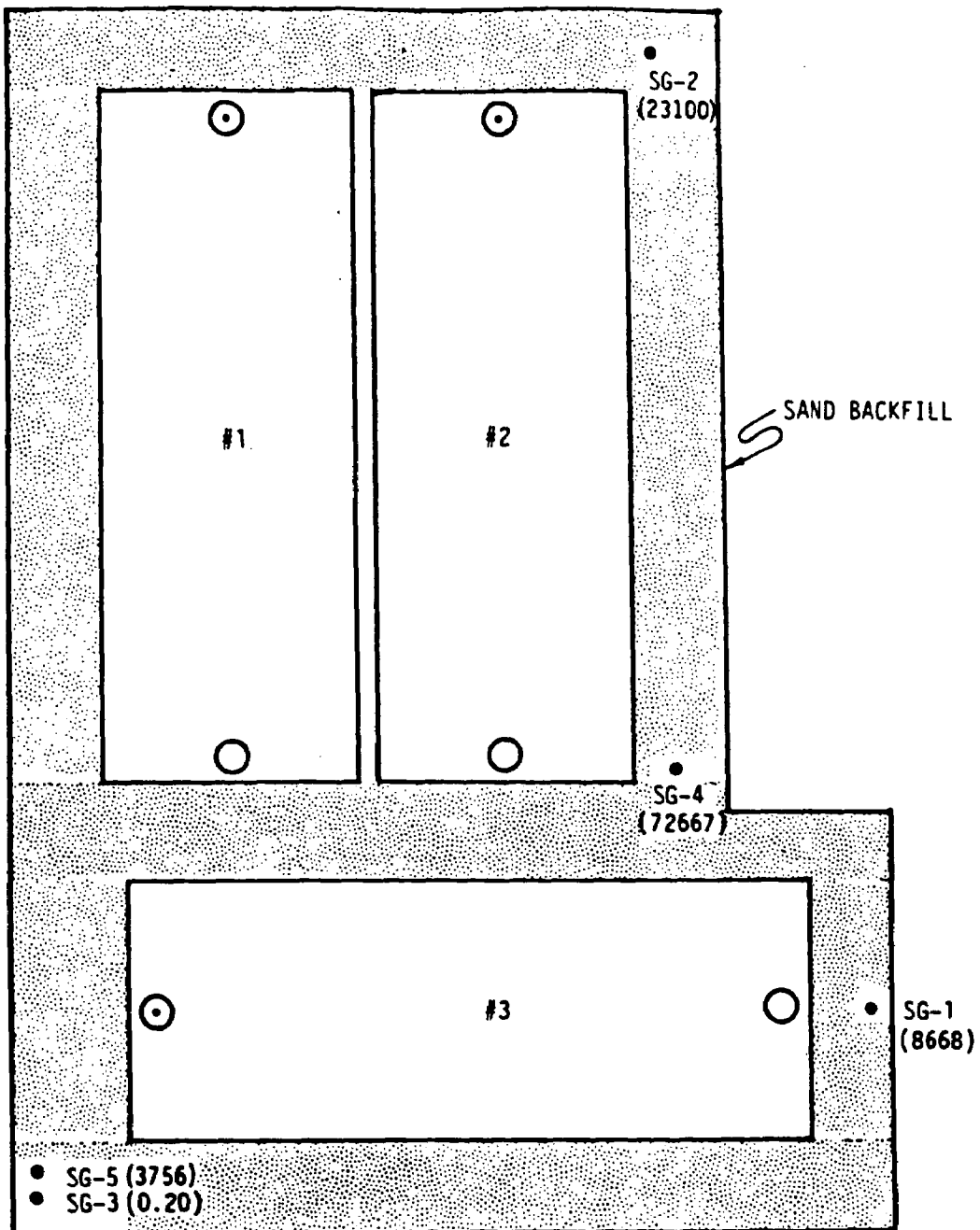
SOIL GAS DATA
(Data Arranged by Sample Number)

New York
Station 5

($\mu\text{g/L}$)

Sample	Methane $\text{C}_1\text{-C}_5$ (as Methane)	Benzene	Toluene	Ethylbenzene	Xylenes	Total Hydrocarbons (less light aliphatics)
<u>Depth - 02 Feet</u>						
SG1-02	0.40	<0.04	<0.04	<0.04	<0.04	3.00
SG2-02	<5.00	290.00	360.00	<7.00	<8.00	7200.00
SG3-02	2.00	<0.04	0.08	<0.04	<0.04	0.20
SG4-02	<20.00	1100.00	960.00	<37.00	<38.00	44000.00
SG5-02	4.00	<0.04	3.00	<0.04	<0.04	13.00
Averages	3.78	278.01	264.62	4.41	4.61	10243.24
<u>Depth - 06 Feet</u>						
SG1-06	3.00	<0.04	<0.04	<0.04	<0.04	<0.04
SG2-06	<24.00	2000.00	2800.00	620.00	<42.00	39000.00
SG4-06	<39.00	2300.00	1500.00	130.00	<76.00	64000.00
SG5-06	<20.00	250.00	360.00	<37.00	<38.00	7500.00
Averages	11.12	1137.51	1165.01	192.13	19.50	27625.00
<u>Depth - 10 Feet</u>						
SG1-10	<24.00	<27.00	1700.00	<37.00	<42.00	26000.00
SG4-10	<39.00	1000000.00	13000.00	2900.00	91.00	110000.00
Averages	15.75	500006.75	7350.00	1459.25	56.00	68000.00


Concentrations at detection limits were approximated by dividing the detection limit by 2.
The approximations were used in computing the averages.



SPECS TYPICAL OF 3 TANKS

INSTALLED 1972
 COVER DEPTH 3'-6"
 BOTTOM OF TANK 11'-6"
 TANK TYPE STEEL
 CAP. 8000 GAL. EA.
 SIZE 8'-0"x21'-6"

#1 REGULAR
 #2 UNLEADED
 #3 SUPER UNLEADED

 NORTH
 NOT TO SCALE

Suffolk County, New York Station 5

SOIL GAS DATA

(Data Arranged by Sample Number)

New York
Station 6

($\mu\text{g/L}$)

Sample	Methane $\text{C}_1\text{-C}_5$ (as Methane)	Benzene	Toluene	Ethylbenzene	Xylenes	Total Hydrocarbons (less light aliphatics)
SG1-02	3.00	<0.04	<0.04	<0.04	<0.04	<0.04
SG1-06	<0.04	<0.06	5.00	<0.08	<0.08	90.00
SG2-02	15.00	<0.04	1.00	<0.04	<0.04	4.00
SG2-06	<0.20	<0.30	20.00	<0.40	<0.40	700.00
SG2-10	<0.40	<0.60	55.00	<0.70	<0.80	1500.00
SG4-03	1.00	<0.04	<0.04	<0.04	<0.04	<0.04
SG4-06	5.00	<0.04	0.20	<0.04	<0.04	13.00

(ppmv)

Sample	Methane $\text{C}_1\text{-C}_5$ (as Methane)	Benzene	Toluene	Ethylbenzene	Xylenes	Total Hydrocarbons (less light aliphatics)
SG1-02	4	0	0	0	0	0
SG1-06	0	0	1	0	0	23
SG2-02	22	0	0	0	0	1
SG2-06	0	0	5	0	0	181
SG2-10	0	0	14	0	0	386
SG4-03	1	0	0	0	0	0
SG4-06	7	0	0	0	0	3

Concentrations in $\mu\text{g/L}$ represent the mean values of three GC/FID analyses per sample. Concentrations at or below detection limits are noted with a less than symbol. Concentrations in ppmv are calculated as discussed in Section 6, and rounded to the nearest whole number. Concentrations at detection limits were approximated by dividing the detection limit value by 2. This procedure resulted in some values being reported as zero.

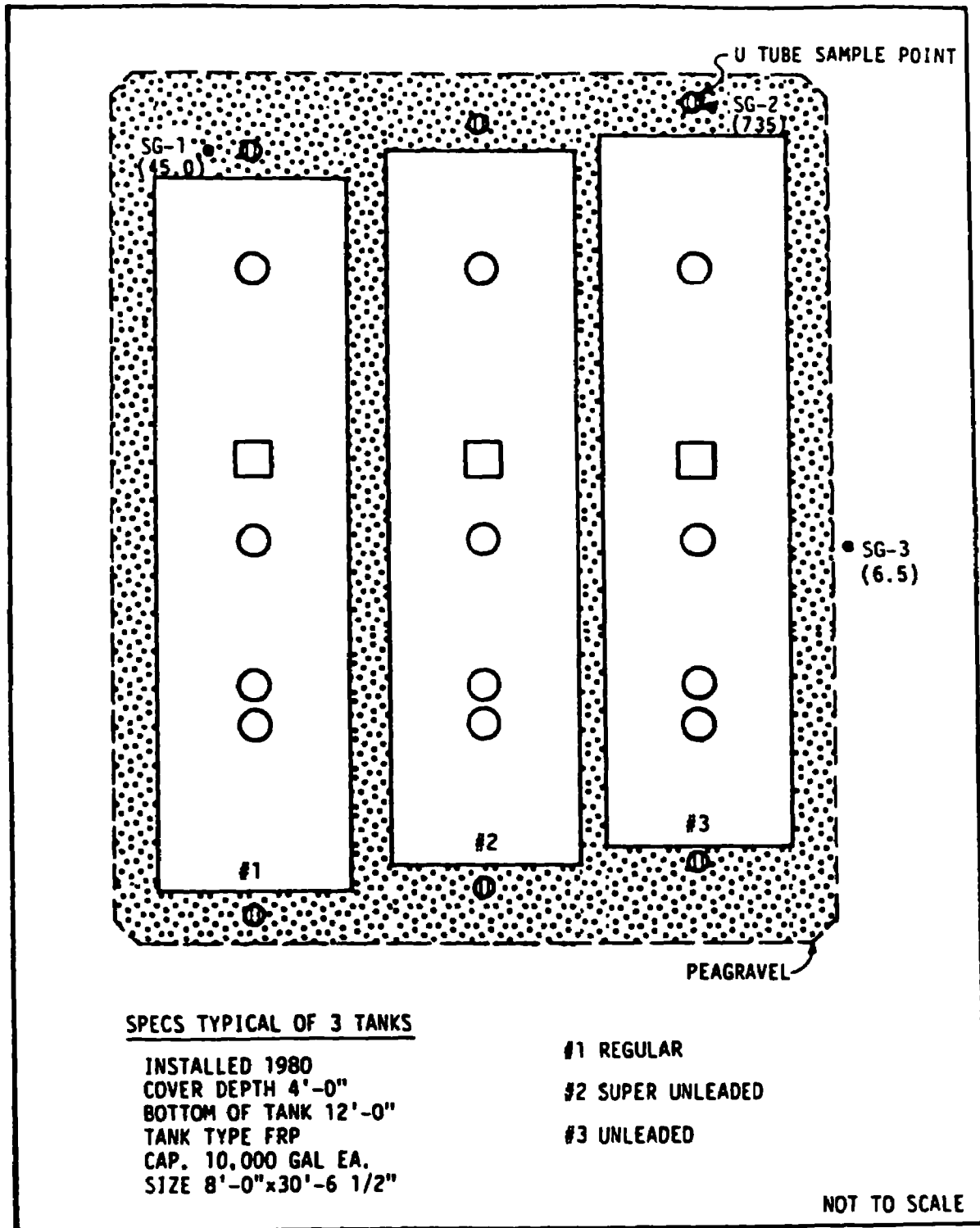
SOIL GAS DATA
(Data Arranged by Sample Number)

New York
Station 6

($\mu\text{g/L}$)

Sample	Methane C ₁ -C ₅ (as Methane)	Benzene	Toluene	Ethylbenzene	Xylenes	Total Hydrocarbons (less light aliphatics)
<u>Depth - 02 Feet</u>						
SG1-02	3.00	<0.04	<0.04	<0.04	<0.04	<0.04
SG2-02	15.00	<0.04	1.00	<0.04	<0.04	4.00
SG4-03	1.00	<0.04	<0.04	<0.04	<0.04	<0.04
Averages	6.33	0.02	0.35	0.02	0.02	1.35
<u>Depth - 06 Feet</u>						
SG1-06	<0.04	<0.06	5.00	<0.08	<0.08	90.00
SG2-06	<0.20	<0.30	20.00	<0.40	<0.40	700.00
SG4-06	5.00	<0.04	0.20	<0.04	<0.04	13.00
Averages	1.71	0.07	8.40	0.09	0.09	267.67
<u>Depth - 10 Feet</u>						
SG2-10	<0.40	<0.60	55.00	<0.70	<0.80	1500.00
Averages	0.20	0.30	55.00	0.35	0.40	1500.00

Concentrations at detection limits were approximated by dividing the detection limit by 2.
The approximations were used in computing the averages.



Suffolk County, New York Station 6

SOIL GAS DATA

(Data Arranged by Sample Number)

Rhode Island
Station 1

($\mu\text{g/L}$)

Sample	Methane $\text{C}_1\text{-C}_5$ (as Methane)	Butanes Pentanes and Hexanes	Benzene	Toluene	Ethyl- benzene	Xylenes	Total Hydrocarbons less methane
SG1-02	6.00	<0.06	<0.10	<0.04	<0.20	<0.30	<1.00
SG1-06	4.00	<0.06	<0.10	<0.04	<0.20	<0.30	<1.00
SG2-02	8.00	<0.06	<0.10	<0.04	<0.20	<0.30	<1.00
SG2-06	4.00	<0.06	<0.10	<0.04	<0.20	<0.30	<1.00
SG3-02	2.00	1.00	<0.10	110.00	110.00	110.00	590.00
SG3-06	1.00	1.00	<0.10	47.00	130.00	100.00	450.00
SG3-10	0.40	<0.06	<0.10	5.00	8.00	6.00	34.00

(ppmv)

Sample	Methane $\text{C}_1\text{-C}_5$ (as Methane)	Butanes Pentanes and Hexanes	Benzene	Toluene	Ethyl- benzene	Xylenes	Total Hydrocarbons less methane
SG1-02	9	0	0	0	0	0	0
SG1-06	6	0	0	0	0	0	0
SG2-02	12	0	0	0	0	0	0
SG2-06	6	0	0	0	0	0	0
SG3-02	3	0	0	28	24	24	136
SG3-06	1	0	0	12	29	22	102
SG3-10	1	0	0	1	2	1	8

Concentrations in $\mu\text{g/L}$ represent the mean values of three GC/FID analyses per sample. Concentrations at or below detection limits are noted with a less than symbol. Concentrations in ppmv are calculated as discussed in Section 6, and rounded to the nearest whole number. Concentrations at detection limits were approximated by dividing the detection limit value by 2. This procedure resulted in some values being reported as zero.

SOIL GAS DATA
($\mu\text{g/L}$)

(Data Arranged by Sample Number)

Rhode Island
Station 1

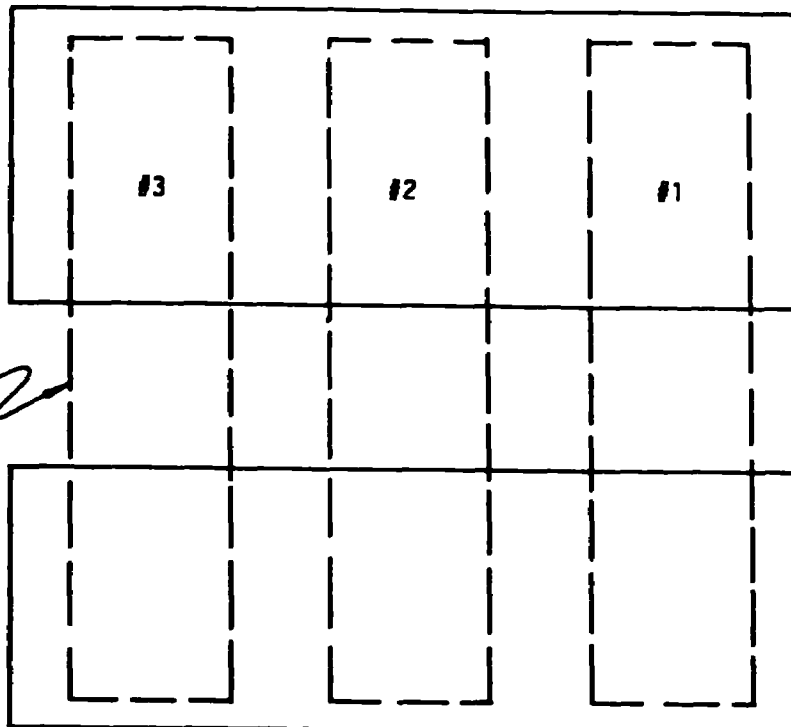
Sample	Methane $\text{C}_1\text{-C}_5$ (as Methane)	Butanes Pentanes and Hexanes	Benzene	Toluene	Ethyl- benzene	Xylenes	Total Hydrocarbons less methane
<u>Depth - 02 Feet</u>							
SG1-02	6.00	<0.06	<0.10	<0.04	<0.20	<0.30	<1.00
SG2-02	8.00	<0.06	<0.10	<0.04	<0.20	<0.30	<1.00
SG3-02	2.00	1.00	<0.10	110.00	110.00	110.00	590.00
Averages	5.33	0.35	0.05	36.68	36.73	36.77	197.00
<u>Depth - 06 Feet</u>							
SG1-06	4.00	<0.06	<0.10	<0.04	<0.20	<0.30	<1.00
SG2-06	4.00	<0.06	<0.10	<0.04	<0.20	<0.30	<1.00
SG3-06	1.00	1.00	<0.10	47.00	130.00	100.00	450.00
Averages	3.00	0.35	0.05	15.68	43.40	33.43	150.33
<u>Depth - 10 Feet</u>							
SG3-10	0.40	<0.06	<0.10	5.00	8.00	6.00	34.00
Averages	0.40	0.03	0.05	5.00	8.00	6.00	34.00

Concentration at detection limits were approximated by dividing the detection limit by 2. The approximations were used in computing the averages.

SG-1 •
(0.25)

TANKS

SG-2 •
(0.25)



• SG-3
(358)

CONCRETE COVER

#1 UNLEADED

INSTALLED 1973
BOTTOM OF TANK 131"
COVER DEPTH 35"
TANK TYPE STEEL
TANK SIZE 21'-4"x8'-0"
CAP 8000 GAL

#2 REGULAR

INSTALLED 1973
BOTTOM OF TANK 125"
COVER DEPTH 29"
TANK TYPE STEEL
TANK SIZE 21'-4"x8'-0"
CAP 8000 GAL.

#3 SUPER UNLEADED

INSTALLED 1973
BOTTOM OF TANK 120"
COVER DEPTH 24"
TANK TYPE STEEL
TANK SIZE 21'-4"x8'-0"
CAP 8000 GAL.

NOT TO SCALE

SOIL GAS DATA

(Data Arranged by Sample Number)

Rhode Island
Station 2

($\mu\text{g/L}$)

Sample	Methane $\text{C}_1\text{-C}_5$ (as Methane)	Butanes Pentanes and Hexanes	Benzene	Toluene	Ethyl- benzene	Xylenes	Total Hydrocarbons less methane
SG1-02	6.00	<0.04	<0.08	0.08	<0.10	<0.20	0.10
SG1-06	14.00	260.00	23.00	230.00	<0.10	130.00	1400.00
SG1-10	4.00	<0.04	<0.08	0.08	<0.10	<0.20	0.10
SG2-02	6.00	<0.06	<0.10	<0.10	<0.20	<0.30	<1.00
SG2-06	11.00	48.00	<0.10	41.00	<0.20	7.00	300.00
SG2-10	72.00	38.00	0.30	57.00	<0.20	31.00	350.00
SG3-02	8.00	<0.06	<0.10	<0.10	<0.20	<0.30	<1.00
SG3-06	3.00	<0.06	<0.10	<0.10	<0.20	<0.30	<1.00
SG3-10	2.00	<0.06	<0.10	<0.10	<0.20	<0.30	<1.00
SG4-02	12.00	<0.06	<0.10	<0.10	<0.20	<0.30	<1.00
SG4-06	9.00	<0.06	<0.10	<0.10	<0.20	<0.30	<1.00
SG4-10	5.00	<0.06	<0.10	<0.10	<0.20	<0.30	<1.00

(ppmv)

Sample	Methane $\text{C}_1\text{-C}_5$ (as Methane)	Butanes Pentanes and Hexanes	Benzene	Toluene	Ethyl- benzene	Xylenes	Total Hydrocarbons less methane
SG1-02	9	0	0	0	0	0	0
SG1-06	21	86	7	59	0	29	348
SG1-10	6	0	0	0	0	0	0
SG2-02	9	0	0	0	0	0	0
SG2-06	16	16	0	10	0	2	74
SG2-10	105	12	0	14	0	7	84
SG3-02	12	0	0	0	0	0	0
SG3-06	4	0	0	0	0	0	0
SG3-10	3	0	0	0	0	0	0
SG4-02	17	0	0	0	0	0	0
SG4-06	13	0	0	0	0	0	0
SG4-10	7	0	0	0	0	0	0

Concentrations in $\mu\text{g/L}$ represent the mean values of three GC/FID analyses per sample.

Concentrations at or below detection limits are noted with a less than symbol.

Concentrations in ppmv are calculated as discussed in Section 6, and rounded to the nearest whole number. Concentrations at detection limits were approximated by dividing the detection limit value by 2. This procedure resulted in some values being reported as zero.

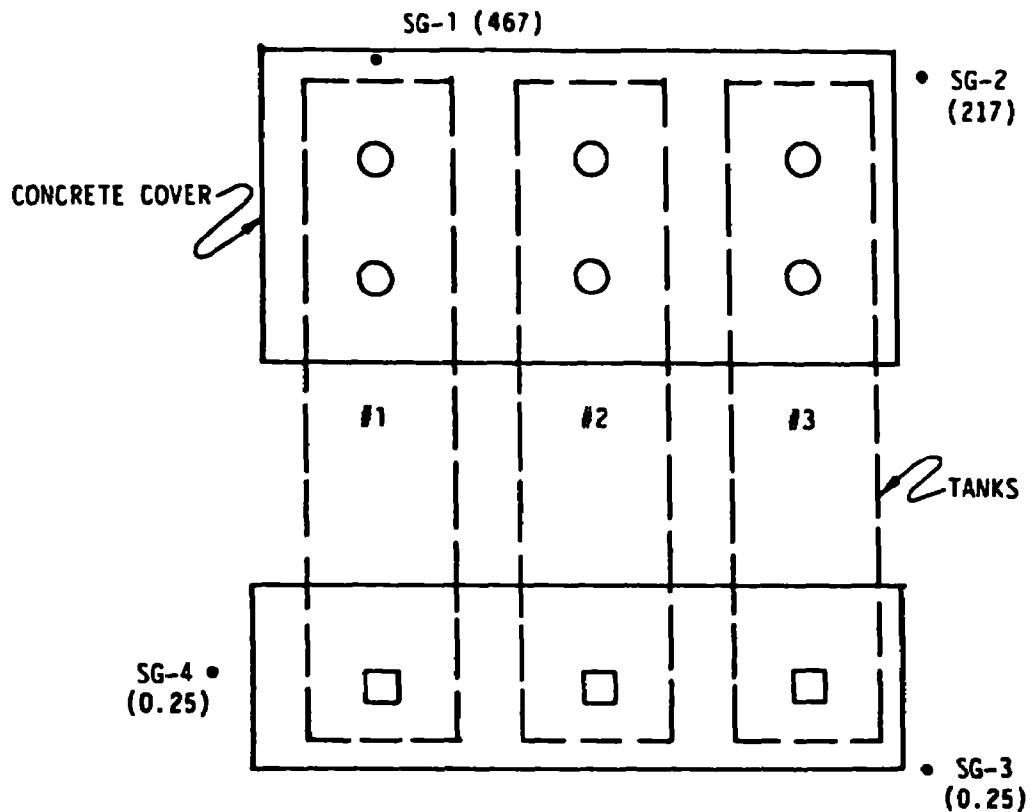
SOIL GAS DATA
($\mu\text{g/L}$)

(Data Arranged by Sample Number)

Rhode Island
Station 2

Sample	Methane $\text{C}_1\text{-C}_5$ (as Methane)	Butanes Pentanes and Hexanes	Benzene	Toluene	Ethyl- benzene	Xylenes	Total Hydrocarbons less methane
<u>Depth - 02 Feet</u>							
SG1-02	6.00	<0.04	<0.08	<0.08	<0.10	<0.20	0.10
SG2-02	6.00	<0.06	<0.10	<0.10	<0.20	<0.30	<1.00
SG3-02	8.00	<0.06	<0.10	<0.10	<0.20	<0.30	<1.00
SG4-02	12.00	<0.06	<0.10	<0.10	<0.20	<0.30	<1.00
Averages	8.00	0.03	0.05	0.06	0.09	0.14	0.40
<u>Depth - 06 Feet</u>							
SG1-06	14.00	260.00	23.00	230.00	<0.10	130.00	1400.00
SG2-06	11.00	48.00	<0.10	41.00	<0.20	7.00	300.00
SG3-06	3.00	<0.06	<0.10	<0.10	<0.20	<0.30	<1.00
SG4-06	9.00	<0.06	<0.10	<0.10	<0.20	<0.30	<1.00
Averages	9.25	77.01	5.79	67.78	0.09	34.33	425.25
<u>Depth - 10 Feet</u>							
SG1-10	4.00	<0.04	<0.08	0.08	<0.10	<0.20	0.10
SG2-10	72.00	38.00	0.30	57.00	<0.20	31.00	350.00
SG3-10	2.00	<0.06	<0.10	<0.10	<0.20	<0.30	<1.00
SG4-10	5.00	<0.06	<0.10	<0.10	<0.20	<0.30	<1.00
Averages	20.75	9.52	0.11	14.29	0.09	7.85	87.78

Concentration at detection limits were approximated by dividing the detection limit by 2. The approximations were used in computing the averages.



#1 UNLEADED

INSTALLED 1976
 BOTTOM OF TANK 143"
 COVER DEPTH 47"
 TANK TYPE STEEL
 TANK SIZE 21'-4"x8'-0"
 CAP 8000 GAL.

#2 SUPER UNLEADED

INSTALLED 1976
 BOTTOM OF TANK 141"
 COVER DEPTH 45"
 TANK TYPE STEEL
 TANK SIZE 21'-4"x8'-0"
 CAP 8000 GAL.

#3 REGULAR

INSTALLED 1976
 BOTTOM OF TANK 141"
 COVER DEPTH 45"
 TANK TYPE STEEL
 TANK SIZE 21'-4"x8'-0"
 CAP 8000 GAL.

SOIL GAS DATA

(Data Arranged by Sample Number)

Rhode Island
Station 3

($\mu\text{g/L}$)

Sample	Methane $\text{C}_1\text{-C}_5$ (as Methane)	Butanes Pentanes and Hexanes	Benzene	Toluene	Ethyl- benzene	Xylenes	Total Hydrocarbons less methane
SG1-02	8.00	<0.04	<0.08	<0.08	<0.10	<0.20	<1.00
SG1-06	5.00	<0.04	<0.08	<0.08	<0.10	<0.20	<1.00
SG1-10	4.00	<0.04	<0.08	<0.08	<0.10	<0.20	<1.00
SG2-02	9.00	<0.04	<0.08	<0.08	<0.10	<0.20	<1.00
SG2-06	3.00	<0.04	<0.08	<0.08	<0.10	<0.20	<1.00
SG2-10	3.00	<0.04	<0.08	<0.08	<0.10	<0.20	<1.00
SG3-02	7.00	<0.04	<0.08	<0.08	<0.10	<0.20	<1.00
SG3-06	5.00	<0.04	<0.08	<0.08	<0.10	<0.20	<1.00
SG3-10	4.00	<0.04	<0.08	<0.08	<0.10	<0.20	<1.00
SG4-02	8.00	<0.04	<0.08	0.80	<0.10	<0.20	<1.00
SG4-06	9.00	<0.04	<0.08	0.20	<0.10	<0.20	0.30

(ppmv)

Sample	Methane $\text{C}_1\text{-C}_5$ (as Methane)	Butanes Pentanes and Hexanes	Benzene	Toluene	Ethyl- benzene	Xylenes	Total Hydrocarbons less methane
SG1-02	12	0	0	0	0	0	0
SG1-06	8	0	0	0	0	0	0
SG1-10	6	0	0	0	0	0	0
SG2-02	13	0	0	0	0	0	0
SG2-06	4	0	0	0	0	0	0
SG2-10	4	0	0	0	0	0	0
SG3-02	10	0	0	0	0	0	0
SG3-06	7	0	0	0	0	0	0
SG3-10	6	0	0	0	0	0	0
SG4-02	12	0	0	0	0	0	0
SG4-06	13	0	0	0	0	0	0

Concentrations in $\mu\text{g/L}$ represent the mean values of three GC/FID analyses per sample. Concentrations at or below detection limits are noted with a less than symbol. Concentrations in ppmv are calculated as discussed in Section 6, and rounded to the nearest whole number. Concentrations at detection limits were approximated by dividing the detection limit value by 2. This procedure resulted in some values being reported as zero.

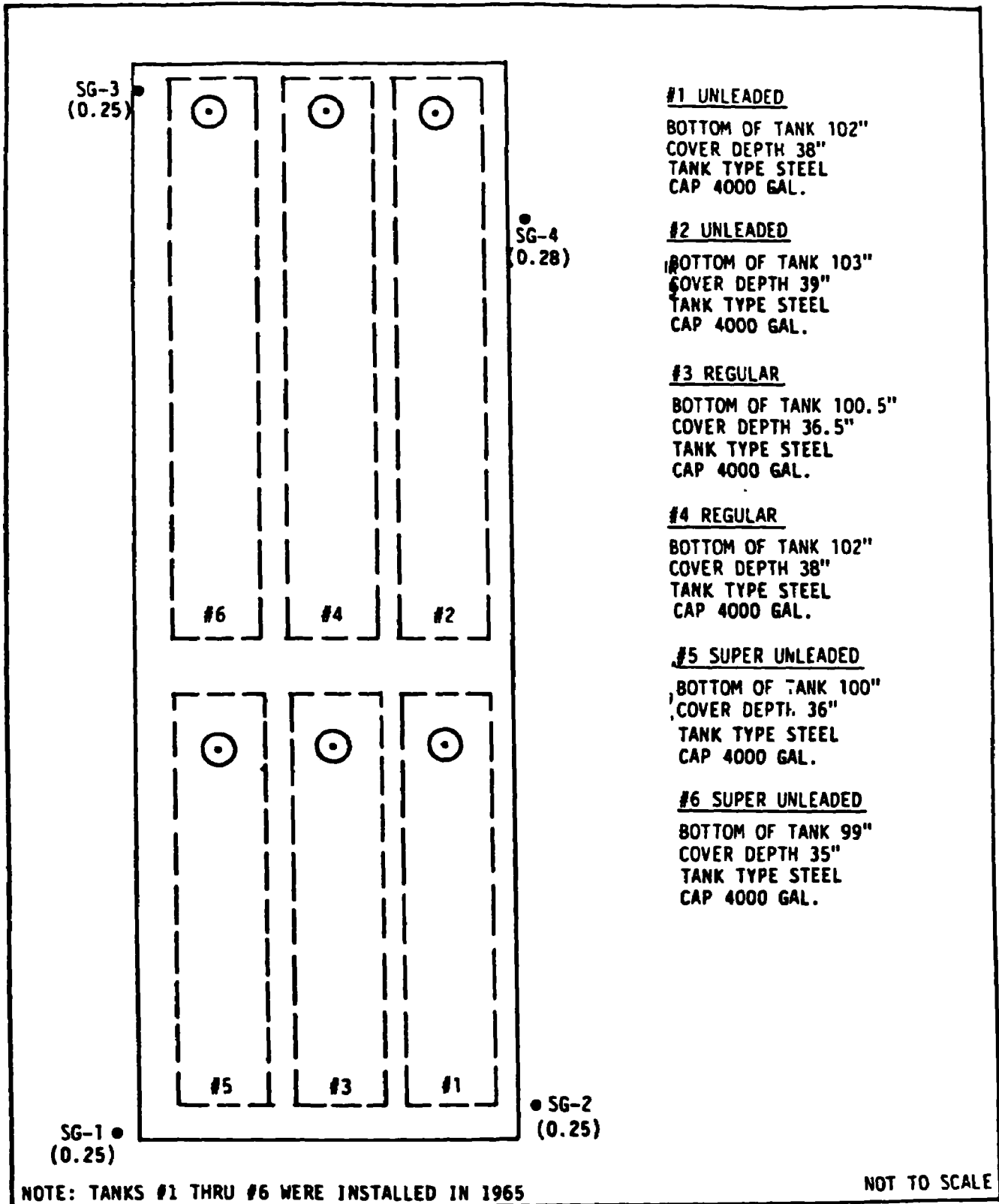
SOIL GAS DATA
($\mu\text{g/L}$)

(Data Arranged by Sample Number)

Rhode Island
Station 3

Sample	Methane $\text{C}_1\text{-C}_5$ (as Methane)	Butanes Pentanes and Hexanes	Benzene	Toluene	Ethyl- benzene	Xylenes	Total Hydrocarbons less methane
<u>Depth - 02 Feet</u>							
SG1-02	8.00	<0.04	<0.08	<0.08	<0.10	<0.20	<1.00
SG2-02	9.00	<0.04	<0.08	<0.08	<0.10	<0.20	<1.00
SG3-02	7.00	<0.04	<0.08	<0.08	<0.10	<0.20	<1.00
SG4-02	8.00	<0.04	<0.08	0.80	<0.10	<0.20	<1.00
Averages	8.00	0.02	0.04	0.23	0.05	0.10	0.50
<u>Depth - 06 Feet</u>							
SG1-06	5.00	<0.04	<0.08	<0.08	<0.10	<0.20	<1.00
SG2-06	3.00	<0.04	<0.08	<0.08	<0.10	<0.20	<1.00
SG3-06	5.00	<0.04	<0.08	<0.08	<0.10	<0.20	<1.00
SG4-06	9.00	<0.04	<0.08	0.20	<0.10	<0.20	0.30
Averages	5.50	0.02	0.04	0.08	0.05	0.10	0.45
<u>Depth - 10 Feet</u>							
SG1-10	4.00	<0.04	<0.08	<0.08	<0.10	<0.20	<1.00
SG2-10	3.00	<0.04	<0.08	<0.08	<0.10	<0.20	<1.00
SG3-10	4.00	<0.04	<0.08	<0.08	<0.10	<0.20	<1.00
Averages	3.67	0.02	0.04	0.04	0.05	0.10	0.50

Concentration at detection limits were approximated by dividing the detection limit by 2. The approximations were used in computing the averages.



SOIL GAS DATA

(Data Arranged by Sample Number)

Rhode Island
Station 4

($\mu\text{g/L}$)

Sample	Methane $\text{C}_1\text{-C}_5$ (as Methane)	Butanes Pentanes and Hexanes	Benzene	Toluene	Ethyl- benzene	Xylenes	Total Hydrocarbons less methane
SG1-02	1100.00	120.00	30.00	31.00	23.00	26.00	640.00
SG1-06	820.00	110.00	23.00	19.00	120.00	25.00	480.00
SG1-10	2800.00	390.00	95.00	78.00	400.00	290.00	2400.00
SG2-02	5.00	<0.02	<0.04	<0.04	<0.06	<0.06	0.04
SG2-06	6.00	<0.02	0.06	<0.04	0.10	0.50	15.00
SG2-10	490.00	3400.00	670.00	<0.10	<2.00	<2.00	12000.00
SG3-02	5.00	<0.04	<0.04	<0.04	<0.06	<0.08	<0.06
SG3-06	9.00	2.00	0.04	5.00	<0.06	<0.08	30.00
SG3-10	15.00	<0.04	<0.04	0.20	<0.06	<0.08	16.00
SG4-02	130.00	10000.00	120.00	1300.00	<0.50	380.00	24000.00
SG4-06	84.00	5600.00	110.00	1400.00	<0.50	840.00	16000.00

(ppmv)

Sample	Methane $\text{C}_1\text{-C}_5$ (as Methane)	Butanes Pentanes and Hexanes	Benzene	Toluene	Ethyl- benzene	Xylenes	Total Hydrocarbons less methane
SG1-02	1627	39	9	8	5	6	163
SG1-06	1218	36	7	5	27	6	114
SG1-10	4162	129	29	20	90	65	568
SG2-02	7	0	0	0	0	0	0
SG2-06	9	0	0	0	0	0	3
SG2-10	714	1101	200	0	0	0	3585
SG3-02	7	0	0	0	0	0	0
SG3-06	13	1	0	1	0	0	8
SG3-10	22	0	0	0	0	0	4
SG4-02	194	3318	37	338	0	86	6133
SG4-06	126	1861	34	364	0	190	4000

Concentrations in $\mu\text{g/L}$ represent the mean values of three GC/FID analyses per sample.

Concentrations at or below detection limits are noted with a less than symbol.

Concentrations in ppmv are calculated as discussed in Section 6, and rounded to the nearest whole number. Concentrations at detection limits were approximated by dividing the detection limit value by 2. This procedure resulted in some values being reported as zero.

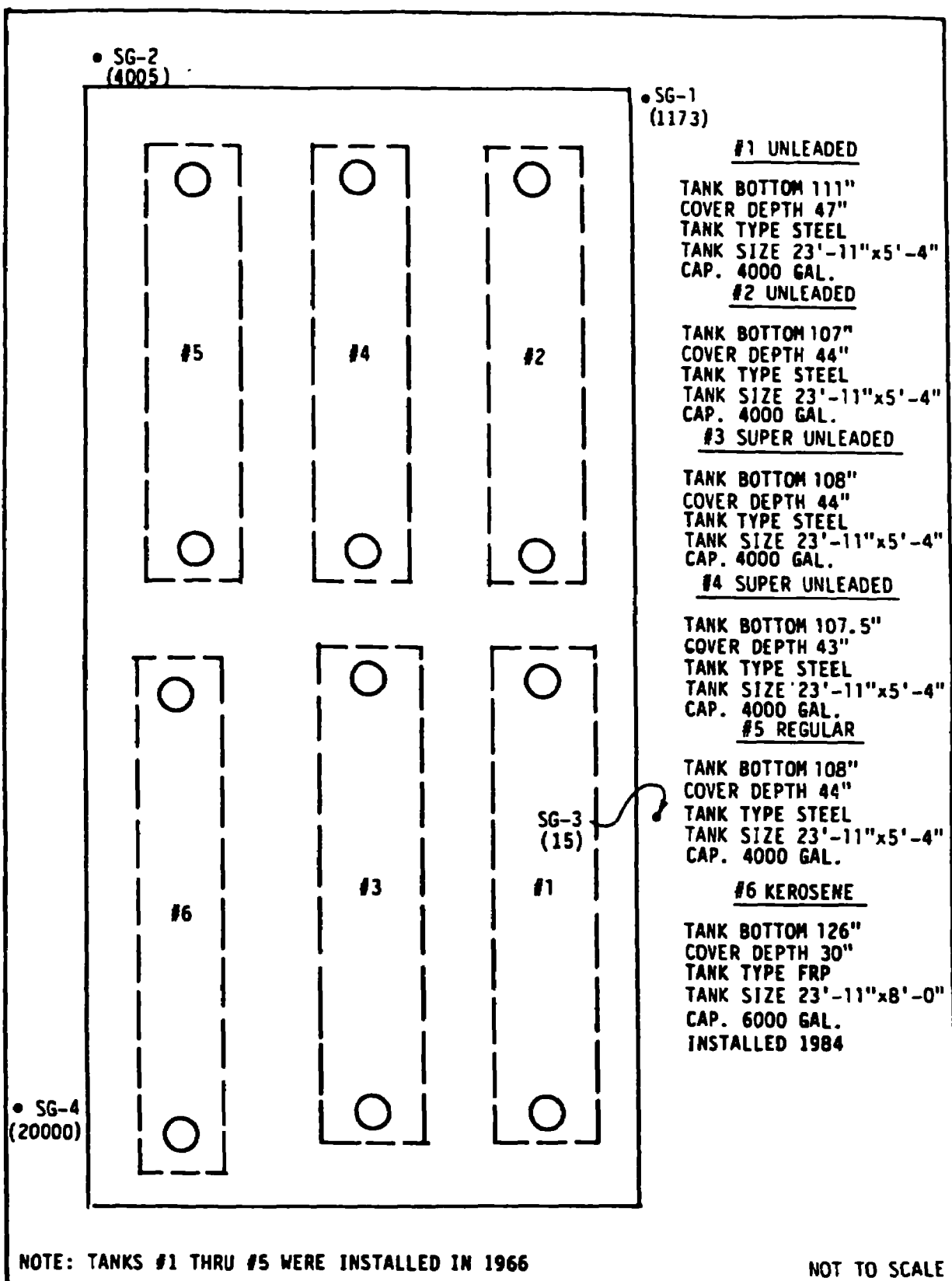
SOIL GAS DATA
($\mu\text{g/L}$)

(Data Arranged by Sample Number)

Rhode Island
Station 4

Sample	Methane $\text{C}_1\text{-C}_5$ (as Methane)	Butanes Pentanes and Hexanes	Benzene	Toluene	Ethyl- benzene	Xylenes	Total Hydrocarbons less methane
<u>Depth - 02 Feet</u>							
SG1-02	1100.00	120.00	30.00	31.00	23.00	26.00	640.00
SG2-02	5.00	<0.02	<0.04	<0.04	<0.06	<0.06	0.04
SG3-02	5.00	<0.04	<0.04	<0.04	<0.06	<0.08	<0.06
SG4-02	130.00	10000.00	120.00	1300.00	<0.50	380.00	24000.00
Averages	310.00	2530.01	37.51	332.76	5.83	101.52	6160.02
<u>Depth - 06 Feet</u>							
SG1-06	820.00	110.00	23.00	19.00	120.00	25.00	480.00
SG2-06	6.00	<0.02	0.06	<0.04	0.10	0.50	15.00
SG3-06	9.00	2.00	0.04	5.00	<0.06	<0.08	30.00
SG4-06	84.00	5600.00	110.00	1400.00	<0.50	840.00	16000.00
Averages	229.75	1428.00	33.27	356.00	30.09	216.38	4131.25
<u>Depth - 10 Feet</u>							
SG1-10	2800.00	390.00	95.00	78.00	400.00	290.00	2400.00
SG2-10	490.00	3400.00	670.00	<0.10	<2.00	<2.00	12000.00
SG3-10	15.00	<0.04	<0.04	0.20	<0.06	<0.08	16.00
Averages	1101.67	1263.34	255.01	26.08	133.68	97.01	4805.33

Concentration at detection limits were approximated by dividing the detection limit by 2. The approximations were used in computing the averages.



SOIL GAS DATA

(Data Arranged by Sample Number)

San Diego
Station 1

($\mu\text{g/L}$)

Sample	Methane $\text{C}_1\text{-C}_5$ (as Methane)	Benzene	Toluene	Ethylbenzene	Xylenes	Total Hydrocarbons (less light aliphatics)
SG1-02	1200.00	<0.90	<0.08	<0.80	<0.80	180.70
SG1-06	38.00	<0.04	<0.04	<0.04	<0.08	40.00
SG2-02	<0.08	<0.04	<0.04	<0.04	<0.08	0.60
SG2-06	34.00	<0.90	180.00	<0.80	150.00	740.00
SG3-02	48000.00	<9.00	3400.00	<12.00	1200.00	12000.00
SG3-06	42000.00	<9.00	6200.00	<12.00	2800.00	14000.00
SG4-02	7100.00	<9.00	1300.00	<12.00	22.00	9500.00
SG4-06	7800.00	<89.00	8300.00	<120.00	1100.00	31000.00
SG5-06	2000.00	<89.00	11000.00	<120.00	4900.00	26000.00

(ppmv)

Sample	Methane $\text{C}_1\text{-C}_5$ (as Methane)	Benzene	Toluene	Ethylbenzene	Xylenes	Total Hydrocarbons (less light aliphatics)
SG1-02	1805	0	0	0	0	46
SG1-06	57	0	0	0	0	10
SG2-02	0	0	0	0	0	0
SG2-06	51	0	47	0	34	181
SG3-02	71692	1	883	1	271	3010
SG3-06	62848	1	1614	1	632	3494
SG4-02	10604	1	338	1	5	2462
SG4-06	11650	14	2156	14	248	7929
SG5-06	2993	14	2863	14	1107	6493

Concentrations in $\mu\text{g/L}$ represent the mean values of three GC/FID analyses per sample. Concentrations at or below detection limits are noted with a less than symbol. Concentrations in ppmv are calculated as discussed in Section 6, and rounded to the nearest whole number. Concentrations at detection limits were approximated by dividing the detection limit value by 2. This procedure resulted in some values being reported as zero.

SOIL GAS DATA

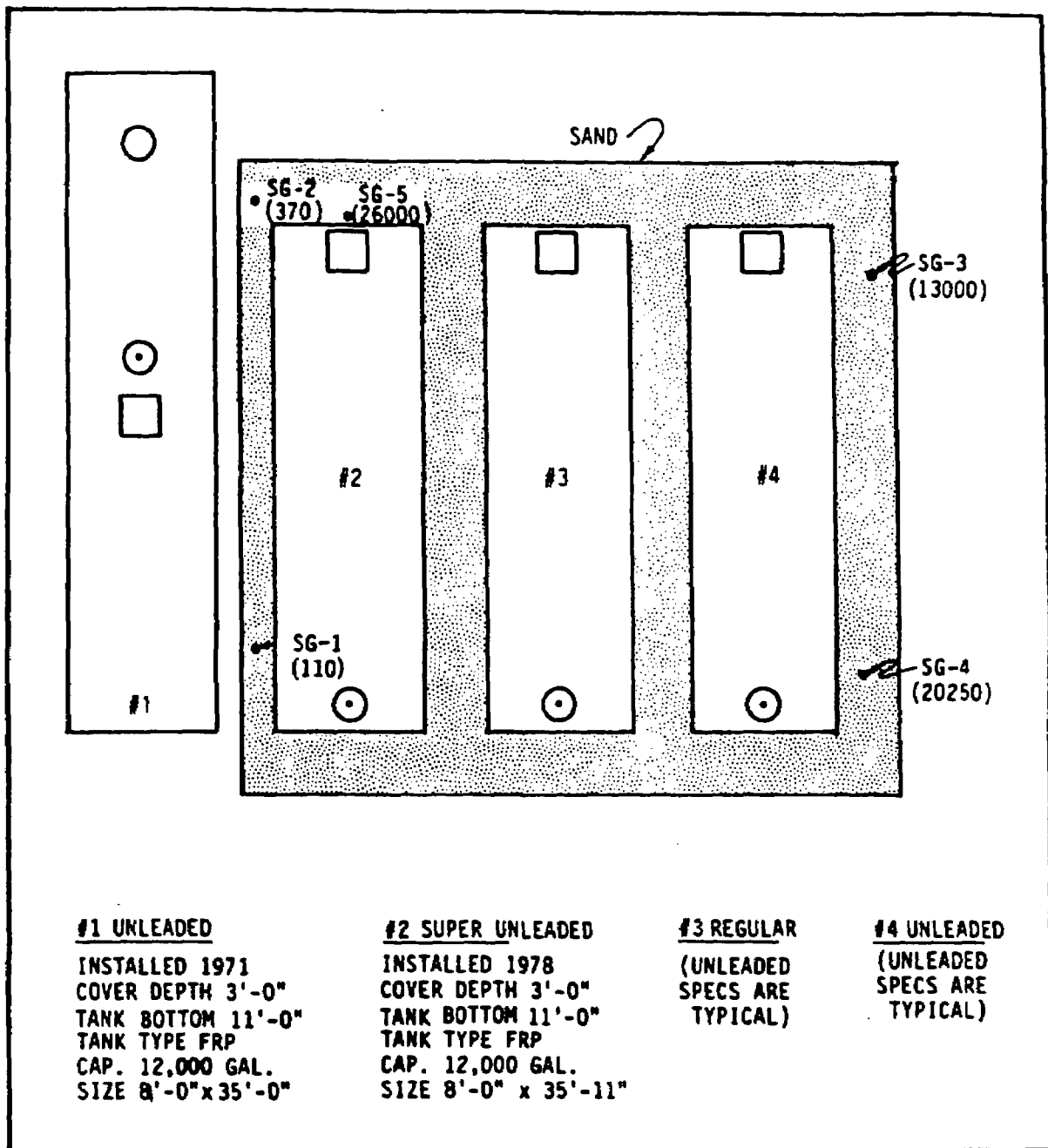
(Data Arranged by Sample Number)

San Diego
Station 1

(µg/L)

Sample	Methane C ₁ -C ₅ (as Methane)	Benzene	Toluene	Ethylbenzene	Xylenes	Total Hydrocarbons (less light aliphatics)
<u>Depth - 02 Feet</u>						
SG1-02	1200.00	<0.90	<0.08	<0.80	<0.80	180.00
SG2-02	<0.08	<0.04	<0.04	<0.04	<0.08	0.60
SG3-02	48000.00	<9.00	3400.00	<12.00	1200.00	12000.00
SG4-02	7100.00	<9.00	1300.00	<12.00	22.00	9500.00
Averages	14075.01	2.37	1175.01	3.10	305.61	5420.15
<u>Depth - 06 Feet</u>						
SG1-06	38.00	<0.04	<0.04	<0.04	<0.08	40.00
SG2-06	34.00	<0.90	180.00	<0.80	150.00	740.00
SG3-06	42000.00	<9.00	6200.00	<12.00	2800.00	14000.00
SG4-06	7800.00	<89.00	8300.00	<120.00	1100.00	31000.00
SG5-06	2000.00	<89.00	11000.00	<120.00	4900.00	26000.00
Averages	10374.40	18.79	5136.00	25.28	1790.01	14356.00

Concentrations at detection limits were approximated by dividing the detection limit by 2.
The approximations were used in computing the averages.



San Diego Station 1

SOIL GAS DATA
(Data Arranged by Sample Number)

San Diego
Station 2

($\mu\text{g/L}$)

Sample	Methane $\text{C}_1\text{-C}_5$ (as Methane)	Benzene	Toluene	Ethylbenzene	Xylenes	Total Hydrocarbons (less light aliphatics)
SG1-02	5200.00	<9.00	710.00	<12.00	<11.00	2200.00
SG1-06	51000.00	<89.00	5000.00	<120.00	700.00	22000.00
SG2-02	110000.00	<89.00	7600.00	<120.00	1900.00	36000.00
SG2-06	110000.00	<89.00	8900.00	<120.00	1900.00	38000.00
SG3-02	21000.00	<89.00	4100.00	<120.00	900.00	37000.00
SG3-06	35000.00	<89.00	11000.00	<120.00	5100.00	76000.00
SG4-02	33000.00	<89.00	7800.00	<120.00	1100.00	64000.00
SG4-06	37000.00	<89.00	9700.00	<120.00	980.00	77000.00

(ppmv)

Sample	Methane $\text{C}_1\text{-C}_5$ (as Methane)	Benzene	Toluene	Ethylbenzene	Xylenes	Total Hydrocarbons (less light aliphatics)
SG1-02	7781	1	185	1	1	572
SG1-06	76889	14	1311	14	159	5677
SG2-02	166149	14	1996	14	433	9210
SG2-06	166767	14	2347	14	435	9789
SG3-02	31837	14	1081	14	206	9528
SG3-06	52964	14	2895	14	1165	19170
SG4-02	50030	14	2057	14	252	16602
SG4-06	55886	14	2548	14	223	19984

Concentrations in $\mu\text{g/L}$ represent the mean values of three GC/FID analyses per sample. Concentrations at or below detection limits are noted with a less than symbol. Concentrations in ppmv are calculated as discussed in Section 6, and rounded to the nearest whole number. Concentrations at detection limits were approximated by dividing the detection limit value by 2. This procedure resulted in some values being reported as zero.

SOIL GAS DATA

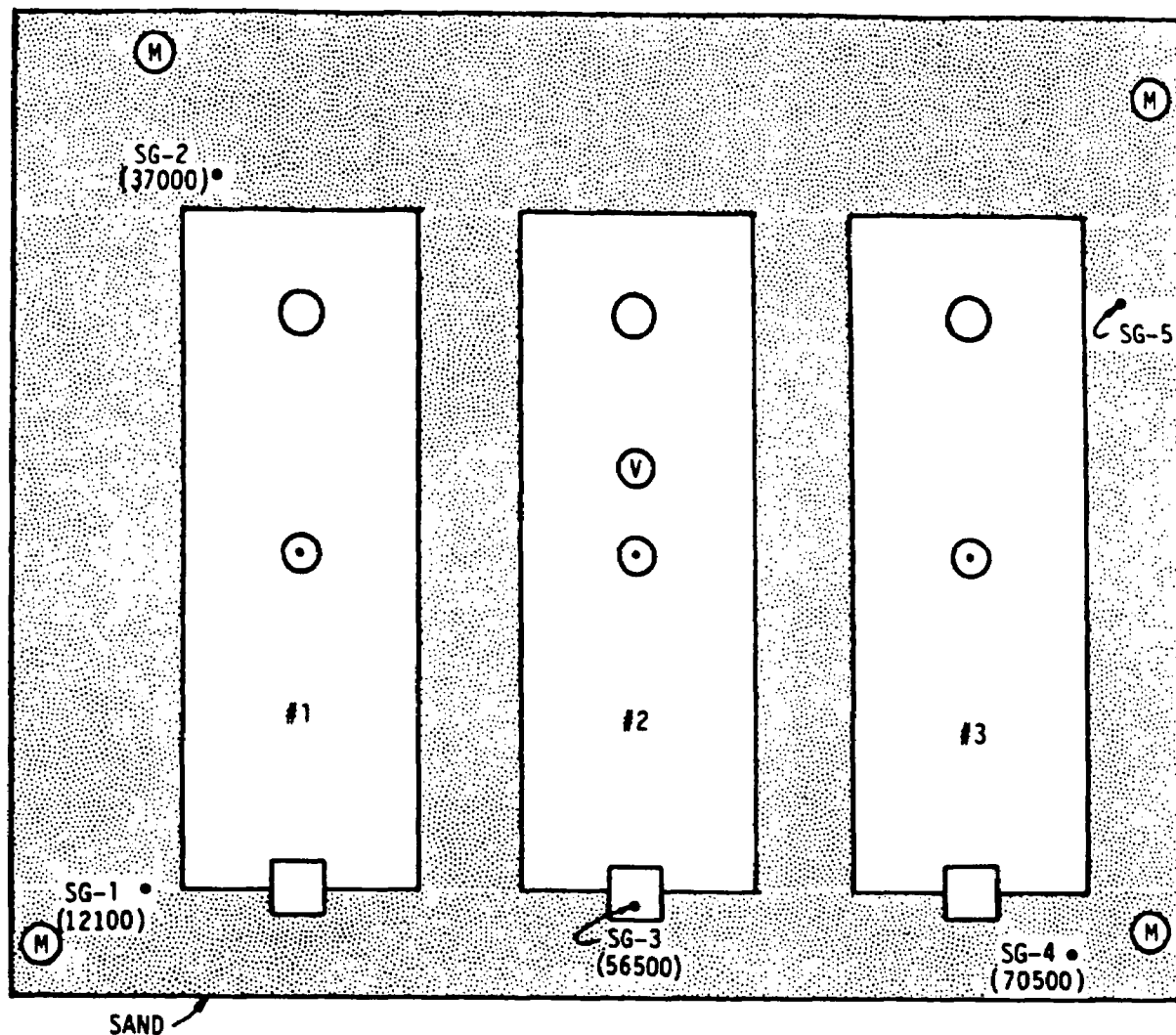
(Data Arranged by Sample Number)

San Diego
Station 2

($\mu\text{g/L}$)

Sample	Methane $\text{C}_1\text{-C}_5$ (as Methane)	Benzene	Toluene	Ethylbenzene	Xylenes	Total Hydrocarbons (less light aliphatics)
Depth - 02 Feet						
SG1-02	5200.00	<9.00	710.00	<12.00	<11.00	2200.00
SG2-02	110000.00	<89.00	7600.00	<120.00	1900.00	36000.00
SG3-02	21000.00	<89.00	4100.00	<120.00	900.00	37000.00
SG4-02	33000.00	<89.00	7800.00	<120.00	1100.00	64000.00
Averages	42300.00	34.50	5052.50	46.50	976.38	34800.00
Depth - 06 Feet						
SG1-06	51000.00	<89.00	5000.00	<120.00	700.00	22000.00
SG2-06	110000.00	<89.00	8900.00	<120.00	1900.00	38000.00
SG3-06	35000.00	<89.00	11000.00	<120.00	5100.00	76000.00
SG4-06	37000.00	<89.00	9700.00	<120.00	980.00	77000.00
Averages	58250.00	44.50	8650.00	60.00	2170.00	53250.00

Concentrations at detection limits were approximated by dividing the detection limit by 2.
The approximations were used in computing the averages.



#1 UNLEADED

INSTALLED 1972
COVER DEPTH 4'-4"
TANK BOTTOM 12'-4"
TANK TYPE STEEL
CAP. 8000 GAL.
SIZE 8'-0" x 21'-10"

#2 SUPER UNLEADED

(SPECS TYPICAL
OF UNLEADED)

#3 REGULAR

(SPECS TYPICAL
OF UNLEADED)



NOT TO SCALE

San Diego Station 2

SOIL GAS DATA

(Data Arranged by Sample Number)

San Diego
Station 3

(µg/L)

Sample	Methane C ₁ -C ₅ (as Methane)	Benzene	Toluene	Ethylbenzene	Xylenes	Total Hydrocarbons (less light aliphatics)
SG1-02	0.40	<0.04	<0.06	<0.06	<0.06	<0.04
SG2-02	10.00	<0.10	<0.10	<0.10	<0.10	<0.10
SG2-06	22.00	<0.10	17.00	0.05	<0.10	62.00
SG3-02	4.00	<0.10	<0.10	<0.10	<0.10	<0.10
SG3-06	17.00	<0.10	<0.10	<0.10	<0.10	<0.10
SG4-02	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
SG5-02	0.90	<0.10	0.20	<0.10	<0.80	1.00
SG5-06	2.00	<0.10	<0.10	<0.10	<0.10	<0.10

(ppmv)

Sample	Methane C ₁ -C ₅ (as Methane)	Benzene	Toluene	Ethylbenzene	Xylenes	Total Hydrocarbons (less light aliphatics)
SG1-02	1	0	0	0	0	0
SG2-02	15	0	0	0	0	0
SG2-06	33	0	4	0	0	16
SG3-02	6	0	0	0	0	0
SG3-06	26	0	0	0	0	0
SG4-02	0	0	0	0	0	0
SG5-02	1	0	0	0	0	0
SG5-06	3	0	0	0	0	0

Concentrations in µg/L represent the mean values of three GC/FID analyses per sample. Concentrations at or below detection limits are noted with a less than symbol. Concentrations in ppmv are calculated as discussed in Section 6, and rounded to the nearest whole number. Concentrations at detection limits were approximated by dividing the detection limit value by 2. This procedure resulted in some values being reported as zero.

SOIL GAS DATA

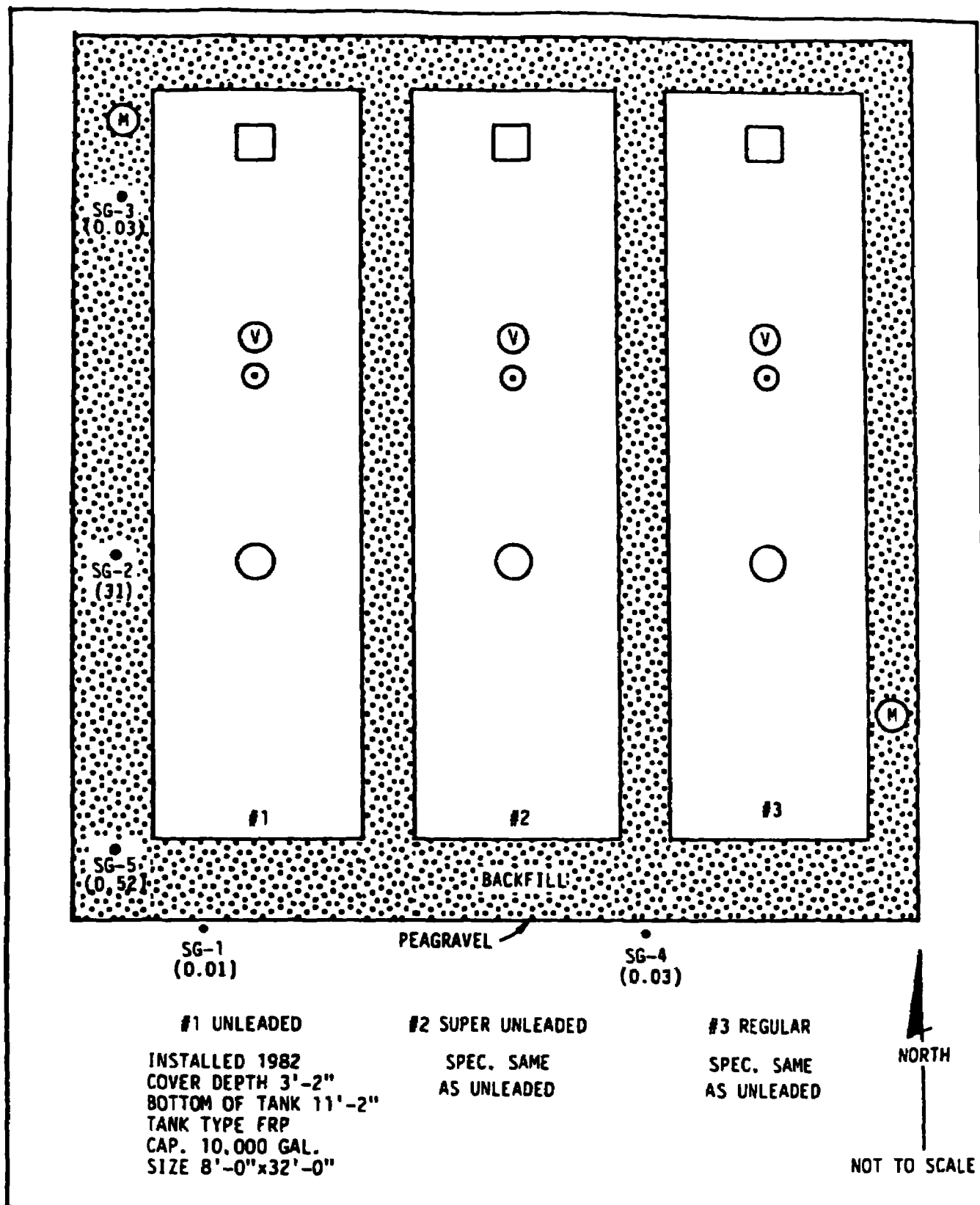
(Data Arranged by Sample Number)

San Diego
Station 3

($\mu\text{g/L}$)

Sample	Methane $\text{C}_1\text{-C}_5$ (as Methane)	Benzene	Toluene	Ethylbenzene	Xylenes	Total Hydrocarbons (less light aliphatics)
<u>Depth - 02 Feet</u>						
SG1-02	0.40	<0.04	<0.06	<0.06	<0.06	<0.04
SG2-02	10.00	<0.10	<0.10	<0.10	<0.10	<0.10
SG3-02	4.00	<0.10	<0.10	<0.10	<0.10	<0.10
SG4-02	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
SG5-02	0.90	<0.10	0.20	<0.10	0.80	1.00
Averages	3.07	0.04	0.08	0.05	0.20	0.23
<u>Depth - 06 Feet</u>						
SG2-06	22.00	<0.10	17.00	0.05	<0.10	62.00
SG3-06	17.00	<0.10	<0.10	<0.10	<0.10	<0.10
SG5-06	2.00	<0.10	<0.10	<0.10	<0.10	<0.10
Averages	13.67	0.05	5.70	0.05	0.05	20.70

Concentrations at detection limits were approximated by dividing the detection limit by 2.
The approximations were used in computing the averages.



SOIL GAS DATA

(Data Arranged by Sample Number)

San Diego
Station 4

(µg/L)

Sample	Methane C ₁ -C ₅ (as Methane)	Benzene	Toluene	Ethylbenzene	Xylenes	Total Hydrocarbons (less light aliphatics)
SG1-02	0.20	<0.10	<0.10	<0.10	<0.10	<0.10
SG1-06	0.40	<0.10	<0.10	<0.10	<0.10	<0.10
SG1-10	3.00	<0.10	<0.10	<0.10	<0.10	<0.10
SG2-02	420000.00	<90.00	5200.00	<0.10	310.00	23000.00
SG2-06	4800.00	<9.00	260.00	<0.10	42.00	780.00
SG2-10	7000.00	<0.90	750.00	<0.10	330.00	1900.00
SG3-02	<0.06	<0.04	<0.04	<0.10	0.06	<0.04
SG3-06	<0.06	<0.04	<0.04	<0.10	0.06	<0.04
SG3-10	0.09	<0.04	<0.04	<0.10	0.06	<0.70
SG4-02	94000.00	<82.00	17000.00	<0.10	1800.00	110000.00
SG4-06	170.00	<8.00	740.00	<0.10	1300.00	2400.00
SG4-10	14000.00	<8.00	610.00	<0.10	170.00	2300.00
SG5-06	2.00	<0.04	<0.04	<0.10	4.00	7.00

(ppmv)

Sample	Methane C ₁ -C ₅ (as Methane)	Benzene	Toluene	Ethylbenzene	Xylenes	Total Hydrocarbons (less light aliphatics)
SG1-02	0	0	0	0	0	0
SG1-06	1	0	0	0	0	0
SG1-10	3	0	0	0	0	0
SG2-02	638400	14	1375	0	71	6037
SG2-06	7296	1	69	0	10	203
SG2-10	10640	0	198	0	76	482
SG3-02	0	0	0	0	0	0
SG3-06	0	0	0	0	0	0
SG3-10	0	0	0	0	0	0
SG4-02	143099	13	4501	0	414	28757
SG4-06	259	1	196	0	299	582
SG4-10	21313	1	162	0	39	592
SG5-06	3	0	0	0	1	2

Concentrations in µg/L represent the mean values of three GC/FID analyses per sample. Concentrations at or below detection limits are noted with a less than symbol. Concentrations in ppmv are calculated as discussed in Section 6, and rounded to the nearest whole number. Concentrations at detection limits were approximated by dividing the detection limit value by 2. This procedure resulted in some values being reported as zero.

SOIL GAS DATA

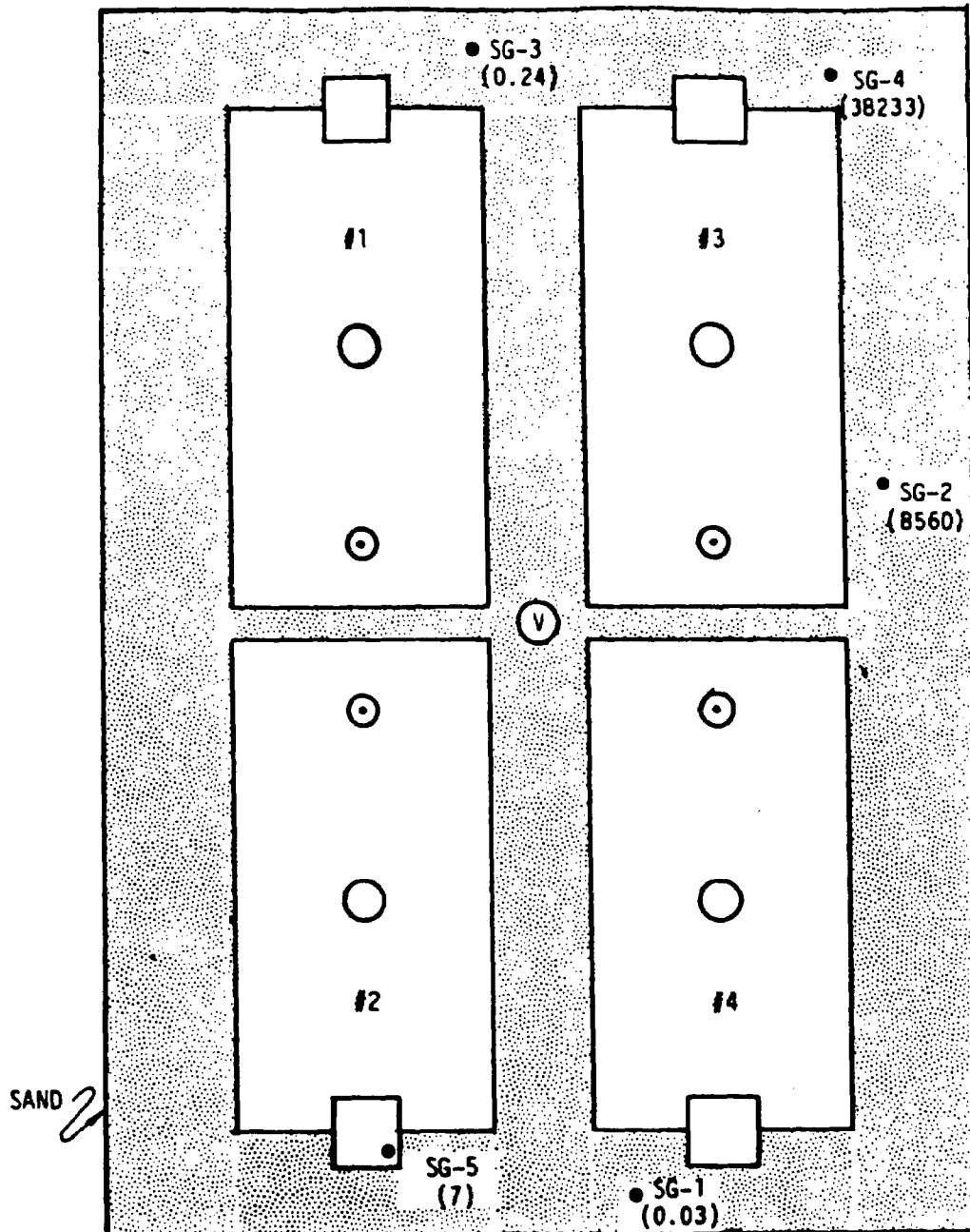
(Data Arranged by Sample Number)

San Diego
Station 4

($\mu\text{g/L}$)

Sample	Methane $\text{C}_1\text{-C}_5$ (as Methane)	Benzene	Toluene	Ethylbenzene	Xylenes	Total Hydrocarbons (less light aliphatics)
<u>Depth - 02 Feet</u>						
SG1-02	0.20	<0.10	<0.10	<0.10	<0.10	<0.10
SG2-02	420000.00	<90.00	5200.00	<0.10	310.00	23000.00
SG3-02	<0.06	<0.04	<0.04	<0.10	0.06	<0.04
SG4-02	94000.00	<82.00	17000.00	<0.10	1800.00	110000.00
Averages	128500.06	21.52	5550.02	0.05	527.52	33250.02
<u>Depth - 06 Feet</u>						
SG1-06	0.40	<0.10	<0.10	<0.10	<0.10	<0.10
SG2-06	4800.00	<9.00	260.00	<0.10	42.00	780.00
SG3-06	<0.06	<0.04	<0.04	<0.10	<0.06	<0.04
SG4-06	170.00	<8.00	740.00	<0.10	1300.00	2400.00
SG5-06	2.00	<0.04	<0.04	<0.10	4.00	7.00
Averages	994.00	1.72	200.02	0.05	269.22	637.41
<u>Depth - 10 Feet</u>						
SG1-10	3.00	<0.10	<0.10	<0.10	<0.10	<0.10
SG2-10	7000.00	<0.90	750.00	<0.10	330.00	1900.00
SG3-10	0.09	<0.04	<0.04	<0.10	0.06	0.70
SG4-10	14000.00	<8.00	610.00	<0.10	170.00	2300.00
Averages	5250.77	1.13	340.02	0.05	125.02	1050.19

Concentrations at detection limits were approximated by dividing the detection limit by 2.
The approximations were used in computing the averages.



- #1 UNLEADED
- #2 SUPER UNLEADED
- #3 UNLEADED
- #4 REGULAR

SPECS TYPICAL OF ALL TANKS

INSTALLED 1965
 COVER DEPTH 4'-9"
 BOTTOM OF TANK 12'-9"
 TANK TYPE STEEL
 CAP. 6000 GAL.
 SIZE 8'-0"x16'-10"



NOT TO SCALE

San Diego Station 4

SOIL GAS DATA
(Data Arranged by Sample Number)

San Diego
Station 5

($\mu\text{g/L}$)

Sample	Methane $\text{C}_1\text{-C}_5$ (as Methane)	Benzene	Toluene	Ethylbenzene	Xylenes	Total Hydrocarbons (less light aliphatics)
SG1-02	5.00	<0.04	<0.04	<0.10	<0.04	<0.04
SG1-06	2400.00	<0.40	110.00	<0.10	5.00	330.00
SG1-10	45000.00	<9.00	2200.00	<0.10	950.00	6000.00
SG2-02	16.00	<0.04	<0.04	<0.10	<0.04	0.30
SG2-06	4300.00	<0.90	420.00	<0.10	31.00	1200.00
SG2-10	28000.00	<86.00	2100.00	<0.10	1600.00	7700.00
SG3-02	12.00	<0.04	<0.04	<0.10	<0.04	<0.04
SG3-06	1200.00	<0.90	160.00	<0.10	4.00	440.00
SG3-10	40000.00	<86.00	2600.00	<0.10	490.00	7100.00
SG4-02	21.00	<0.04	<0.04	<0.10	<0.04	<0.04
SG4-06	9000.00	<0.90	310.00	<0.10	9.00	960.00
SG4-10	55000.00	<9.00	360.00	<0.10	160.00	4200.00

(ppmv)

Sample	Methane $\text{C}_1\text{-C}_5$ (as Methane)	Benzene	Toluene	Ethylbenzene	Xylenes	Total Hydrocarbons (less light aliphatics)
SG1-02	8	0	0	0	0	0
SG1-06	3674	0	29	0	1	87
SG1-10	69040	1	587	0	220	1537
SG2-02	25	0	0	0	0	0
SG2-06	6602	0	112	0	7	318
SG2-10	43001	14	561	0	371	1943
SG3-02	18	0	0	0	0	0
SG3-06	1844	0	43	0	1	117
SG3-10	61492	14	695	0	114	1860
SG4-02	32	0	0	0	0	0
SG4-06	13922	0	83	0	2	257
SG4-10	84793	1	97	0	37	1082

Concentrations in $\mu\text{g/L}$ represent the mean values of three GC/FID analyses per sample. Concentrations at or below detection limits are noted with a less than symbol. Concentrations in ppmv are calculated as discussed in Section 6, and rounded to the nearest whole number. Concentrations at detection limits were approximated by dividing the detection limit value by 2. This procedure resulted in some values being reported as zero.

SOIL GAS DATA

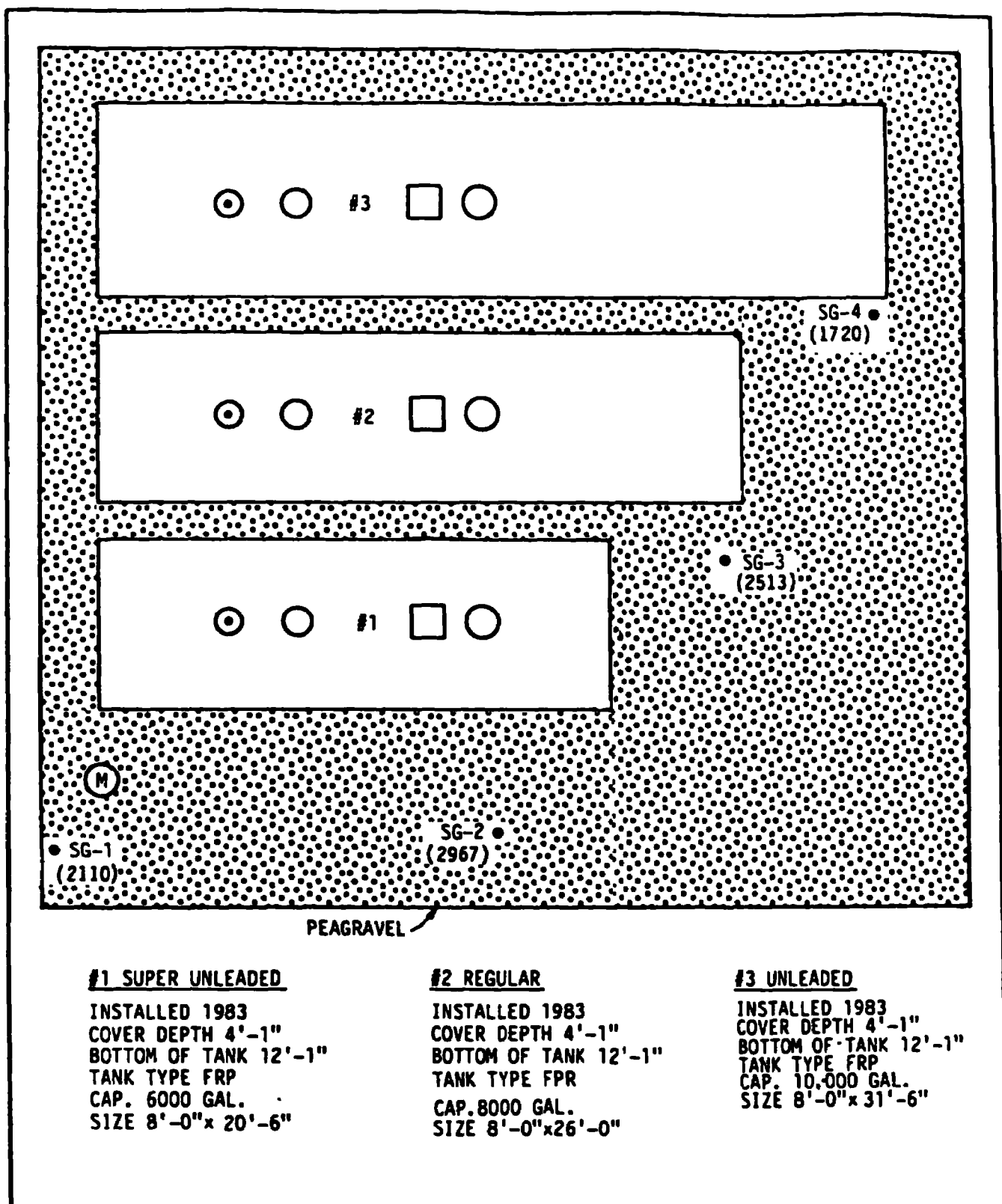
(Data Arranged by Sample Number)

San Diego
Station 5

(µg/L)

Sample	Methane C ₁ -C ₅ (as Methane)	Benzene	Toluene	Ethylbenzene	Xylenes	Total Hydrocarbons (less light aliphatics)
<u>Depth - 02 Feet</u>						
SG1-02	5.00	<0.04	<0.04	<0.10	<0.04	<0.04
SG2-02	16.00	<0.04	<0.04	<0.10	<0.04	0.30
SG3-02	12.00	<0.04	<0.04	<0.10	<0.04	<0.04
SG4-02	21.00	<0.04	<0.04	<0.10	<0.04	<0.04
Averages	13.50	0.02	0.02	0.05	0.02	0.09
<u>Depth - 06 Feet</u>						
SG1-06	2400.00	<0.40	110.00	<0.10	5.00	330.00
SG2-06	4300.00	<0.90	420.00	<0.10	31.00	1200.00
SG3-06	1200.00	<0.90	160.00	<0.10	4.00	440.00
SG4-06	9000.00	<0.90	310.00	<0.10	9.00	960.00
Averages	4225.00	0.39	250.00	0.05	12.25	732.50
<u>Depth - 10 Feet</u>						
SG1-10	45000.00	<9.00	2200.00	<0.10	950.00	6000.00
SG2-10	28000.00	<86.00	2100.00	<0.10	1600.00	7700.00
SG3-10	40000.00	<86.00	2600.00	<0.10	490.00	7100.00
SG4-10	55000.00	<9.00	360.00	<0.10	160.00	4200.00
Averages	42000.00	23.75	1815.00	0.05	800.00	6250.00

Concentrations at detection limits were approximated by dividing the detection limit by 2.
The approximations were used in computing the averages.



San Diego Station 5

SOIL GAS DATA

(Data Arranged by Sample Number)

San Diego
Station 6

($\mu\text{g/L}$)

Sample	Methane $\text{C}_1\text{-C}_5$ (as Methane)	Benzene	Toluene	Ethylbenzene	Xylenes	Total Hydrocarbons (less light aliphatics)
SG1-02	5.00	<0.04	<0.04	<0.10	<0.04	<0.04
SG1-06	140.00	<0.80	260.00	<0.10	18.00	1000.00
SG1-10	10000.00	<83.00	9100.00	<0.10	2100.00	22000.00
SG2-02	5.00	<0.04	<0.04	<0.10	<0.04	<0.04
SG2-06	3900.00	<8.00	1300.00	<0.10	530.00	5100.00
SG2-10	33000.00	<41.00	15000.00	<0.10	10000.00	52000.00
SG3-02	7.00	<0.04	<0.04	<0.10	<0.04	<0.04
SG3-06	150.00	<0.80	110.00	<0.10	6.00	480.00
SG3-10	25000.00	<83.00	23000.00	<0.10	10000.00	58000.00
SG4-02	9.00	<0.04	<0.04	<0.10	<0.04	45.00
SG4-06	18.00	<0.04	2.00	<0.10	0.20	10.00
SG4-08	190.00	<0.80	95.00	<0.10	9.00	400.00
SG5-02	1100.00	<0.40	25.00	<0.10	<0.40	140.00

(ppmv)

Sample	Methane $\text{C}_1\text{-C}_5$ (as Methane)	Benzene	Toluene	Ethylbenzene	Xylenes	Total Hydrocarbons (less light aliphatics)
SG1-02	8	0	0	0	0	0
SG1-06	212	0	69	0	4	261
SG1-10	15298	13	2421	0	485	5710
SG2-02	8	0	0	0	0	0
SG2-06	5975	1	346	0	123	1307
SG2-10	50559	6	3997	0	2313	13125
SG3-02	11	0	0	0	0	0
SG3-06	231	0	29	0	1	127
SG3-10	38432	13	6149	0	2320	14888
SG4-02	14	0	0	0	0	12
SG4-06	27	0	1	0	0	3
SG4-08	289	0	25	0	2	105
SG5-02	1672	0	7	0	0	37

Concentrations in $\mu\text{g/L}$ represent the mean values of three GC/FID analyses per sample. Concentrations at or below detection limits are noted with a less than symbol. Concentrations in ppmv are calculated as discussed in Section 6, and rounded to the nearest whole number. Concentrations at detection limits were approximated by dividing the detection limit value by 2. This procedure resulted in some values being reported as zero.

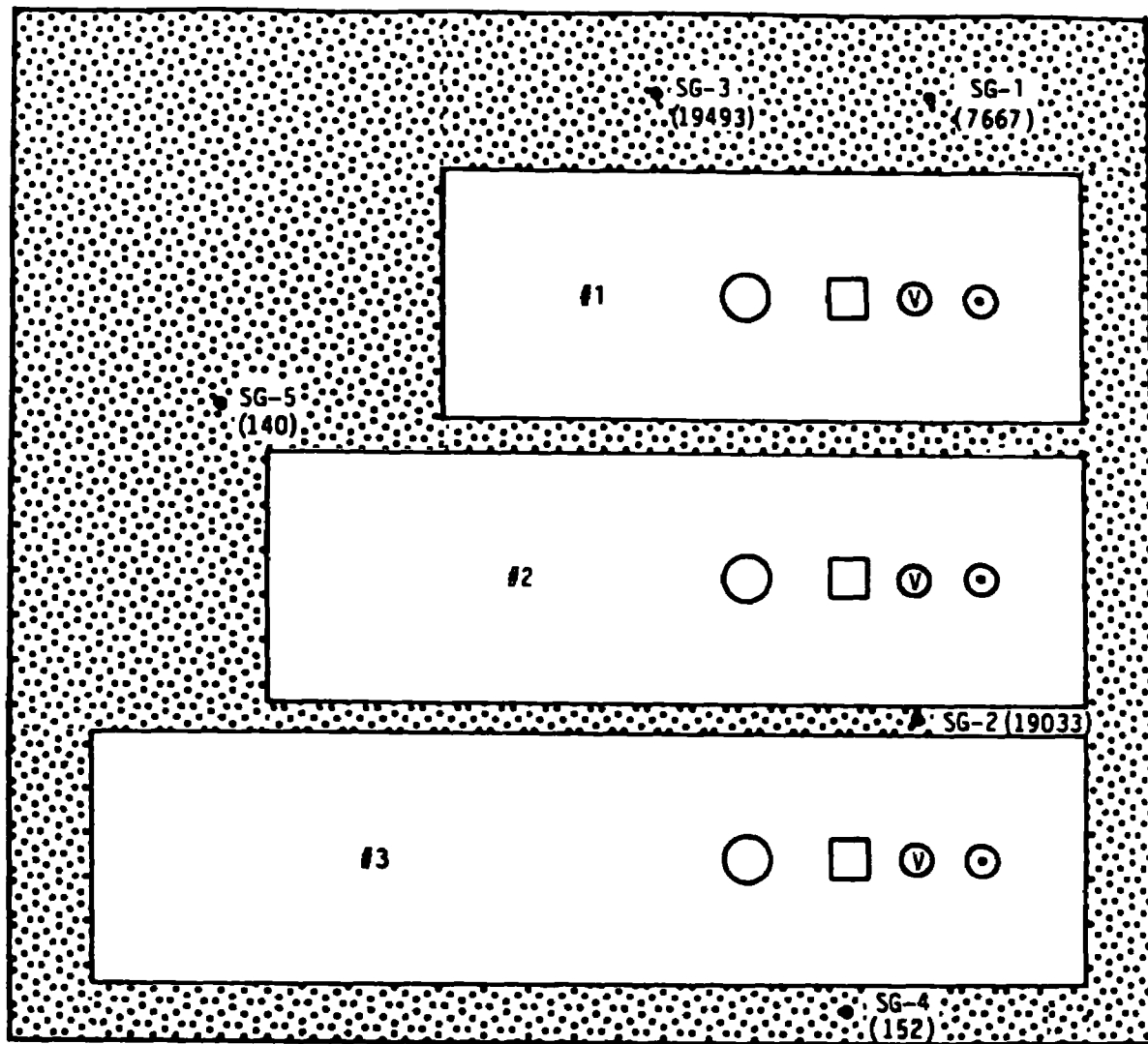
SOIL GAS DATA
(Data Arranged by Sample Number)

San Diego
Station 6

(µg/L)

Sample	Methane C ₁ -C ₅ (as Methane)	Benzene	Toluene	Ethylbenzene	Xylenes	Total Hydrocarbons (less light aliphatics)
<u>Depth - 02 Feet</u>						
SG1-02	5.00	<0.04	<0.04	<0.10	<0.04	<0.04
SG2-02	5.00	<0.04	<0.04	<0.10	<0.04	<0.04
SG3-02	7.00	<0.04	<0.04	<0.10	<0.04	<0.04
SG4-02	9.00	<0.04	<0.04	<0.10	<0.04	<0.04
SG5-02	1100.00	<0.40	25.00	<0.10	<0.40	45.00
Averages	225.00	0.06	5.02	0.05	0.06	140.00
<u>Depth - 06 Feet</u>						
SG1-06	140.0	<0.80	260.00	<0.10	18.00	1000.00
SG2-06	3900.00	<8.00	1300.00	<0.10	530.00	5100.00
SG3-06	150.00	<0.80	110.00	<0.10	6.00	480.00
SG4-06	18.00	<0.04	2.00	<0.10	0.20	10.00
Averages	1052.00	1.21	418.00	0.05	138.55	1647.50
<u>Depth - 10 Feet</u>						
SG1-10	10000.00	<83.00	9100.00	<0.10	2100.00	22000.00
SG2-10	33000.00	<41.00	15000.00	<0.10	1000.00	52000.00
SG3-10	25000.00	<83.00	23000.00	<0.10	10000.00	58000.00
SG4-08	190.00	<0.80	95.00	<0.10	9.00	400.00
Averages	17047.50	25.98	11798.75	0.05	5527.25	33100.00

Concentrations at detection limits were approximated by dividing the detection limit by 2.
The approximations were used in computing the averages.



PEAGRAVEL

#1 SUPER UNLEADED

INSTALLED 1983
COVER DEPTH 3'-11"
BOTTOM OF TANK 11'-11"
TANK TYPE FRP
CAP. 6000 GAL.
SIZE 8'-0"x20'-6 1/2"

#2 REGULAR

INSTALLED 1983
COVER DEPTH 3'-11"
BOTTOM OF TANK 11'-11"
TANK TYPE FRP
CAP. 8000 GAL.
SIZE 8'-0"x26'-0"

#3 UNLEADED

INSTALLED 1983
COVER DEPTH 3'-11"
BOTTOM OF TANK 11'-11"
TANK TYPE FRP
CAP. 10,000 GAL.
SIZE 8'-0"x31'-6 1/2"

San Diego Station 6



SOIL GAS DATA

(Data Arranged by Sample Number)

San Diego
Station 7

(µg/L)

Sample	Methane C ₁ -C ₅ (as Methane)	Benzene	Toluene	Ethylbenzene	Xylenes	Total Hydrocarbons (less light aliphatics)
SG1-02	1500.00	<11.00	1100.00	<0.10	<15.00	4500.00
SG1-06	76000.00	<90.00	9000.00	<0.10	520.00	98000.00
SG1-10	140000.00	<90.00	8400.00	<0.10	<120.00	120000.00
SG2-02	62000.00	<90.00	17000.00	<0.10	7800.00	120000.00
SG2-06	71000.00	<90.00	19000.00	<0.10	8800.00	130000.00
SG2-10	130000.00	<90.00	31000.00	<0.10	8400.00	210000.00
SG3-02	120000.00	<90.00	6900.00	<0.10	440.00	34000.00
SG3-06	250000.00	<90.00	15000.00	<0.10	2000.00	70000.00
SG3-10	270000.00	<90.00	13000.00	<0.10	1100.00	64000.00
SG4-02	40000.00	<45.00	630.00	<0.10	<62.00	5100.00
SG4-06	170000.00	<45.00	4600.00	<0.10	<62.00	28000.00
SG4-10	210000.00	<45.00	7100.00	<0.10	220.00	40000.00
SG5-02	110000.00	<45.00	4300.00	<0.10	560.00	26000.00
SG5-06	250000.00	<90.00	20000.00	<0.10	3300.00	78000.00
SG5-10	390000.00	<90.00	23000.00	<0.10	4000.00	94000.00

(ppmv)

Sample	Methane C ₁ -C ₅ (as Methane)	Benzene	Toluene	Ethylbenzene	Xylenes	Total Hydrocarbons (less light aliphatics)
SG1-02	2275	2	290	0	1	1186
SG1-06	115063	14	2370	0	119	25616
SG1-10	211958	14	2212	0	14	31563
SG2-02	93867	14	4476	0	1783	30288
SG2-06	107493	14	5003	0	2011	32803
SG2-10	198299	14	8224	0	1934	54144
SG3-02	176728	14	1767	0	98	8639
SG3-06	368183	14	3842	0	445	17651
SG3-10	397637	14	3330	0	245	16223
SG4-02	58799	7	161	0	7	1296
SG4-06	250832	7	1180	0	7	7178
SG4-10	309273	7	1819	0	49	10204
SG5-02	161395	7	1097	0	124	6534
SG5-06	366807	14	5103	0	731	19532
SG5-10	572219	14	5869	0	886	23518

Concentrations in µg/L represent the mean values of three GC/FID analyses per sample

Concentrations at or below detection limits are noted with a less than symbol.

Concentrations in ppmv are calculated as discussed in Section 6, and rounded to the nearest whole number. Concentrations at detection limits were approximated by dividing the detection limit value by 2. This procedure resulted in some values being reported as zero.

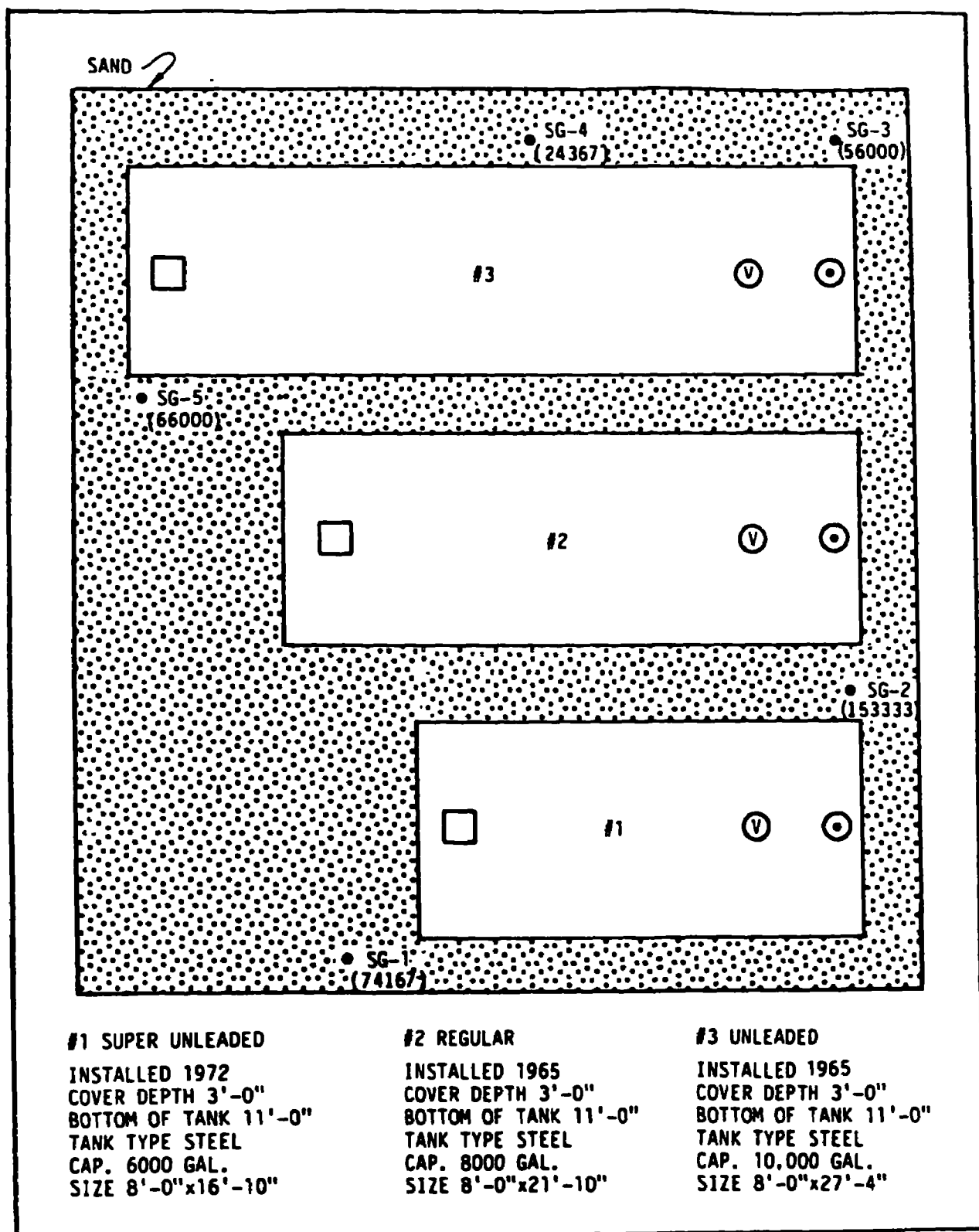
SOIL GAS DATA
(Data Arranged by Sample Number)

San Diego
Station 7

(µg/L)

Sample	Methane C ₁ -C ₅ (as Methane)	Benzene	Toluene	Ethylbenzene	Xylenes	Total Hydrocarbons (less light aliphatics)
Depth - 02 Feet						
SG1-02	1500.00	<11.00	1100.00	<0.10	<15.00	4500.00
SG2-02	62000.00	<90.00	17000.00	<0.10	7800.00	120000.00
SG3-02	120000.00	<90.00	6900.00	<0.10	440.00	34000.00
SG4-02	40000.00	<45.00	630.00	<0.10	<62.00	5100.00
SG5-02	110000.00	<45.00	4300.00	<0.10	560.00	26000.00
Averages	66700.00	28.10	5986.00	0.05	1767.70	37920.00
Depth - 06 Feet						
SG1-06	76000.00	<90.00	9000.00	<0.10	520.00	98000.00
SG2-06	71000.00	<90.00	1900.00	<0.10	8800.00	130000.00
SG3-06	250000.00	<90.00	15000.00	<0.10	2000.00	70000.00
SG4-06	170000.00	<45.00	4600.00	<0.10	<62.00	28000.00
SG5-06	250000.00	<90.00	20000.00	<0.10	3300.00	78000.00
Averages	163400.00	40.50	13520.00	0.05	2930.20	80800.00
Depth - 10 Feet						
SG1-10	140000.00	<90.00	8400.00	<0.10	<120.00	120000.00
SG2-10	130000.00	<90.00	31000.00	<0.10	8400.00	210000.00
SG3-10	270000.00	<90.00	13000.00	<0.10	1100.00	64000.00
SG4-10	210000.00	<45.00	7100.00	<0.10	220.00	40000.00
SG5-10	390000.00	<90.00	23000.00	<0.10	4000.00	94000.00
Averages	228000.00	40.50	16500.00	0.05	2756.00	105600.00

Concentrations at detection limits were approximated by dividing the detection limit by 2.
The approximations were used in computing the averages.



San Diego Station 7



SOIL GAS DATA

(Data Arranged by Sample Number)

San Diego
Station 8

(µg/L)

Sample	Methane C ₁ -C ₅ (as Methane)	Benzene	Toluene	Ethylbenzene	Xylenes	Total Hydrocarbons (less light aliphatics)
SG1-02	<0.10	<0.90	710.00	<0.10	100.00	8500.00
SG1-06	11000.00	<46.00	5900.00	<0.10	3500.00	55000.00
SG1-10	21000.00	<91.00	11000.00	<0.10	5400.00	71000.00
SG2-02	4100.00	<46.00	2900.00	<0.10	1600.00	22000.00
SG2-06	10000.00	<46.00	9400.00	<0.10	5700.00	70000.00
SG2-10	18000.00	<91.00	19000.00	<0.10	8600.00	110000.00
SG3-02	8400.00	<46.00	3900.00	<0.10	3200.00	28000.00
SG3-06	12000.00	<91.00	7000.00	<0.10	4200.00	54000.00
SG3-10	17000.00	<91.00	19000.00	<0.10	6500.00	104000.00
SG4-02	7900.00	<46.00	5200.00	<0.10	4000.00	32000.00
SG4-06	13000.00	<46.00	12000.00	<0.10	5700.00	67000.00
SG4-10	21000.00	<46.00	22000.00	<0.10	8300.00	120000.00

(ppmv)

Sample	Methane C ₁ -C ₅ (as Methane)	Benzene	Toluene	Ethylbenzene	Xylenes	Total Hydrocarbons (less light aliphatics)
SG1-02	0	0	189	0	23	2222
SG1-06	16809	7	1568	0	807	13902
SG1-10	31852	14	2902	0	1236	17920
SG2-02	6242	7	768	0	368	5555
SG2-06	15224	7	2489	0	1310	17613
SG2-10	27353	14	5021	0	1973	27879
SG3-02	13003	7	1050	0	748	7093
SG3-06	18575	14	1884	0	981	13824
SG3-10	26122	14	5077	0	1508	26861
SG4-02	12050	7	1379	0	921	8004
SG4-06	19865	7	3189	0	1315	17051
SG4-10	32328	7	5890	0	1929	30967

Concentrations in µg/L represent the mean values of three GC/FID analyses per sample.
Concentrations at or below detection limits are noted with a less than symbol.
Concentrations in ppmv are calculated as discussed in Section 6, and rounded to the nearest whole number. Concentrations at detection limits were approximated by dividing the detection limit value by 2. This procedure resulted in some values being reported as zero.

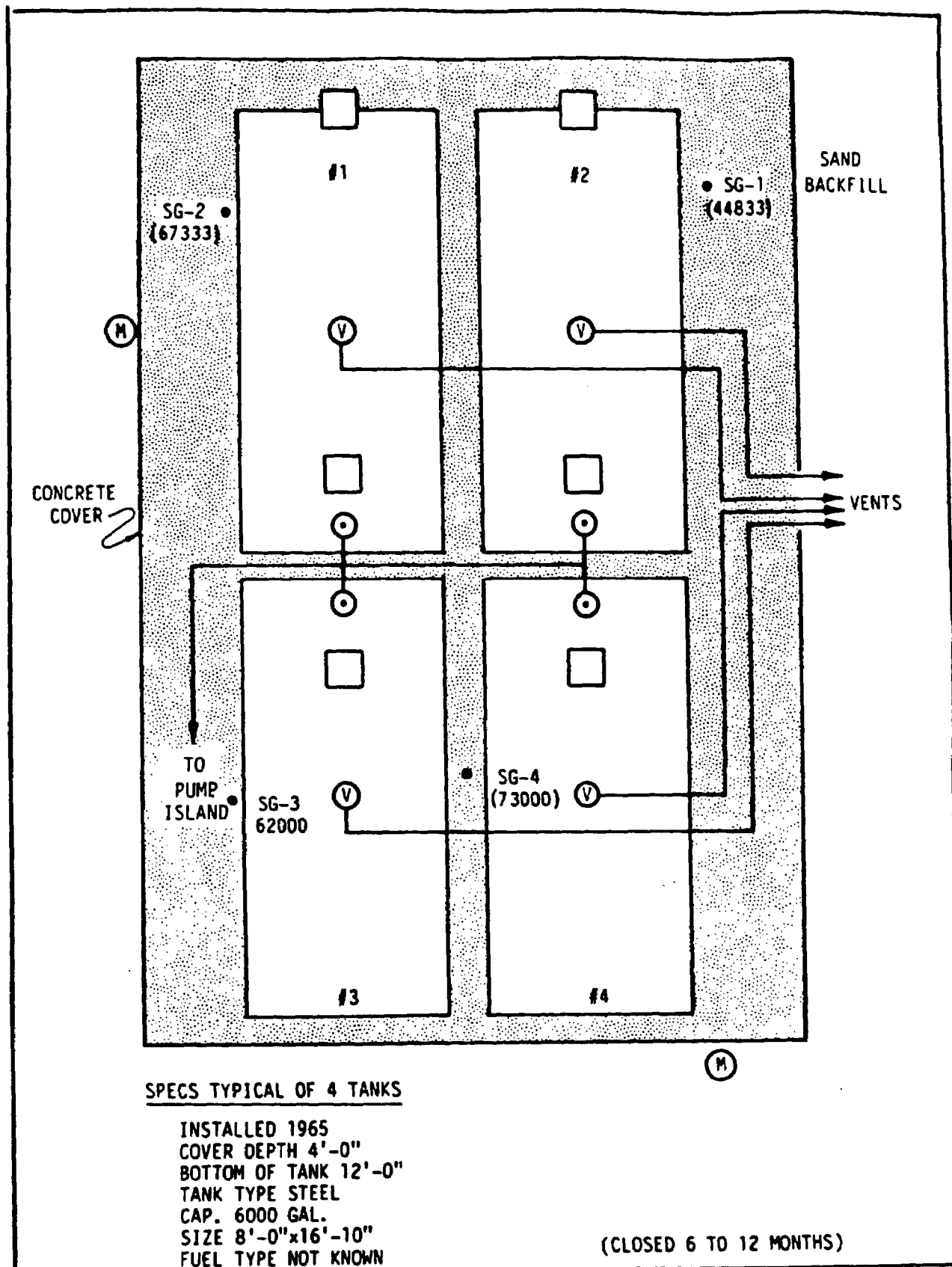
SOIL GAS DATA
(Data Arranged by Sample Number)

San Diego
Station 8

(µg/L)

Sample	Methane C ₁ -C ₃ (as Methane)	Benzene	Toluene	Ethylbenzene	Xylenes	Total Hydrocarbons (less light aliphatics)
<u>Depth - 02 Feet</u>						
SG1-02	<0.10	<0.90	710.00	<0.10	100.00	8500.00
SG2-02	4100.00	<46.00	2900.00	<0.10	1600.00	22000.00
SG3-02	8400.00	<46.00	3900.00	<0.10	3200.00	28000.00
SG4-02	7900.00	<46.00	5200.00	<0.10	4000.00	32000.00
Averages	5100.01	17.36	3177.50	0.05	2225.00	22625.00
<u>Depth - 06 Feet</u>						
SG1-06	11000.00	<46.00	5900.00	<0.10	3500.00	55000.00
SG2-06	10000.00	<46.00	9400.00	<0.10	5700.00	70000.00
SG3-06	12000.00	<91.00	7000.00	<0.10	4200.00	54000.00
SG4-06	13000.00	<46.00	12000.00	<0.10	5700.00	67000.00
Averages	11500.00	28.62	8575.00	0.05	4775.00	61500.00
<u>Depth - 10 Feet</u>						
SG1-10	21000.00	<91.00	11000.00	<0.10	5400.00	71000.00
SG2-10	18000.00	<91.00	19000.00	<0.10	8600.00	110000.00
SG3-10	17000.00	<91.00	19000.00	<0.10	6500.00	104000.00
SG4-10	21000.00	<46.00	22000.00	<0.10	8300.0	120000.00
Averages	19250.00	39.88	17750.00	0.05	7200.00	101250.00

Concentrations at detection limits were approximated by dividing the detection limit by 2.
The approximations were used in computing the averages.



San Diego Station 8

SOIL GAS DATA

(Data Arranged by Sample Number)

San Diego
Station 9

($\mu\text{g/L}$)

Sample	Methane $\text{C}_1\text{-C}_5$ (as Methane)	Benzene	Toluene	Ethylbenzene	Xylenes	Total Hydrocarbons (less light aliphatics)
SG1-02	130000.00	<98.00	9200.00	<0.10	1700.00	42000.00
SG1-06	120000.00	<98.00	8800.00	<0.10	1800.00	41000.00
SG2-02	260000.00	<98.00	12000.00	<0.10	1300.00	54000.00
SG2-06	280000.00	<98.00	32000.00	<0.10	5900.00	110000.00
SG2-10	230000.00	<98.00	26000.00	<0.10	4500.00	89000.00
SG3-02	91000.00	<98.00	12000.00	<0.10	2400.00	46000.00
SG3-06	110000.00	<98.00	15000.00	<0.10	5800.00	58000.00
SG3-10	150000.00	<98.00	18000.00	<0.10	3200.00	71000.00
SG4-02	83000.00	<98.00	6600.00	<0.10	840.00	28000.00
SG4-06	130000.00	<98.00	11000.00	<0.10	4400.00	45000.00
SG4-10	230000.00	<98.00	22000.00	<0.10	8200.00	86000.00
SG5-02	81000.00	<98.00	6700.00	<0.10	200.00	28000.00
SG5-06	100000.00	<98.00	7200.00	<0.10	260.00	35000.00
SG5-10	100000.00	<98.00	9500.00	<0.10	1300.00	39000.00

(ppmv)

Sample	Methane $\text{C}_1\text{-C}_5$ (as Methane)	Benzene	Toluene	Ethylbenzene	Xylenes	Total Hydrocarbons (less light aliphatics)
SG1-02	193683	15	2384	0	382	10660
SG1-06	180135	15	2297	0	408	10465
SG2-02	390293	15	3133	0	295	13916
SG2-06	419527	15	8338	0	1334	28075
SG2-10	343964	15	6762	0	1016	22698
SG3-02	137115	15	3145	0	546	11790
SG3-06	164814	15	3909	0	1312	14559
SG3-10	228968	15	4778	0	737	18474
SG4-02	127163	15	1759	0	194	7350
SG4-06	198805	15	2926	0	1016	11519
SG4-10	353026	15	5873	0	1900	22136
SG5-02	123415	15	1775	0	46	7390
SG5-06	152364	15	1908	0	60	9231
SG5-10	151801	15	2508	0	298	10133

Concentrations in $\mu\text{g/L}$ represent the mean values of three GC/FID analyses per sample. Concentrations at or below detection limits are noted with a less than symbol. Concentrations in ppmv are calculated as discussed in Section 6, and rounded to the nearest whole number. Concentrations at detection limits were approximated by dividing the detection limit value by 2. This procedure resulted in some values being reported as zero.

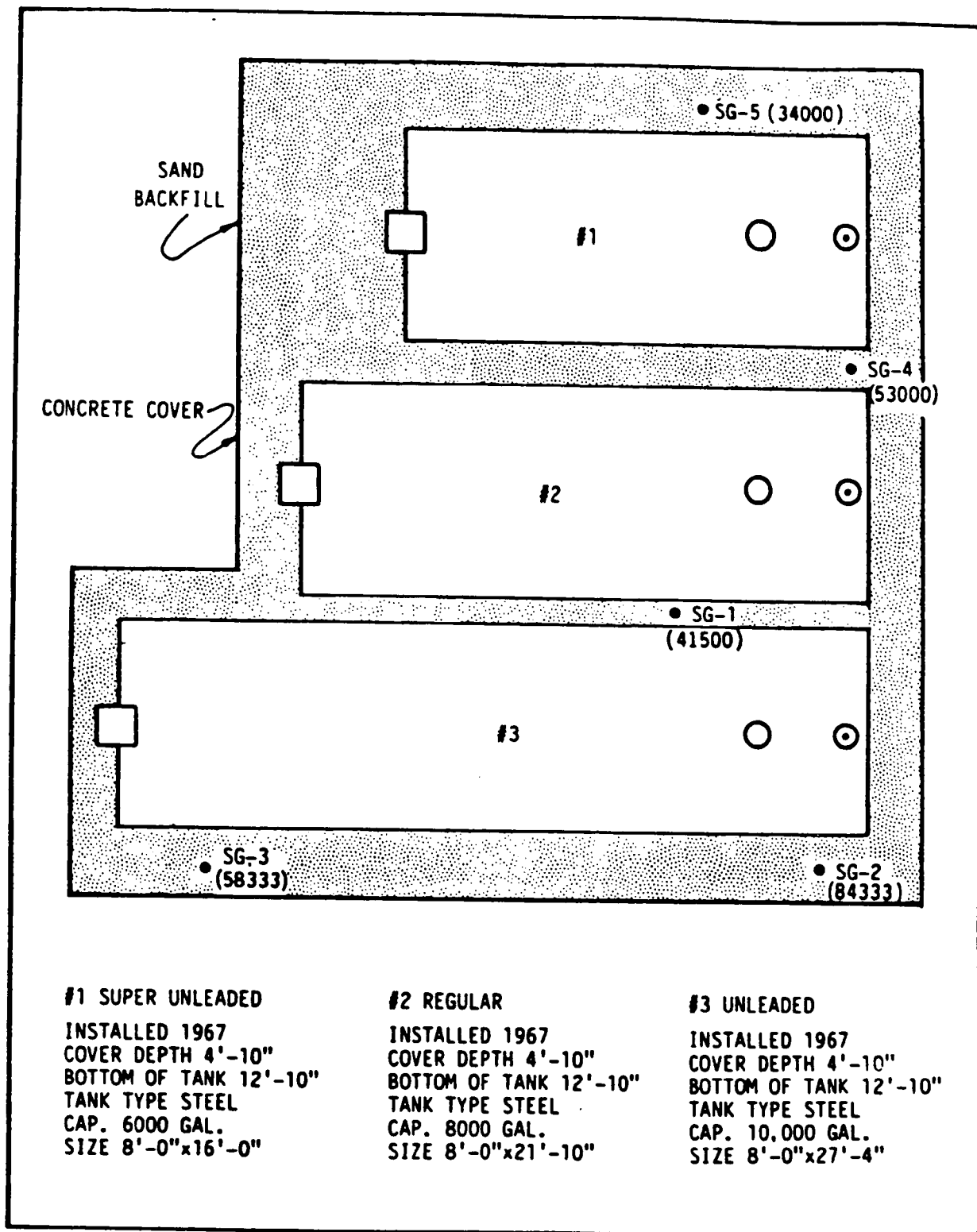
SOIL GAS DATA
(Data Arranged by Sample Number)

San Diego
Station 9

($\mu\text{g/L}$)

Sample	Methane $\text{C}_1\text{-C}_5$ (as Methane)	Benzene	Toluene	Ethylbenzene	Xylenes	Total Hydrocarbons (less light aliphatics)
Depth - 02 Feet						
SG1-02	130000.00	<98.00	9200.00	<0.10	1700.00	42000.00
SG2-02	260000.00	<98.00	12000.00	<0.10	1300.00	54000.00
SG3-02	91000.00	<98.00	12000.00	<0.10	2400.00	46000.00
SG4-02	83000.00	<98.00	6600.00	<0.10	840.00	28000.00
SG5-02	81000.00	<98.00	6700.00	<0.10	200.00	28000.00
Averages	129000.00	49.00	9300.00	0.05	1288.00	39600.00
Depth - 06 Feet						
SG1-06	120000.00	<98.00	8800.00	<0.10	1800.00	41000.00
SG2-06	280000.00	<98.00	32000.00	<0.10	5900.00	110000.00
SG3-06	110000.00	<98.00	15000.00	<0.10	5800.00	58000.00
SG4-06	130000.00	<98.00	11000.00	<0.10	4400.00	45000.00
SG5-06	100000.00	<98.00	7200.00	<0.10	260.00	35000.00
Averages	148000.00	49.00	14800.00	0.05	3632.00	57800.00
Depth - 10 Feet						
SG2-10	230000.00	<98.00	26000.00	<0.10	4500.00	89000.00
SG3-10	150000.00	<98.00	18000.00	<0.10	3200.00	71000.00
SG4-10	230000.00	<98.00	22000.00	<0.10	8200.00	86000.00
SG5-10	100000.00	<98.00	9500.00	<0.10	1300.00	39000.00
Averages	177500.00	49.00	18875.00	0.05	4300.00	71250.00

Concentrations at detection limits were approximated by dividing the detection limit by 2.
The approximations were used in computing the averages.



San Diego Station 9

Austin Station 6

(All concentration values in $\mu\text{g/L}$)

Station	Sample Number	Depth (ft)	Sample Date	Sample Time	Light	Butane	Benzene	Toluene	Ethyl- benzene	Xylenes	Total Hydrocarbons
					Aliphatics ($C_1 - C_3$)						
AU6	SG-01	2.	10/27/87	8:54:00	4500.0	NA	<38.0	3100.0	<44.0	-48.0	71000.0
AU6	SG-01	6.	10/27/87	9:02:00	710,000	NA	110000	90000.0	<220.0	-240.0	960000.0
AU6	SG-02	6.	10/27/87	9:15:00	4500.0	NA	<38.0	<43.0	<44.0	-48.0	8700.0
AU6	SG-02	2.	10/27/87	9:40:00	6100.0	NA	<190.0	<220.0	<220.0	-240.0	130000.0
AU6	SG-03	2.	10/27/87	10:12:00	0.3	NA	<0.2	<0.2	<0.2	-0.2	-0.2
AU6	SG-03	6.	10/27/87	10:38:00	14000.0	NA	<190.0	<220.0	<220.0	-240.0	180000.0
AU6	SG-04	2.	10/27/87	11:14:00	6700.0	NA	<190.0	<220.0	<220.0	-240.0	150000.0
AU6	SG-04	6.	10/27/87	11:38:00	6300.0	NA	<190.0	<220.0	<220.0	-240.0	130000.0
AU6	SG-05	2.	10/27/87	12:49:00	4800.0	NA	<190.0	<220.0	<220.0	-240.0	88000.0
AU6	SG-05	6.	10/27/87	13:13:00	3600.0	NA	<190.0	<220.0	<220.0	-240.0	90000.0
AU6	SG-03	2.	10/28/87	13:48:00	200.0	620.0	<4.2	<4.8	<4.9	-5.8	1900.0
AU6	SG-03	6.	10/28/87	14:17:00	200.0	530.0	<4.2	<4.8	<4.9	-5.8	2100.0
AU6	SG-02	2.	10/28/87	14:50:00	5493.0	58000	<42.0	<48.0	<49.0	-58.0	190000.0
AU6	SG-02	6.	10/28/87	15:31:00	4100.0	210000	8300.0	8100.0	<49.0	-58.0	610000.0
AU6	SG-05	2.	10/28/87	16:20:00	2400.0	57000	<42.0	1800.0	<49.0	-58.0	150000.0
AU6	SG-05	6.	10/28/87	16:50:00	4400.0	300000	5600.0	5600.0	<49.0	-58.0	740000.0
AU6	SG-04	2.	10/28/87	18:03:00	5000.0	64000	<42.0	<48.0	-49.0	-58.0	200000.0
AU6	SG-03	6.	10/29/87	16:30:00	5600.0	13000	<250.0	<290.0	-270.0	-260.0	180000.0
AU6	SG-02	6.	10/29/87	17:07:00	8500.0	41000	<250.0	<290.0	-270.0	-260.0	420000.0
AU6	SG-05	6.	10/29/87	17:32:00	10000.0	71000	<250.0	<290.0	-270.0	-260.0	690000.0
AU6	SG-04	6.	10/29/87	17:53:00	13000.0	55000	<250.0	<290.0	-270.0	-260.0	660000.0
AU6	SG-04	6.	10/30/87	11:48:00	3600.0	250000	76000.0	700.0	-20.0	-31.0	250000.0
AU6	SG-05	6.	10/30/87	12:20:00	4800.0	270000	4500.0	1200.0	-20.0	-31.0	290000.0
AU6	SG-02	6.	10/30/87	12:45:00	3400.0	150000	38000.0	7600.0	-20.0	-31.0	160000.0
AU6	SG-03	6.	10/30/87	13:15:00	4600.0	140000	<78.0	<15.0	-20.0	-31.0	150000.0

Total hydrocarbon calculated less light aliphatics, C_1-C_3 , using an average RF

Pipeling punctured 10/17/87 at 09:00:00.

(NA) = Not Analyzed

APPENDIX D

SUPPORTING DOCUMENTATION FOR REPORTING METHODS EVALUATION

- 1) Calculation of BTEX to total hydrocarbon ratio (total hydrocarbon calculated as benzene)
- 2) Calculation of percent difference between total hydrocarbons as benzene and total hydrocarbons as BTEX
- 3) Calculation of BTEX to total hydrocarbon ratio (total hydrocarbons calculated using an average RF as BTEX)
- 4) Tabular data used to generate Figure 2
- 5) Chromatograms for selected sites
- 6) Discussion of compressibility factor.

CALCULATION OF BTEX TO TOTAL HYDROCARBON RATIO

(Total Hydrocarbons Calculated as Benzene)

<u>Station</u>	<u>Sample Number</u>	<u>Sum of BTEX</u>	<u>Total Hydrocarbons (as benzene)</u>	<u>Ratio</u>
AU1	SG1-02	14845.00	16000.00	0.93
AU1	SG1A-06	20.50	160.00	0.13
AU1	SG1A-09	104.00	120.00	0.87
AU1	SG2-02	105.50	84.00	1.26
AU1	SG2-06	62.10	61.00	1.02
AU1	SG2-10	27.91	21.00	1.33
AU1	SG3-02	445.50	440.00	1.01
AU1	SG3-06	285.50	350.00	0.82
AU1	SG3-10	103.50	40.00	2.59
AU1	SG4-02	258.50	380.00	0.68
AU1	SG4-06	136.00	240.00	0.57
AU1	SG4-10	51.50	120.00	0.43
AU1	SG5-02	724.50	620.00	1.17
AU1	SG5-06	614.50	600.00	1.02
AU1	SG5-10	7874.50	9500.00	0.83
AU2	SG1-02	12160.00	10000.00	1.22
AU2	SG1-06	24260.00	19000.00	1.28
AU2	SG1-10	25360.00	20000.00	1.27
AU2	SG2-02	2370.00	2100.00	1.13
AU2	SG2-06	7880.00	7100.00	1.11
AU2	SG2-08	6680.00	6000.00	1.11
AU2	SG3-02	48.00	47.00	1.02
AU2	SG3-06	19860.00	15000.00	1.32
AU2	SG3-10	27560.00	23000.00	1.20
AU2	SG4-02	13280.00	13000.00	1.02
AU2	SG4-06	30560.00	26000.00	1.18
AU2	SG4-10	26920.00	24000.00	1.12
AU2	SG5-02	25760.00	22000.00	1.17
AU2	SG5-06	35360.00	28000.00	1.26
AU2	SG5-10	53920.00	42000.00	1.28
AU3	SG1-02	0.13	0.10	1.30
AU3	SG1-06	0.25	0.40	0.62
AU3	SG1-10	1588.50	1600.00	0.99
AU3	SG2-02	0.03	0.09	0.33
AU3	SG2-06	1.70	2.00	0.85
AU3	SG2-10	2386.47	2300.00	1.04
AU3	SG3-02	27.96	0.09	310.67
AU3	SG3-06	1020.50	1000.00	1.02
AU3	SG3-10	4340.50	4400.00	0.99
AU3	SG4-02	0.10	0.04	2.50
AU3	SG4-06	2.17	2.00	1.09
AU3	SG4-10	3810.50	3900.00	0.98
AU3	SG5-02	0.13	0.10	1.30
AU3	SG5-06	0.30	1.00	0.30

(Continued)

<u>Station</u>	<u>Sample Number</u>	<u>Sum of BTEX</u>	<u>Total Hydrocarbons (as benzene)</u>	<u>Ratio</u>
AU3	SG5-10	3994.50	3600.00	1.11
AU5	SG1-02	17734.00	72000.00	0.25
AU5	SG1-06	40490.00	2.4E5	0.17
AU5	SG1-10	25084.00	1.E6	0.03
AU5	SG2-02	11234.00	1.2E5	0.09
AU5	SG2-06	9984.00	1.1E5	0.09
AU5	SG2-10	64800.00	1500.00	43.20
AU5	SG3-02	45100.00	7900.00	5.71
AU5	SG4-02	13984.00	12000.00	1.17
AU5	SG5-1.5	912.00	50000.00	0.02
AU7	SG2-02	0.10	13861.00	7.21E-6
AU7	SG2-06	99.00	35810.00	2.76E-3
AU7	SG3-02	0.73	13186.00	5.54E-5
AU7	SG3-06	99.00	46874.00	2.11E-3
AU7	SG4-02	4.65	28000.00	1.66E-4
CONN1	SG1-02	0.07	0.04	1.75
CONN1	SG1-06	0.10	0.08	1.31
CONN1	SG1-10	0.09	4.00	0.02
CONN1	SG2-02	0.06	0.03	2.00
CONN1	SG2-06	0.07	0.80	0.09
CONN1	SG3-02	238.00	3100.00	0.08
CONN1	SG3-06	828.00	4300.00	0.19
CONN1	SG4-02	0.09	0.04	2.25
CONN1	SG4-06	0.07	0.03	2.33
CONN1	SG5-02	0.13	0.06	2.17
CONN1	SG5-06	0.13	2.00	0.06
CONN1	SG5-10	0.13	0.03	4.33
CONN2	SG1-02	0.10	1.00	0.10
CONN2	SG1-06	0.09	0.03	2.83
CONN2	SG2-02	0.14	0.06	2.33
CONN2	SG2-06	0.17	0.08	2.19
CONN2	SG2-08	0.10	0.04	2.50
CONN2	SG3-02	0.10	0.04	2.50
CONN2	SG3-06	0.19	9.00	0.02
CONN2	SG4-02	0.10	0.04	2.50
CONN2	SG4-06	0.09	0.20	0.47
CONN2	SG5-02	0.01	2.00	7.5E-3
CONN2	SG5-06	2290.50	41000.00	0.06
NY1	SG1-02	0.20	0.07	2.79
NY1	SG1-06	0.20	0.07	2.79
NY1	SG1-10	0.20	0.07	2.79
NY1	SG2-02	565.00	89000.00	6.35E-3
NY1	SG2-06	3595.00	1.1E5	0.03
NY1	SG2-08	35700.00	1.4E5	0.26
NY1	SG3-02	0.28	0.07	4.07
NY1	SG3-06	0.28	0.07	4.07
NY1	SG3-10	0.28	0.07	4.07
NY1	SG4-02	0.28	0.07	4.07

(Continued)

<u>Station</u>	<u>Sample Number</u>	<u>Sum of BTEX</u>	<u>Total Hydrocarbons (as benzene)</u>	<u>Ratio</u>
NY1	SG4-06	135.50	1000.00	0.14
NY1	SG4-09	105.50	660.00	0.16
NY2	SG1-02	0.08	0.03	2.67
NY2	SG1-06	0.08	0.03	2.67
NY2	SG1-10	0.08	0.03	2.67
NY2	SG2-02	515.00	1600.00	0.32
NY2	SG2-06	434.50	810.00	0.54
NY2	SG2-10	37.45	83.00	0.45
NY2	SG3-02	0.08	0.03	2.67
NY2	SG4-02	0.08	0.03	2.67
NY2	SG4-06	0.24	0.20	1.20
NY2	SG4-10	0.08	0.03	2.67
NY2	SG5-02	0.04	0.10	0.40
NY4	SG1-02	13.50	850.00	0.02
NY4	SG1-06	565.50	21000.00	0.03
NY4	SG1-10	810.50	34000.00	0.02
NY4	SG2-02	45.00	1300.00	0.03
NY4	SG2-06	560.50	25000.00	0.02
NY4	SG2-10	1240.50	34000.00	0.04
NY4	SG3-02	1245.50	43000.00	0.03
NY4	SG3-06	3645.50	49000.00	0.07
NY4	SG3-10	4260.50	55000.00	0.08
NY4	SG4-02	67.00	20000.00	3.35E-3
NY4	SG4-06	1040.50	35000.00	0.03
NY4	SG4-10	2690.50	46000.00	0.06
NY5	SG1-02	0.08	2.00	0.04
NY5	SG1-06	0.08	0.03	2.67
NY5	SG1-10	1647.00	21000.00	0.08
NY5	SG2-02	642.50	5800.00	0.11
NY5	SG2-06	5399.00	31000.00	0.17
NY5	SG3-02	0.02	0.20	0.10
NY5	SG4-02	2022.50	40000.00	0.05
NY5	SG4-06	3892.00	58000.00	0.07
NY5	SG5-02	2.94	12.00	0.25
NY5	SG5-05	572.50	6800.00	0.08
NY6	SG1-02	0.08	0.03	2.67
NY6	SG1-06	4.89	82.00	0.06
NY6	SG2-02	0.94	4.00	0.23
NY6	SG2-06	19.45	640.00	0.03
NY6	SG2-10	53.95	1400.00	0.04
NY6	SG4-06	0.14	12.00	0.01
RI1	SG1-02	0.32	0.90	0.36
RI1	SG1-06	0.32	0.90	0.36
RI1	SG2-02	0.32	0.90	0.36
RI1	SG2-06	0.32	0.90	0.36
RI1	SG3-02	329.95	370.00	0.89
RI1	SG3-06	276.95	280.00	0.99
RI1	SG3-10	18.95	21.00	0.90

(Continued)

<u>Station</u>	<u>Sample Number</u>	<u>Sum of BTEX</u>	<u>Total Hydrocarbons (as benzene)</u>	<u>Ratio</u>
RI2	SG1-02	0.10	0.08	1.31
RI2	SG1-06	382.95	920.00	0.42
RI2	SG1-10	0.10	0.08	1.31
RI2	SG1-02	0.35	0.90	0.39
RI2	SG2-06	47.85	190.00	0.25
RI2	SG2-10	88.20	220.00	0.40
RI2	SG3-02	0.35	0.90	0.39
RI2	SG3-06	0.35	0.90	0.39
RI2	SG3-10	0.35	0.90	0.39
RI2	SG4-02	0.35	0.90	0.39
RI2	SG4-06	0.35	0.90	0.39
RI2	SG4-10	0.35	0.90	0.39
RI3	SG1-02	0.22	0.60	0.37
RI3	SG1-06	0.22	0.60	0.37
RI3	SG1-10	0.22	0.60	0.37
RI3	SG2-02	0.22	0.60	0.37
RI3	SG2-06	0.22	0.60	0.37
RI3	SG2-10	0.22	0.60	0.37
RI3	SG3-02	0.22	0.60	0.37
RI3	SG3-06	0.22	0.60	0.37
RI3	SG3-10	0.22	0.60	0.37
RI3	SG4-02	0.61	0.60	1.02
RI3	SG4-06	0.01	1.00	0.01
RI4	SG1-02	110.00	430.00	0.26
RI4	SG1-06	187.00	320.00	0.58
RI4	SG1-10	863.00	1600.00	0.54
RI4	SG2-02	0.10	0.03	3.33
RI4	SG2-06	0.64	10.00	0.06
RI4	SG2-10	667.95	7800.00	0.09
RI4	SG3-02	0.10	0.30	0.35
RI4	SG3-06	4.97	20.00	0.25
RI4	SG3-10	0.12	11.00	0.01
RI4	SG4-02	1799.75	16000.00	0.11
RI4	SG4-06	2349.75	11000.00	0.21
SD1	SG1-02	1.29	190.00	6.79E-3
SD1	SG1-06	0.10	42.00	2.38E-3
SD1	SG2-02	0.10	0.60	0.17
SD1	SG2-06	329.15	780.00	0.42
SD1	SG3-02	4589.50	13000.00	0.35
SD1	SG3-06	8989.50	15000.00	0.60
SD1	SG4-02	1311.50	10000.00	0.13
SD1	SG4-06	9295.50	33000.00	0.28
SD1	SG5-06	15795.50	27000.00	0.59
SD2	SG1-02	694.00	1800.00	0.39
SD2	SG1-06	5595.50	18000.00	0.31
SD2	SG2-02	9395.50	30000.00	0.31
SD2	SG2-06	10695.50	32000.00	0.33
SD2	SG3-02	4895.50	31000.00	0.16

(Continued)

<u>Station</u>	<u>Sample Number</u>	<u>Sum of BTEX</u>	<u>Total Hydrocarbons (as benzene)</u>	<u>Ratio</u>
SD2	SG3-06	15995.50	63000.00	0.25
SD2	SG4-02	8795.50	53000.00	0.17
SD2	SG4-06	10575.50	64000.00	0.17
SD3	SG1-02	0.11	0.04	2.75
SD3	SG2-02	0.19	0.09	2.17
SD3	SG2-06	16.95	56.00	0.30
SD3	SG3-02	0.19	0.09	2.17
SD3	SG3-06	0.19	0.09	2.17
SD3	SG4-02	0.19	0.09	2.17
SD3	SG5-02	0.91	0.90	1.01
SD3	SG5-06	0.19	0.09	2.17
SD4	SG1-02	0.19	0.09	2.17
SD4	SG1-06	0.19	0.09	2.17
SD4	SG1-10	0.19	0.09	2.17
SD4	SG2-02	5464.95	21000.00	0.26
SD4	SG2-06	297.45	710.00	0.42
SD4	SG2-10	1079.50	1700.00	0.64
SD4	SG3-02	0.11	0.04	2.87
SD4	SG3-06	0.11	0.04	2.87
SD4	SG3-10	0.11	0.60	0.19
SD4	SG4-02	18758.95	1.E5	0.19
SD4	SG4-06	2035.95	2200.00	0.93
SD4	SG4-10	775.95	2100.00	0.37
SD4	SG5-06	3.91	6.00	0.65
SD5	SG1-02	0.11	0.04	2.75
SD5	SG1-06	114.75	330.00	0.35
SD5	SG1-10	3145.45	6000.00	0.52
SD5	SG2-02	0.11	0.30	0.37
SD5	SG2-06	450.50	1200.00	0.38
SD5	SG2-10	3656.95	7700.00	0.47
SD5	SG3-02	0.11	0.04	2.75
SD5	SG3-06	163.50	440.00	0.37
SD5	SG3-10	3046.95	7100.00	0.43
SD5	SG4-02	0.11	0.04	2.75
SD5	SG4-06	318.50	960.00	0.33
SD5	SG4-10	515.45	4200.00	0.12
SD6	SG1-02	0.11	0.04	2.75
SD6	SG1-06	277.55	1000.00	0.28
SD6	SG1-10	11158.45	22000.00	0.51
SD6	SG2-02	0.11	0.04	2.75
SD6	SG2-06	1825.95	5100.00	0.36
SD6	SG2-10	24979.45	52000.00	0.48
SD6	SG3-02	0.11	0.04	2.75
SD6	SG3-06	115.55	480.00	0.24
SD6	SG3-10	32958.45	58000.00	0.57
SD6	SG4-02	0.11	45.00	2.44E-3
SD6	SG4-06	2.13	10.00	0.21
SD6	SG4-08	103.55	400.00	0.26

(Continued)

<u>Station</u>	<u>Sample Number</u>	<u>Sum of BTEX</u>	<u>Total Hydrocarbons (as benzene)</u>	<u>Ratio</u>
SD6	SG5-02	24.55	140.00	0.18
SD7	SG1-02	1086.95	3600.00	0.30
SD7	SG1-06	9474.95	78000.00	0.12
SD7	SG1-10	8294.95	99000.00	0.08
SD7	SG2-02	24754.95	92000.00	0.27
SD7	SG2-06	27754.95	1.E5	0.28
SD7	SG2-10	39354.95	1.7E5	0.23
SD7	SG3-02	7294.95	27000.00	0.27
SD7	SG3-06	16954.95	56000.00	0.30
SD7	SG3-10	14054.95	51000.00	0.28
SD7	SG4-02	576.45	4100.00	0.14
SD7	SG4-06	4546.45	22000.00	0.21
SD7	SG4-10	7297.45	32000.00	0.23
SD7	SG5-02	4837.45	21000.00	0.23
SD7	SG5-06	23254.95	62000.00	0.38
SD7	SG5-10	26954.95	75000.00	0.36
SD8	SG1-02	809.50	7400.00	0.11
SD8	SG1-06	9376.95	48000.00	0.20
SD8	SG1-10	16354.45	62000.00	0.26
SD8	SG2-02	4476.95	19000.00	0.24
SD8	SG2-06	15076.95	61000.00	0.25
SD8	SG2-10	27554.45	97000.00	0.28
SD8	SG3-02	7076.95	24000.00	0.29
SD8	SG3-06	11154.45	47000.00	0.24
SD8	SG3-10	25454.45	90000.00	0.28
SD8	SG4-02	9176.95	28000.00	0.33
SD8	SG4-06	17676.95	58000.00	0.30
SD8	SG4-10	30276.95	1.E5	0.30
SD9	SG1-02	10850.95	34000.00	0.32
SD9	SG1-06	10550.95	33000.00	0.32
SD9	SG2-02	13250.95	43000.00	0.31
SD9	SG2-06	37850.95	86000.00	0.44
SD9	SG2-10	30450.95	71000.00	0.43
SD9	SG3-02	14350.95	37000.00	0.39
SD9	SG3-06	20750.95	46000.00	0.45
SD9	SG3-10	21150.95	57000.00	0.37
SD9	SG4-02	7390.95	22000.00	0.34
SD9	SG4-06	15350.95	36000.00	0.43
SD9	SG4-10	30150.95	69000.00	0.44
SD9	SG5-02	6850.95	22000.00	0.31
SD9	SG5-06	7410.95	28000.00	0.26
SD9	SG5-10	10750.95	31000.00	0.35
NY5	SG4-10		1.02E5	

**CALCULATION OF PERCENT DIFFERENCE BETWEEN TOTAL HYDROCARBONS
AS BENZENE AND TOTAL HYDROCARBONS AS BTEX**

**COMPARISONS OF TOTAL HYDROCARBONS CALCULATED FROM
AVERAGE RPS AND AS BENZENE**

<u>Station</u>	<u>Sample Number</u>	<u>Old Values</u>	<u>New Values</u>	<u>Percent Difference</u>
AU7	SG2-02	13861.00	16.00	-99.88
AU7	SG3-02	13186.00	150.00	-98.86
RI4	SG3-02	0.30	0.03	-90.00
AU5	SG5-1.5	50000.00	12000.00	-76.00
AU5	SG2-06	1.1E5	30000.00	-72.73
RI3	SG4-06	1.00	0.30	-70.00
AU5	SG2-02	1.2E5	36000.00	-70.00
AU5	SG1-06	2.4E5	1.1E5	-54.17
SD6	SG3-02	0.04	0.02	-50.00
CONN2	SG2-02	0.06	0.03	-50.00
SD6	SG2-02	0.04	0.02	-50.00
CONN2	SG2-08	0.04	0.02	-50.00
SD3	SG1-02	0.04	0.02	-50.00
SD5	SG1-02	0.04	0.02	-50.00
CONN1	SG4-02	0.04	0.02	-50.00
SD4	SG3-06	0.04	0.02	-50.00
CONN2	SG2-06	0.08	0.04	-50.00
SD6	SG1-02	0.04	0.02	-50.00
SD5	SG4-02	0.04	0.02	-50.00
SD5	SG3-02	0.04	0.02	-50.00
CONN2	SG4-02	0.04	0.02	-50.00
SD4	SG3-02	0.04	0.02	-50.00
SD3	SG4-02	0.09	0.05	-44.44
SD3	SG5-06	0.09	0.05	-44.44
SD3	SG3-06	0.09	0.05	-44.44
SD4	SG1-06	0.09	0.05	-44.44
SD4	SG1-02	0.09	0.05	-44.44
SD3	SG3-02	0.09	0.05	-44.44
SD4	SG1-10	0.09	0.05	-44.44
SD3	SG2-02	0.09	0.05	-44.44
RI2	SG3-06	0.90	0.50	-44.44
RI2	SG4-06	0.90	0.50	-44.44
RI2	SG2-02	0.90	0.50	-44.44
RI2	SG3-10	0.90	0.50	-44.44
RI1	SG2-02	0.90	0.50	-44.44
RI2	SG3-02	0.90	0.50	-44.44
RI2	SG4-10	0.90	0.50	-44.44
RI1	SG2-06	0.90	0.50	-44.44
RI1	SG1-02	0.90	0.50	-44.44
RI1	SG1-06	0.90	0.50	-44.44
RI2	SG4-02	0.90	0.50	-44.44
AU1	SG3-10	40.00	26.00	-35.00

(Continued)

<u>Station</u>	<u>Sample Number</u>	<u>Old Values</u>	<u>New Values</u>	<u>Percent Difference</u>
NY2	SG4-02	0.03	0.02	-33.33
CONN1	SG4-06	0.03	0.02	-33.33
NY2	SG3-02	0.03	0.02	-33.33
NY2	SG1-06	0.03	0.02	-33.33
NY5	SG1-06	0.03	0.02	-33.33
NY2	SG4-10	0.03	0.02	-33.33
NY2	SG1-10	0.03	0.02	-33.33
NY2	SG1-02	0.03	0.02	-33.33
NY6	SG1-02	0.03	0.02	-33.33
NY1	SG3-06	0.07	0.05	-28.57
NY1	SG4-02	0.07	0.05	-28.57
NY1	SG1-06	0.07	0.05	-28.57
NY1	SG1-02	0.07	0.05	-28.57
NY1	SG1-10	0.07	0.05	-28.57
NY1	SG3-10	0.07	0.05	-28.57
NY1	SG3-02	0.07	0.05	-28.57
CONN1	SG1-10	4.00	3.00	-25.00
AU3	SG4-02	0.04	0.03	-25.00
RI3	SG2-06	0.60	0.50	-16.67
RI3	SG3-10	0.60	0.50	-16.67
RI3	SG4-02	0.60	0.50	-16.67
RI3	SG1-02	0.60	0.50	-16.67
RI3	SG2-02	0.60	0.50	-16.67
RI3	SG1-10	0.60	0.50	-16.67
RI3	SG1-06	0.60	0.50	-16.67
RI3	SG3-02	0.60	0.50	-16.67
RI3	SG3-06	0.60	0.50	-16.67
RI3	SG2-10	0.60	0.50	-16.67
CONN1	SG3-06	4300.00	3700.00	-13.95
CONN1	SG3-02	3100.00	2700.00	-12.90
CONN1	SG2-06	0.80	0.70	-12.50
SD1	SG3-02	13000.00	12000.00	-7.69
SD1	SG3-06	15000.00	14000.00	-6.67
SD1	SG4-06	33000.00	31000.00	-6.06
SD1	SG1-02	190.00	180.00	-5.26
SD1	SG2-06	780.00	740.00	-5.13
SD1	SG4-02	10000.00	9500.00	-5.00
SD1	SG1-06	42.00	40.00	-4.76
SD1	SG5-06	27000.00	26000.00	-3.70
SD6	SG5-02	140.00	140.00	0.00
NY6	SG2-02	4.00	4.00	0.00
SD5	SG3-10	7100.00	7100.00	0.00
SD6	SG4-08	400.00	400.00	0.00
SD1	SG2-02	0.60	0.60	0.00
SD6	SG1-06	1000.00	1000.00	0.00
SD6	SG2-06	5100.00	5100.00	0.00
SD5	SG3-06	440.00	440.00	0.00
SD5	SG2-06	1200.00	1200.00	0.00
NY5	SG3-02	0.20	0.20	0.00

(Continued)

<u>Station</u>	<u>Sample Number</u>	<u>Old Values</u>	<u>New Values</u>	<u>Percent Difference</u>
AU3	SG5-06	1.00	1.00	0.00
NY2	SG5-02	0.10	0.10	0.00
SD6	SG3-10	58000.00	58000.00	0.00
SD6	SG2-10	52000.00	52000.00	0.00
SD6	SG4-06	10.00	10.00	0.00
SD5	SG2-02	0.30	0.30	0.00
SD6	SG1-10	22000.00	22000.00	0.00
SD6	SG4-02	45.00	45.00	0.00
CONN2	SG4-06	0.02	0.02	0.00
CONN2	SG5-02	2.00	2.00	0.00
SD5	SG4-06	960.00	960.00	0.00
SD5	SG1-06	330.00	330.00	0.00
SD5	SG1-10	6000.00	6000.00	0.00
SD6	SG3-06	480.00	480.00	0.00
CONN2	SG1-02	1.00	1.00	0.00
SD5	SG2-10	7700.00	7700.00	0.00
SD5	SG4-10	4200.00	4200.00	0.00
AU3	SG1-02	0.10	0.10	0.00
AU3	SG5-02	0.10	0.10	0.00
NY6	SG2-10	1400.00	1500.00	7.14
NY5	SG4-10	1.02E5	1.1E5	7.84
NY6	SG4-06	12.00	13.00	8.33
NY5	SG5-02	12.00	13.00	8.33
SD4	SG4-06	2200.00	2400.00	9.09
NY6	SG2-06	640.00	700.00	9.38
SD4	SG2-02	21000.00	23000.00	9.52
SD4	SG4-10	2100.00	2300.00	9.52
NY6	SG1-06	82.00	90.00	9.76
SD4	SG2-06	710.00	780.00	9.86
SD4	SG4-02	1.E5	1.1E5	10.00
NY5	SG4-02	40000.00	44000.00	10.00
AU5	SG1-10	1.E6	1.1E6	10.00
NY5	SG5-05	6800.00	7500.00	10.29
NY5	SG4-06	58000.00	64000.00	10.34
SD3	SG2-06	56.00	62.00	10.71
AU3	SG3-02	0.09	0.10	11.11
AU3	SG2-02	0.09	0.10	11.11
SD3	SG5-02	0.90	1.00	11.11
SD4	SG2-10	1700.00	1900.00	11.76
SD8	SG2-10	97000.00	1.1E5	13.40
SD8	SG4-02	28000.00	32000.00	14.29
AU7	SG4-02	28000.00	32000.00	14.29
SD8	SG1-10	62000.00	71000.00	14.52
SD8	SG1-06	48000.00	55000.00	14.58
SD8	SG2-06	61000.00	70000.00	14.75
SD8	SG1-02	7400.00	8500.00	14.86
SD8	SG3-06	47000.00	54000.00	14.89
SD8	SG4-06	58000.00	67000.00	15.52
SD8	SG3-10	90000.00	1.04E5	15.56

(Continued)

<u>Station</u>	<u>Sample Number</u>	<u>Old Values</u>	<u>New Values</u>	<u>Percent Difference</u>
SD8	SG2-02	19000.00	22000.00	15.79
SD4	SG3-10	0.60	0.70	16.67
SD8	SG3-02	24000.00	28000.00	16.67
SD4	SG5-06	6.00	7.00	16.67
AU7	SG2-06	35810.00	42000.00	17.29
AU7	SG3-06	46874.00	55000.00	17.34
SD2	SG2-06	32000.00	38000.00	18.75
SD2	SG3-02	31000.00	37000.00	19.35
CONN2	SG5-06	41000.00	49000.00	19.51
SD8	SG4-10	1.E5	1.2E5	20.00
SD2	SG2-02	30000.00	36000.00	20.00
SD2	Sg4-06	64000.00	77000.00	20.31
SD2	SG3-06	63000.00	76000.00	20.63
SD2	SG4-02	53000.00	64000.00	20.75
SD7	SG1-10	99000.00	1.2E5	21.21
SD2	SG1-06	18000.00	22000.00	22.22
SD2	SG1-02	1800.00	2200.00	22.22
NY4	SG2-02	1300.00	1600.00	23.08
SD9	SG1-02	34000.00	42000.00	23.53
NY4	SG1-10	34000.00	42000.00	23.53
NY4	SG2-10	34000.00	42000.00	23.53
SD7	SG2-10	1.7E5	2.1E5	23.53
NY4	SG1-06	21000.00	26000.00	23.81
NY5	SG1-10	21000.00	26000.00	23.81
SD7	SG5-02	21000.00	26000.00	23.81
NY4	SG2-06	25000.00	31000.00	24.00
NY5	SG2-02	5800.00	7200.00	24.14
SD9	SG1-06	33000.00	41000.00	24.24
SD9	SG3-02	37000.00	46000.00	24.32
SD7	SG4-02	4100.00	5100.00	24.39
NY4	SG3-06	49000.00	61000.00	24.49
SD9	SG3-10	57000.00	71000.00	24.56
SD9	SG4-10	69000.00	86000.00	24.64
CONN1	SG1-06	0.08	0.10	25.00
AU3	SG1-06	0.40	0.50	25.00
SD9	SG5-06	28000.00	35000.00	25.00
SD7	SG3-06	56000.00	70000.00	25.00
SD7	SG4-10	32000.00	40000.00	25.00
SD7	SG1-02	3600.00	4500.00	25.00
NY4	SG4-02	20000.00	25000.00	25.00
SD9	SG4-06	36000.00	45000.00	25.00
RI2	SG1-02	0.08	0.10	25.00
RI2	SG1-10	0.08	0.10	25.00
SD7	SG5-10	75000.00	94000.00	25.33
SD9	SG2-10	71000.00	89000.00	25.35
NY4	SG3-10	55000.00	69000.00	25.45
SD7	SG3-10	51000.00	64000.00	25.49
SD9	SG2-02	43000.00	54000.00	25.58
NY4	SG3-02	43000.00	54000.00	25.58

(Continued)

<u>Station</u>	<u>Sample Number</u>	<u>Old Values</u>	<u>New Values</u>	<u>Percent Difference</u>
SD7	SG1-06	78000.00	98000.00	25.64
NY4	SG4-06	35000.00	44000.00	25.71
SD9	SG5-10	31000.00	39000.00	25.81
NY5	SG2-06	31000.00	39000.00	25.81
SD7	SG5-06	62000.00	78000.00	25.81
SD7	SG3-02	27000.00	34000.00	25.93
NY4	SG4-10	46000.00	58000.00	26.09
SD9	SG3-06	46000.00	58000.00	26.09
AU1	SG5-10	9500.00	12000.00	26.32
SD9	SG5-02	22000.00	28000.00	27.27
SD7	SG4-06	22000.00	28000.00	27.27
SD9	SG4-02	22000.00	28000.00	27.27
SD9	SG2-06	86000.00	1.1E5	27.91
SD9	SG2-10	21.00	27.00	28.57
SD9	SG4-02	380.00	490.00	29.95
AU1	SG4-06	240.00	310.00	29.17
NY4	SG1-02	850.00	1100.00	29.41
AU1	SG2-06	61.00	79.00	29.51
AU3	SG3-10	4400.00	5700.00	29.55
AU1	SG3-02	440.00	570.00	29.55
AU1	SG5-06	600.00	780.00	30.00
SD7	SG2-06	1.E5	1.3E5	30.00
AU3	SG3-06	1000.00	1300.00	30.00
SD7	SG2-02	92000.00	1.2E5	30.43
AU3	SG2-10	2300.00	3000.00	30.43
AU3	SG5-10	3600.00	4700.00	30.56
AU1	SG5-02	620.00	810.00	30.65
AU3	SG4-10	3900.00	5100.00	30.77
AU1	SG2-02	84.00	110.00	30.95
AU3	SG1-10	1600.00	2100.00	31.25
AU1	SG1-02	16000.00	21000.00	31.25
NY2	SG2-02	1600.00	2100.00	31.25
AU1	SG1A-06	160.00	210.00	31.25
AU1	SG3-06	350.00	460.00	31.43
NY2	SG2-10	83.00	110.00	32.53
AU1	SG1A-09	120.00	160.00	33.33
AU1	SG4-10	120.00	160.00	33.33
RI4	SG2-02	0.03	0.04	33.33
NY2	SG2-06	810.00	1100.00	35.80
RI4	SG3-10	11.00	16.00	45.45
RI4	SG4-06	11000.00	16000.00	45.45
AU2	SG3-06	15000.00	22000.00	46.67
AU2	SG1-06	19000.00	28000.00	47.37
AU2	SG3-10	23000.00	34000.00	47.83
RI4	SG1-02	430.00	640.00	48.84
AU2	SG3-02	47.00	70.00	48.94
AU3	SG2-06	2.00	3.00	50.00
AU2	SG5-06	28000.00	42000.00	50.00
RI4	SG4-02	16000.00	24000.00	50.00

(Continued)

<u>Station</u>	<u>Sample Number</u>	<u>Old Values</u>	<u>New Values</u>	<u>Percent Difference</u>
RI4	SG1-10	1600.00	2400.00	50.00
AU2	SG5-10	42000.00	63000.00	50.00
AU2	SG2-08	6000.00	9000.00	50.00
RI4	SG1-06	320.00	480.00	50.00
AU2	SG4-10	24000.00	36000.00	50.00
NY5	SG1-02	2.00	3.00	50.00
AU3	SG4-06	2.00	3.00	50.00
AU2	SG4-06	26000.00	39000.00	50.00
RI4	SG2-06	10.00	15.00	50.00
AU2	SG5-02	22000.00	33000.00	50.00
AU2	SG1-10	20000.00	30000.00	50.00
RI4	SG3-06	20.00	30.00	50.00
AU2	SG1-02	10000.00	15000.00	50.00
NY2	SG4-06	0.20	0.30	50.00
RI2	SG1-06	920.00	1400.00	52.17
AU2	SG2-02	2100.00	3200.00	52.38
AU2	SG4-02	13000.00	20000.00	53.85
RI4	SG2-10	7800.00	12000.00	53.85
AU2	SG2-06	7100.00	11000.00	54.93
RI2	SG2-06	190.00	300.00	57.89
RI2	SG2-10	220.00	350.00	59.09
RI1	SG3-02	370.00	590.00	59.46
RI1	SG3-06	280.00	450.00	60.71
RI1	SG3-10	21.00	34.00	61.90
CONN2	SG3-06	9.00	15.00	66.67
NY1	SG4-06	1000.00	1900.00	90.00
NY1	SG2-06	1.1E5	2.1E5	90.91
NY1	SG2-02	89000.00	1.7E5	91.01
NY1	SG2-08	1.4E5	2.7E5	92.86
NY1	SG4-09	660.00	1300.00	96.97
AU5	SG1-02	72000.00	1.5E5	108.33
CONN2	SG1-06	0.03	0.15	400.00
CONN1	SG5-06	2.00	11.00	450.00
CONN1	SG2-02	0.03	0.30	900.00
AU5	SG4-02	12000.00	1.4E5	1066.67
CONN1	SG5-10	0.03	0.50	1566.67
AU5	SG3-02	7900.00	1.9E5	2305.06
CONN2	SG3-02	0.04	1.00	2400.00
CONN1	SG5-02	0.06	2.00	3233.33
AU5	SG2-10	1500.00	1.2E5	7900.00
CONN1	SG1-02	0.04	28.00	69900.00

CALCULATION OF BTEX TO TOTAL HYDROCARBON RATIO
(Total Hydrocarbons Calculated using an Average RF)

<u>Station</u>	<u>Sample Number</u>	<u>Sum of BTEX</u>	<u>Total Hydrocarbons (as benzene)</u>	<u>Ratio</u>
AUI	SG1-02	14845.00	21000.00	0.71
AUI	SG1A-06	20.50	210.00	0.10
AUI	SG1A-09	104.00	160.00	0.65
AUI	SG2-02	105.50	110.00	0.96
AUI	SG2-06	62.10	79.00	0.79
AUI	SG2-10	27.91	27.00	1.03
AUI	SG3-02	445.50	570.00	0.78
AUI	SG3-06	285.50	460.00	0.62
AUI	SG3-10	103.50	26.00	3.98
AUI	SG4-02	258.50	490.00	0.53
AUI	SG4-06	136.00	310.00	0.44
AUI	SG4-10	51.50	160.00	0.32
AUI	SG5-02	724.50	810.00	0.89
AUI	SG5-06	614.50	780.00	0.79
AUI	SG5-10	7874.50	12000.00	0.66
AU2	SG1-02	12160.00	15000.00	0.81
AU2	SG1-06	24260.00	28000.00	0.87
AU2	SG1-10	25360.00	30000.00	0.85
AU2	SG2-02	2370.00	3200.00	0.74
AU2	SG2-06	7880.00	11000.00	0.72
AU2	SG2-08	6680.00	9000.00	0.74
AU2	SG3-02	48.00	70.00	0.69
AU2	SG3-06	19860.00	22000.00	0.90
AU2	SG3-10	27560.00	34000.00	0.81
AU2	SG4-02	13280.00	20000.00	0.66
AU2	SG4-06	30560.00	39000.00	0.78
AU2	SG4-10	26920.00	36000.00	0.75
AU2	SG5-02	25760.00	33000.00	0.78
AU2	SG5-06	35360.00	42000.00	0.84
AU2	SG5-10	53920.00	63000.00	0.86
AU3	SG1-02	0.13	0.10	1.30
AU3	SG1-06	0.25	0.50	0.50
AU3	SG1-10	1588.50	2100.00	0.76
AU3	SG2-02	0.03	0.10	0.30
AU3	SG2-06	1.70	3.00	0.57
AU3	SG2-10	2386.47	3000.00	0.80
AU3	SG3-02	27.96	0.10	279.60
AU3	SG3-06	1020.50	1300.00	0.79
AU3	SG3-10	4340.50	5700.00	0.76
AU3	SG4-02	0.10	0.03	3.33
AU3	SG4-06	2.17	3.00	0.72
AU3	SG4-10	3810.50	5100.00	0.75
AU3	SG5-02	0.13	0.10	1.30
AU3	SG5-06	0.30	1.00	0.30
AU3	SG5-10	3994.50	4700.00	0.85

(Continued)

<u>Station</u>	<u>Sample Number</u>	<u>Sum of BTEX</u>	<u>Total Hydrocarbons (as benzene)</u>	<u>Ratio</u>
AU5	SG1-02	17734.00	1.5E5	0.12
AU5	SG1-06	40490.00	1.1E5	0.37
AU5	SG1-10	25084.00	1.1E6	0.02
AU5	SG2-02	11234.00	36000.00	0.31
AU5	SG2-06	9984.00	30000.00	0.33
AU5	SG2-10	64800.00	1.2E5	0.54
AU5	SG3-02	45100.00	1.9E5	0.24
AU5	SG4-02	13984.00	1.4E5	0.10
AU5	SG5-1.5	912.00	12000.00	0.08
AU7	SG2-02	0.10	16.00	6.2E-3
AU7	SG2-06	99.00	42000.00	2.4E-3
AU7	SG3-02	0.73	150.00	4.9E-3
AU7	SG3-06	99.00	55000.00	1.8E-3
AU7	SG4-02	4.65	32000.00	1.5E-4
CONN1	SG1-02	0.07	28.00	2.5E-3
CONN1	SG1-06	0.10	0.10	1.05
CONN1	SG1-10	0.09	3.00	0.03
CONN1	SG2-02	0.06	0.30	0.20
CONN1	SG2-06	0.07	0.70	0.10
CONN1	SG3-02	238.00	2700.00	0.09
CONN1	SG3-06	828.00	3700.00	0.22
CONN1	SG4-02	0.09	0.02	4.50
CONN1	SG4-06	0.07	0.02	3.50
CONN1	SG5-02	0.13	2.00	0.06
CONN1	SG5-06	0.13	11.00	0.01
CONN1	SG5-10	0.13	0.50	0.26
CONN2	SG1-02	0.10	1.00	0.10
CONN2	SG1-06	0.09	0.15	0.57
CONN2	SG2-02	0.14	0.03	4.67
CONN2	SG2-06	0.17	0.04	4.38
CONN2	SG2-08	0.10	0.02	5.00
CONN2	SG3-02	0.10	1.00	0.10
CONN2	SG3-06	0.19	15.00	0.01
CONN2	SG4-02	0.10	0.02	5.00
CONN2	SG4-06	0.09	0.20	0.47
CONN2	SG5-02	0.01	2.00	7.5E-3
CONN2	SG5-06	2290.50	49000.00	0.05
NY1	SG1-02	0.20	0.05	3.90
NY1	SG1-06	0.20	0.05	3.90
NY1	SG1-10	0.20	0.05	3.90
NY1	SG2-02	565.00	1.7E5	3.3E-3
NY1	SG2-06	3595.00	2.1E5	0.02
NY1	SG2-08	35700.00	2.7E5	0.13
NY1	SG3-02	0.28	0.05	5.70
NY1	SG3-06	0.28	0.05	5.70
NY1	SG3-10	0.28	0.05	5.70
NY1	SG4-02	0.28	0.05	5.70
NY1	SG4-06	135.50	1900.00	0.07

(Continued)

<u>Station</u>	<u>Sample Number</u>	<u>Sum of BTEX</u>	<u>Total Hydrocarbons (as benzene)</u>	<u>Ratio</u>
NY1	SG4-09	105.50	1300.00	0.08
NY1	SG1-02	0.08	0.02	4.00
NY2	SG1-06	0.08	0.02	4.00
NY2	SG1-10	0.08	0.02	4.00
NY2	SG2-02	515.00	2100.00	0.25
NY2	SG2-06	434.50	1100.00	0.40
NY2	SG2-10	37.45	110.00	0.34
NY2	SG3-02	0.08	0.02	4.00
NY2	SG4-02	0.08	0.02	4.00
NY2	SG4-06	0.24	0.30	0.80
NY2	SG4-10	0.08	0.02	4.00
NY2	SG5-02	0.04	0.10	0.40
NY4	SG1-02	13.50	1100.00	0.01
NY4	SG1-06	565.50	26000.00	0.02
NY4	SG1-10	810.50	42000.00	0.02
NY4	SG2-02	45.00	1600.00	0.03
NY4	SG2-06	560.50	31000.00	0.02
NY4	SG2-10	1240.50	42000.00	0.03
NY4	SG3-02	1245.50	54000.00	0.02
NY4	SG3-06	3645.50	61000.00	0.06
NY4	SG3-10	4260.50	69000.00	0.06
NY4	SG4-02	67.00	25000.00	2.7E-3
NY4	SG4-06	1040.50	44000.00	0.02
NY4	SG4-10	2690.50	58000.00	0.05
NY5	SG1-02	0.08	3.00	0.03
NY5	SG1-06	0.08	0.02	4.00
NY5	SG1-10	1647.00	26000.00	0.06
NY5	SG2-02	642.50	7200.00	0.09
NY5	SG2-06	5399.00	39000.00	0.14
NY5	SG3-02	0.02	0.20	0.10
NY5	SG4-02	2022.50	44000.00	0.05
NY5	SG4-06	3892.00	64000.00	0.06
NY5	SG5-02	2.94	13.00	0.23
NY5	SG5-05	572.50	7500.00	0.08
NY6	SG1-02	0.08	0.02	4.00
NY6	SG1-06	4.89	90.00	0.05
NY6	SG2-02	0.94	4.00	0.23
NY6	SG2-06	19.45	700.00	0.03
NY6	SG2-10	53.95	1500.00	0.04
NY6	SG4-06	0.14	13.00	0.01
RI1	SG1-02	0.32	0.50	0.64
RI1	SG1-06	0.32	0.50	0.64
RI1	SG2-02	0.32	0.50	0.64
RI1	SG2-06	0.32	0.50	0.64
RI1	SG3-02	329.95	590.00	0.56
RI1	SG3-06	276.95	450.00	0.62
RI1	SG3-10	18.75	34.00	0.56
RI2	SG1-02	0.10	0.10	1.05

(Continued)

<u>Station</u>	<u>Sample Number</u>	<u>Sum of BTEX</u>	<u>Total Hydrocarbons (as benzene)</u>	<u>Ratio</u>
RI2	SG1-06	382.95	1400.00	0.27
RI2	SG1-10	0.10	0.10	1.05
RI2	SG2-02	0.35	0.00	0.70
RI2	SG2-06	47.85	300.00	0.16
RI2	SG2-10	88.20	350.00	0.25
RI2	SG3-02	0.35	0.50	0.70
RI2	SG3-06	0.35	0.50	0.70
RI2	SG3-10	0.35	0.50	0.70
RI2	SG4-02	0.35	0.50	0.70
RI2	SG4-06	0.35	0.50	0.70
RI2	SG4-10	0.35	0.50	0.70
RI3	SG1-02	0.22	0.50	0.45
RI3	SG1-06	0.22	0.50	0.45
RI3	SG1-10	0.22	0.50	0.45
RI3	SG2-02	0.22	0.50	0.45
RI3	SG2-06	0.22	0.50	0.45
RI3	SG2-10	0.22	0.50	0.45
RI3	SG3-02	0.22	0.50	0.45
RI3	SG3-06	0.22	0.50	0.45
RI3	SG3-10	0.22	0.50	0.45
RI3	SG4-02	0.61	0.50	1.23
RI3	SG4-06	0.01	0.30	0.05
RI4	SG1-02	110.00	640.00	0.17
RI4	SG1-06	187.00	480.00	0.39
RI4	SG1-10	863.00	2400.00	0.36
RI4	SG2-02	0.10	0.04	2.50
RI4	SG2-06	0.64	15.00	0.04
RI4	SG2-10	667.95	12000.00	0.06
RI4	SG3-02	0.10	0.03	3.50
RI4	SG3-06	4.97	30.00	0.17
RI4	SG3-10	0.12	16.00	7.2E-3
RI4	SG4-02	1799.75	24000.00	0.07
RI4	SG4-06	2349.75	16000.00	0.15
SD1	SG1-02	1.29	180.00	7.2E-3
SD1	SG1-06	0.10	40.00	2.5E-3
SD1	SG2-02	0.10	0.60	0.17
SD1	SG2-06	329.15	740.00	0.44
SD1	SG3-02	4589.50	12000.00	0.38
SD1	SG3-06	8989.50	14000.00	0.64
SD1	SG4-02	1311.50	9500.00	0.14
SD1	SG4-06	9295.50	31000.00	0.30
SD1	SG5-06	15795.50	26000.00	0.61
SD2	SG1-02	694.00	2200.00	0.32
SD2	SG1-06	5595.50	22000.00	0.25
SD2	SG2-02	9395.50	36000.00	0.26
SD2	SG2-06	10695.50	38000.00	0.28
SD2	SG3-02	4895.50	37000.00	0.13
SD2	SG3-06	15995.50	76000.00	0.21

(Continued)

<u>Station</u>	<u>Sample Number</u>	<u>Sum of BTEX</u>	<u>Total Hydrocarbons (as benzene)</u>	<u>Ratio</u>
SD2	SG4-02	8795.50	64000.00	0. 1 4
SD2	SG4-06	10575.50	77000.00	0.14
SD3	SG1-02	0.11	0.02	5.50
SD3	SG2-02	0.19	0.05	3.90
SD3	SG2-06	16.95	62.00	0.27
SD3	SG3-02	0.19	0.05	3.90
SD3	SG3-06	0.19	0.05	3.90
SD3	SG4-02	0.19	0.05	3.90
SD3	SG5-02	0.91	1.00	0.91
SD3	SG5-06	0.19	0.05	3.90
SD4	SG1-02	0.19	0.05	3.90
SD4	SG1-06	0.19	0.05	3.90
SD4	SG1-10	0.19	0.05	3.90
SD4	SG2-02	5464.95	23000.00	0.24
SD4	SG2-06	297.45	780.00	0.38
SD4	SG2-10	1079.50	1900.00	0.57
SD4	SG3-02	0.11	0.02	5.75
SD4	SG3-06	0.11	0.02	5.75
SD4	SG3-10	0.11	0.70	0.16
SD4	SG4-02	18758.95	1.1E5	0.17
SD4	SG4-06	2035.95	2400.00	0.85
SD4	SG4-10	775.95	2300.00	0.34
SD4	SG5-06	3.91	7.00	0.56
SD5	SG1-02	0.11	0.02	5.50
SD5	SG1-06	114.75	330.00	0.35
SD5	SG1-10	3145.45	6000.00	0.52
SD5	SG2-02	0.11	0.30	0.37
SD5	SG2-06	450.50	1200.00	0.38
SD5	SG2-10	3656.95	7700.00	0.47
SD5	SG3-02	0.11	0.02	5.50
SD5	SG3-06	163.50	440.00	0.37
SD5	SG3-10	3046.95	7100.00	0.43
SD5	SG4-02	0.11	0.02	5.50
SD5	SG4-06	318.50	960.00	0.33
SD5	SG4-10	515.45	4200.00	0.12
SD6	SG1-02	0.11	0.02	5.50
SD6	SG1-06	277.55	1000.00	0.28
SD6	SG1-10	11158.45	22000.00	0.51
SD6	SG2-02	0.11	0.02	5.50
SD6	SG2-06	1825.95	5100.00	0.36
SD6	SG2-10	24979.45	52000.00	0.48
SD6	SG3-02	0.11	0.02	5.50
SD6	SG3-06	115.55	480.00	0.24
SD6	SG3-10	32958.45	58000.00	0.57
SD6	SG4-02	0.11	45.00	2.4E-3
SD6	SG4-06	2.13	10.00	0.21
SD6	SG4-08	103.55	400.00	0.26
SD6	SG5-02	24.55	140.00	0.18

(Continued)

<u>Station</u>	<u>Sample Number</u>	<u>Sum of BTEX</u>	<u>Total Hydrocarbons (as benzene)</u>	<u>Ratio</u>
SD7	SG1-02	1086.95	4500.00	0.24
SD7	SG1-06	9474.95	98000.00	0.10
SD7	SG1-10	8294.95	1.2E5	0.07
SD7	SG2-02	24754.95	1.2E5	0.21
SD7	SG2-06	27754.95	1.3E5	0.21
SD7	SG2-10	39354.95	2.1E5	0.19
SD7	SG3-02	7294.95	34000.00	0.21
SD7	SG3-06	16954.95	70000.00	0.24
SD7	SG3-10	14054.95	64000.00	0.22
SD7	SG4-02	576.45	5100.00	0.11
SD7	SG4-06	4546.45	28000.00	0.16
SD7	SG4-10	7297.45	40000.00	0.18
SD7	SG5-02	4837.45	26000.00	0.19
SD7	SG5-06	23254.95	78000.00	0.30
SD7	SG5-10	26954.95	94000.00	0.29
SD8	SG1-02	809.50	8500.00	0.10
SD8	SG1-06	9376.95	55000.00	0.17
SD8	SG1-10	16354.45	71000.00	0.23
SD8	SG2-02	4476.95	22000.00	0.20
SD8	SG2-06	15076.95	70000.00	0.22
SD8	SG2-10	27554.45	1.1E5	0.25
SD8	SG3-02	7076.95	28000.00	0.25
SD8	SG3-06	11154.45	54000.00	0.21
SD8	SG3-10	25454.45	1.04E5	0.24
SD8	SG4-02	9176.95	32000.00	0.29
SD8	SG4-06	17676.95	67000.00	0.26
SD8	SG4-10	30276.95	1.2E5	0.25
SD9	SG1-02	10850.95	42000.00	0.26
SD9	SG1-06	10550.95	41000.00	0.26
SD9	SG2-02	13250.95	54000.00	0.25
SD9	SG2-06	37850.95	1.1E5	0.34
SD9	SG2-10	30450.95	89000.00	0.34
SD9	SG3-02	14350.95	46000.00	0.31
SD9	SG3-06	20750.95	58000.00	0.36
SD9	SG3-10	21150.95	71000.00	0.30
SD9	SG4-02	7390.95	28000.00	0.26
SD9	SG4-06	15350.95	45000.00	0.34
SD9	SG4-10	30150.95	86000.00	0.35
SD9	SG5-02	6850.95	28000.00	0.24
SD9	SG5-06	7410.95	35000.00	0.21
SD9	SG5-10	10750.95	39000.00	0.28
NY5	SG4-10		1.1E5	

**TABULAR DATA USED TO GENERATE
FIGURE 2**

<u>Station</u>	<u>Sample Number</u>	<u>Total HC (ug/L)</u>	<u>Sum of BTEX (ug/L)</u>	<u>Ratio</u>	<u>Cumulative Percent</u>
AU7	SG4-02	32000.00	5.45	0.00	0.4
AU7	SG3-06	55000.00	99.00	0.00	0.7
SD6	SG4-02	45.00	0.08	0.00	1.1
SD1	SG1-06	40.00	0.08	0.00	1.4
CONN1	SG1-02	28.00	0.06	0.00	1.8
AU7	SG2-06	42000.00	99.00	0.00	2.1
NY1	SG2-02	170000.00	565.00	0.00	2.5
AU7	SG3-02	150.00	1.00	0.01	2.9
NY4	SG4-02	25000.00	173.00	0.01	3.2
SD1	SG1-02	180.00	1.65	0.01	3.6
CONN1	SG5-06	11.00	0.13	0.01	3.9
NY4	SG1-02	1100.00	15.00	0.01	4.3
RI4	SG3-10	16.00	0.29	0.02	4.6
NY1	SG2-06	210000.00	4005.00	0.02	5.0
NY6	SG4-06	13.00	0.26	0.02	5.4
AU7	SG2-02	16.00	0.32	0.02	5.7
NY4	SG2-06	31000.00	639.50	0.02	6.1
NY4	SG1-10	42000.00	889.50	0.02	6.4
AU5	SG1-10	1100000.00	25116.00	0.02	6.8
NY5	SG1-02	3.00	0.07	0.02	7.1
NY4	SG3-02	54000.00	1354.50	0.03	7.5
NY4	SG4-06	44000.00	1119.50	0.03	7.9
NY4	SG1-06	26000.00	674.50	0.03	8.2
NY6	SG2-06	700.00	20.55	0.03	8.6
NY4	SG2-02	1600.00	47.00	0.03	8.9
CONN1	SG1-10	3.00	0.09	0.03	9.3
NY4	SG2-10	42000.00	1319.50	0.03	9.6
NY6	SG2-10	1500.00	56.05	0.04	10.0
RI4	SG2-06	15.00	0.68	0.05	10.4
CONN2	SG5-06	49000.00	2309.50	0.05	10.7
NY5	SG4-02	44000.00	2097.50	0.05	11.1
NY4	SG4-10	58000.00	2769.50	0.05	11.4
RI4	SG2-10	12000.00	672.50	0.06	11.8
NY6	SG1-06	90.00	5.10	0.06	12.1
CONN2	SG3-06	15.00	0.87	0.06	12.5
NY4	SG3-06	61000.00	3754.50	0.06	12.9
NY5	SG4-06	64000.00	3968.00	0.06	13.2
NY4	SG3-10	69000.00	4339.50	0.06	13.6
CONN1	SG5-02	2.00	0.13	0.06	13.9
NY5	SG1-10	26000.00	1753.00	0.07	14.3
SD7	SG1-10	120000.00	8575.00	0.07	14.6
RI4	SG4-02	24000.00	1800.25	0.08	15.0
NY1	SG4-06	1900.00	144.50	0.08	15.4
AU5	SG5-1.5	12000.00	914.60	0.08	15.7
CONN1	SG2-06	0.70	0.05	0.08	16.1
NY5	SG5-05	7500.00	647.50	0.09	16.4

(Continued)

<u>Station</u>	<u>Sample Number</u>	<u>Total HC (ug/L)</u>	<u>Sum of BTEX (ug/L)</u>	<u>Ratio</u>	<u>Cumulative Percent</u>
NY1	SG4-09	1300.00	114.50	0.09	16.8
NY5	SG2-02	7200.00	657.50	0.09	17.1
SD8	SG1-02	8500.00	810.95	0.10	17.5
CONN1	SG3-02	2700.00	262.00	0.10	17.9
AUI	SG1A-06	210.00	20.50	0.10	18.2
SD7	SG1-06	98000.00	9635.00	0.10	18.6
CONN2	SG3-02	1.00	0.10	0.10	18.9
CONN2	SG1-02	1.00	0.10	0.10	19.3
AU5	SG4-02	140000.00	14016.00	0.10	19.6
AU5	SG1-02	150000.00	17766.00	0.12	20.0
SD5	SG4-10	4200.00	529.00	0.13	20.4
SD4	SG3-10	0.70	0.09	0.13	20.7
NY1	SG2-08	270000.00	35700.00	0.13	21.1
SD1	SG2-02	0.60	0.08	0.13	21.4
SD2	SG3-02	37000.00	5104.50	0.14	21.8
NY5	SG2-06	39000.00	5441.00	0.14	22.1
SD2	SG4-06	77000.00	10784.50	0.14	22.5
SD1	SG4-02	9500.00	1332.50	0.14	22.9
SD7	SG4-02	5100.00	717.50	0.14	23.2
SD2	SG4-02	64000.00	9004.50	0.14	23.6
RI4	SG4-06	16000.00	2350.25	0.15	23.9
RI2	SG2-06	300.00	48.15	0.16	24.3
CONN1	SG2-02	0.30	0.05	0.17	24.6
SD7	SG4-06	28000.00	4687.50	0.17	25.0
RI4	SG3-06	30.00	5.08	0.17	25.4
SD4	SG4-02	110000.00	18891.00	0.17	25.7
SD8	SG1-06	55000.00	9452.50	0.17	26.1
RI4	SG1-02	640.00	110.00	0.17	26.4
SD6	SG5-02	140.00	25.65	0.18	26.8
SD7	SG4-10	40000.00	7376.50	0.18	27.1
SD7	SG2-10	210000.00	39515.00	0.19	27.5
SD7	SG5-02	26000.00	4916.50	0.19	27.9
NY5	SG4-10	110000.00	20990.50	0.19	28.2
SD8	SG2-02	22000.00	4552.50	0.21	28.6
SD7	SG2-02	120000.00	24915.00	0.21	28.9
SD8	SG3-06	54000.00	11305.50	0.21	29.3
SD2	SG3-06	76000.00	16204.50	0.21	29.6
SD7	SG2-06	130000.00	27915.00	0.21	30.0
SD8	SG2-06	70000.00	15152.50	0.22	30.4
SD9	SG5-06	35000.00	7584.00	0.22	30.7
SD7	SG3-02	34000.00	7455.00	0.22	31.1
SD7	SG3-10	64000.00	14215.00	0.22	31.4
SD6	SG4-06	10.00	2.25	0.22	31.8
CONN1	SG3-06	3700.00	852.00	0.23	32.1
SD8	SG1-10	71000.00	16505.50	0.23	32.5
NY5	SG5-02	13.00	3.05	0.23	32.9
SD6	SG3-06	480.00	116.00	0.24	33.2
SD4	SG2-02	23000.00	5610.00	0.24	33.6
SD7	SG3-06	70000.00	17115.00	0.24	33.9

(Continued)

<u>Station</u>	<u>Sample Number</u>	<u>Total HC (ug/L)</u>	<u>Sum of BTEX (ug/L)</u>	<u>Ratio</u>	<u>Cumulative Percent</u>
SD8	SG3-10	104000.00	25605.50	0.25	34.3
SD9	SG2-02	54000.00	13424.00	0.25	34.6
SD7	SG1-02	4500.00	1121.50	0.25	35.0
SD9	SG5-02	28000.00	7024.00	0.25	35.4
SD8	SG2-10	110000.00	27705.50	0.25	35.7
RI2	SG2-10	350.00	88.40	0.25	36.1
SD8	SG4-10	120000.00	30352.50	0.25	36.4
SD8	SG3-02	28000.00	7152.50	0.26	36.8
CONN1	SG5-10	0.50	0.13	0.26	37.1
SD9	SG1-06	41000.00	10724.00	0.26	37.5
SD6	SG4-08	400.00	104.90	0.26	37.9
SD9	SG1-02	42000.00	11024.00	0.26	38.2
NY6	SG2-02	4.00	1.05	0.26	38.6
SD2	SG1-06	22000.00	5804.50	0.26	38.9
SD8	SG4-06	67000.00	17752.50	0.26	39.3
SD2	SG2-02	36000.00	9604.50	0.27	39.6
SD9	SG4-02	28000.00	7564.00	0.27	40.0
RI2	SG1-06	1400.00	383.05	0.27	40.4
SD3	SG2-06	62.00	17.15	0.28	40.7
NY2	SG2-02	2100.00	585.00	0.28	41.1
SD6	SG1-06	1000.00	278.90	0.28	41.4
SD9	SG5-10	39000.00	10924.00	0.28	41.8
SD5	SG2-02	0.30	0.08	0.28	42.1
SD2	SG2-06	38000.00	10904.50	0.29	42.5
SD7	SG5-10	94000.00	27115.00	0.29	42.9
AU5	SG3-02	190000.00	54900.00	0.29	43.2
SD8	SG4-02	32000.00	9252.50	0.29	43.6
SD7	SG5-06	78000.00	23415.00	0.30	43.9
SD9	SG3-10	71000.00	21324.00	0.30	44.3
SD1	SG4-06	31000.00	9504.50	0.31	44.6
AU5	SG2-02	36000.00	11266.00	0.31	45.0
SD9	SG3-02	46000.00	14524.00	0.32	45.4
SD2	SG1-02	2200.00	726.00	0.33	45.7
SD5	SG4-06	960.00	319.90	0.33	46.1
AU5	SG2-06	30000.00	10016.00	0.33	46.4
RI4	SG1-10	2400.00	823.00	0.34	46.8
SD4	SG4-10	2300.00	789.00	0.34	47.1
SD9	SG2-10	89000.00	30624.00	0.34	47.5
SD9	SG4-06	45000.00	15524.00	0.34	47.9
SD9	SG2-06	110000.00	38024.00	0.35	48.2
SD5	SG1-06	330.00	115.45	0.35	48.6
NY2	SG2-10	110.00	38.55	0.35	48.9
SD9	SG4-10	86000.00	30324.00	0.35	49.3
SD6	SG2-06	5100.00	1839.00	0.36	49.6
SD9	SG3-06	58000.00	20924.00	0.36	50.0
AU5	SG1-06	110000.00	40060.00	0.36	50.4
SD5	SG3-06	440.00	164.00	0.37	50.7
SD5	SG2-06	1200.00	451.00	0.38	51.1
SD1	SG3-02	12000.00	4610.50	0.38	51.4

(Continued)

<u>Station</u>	<u>Sample Number</u>	<u>Total HC (µg/L)</u>	<u>Sum of BTEX (µg/L)</u>	<u>Ratio</u>	<u>Cumulative Percent</u>
RI4	SG1-06	480.00	187.00	0.39	51.8
SD4	SG2-06	780.00	312.00	0.40	52.1
NY2	SG2-06	1100.00	441.50	0.40	52.5
AU3	SG5-06	1.00	0.42	0.42	52.9
CONN2	SG5-02	2.00	0.86	0.43	53.2
SD1	SG2-06	740.00	330.85	0.45	53.6
SD5	SG3-10	7100.00	3180.00	0.45	53.9
CONN2	SG4-06	0.20	0.09	0.45	54.3
RI3	SG1-02	-0.50	0.23	0.45	54.6
RI3	SG2-06	-0.50	0.23	0.45	55.0
RI3	SG4-02	-0.50	0.23	0.45	55.4
RI3	SG2-10	-0.50	0.23	0.45	55.7
RI3	SG1-06	-0.50	0.23	0.45	56.1
RI3	SG3-02	-0.50	0.23	0.45	56.4
RI3	SG2-02	-0.50	0.23	0.45	56.8
RI3	SG1-10	-0.50	0.23	0.45	57.1
RI3	SG3-10	-0.50	0.23	0.45	57.5
RI3	SG3-06	-0.50	0.23	0.45	57.9
SD6	SG2-10	52000.00	25044.50	0.48	58.2
SD5	SG2-10	7700.00	3790.00	0.49	58.6
CONN2	SG1-06	-0.15	0.07	0.50	58.9
SD6	SG1-10	22000.00	11289.50	0.51	59.3
SD5	SG1-10	6000.00	3159.00	0.53	59.6
AU5	SG2-10	120000.00	64800.00	0.54	60.0
RI1	SG3-02	590.00	330.05	0.56	60.4
RI1	SG3-10	34.00	19.05	0.56	60.7
SD4	SG2-10	1900.00	1080.95	0.57	61.1
SD6	SG3-10	58000.00	33089.50	0.57	61.4
SD4	SG5-06	7.00	4.06	0.58	61.8
AU3	SG2-06	3.00	1.76	0.59	62.1
SD1	SG5-06	26000.00	16004.50	0.62	62.5
RI1	SG3-06	450.00	277.05	0.62	62.9
SD1	SG3-06	14000.00	9010.50	0.64	63.2
AU1	SG1-09	160.00	104.00	0.65	63.6
AU1	SG5-10	12000.00	7905.50	0.66	63.9
AU2	SG4-02	20000.00	13320.00	0.67	64.3
NY5	SG3-02	0.20	0.13	0.67	64.6
AU1	SG4-02	490.00	341.50	0.70	65.0
AU3	SG1-06	0.50	0.35	0.70	65.4
RI2	SG4-06	-0.50	0.35	0.70	65.7
RI1	SG1-02	-0.50	0.35	0.70	66.1
RI1	SG2-06	-0.50	0.35	0.70	66.4
RI2	SG3-02	-0.50	0.35	0.70	66.8
RI1	SG2-02	-0.50	0.35	0.70	67.1
RI2	SG3-10	-0.50	0.35	0.70	67.5
RI1	SG1-06	-0.50	0.35	0.70	67.9
RI2	SG3-06	-0.50	0.35	0.70	68.2
RI2	SG4-02	-0.50	0.35	0.70	68.6
RI2	SG2-02	-0.50	0.35	0.70	68.9

(Continued)

<u>Station</u>	<u>Sample Number</u>	<u>Total HC (µg/L)</u>	<u>Sum of BTEX (µg/L)</u>	<u>Ratio</u>	<u>Cumulative Percent</u>
RI2	SG4-10	-0.50	0.35	0.70	69.3
AU2	SG2-06	11000.00	7920.00	0.72	69.6
AU1	SG1-02	21000.00	15155.00	0.72	70.0
AU2	SG3-02	70.00	52.00	0.74	70.4
AU3	SG4-06	3.00	2.23	0.74	70.7
AU2	SG2-08	9000.00	6720.00	0.75	71.1
AU2	SG4-10	36000.00	27080.00	0.75	71.4
AU2	SG2-02	3200.00	2410.00	0.75	71.8
AU3	SG4-10	5100.00	3869.50	0.76	72.1
AU3	SG1-10	2100.00	1619.50	0.77	72.5
AU3	SG3-10	5700.00	4459.50	0.78	72.9
AU2	SG5-02	33000.00	25840.00	0.78	73.2
AU2	SG4-06	39000.00	30640.00	0.79	73.6
AU2	SG3-10	34000.00	27560.00	0.81	73.9
AU2	SG1-02	15000.00	12240.00	0.82	74.3
AU3	SG2-10	3000.00	2469.50	0.82	74.6
AU1	SG5-06	780.00	645.50	0.83	75.0
AU3	SG3-06	1300.00	1079.50	0.83	75.4
AU1	SG4-10	160.00	134.50	0.84	75.7
AU2	SG5-06	42000.00	35440.00	0.84	76.1
AU2	SG1-10	30000.00	25440.00	0.85	76.4
SD4	SG4-06	2400.00	2049.00	0.85	76.8
AU3	SG5-10	4700.00	4025.50	0.86	77.1
AU2	SG5-10	63000.00	54080.00	0.86	77.5
AU2	SG1-06	28000.00	24340.00	0.87	77.9
AU2	SG3-06	22000.00	19940.00	0.91	78.2
AU1	SG5-02	810.00	755.50	0.93	78.6
AU1	SG3-06	460.00	434.50	0.94	78.9
AU1	SG4-06	310.00	304.00	0.98	79.3
AU1	SG2-10	27.00	28.09	1.04	79.6
AU1	SG3-02	570.00	594.50	1.04	80.0
SD3	SG5-02	1.00	1.10	1.10	80.4
NY2	SG4-06	0.30	0.36	1.18	80.7
AU1	SG2-02	110.00	134.50	1.22	81.1
CONN1	SG1-06	-0.10	0.13	1.30	81.4
AU1	SG2-06	79.00	109.90	1.39	81.8
NY2	SG5-02	0.10	0.16	1.55	82.1
AU3	SG2-02	0.10	0.17	1.70	82.5
AU3	SG3-02	0.10	0.17	1.70	82.9
SD3	SG2-02	-0.05	0.10	2.00	83.2
RI4	SG2-02	0.04	0.09	2.25	83.6
RI2	SG1-02	0.10	0.27	2.65	83.9
RI2	SG1-10	0.10	0.27	2.65	84.3
AU3	SG5-02	0.10	0.27	2.70	84.6
AU3	SG1-02	0.10	0.27	2.70	85.0
CONN1	SG4-06	-0.02	0.06	3.25	85.4
RI3	SG4-06	0.30	0.33	3.28	85.7
AU3	SG4-02	-0.03	0.10	3.33	86.1
NY5	SG1-06	-0.02	0.07	3.50	86.4

(Continued)

<u>Station</u>	<u>Sample Number</u>	<u>Total HC (µg/L)</u>	<u>Sum of BTEX (µg/L)</u>	<u>Ratio</u>	<u>Cumulative Percent</u>
NY6	SG1-02	-0.02	0.07	3.50	86.8
NY6	SG4-03	-0.02	0.07	3.50	87.1
RI4	SG3-02	-0.03	0.10	3.50	87.5
NY2	SG1-10	-0.02	0.07	3.75	87.9
NY2	SG3-02	-0.02	0.07	3.75	88.2
NY2	SG1-02	-0.02	0.07	3.75	88.6
NY2	SG4-10	-0.02	0.07	3.75	88.9
NY2	SG1-06	-0.02	0.07	3.75	89.3
NY2	SG4-02	-0.02	0.07	3.75	89.6
SD4	SG1-06	-0.05	0.19	3.80	90.0
SD4	SG1-10	-0.05	0.19	3.80	90.4
SD3	SG5-06	-0.05	0.19	3.80	90.7
SD3	SG3-02	-0.05	0.19	3.80	91.1
SD3	SG3-06	-0.05	0.19	3.80	91.4
SD3	SG4-02	-0.05	0.19	3.80	91.8
SD4	SG1-02	-0.05	0.19	3.80	92.1
AU1	SG3-10	-26.00	104.00	4.00	92.5
SD5	SG3-02	-0.02	0.08	4.25	92.9
SD6	SG2-02	-0.02	0.08	4.25	93.2
SD5	SG4-02	-0.02	0.08	4.25	93.6
SD6	SG3-02	-0.02	0.08	4.25	93.9
SD6	SG1-02	-0.02	0.08	4.25	94.3
SD5	SG1-02	-0.02	0.08	4.25	94.6
CONN1	SG4-02	-0.02	0.08	4.25	95.0
CONN2	SG2-06	-0.04	0.18	4.38	95.4
SD4	SG3-06	-0.02	0.09	4.50	95.7
SD4	SG3-02	-0.02	0.09	4.50	96.1
CONN2	SG2-02	-0.03	0.14	4.67	96.4
CONN2	SG4-02	-0.02	0.10	5.00	96.8
CONN2	SG2-08	-0.02	0.10	5.00	97.1
SD3	SG1-02	-0.02	0.10	5.00	97.5
NY1	SG4-02	-0.05	0.29	5.70	97.9
NY1	SG3-10	-0.05	0.29	5.70	98.2
NY1	SG3-02	-0.05	0.29	5.70	98.6
NY1	SG3-06	-0.05	0.29	5.70	98.9
NY1	SG1-06	-0.05	0.39	7.70	99.3
NY1	SG1-02	-0.05	0.39	7.70	99.6
NY1	SG1-10	-0.05	0.39	7.70	100.0

CHROMATOGRAMS FOR SELECTED SITES

GC/EPA SAN DIEGO

09/23/87 10:19:40

CH= "A" PS= 1.

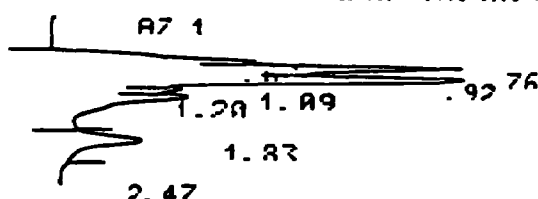
FILE 1. METHOD A. RUN 26 INDEX 26

PEAK #	AREA%	RT	AREA AC
1	0.474	0.74	7557 AC
2	47.965	0.75	755912 AC
3	70.317	0.91	705487 AC
4	12.721	1.2	104135 AC
5	4.531	1.87	37093 AC
6	0.784	2.08	3141 AC
7	0.649	2.9	5312 AC

TOTAL 100. 818633

AT= 30

CHANNEL A INJECT 09/23/87 10:45:42



508
 $50 \times 2 - 2' \div 0'$
 $50 \times 2 - 2' \div 100$

GC/EPA SAN DIEGO

09/23/87 10:45:42

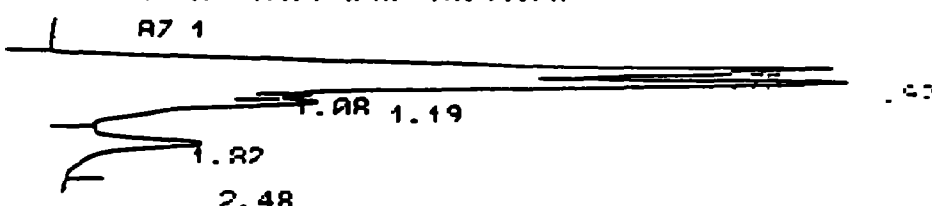
CH= "A" PS= 1.

FILE 1. METHOD A. RUN 27 INDEX 27

PEAK #	AREA%	RT	AREA AC
1	12.384	0.67	62488 AC BUTANE
2	27.501	0.76	138745 AC ISO PENTANE
3	34.077	0.92	171920 AC 2-METHYL HEXANE
4	6.017	1.09	30354 AC ISO OCTANE
5	12.965	1.2	65407 AC TOLUENE
6	7.056	1.83	35600 AC OCTANE

TOTAL 100. 584506

CHANNEL A INJECT 09/23/87 10:49:28



508
 $50 \times 2 - 2' \div 100$

GC/EPA SAN DIEGO

09/23/87 10:49:28

CH= "A" PS= 1.

FILE 1. METHOD A. RUN 28 INDEX 28

PEAK #	AREA%	RT	AREA AC
1	77.194	0.75	410330 AC BUTANE
2	77.608	0.92	370773 AC ISO PENTANE
3	5.007	1.08	57790 AC 2-METHYL HEXANE
4	14.02	1.19	154676 AC ISO OCTANE
5	9.975	1.82	110047 AC TOLUENE

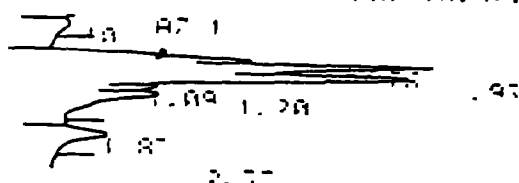
508
 $50 \times 2 - 2' \div 100$

1	5.007	1.08	50799	02
4	11.02	1.19	154876	02
5	9.975	1.00	116947	01

TOTAL 100. 1167205

50 2 100 1/10
RECEIVED FEB - 9 1988

CHANNEL A INJECT 09/23/87 10:52:47



GC/EPA SAN DIEGO 09/23/87 10:52:47 CH= "A" PS= 1.

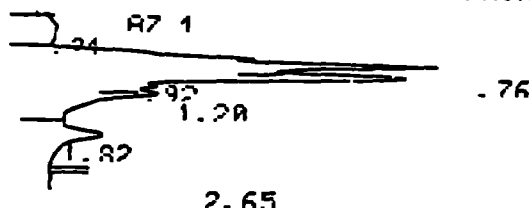
FILE 1. METHOD A. RUN 29 INDEX 29

PEAK#	AREA%	RT	AREA	RC
1	1.22	0.1	5551	01 NA
2	17.977	0.67	67423	02 BUTANE
3	29.65	0.76	124921	02 ISOPENTANE
4	37.127	0.92	150753	02 2-METHYL HEXANE
5	5.642	1.09	25674	02 ISO OCTANE
6	11.258	1.2	51231	02 TOLUENE
7	5.167	1.83	23514	01 OCTANE

TOTAL 100. 455077

50 2 100 1/100

CHANNEL A INJECT 09/23/87 10:56:00



GC/EPA SAN DIEGO 09/23/87 10:56:00 CH= "A" PS= 1.

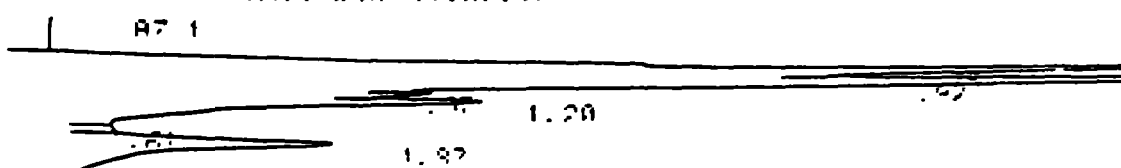
FILE 1. METHOD A. RUN 30 INDEX 30

PEAK#	AREA%	RT	AREA	RC
1	1.039	0.24	5000	02 NA
2	40.08	0.76	195920	02 BUTANE + ISOPENTANE
3	37.267	0.92	182167	02 2-METHYL HEXANE + ISOOCTANE
4	16.41	1.2	80217	02 TOLUENE
5	5.203	1.82	25433	05 OCTANE

TOTAL 100. 488817

50 2 100 1/100

CHANNEL A INJECT 09/23/87 11:07:47



RECEIVED 128 - 9 1506

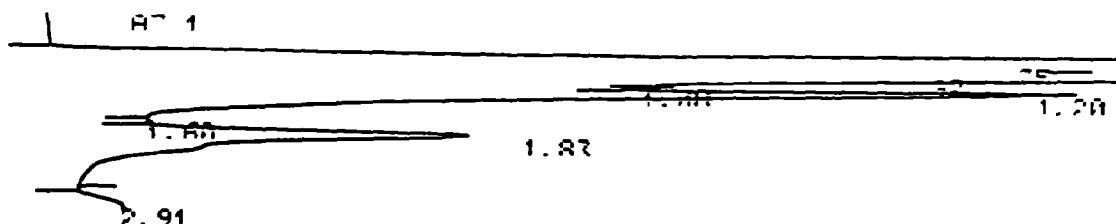
FILE 1. METHOD A. RUN 40 INDEX 40

PEAK#	AREA%	RT	AREA	RT
1	2.588	0.75	2252	02
2	97.412	0.55	81595	02

TOTAL 100. 87649

AT= 7.0

CHANNEL A INJECT 09/23/87 11:48:03



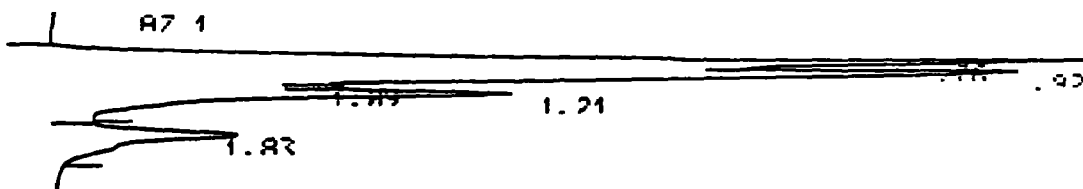
GC/EPR SAN DIEGO 09/23/87 11:48:03 CH= "A" PS= 1.

FILE 1. METHOD A. RUN 41 INDEX 41

PEAK#	AREA%	RT	AREA	RT	IDENTIFICATION
1	24.542	0.75	1019514	02	BUTANE + ISOPENTANE
2	32.282	0.92	952826	02	2-METHYL HEXANE
3	4.027	1.08	118852	02	ISOOCTANE
4	18.064	1.2	522145	02	TOLUENE
5	0.92	1.6	27444	02	NA
6	10.102	1.83	298146	02	OCTANE
7	0.051	2.91	1519	01	NA

TOTAL 100. 2951447

CHANNEL A INJECT 09/23/87 11:52:13



GC/EPR SAN DIEGO 09/23/87 11:52:13 CH= "A" PS= 1.

FILE 1. METHOD A. RUN 42 INDEX 42

PEAK#	AREA%	RT	AREA	RT	IDENTIFICATION
1	40.877	0.75	528245	02	BUTANE + ISOPENTANE
2	32.721	0.92	422843	02	2-METHYL HEXANE
3	7.259	1.09	51162	02	ISOOCTANE
4	15.519	1.21	200547	02	TOLUENE
5	6.925	1.83	89488	01	OCTANE

TOTAL 100. 1292286

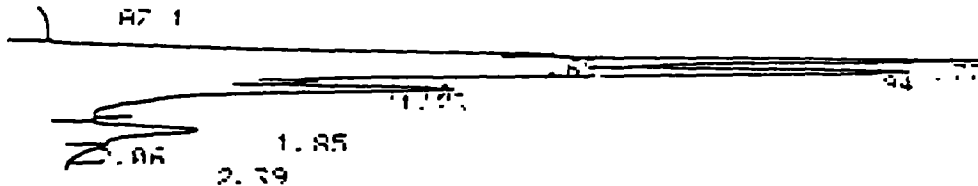
CHANNEL A INJECT 09/23/87 11:52:13

PEAK#	AREA%	RT	AREA AC
1	40.877	0.76	508045 00
2	70.721	0.92	400844 00
3	3.959	1.09	51160 00
4	15.519	1.21	200547 00
5	6.905	1.83	89488 01
TOTAL	100.		1290086

RECEIVED FEB - 3 1988

SG 2-10
50 ml 1/100

CHANNEL A INJECT 09/23/87 11:56:04
A7 1



GC/MS SAN DIEGO 09/23/87 11:56:04 CH= "A" PS= 1.

FILE 1. METHOD A. RUN 43 INDEX 43

PEAK#	AREA%	RT	AREA AC
1	10.992	0.69	124869 00 BUTANE
2	30.368	0.77	344982 00 ISO PENTANE
3	32.578	0.94	370888 00 2-METHYL HEXANE
4	4.897	1.1	55624 00 ISO OCTANE
5	15.211	1.23	172800 00 TOLUENE
6	5.037	1.85	57225 00 OCTANE
7	0.916	2.06	10402 00 NA
TOTAL	100.		1135990

SG 2-10
50 ml 1/100

CHANNEL A INJECT 09/23/87 11:59:03
A7 1

CHANNEL A INJECT 09/23/87 11:59:57
A7 1

NO DATA. CHANNEL A

CHANNEL A INJECT 09/23/87 12:00:31
A7 1

Runs Overlapped

GC/MS SAN DIEGO 09/23/87 12:00:31 CH= "A" PS= 1.

FILE 1. METHOD A. RUN 45 INDEX 45

PEAK#	AREA%	RT	AREA AC
1	0.760	0.14	789 00
2	99.238	0.36	50658 00
TOTAL	100.		51047

SG 2-10
50 ml 1/100

RECEIVED 12-3-1988

CHANNEL A INJECT 09/27/87 12:00:11

200

GC/EPA SAN DIEGO 09/27/87 12:00:11 CH= "A" PS= 1.

FILE 1. METHOD A. RUN 45 INDEX 45

PEAK# AREA% RT AREA RC

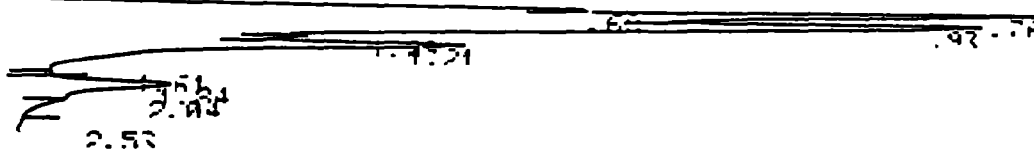
1	0.762	0.14	789 02
2	99.238	0.76	50658 03

TOTAL 100. 51047

502-10
500 1/100

CHANNEL A INJECT 09/27/87 12:04:07

A7 1



GC/EPA SAN DIEGO 09/27/87 12:04:07 CH= "A" PS= 1.

FILE 1. METHOD A. RUN 46 INDEX 46

PEAK# AREA% RT AREA RC

1	10.554	0.68	140645 02 BUTANE
2	28.564	0.76	380657 02 ISO PENTANE
3	31.558	0.93	420551 02 2-METHYL HEXANE
4	4.578	1.09	61004 02 ISO OCTANE
5	19.192	1.21	255764 02 TOLUENE
6	0.033	1.61	440 05 NA
7	4.803	1.84	63013 06 OCTANE
8	0.718	2.04	9574 07 NA

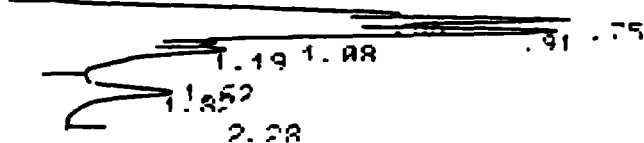
TOTAL 100. 1332648

503-2
100 1/100

12:57:20

CHANNEL A INJECT 09/27/87 13:03:56

A7 1



GC/EPA SAN DIEGO 09/27/87 13:03:56 CH= "A" PS= 1.

FILE 1. METHOD A. RUN 47 INDEX 47

PEAK# AREA% RT AREA RC

1	15.714	0.65	117764 02
2	33.907	0.75	179811 02
3	70.471	0.91	228761 02

1
7,

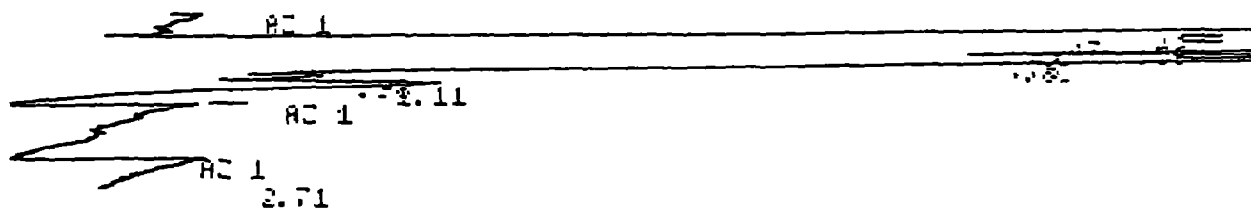
RECEIVED FEB - 9 1988

FILE 1. METHOD 0. RUN 17 INDEX 17

PEAK #	AREA:	PT	AREA BC
1	10.000	0.42	574551 01
2	8.100	0.47	574551 02
3	17.304	0.56	574551 03
4	4.000	0.76	574551 04
5	9.582	0.82	574551 05
6	11.978	0.97	574551 06
7	12.440	1.11	1880475 07
8	17.117	1.91	991041 08
TOTAL	100.		5704554

NY5-SG4-2'
1/100 100%

CHANNEL A INJECT 09/25/87 10:46:16



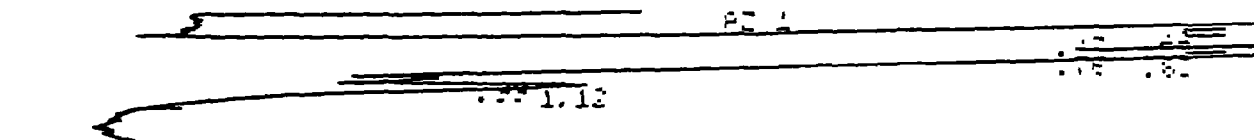
GEOSCIENCE SUFFOLK CO NY 09/25/87 10:46:16 CH= "A" PS= 1.

FILE 1. METHOD 0. RUN 18 INDEX 18

PEAK#	AREA:	PT	AREA BC
1	32.095	0.42	201301 02 METHANE
2	35.559	0.47	222060 02 } UNK
3	21.566	0.56	147901 02 } UNK
4	2.699	0.76	16932 02 BENZENE
5	1.403	0.83	21507 02 3-METHYL HEXANE
6	0.643	0.98	4031 02 ISO OCTANE
7	2.004	1.11	12571 01 TOLUENE
TOTAL	100.		627295

NY5-SG4-2'
1/100 100%

CHANNEL A INJECT 09/25/87 10:49:50



GEOSCIENCE SUFFOLK CO NY 09/25/87 10:49:50 CH= "A" PS= 1.

FILE 1. METHOD 0. RUN 19 INDEX 19

PEAK#	AREA:	PT	AREA BC
1	10.827	0.42	195119 01
2	15.100	0.47	222060 02
3	21.304	0.56	147901 03
4	1.700	0.76	16932 04
5	1.100	0.83	21507 05

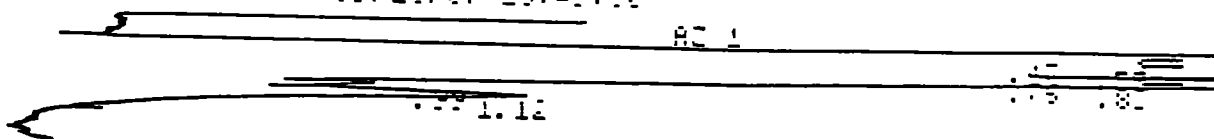
114-2'

10.04 2.781 0.76 17605 02
 16.232 0.47 22940 02
 23.614 0.57 14951 02
 2.000 1.12 12578 01

TOTAL 100. 627135

RECEIVED FEB - 3 1987
 NY5-SG4-2
 1/100 100%

CHANNEL A INJECT 09/25/87 10:49:50

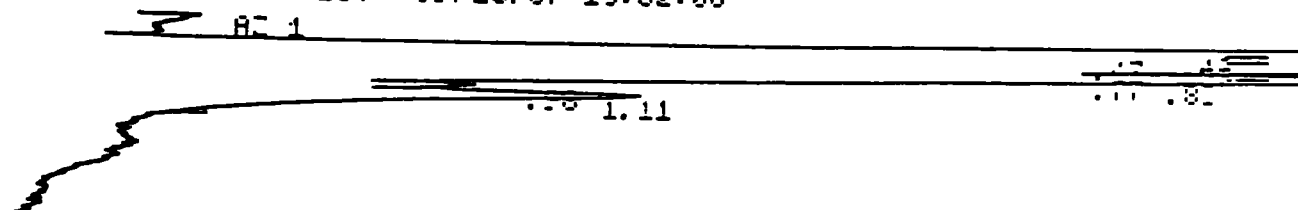


GEOSCIENCE SUFFOLK CO NY 09/25/87 10:49:50 CH= "A" PS= 1.
 FILE 1. METHOD 0. RUN 19 INDEX 19

PEAK#	AREA%	RT	AREA	EC
1	10.827	0.42	195180	02 METHANE
2	16.232	0.47	229407	02 } WAX
3	23.614	0.57	149511	02 } WAX
4	2.781	0.76	17605	02 BENZENE
5	3.615	0.87	22890	02 3-METHYL HEXANE
6	0.787	0.99	4981	02 1,4 OCTANE
7	2.145	1.12	12578	01 TOLUENE
TOTAL	100.		633150	

NY5-SG4-2
 1/100 100%

CHANNEL A INJECT 09/25/87 10:52:08



GEOSCIENCE SUFFOLK CO NY 09/25/87 10:52:08 CH= "A" PS= 1.
 FILE 1. METHOD 0. RUN 20 INDEX 20

PEAK#	AREA%	RT	AREA	EC
1	11.47	0.42	198875	01 METHANE
2	15.918	0.47	227137	01 } WAX
3	23.047	0.57	145611	01 } WAX
4	2.721	0.77	17220	01 BENZENE
5	1.572	0.87	22802	01 3-METHYL HEXANE
6	0.809	0.98	5113	01 1,4 OCTANE
7	2.482	1.11	15708	01 TOLUENE
TOTAL	100.		622752	

Test of dirt samples
 For my info!
 500%

CHANNEL A INJECT 09/25/87 11:03:11

RECEIVED FEB - 9 1988

GEOSCIENCE SUFFOLK CO NY 09/25/87 11:23:11 CH= "A" FS= 1.

FILE 1. METHOD 0. RUN 24 INDE. 24

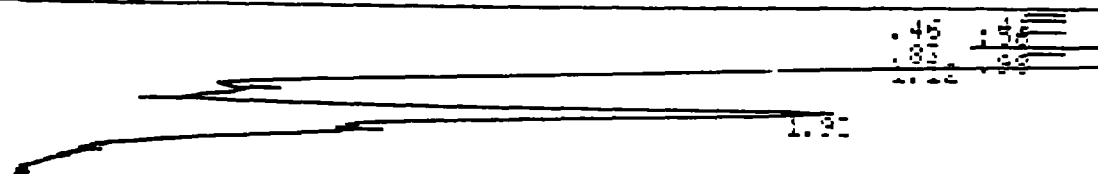
PEAK #	AREA:	RT	AREA BC
1	16.216	0.42	166475 02
2	18.101	0.47	175104 02
3	16.092	0.56	71954 02
4	3.786	0.82	17198 02
5	2.163	0.84	9942 02
6	0.88	0.98	4045 02
7	2.559	1.11	11760 02
8	0.2	1.92	919 01

NY5-564-10
1/100 50%

TOTAL 100. 459557

CHANNEL A INJECT 09/25/87 11:40:55

AC 1



GEOSCIENCE SUFFOLK CO NY 09/25/87 11:40:55 CH= "A" FS= 1.

FILE 1. METHOD 0. RUN 25 INDE. 25

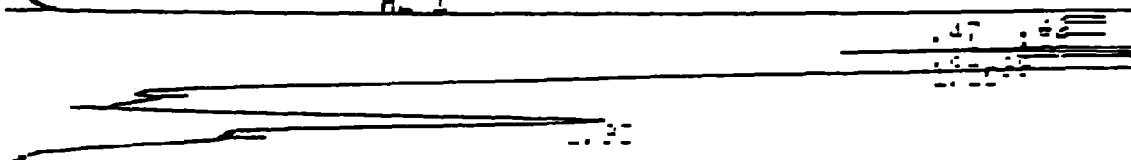
PEAK #	AREA:	RT	AREA BC
1	25.147	0.41	207968 02 METHANE
2	26.599	0.46	218214 02
3	17.661	0.56	144902 02
4	15.264	0.82	125219 02 2-METHYL HEXANE
5	2.526	0.98	20725 02 ISO OCTANE
6	10.291	1.12	84416 01 TOLUENE
7	2.112	1.93	18968 01 ETHYL BENZENE

NY5-564-10
1/100 50%

TOTAL 100. 820472

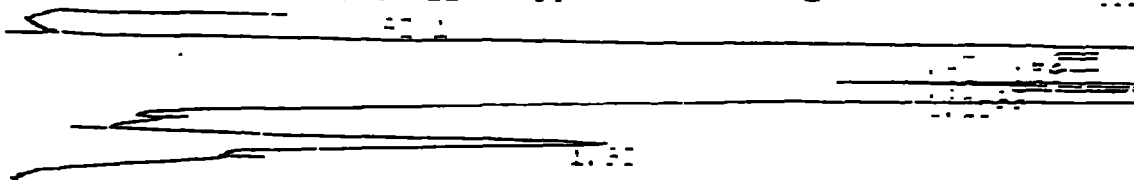
CHANNEL A INJECT 09/25/87 11:44:16

AC 1



CHANNEL A INJECT 09/25/87 11:44:16

RECEIVED FEB - 9 1988



GEOSCIENCE SUFFOLK CO NY 09/25/87 11:44:16 CH= "A" PS= 1.

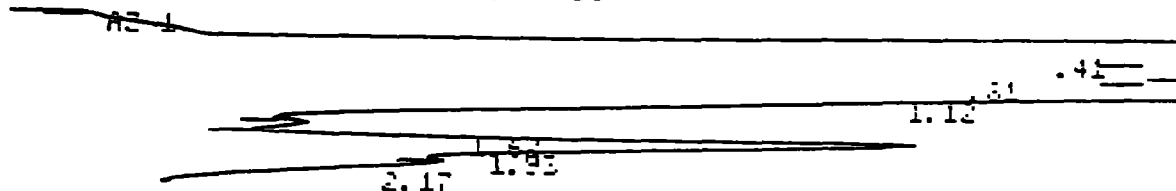
FILE 1. METHOD 0. RUN 25 INDEX 25

PEAK #	AREA:	FT	AREA BC
1	25.421	0.42	194709 02 METHANE
2	27.111	0.47	207698 02 } UNK
3	17.110	0.56	123694 02 }
4	14.867	0.81	111601 02 2-METHYL HEXANE
5	2.585	0.99	17500 02 100 OCTANE
6	9.333	1.11	74801 01 TOLUENE
7	1.856	1.91	12914 01 ETHYL BENZENE

TOTAL 100. 750619

*NY 5-564-10'
1/100 50%*

CHANNEL A INJECT 09/25/87 11:47:18



GEOSCIENCE SUFFOLK CO NY 09/25/87 11:47:18 CH= "A" PS= 1.

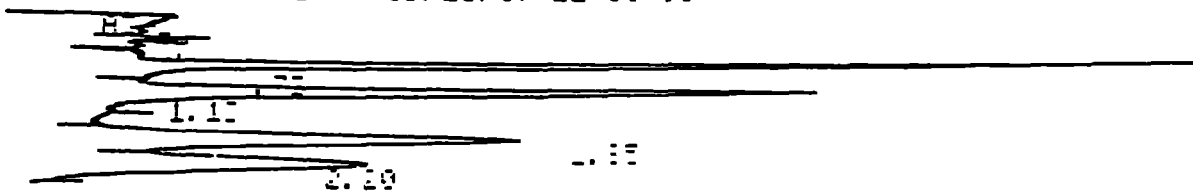
FILE 1. METHOD 0. RUN 27 INDEX 27

PEAK #	AREA:	FT	AREA BC
1	65.492	0.41	569345 02 METHANE
2	16.58	0.81	144119 02 UNK
3	14.004	1.12	121741 08 TOLUENE
4	0.052	1.62	451 06 OCTANE
5	1.968	1.91	26670 06 ETHYL BENZENE
6	0.804	2.17	6991 07 4-XYLENE

TOTAL 100. 862117

100%

CHANNEL A INJECT 09/25/87 12:00:05



10/26/87 11:41:16 CH= "A" FS= 1.
 FILE 1. METHOD 0. RUN 19 INDEX 19
 RECEIVED FEB - 9 1988
 PEAK # AREA% PT AREA BC
 1 100. 0.4 587907 02
 TOTAL 100. 587907

u 5
 Sq 1-2' + 10'

N₂ to blank
 10 ml microtit²¹
 syringe

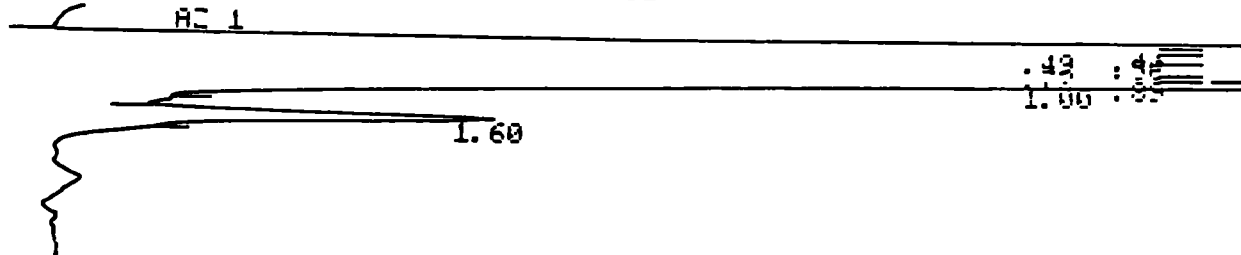
CHANNEL A INJECT 10/26/87 11:49:59
 AC 1



NO DATA. CHANNEL A

1 µl
 156-1-2'

CHANNEL A INJECT 10/26/87 11:55:51
 AC 1



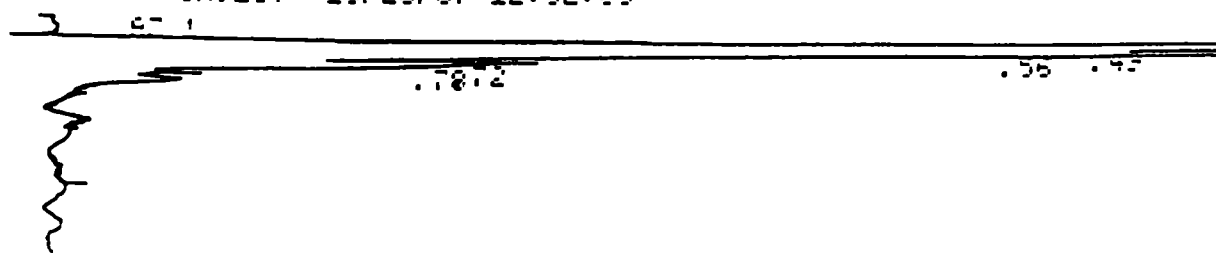
AUSTIN TX 10/26/87 11:55:51 CH= "A" FS= 1.

FILE 1. METHOD 0. RUN 21 INDEX 21

PEAK #	AREA%	PT	AREA BC	
1	16.657	0.44	1154519 02	METHANE
2	48.193	0.49	3254156 02	} UNK
3	22.516	0.56	1560601 02	
4	8.147	0.72	578521 02	BENZENE
5	1.048	0.89	72640 02	3-METHYL BENZENE BP 92C
6	2.55	1.	176777 01	TOLUENE
7	0.489	1.6	11394 01	ETHYL BENZENE
TOTAL	100.		6901113	

0.5 µl
 156 1 2'
 diluted
 1-10

CHANNEL A INJECT 10/26/87 12:02:00

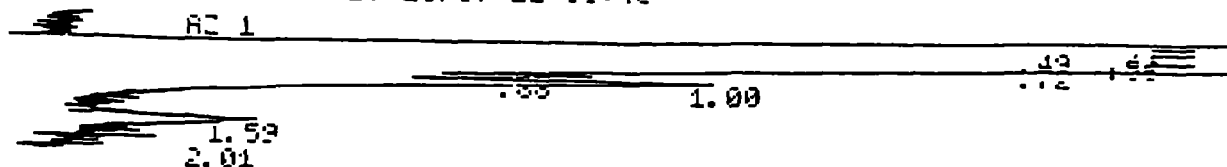


RECEIVED 118 - 9 1920

5ul 156.12
1-10 dilution

	AREA	RT	AREA BC
1	69.54	0.49	308716 02
2	21.449	0.56	194098 02
3	4.627	0.72	20541 02
4	2.185	0.78	10586 02
TOTAL	100.		440940

CHANNEL A INJECT 10/26/87 12:06:40



AUSTIN TX 10/26/87 12:06 1 CH= "A" PS= 1.

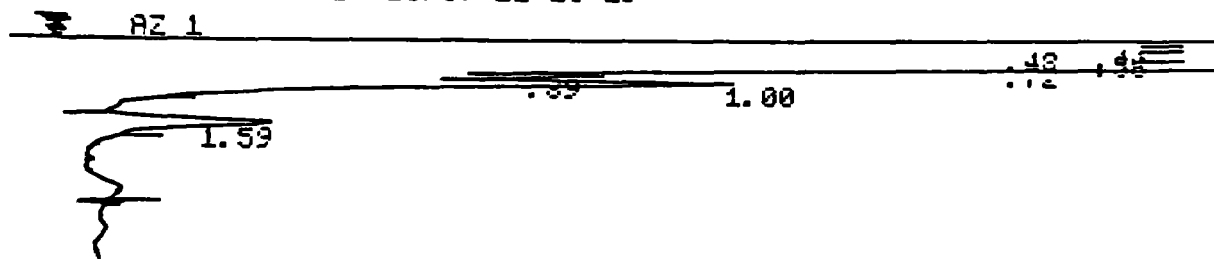
FILE 1. METHOD 0. RUN 23 INDEX 23

PEAK#	AREA%	RT	AREA BC	
1	16.743	0.44	400114 02	METHANE
2	48.1	0.49	1149477 02	} UNK
3	22.619	0.56	540539 02	
4	8.572	0.72	204048 02	BENZENE
5	1.009	0.88	24119 02	3-METHYL HEXANE
6	2.524	1.	60311 03	TOLUENE
7	0.432	1.59	10334 01	ETHYL BENZENE

TOTAL 100. 2389742

5ul 156.12
1-10 dilution

CHANNEL A INJECT 10/26/87 12:10:29



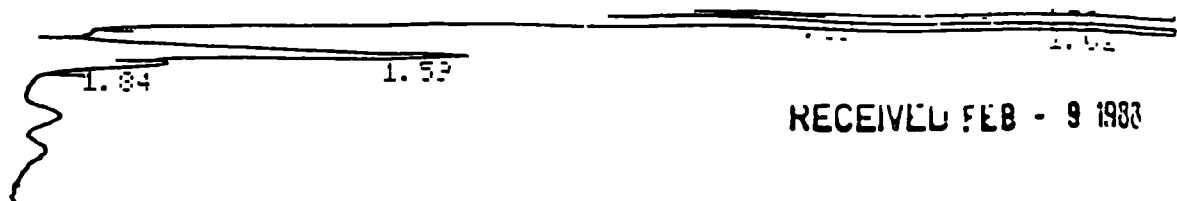
AUSTIN TX 10/26/87 12:10:29 CH= "A" PS=

FILE 1. METHOD 0. RUN 24 INDEX 24

PEAK#	AREA%	RT	AREA BC	
1	16.198	0.44	107145 02	METHANE
2	48.17	0.48	1125520 02	} UNK
3	22.695	0.	530284 02	
4	8.627	0.	201574	BENZENE
5	1.008	0.89	24257	3-METHYL HEXANE
6	2.171	1.	60311	TOLUENE
	0.60	1.59	10114	01 ETHYL BENZENE

TOTAL 100. 2329545

5ul 156.12
1-10 dilution



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AUSTIN TX 10/26/87 12:10:15 CH= "A" PS= 1.

FILE 1. METHOD 0. RUN 27 INDEX 27

PEAK#	AREA:	RT	AREA BC
1	56.817	0.49	2027708 02
2	24.697	0.57	881091 02
3	10.111	0.72	168567 02
4	1.019	0.89	16149 02
5	5.551	1.02	198052 02
6	1.244	1.59	44171 02
7	0.121	1.84	11448 02

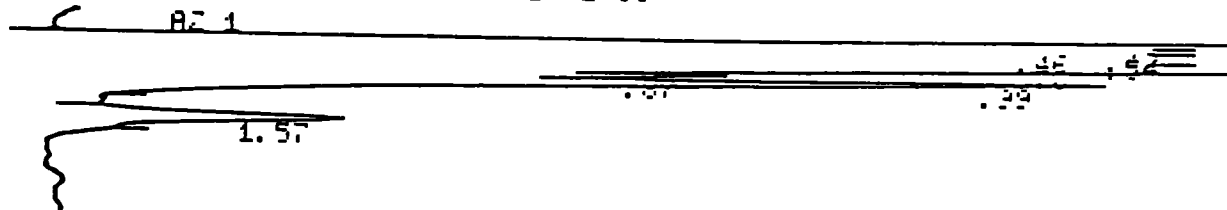
TOTAL 100. 1567587

CHANNEL A INJECT 10/26/87 12:13:41

5 ml 156-1 10

NO DATA, CHANNEL A

CHANNEL A INJECT 10/26/87 12:41:55



AUSTIN TX 10/26/87 12:41:55 CH= "A" PS= 1.

FILE 1. METHOD 0. RUN 29 INDEX 29

PEAK #	AREA:	RT	AREA BC	
1	15.965	0.42	495150 02	METHANE
2	47.49	0.46	1472879 02	} UNK
3	22.759	0.54	705842 02	
4	8.857	0.7	274700 02	BENZENE
5	1.019	0.87	21609 02	3-METHYL HEXANE
6	1.114	0.96	97201 02	TOLUENE
7	0.775	1.37	24219 01	ETHYL BENZENE

TOTAL 100. 1011417

5 ml 156-1 10

DISCUSSION OF COMPRESSIBILITY FACTOR

MEAN COMPRESSIBILITY FACTOR, z_m , FOR

SOIL/GAS SAMPLE SG-4 AT RI-4

To support the assumption that the soil gas mixtures sampled in this study can be approximated to an ideal gas, calculations are presented for the mean compressibility factor, z_m , in the equation $pV = z_m nRT$. For an ideal gas, the perfect gas law is applied:

$$pV = nRT$$

z_m is not included in the perfect gas law because its value is always equal to one for an ideal gas. If calculations can show that z_m is approximately equal to one for the soil gas mixtures, then the assumption that the samples in this study can be approximated to an ideal gas is a valid one.

The mean compressibility factor, z_m , can be determined from:

$$\begin{aligned} z_m &= z_a y_a + z_b y_b + \dots \\ z_m &= \sum z_i y_i \end{aligned}$$

where z_i = compressibility factor at critical point for component, and y_i = mole fraction of component. z_i is determined using the reduced pressure, p_r , and reduced temperature, t_r ,

$$t_r = \frac{T}{T_c} \quad \text{where } T \text{ is temperature of gaseous mixture, and } T_c \text{ is critical temperature of component}$$

$$p_r = \frac{P}{P_c} \quad \text{where } P \text{ is pressure of gaseous mixture, and } P_c \text{ is critical pressure of component}$$

Using t_r and p_r , z_i is read from a general compressibility chart.

Calculation of z_m for soil/gas sample SG-4 at Rhode Island Station 4 (RI-4)

KNOWN:

$$\text{B.P.} = 29.72 \text{ in Hg} \times \frac{1 \text{ atm}}{29.92 \text{ in Hg}} = 0.99 \text{ atm}$$

$$\text{B.P.} = 0.99 \text{ atm}$$

$$\text{Temp}_{\text{H}_2\text{O}} = 11^\circ\text{C}$$

$$\text{Temp}_{\text{Air}} = 61^\circ\text{F} = 16^\circ\text{C}$$

$$\text{Temp}_{\text{AVG}} = \frac{11 + 16}{2} = 13.5^\circ\text{C} + 273 = 286.5\text{K}$$

$$T = 286\text{K}$$

BASIS: 1 liter of soil gas

ASSUMPTION: Largest components of soil gas are Water and Air

Soil Gas Makeup

Compound	Wt. g	M.Wt. g/mol	Moles	T_c, K	P_c, atm
Methane	0.15	16.04	$9.3(10^{-3})$	190	45.4
Benzene	0.009	78.11	$1.1(10^{-4})$	562	48.3
Toluene	0.006	92.13	$6.8(10^{-5})$	592	41.1
Ethyl- benzene	$8.0(10^{-6})$	106.16	$7.5(10^{-8})$	617	36.3
Xylene	0.01	106.12	$9.4(10^{-5})$	622	35.8
Water	UK	18.02	UK	647	218.3
Nitrogen	UK	28.01	UK	126	33.6
Oxygen	UK	32.00	UK	155	49.8

UK = Unknown

CASE 1. ASSUMPTION: Air is 80 percent of soil gas

$$0.80 \times 1 \text{ liter} = 0.80 \text{ liter air}$$

$$\text{O}_2 \text{ is 21 percent air, N}_2 \text{ is 79 percent air}$$

$$\text{O}_2: 0.21(0.80) = 0.17 \text{ liter} \left(\frac{1 \text{ mol}}{22.41} \right) = 0.0076 \text{ mol} \left(\frac{32\text{g}}{\text{mol}} \right) = 0.2129\text{g}$$

$$\text{N}_2: 0.79(0.80) = 0.63 \text{ liter} \left(\frac{1 \text{ mol}}{22.41} \right) = 0.0281 \text{ mol} \left(\frac{28.01\text{g}}{\text{mol}} \right) = 0.8022\text{g}$$

ASSUMPTION: Soil gas mixture has same molecular weight as air since air is 80 percent of soil gas

$$1 \text{ liter} \times \frac{1 \text{ mol}}{22.41} = 0.045 \text{ mol} \times 29 \text{ g/mol} = 1.2946 \text{ g}$$

Soil gas	1.2946
Components (w/o H ₂ O)	1.2871

$$\text{Water} \quad 0.0075 \text{ g} \times \frac{1 \text{ mol}}{18.02 \text{ g}} = 0.00042 \text{ mol}$$

The weight of water, nitrogen, & oxygen is now known:

	Wt. <u>g</u>	<u>Moles</u>
Water	.0075	4.2(10 ⁻⁴)
Nitrogen	.2129	.0076
Oxygen	.8992	.0281

Mole fraction of compounds: $\frac{y_{\text{compound}}}{y_{\text{soil gas}}}$

<u>Compound</u>	$\frac{y_{\text{com}}}{y_t} = y_i$	$\frac{T}{T_c} = T_r$	$\frac{P}{P_c} = P_r$	z_i
Methane	2.1(10 ⁻¹)	1.5	0.022	0.99
Benzene	2.4(10 ⁻³)	0.49	0.021	0.5
Toluene	1.5(10 ⁻³)	0.46	0.024	0.5
Ethylbenzene	1.7(10 ⁻⁶)	0.44	0.027	0.5
Xylene	2.1(10 ⁻³)	0.44	0.028	0.5
Water	9.3(10 ⁻³)	0.42	0.005	0.9
Nitrogen	1.7(10 ⁻¹)	2.2	0.030	0.99
Oxygen	6.2(10 ⁻¹)	1.7	0.020	0.99

where z_i is taken from "General Compressibility Chart, low pressures," page 175, Basic Principles and Calculations in Chemical Engineering, D.M. Himmelblau, 1962, Prentice-Hall, Inc.

$$z_m = \sum z_i y_i = 0.99(2.1 \times 10^{-1}) + 0.5(2.4 \times 10^{-3}) + 0.5(1.5 \times 10^{-3}) + 0.5(1.7 \times 10^{-6}) + 0.9(2.1 \times 10^{-3}) + 0.5(9.3 \times 10^{-3}) + 0.99(1.7 \times 10^{-1}) + 0.99(6.2 \times 10^{-1})$$

$$z_m = 0.21 + 0.0012 + 7.5(10^{-4}) + 8.0(10^{-7}) + 1.8(10^{-4}) + 4.7(10^{-3}) + 0.17 + 0.61$$

$$z_m = 0.997$$

CASE 2. ASSUMPTION: Air is 20 percent of soil gas

$$0.20 \times 1 \text{ liter} = 0.20 \text{ liter air}$$

$$\text{O}_2: 0.21(0.20) = 0.0421 \left(\frac{1 \text{ mol}}{22.41} \right) = 0.002 \text{ mol} \left(\frac{32 \text{ g}}{\text{mol}} \right) = 0.064 \text{ g}$$

$$N_2: 0.79(0.20) = 0.1581 \left(\frac{1 \text{ mol}}{22.41} \right) = 0.007 \text{ mol} \left(\frac{28.01 \text{ g}}{\text{mol}} \right) = 0.196 \text{ g}$$

ASSUMPTION: Soil gas mixture has same molecular weight as water since it is main component

$$1 \text{ liter} \times \frac{1 \text{ mol}}{22.41} = 0.045 \text{ mol} \times 18 \text{ g/mol} = 0.80 \text{ g}$$

Soil gas	0.80g	
Components (w/o H ₂ O)	<u>0.44g</u>	
Water	0.36g	$\times \frac{1 \text{ mol}}{18.02 \text{ g}} = 0.020 \text{ mol}$

Component	Moles	Y_i
Water	0.020	0.44
Nitrogen	0.007	0.16
Oxygen	0.002	0.04

$$z_m = \sum z_i y_i = 0.99(0.19) + 0.5(0.1) + 0.5(.008) + 0.5(1.0 \times 10^{-5}) + 0.5(.0125) + 0.9(.044) + 0.99(0.16) + 0.99(0.04)$$

$$z_m = 0.19 + 0.05 + 4.3(10^{-3}) + 1.0(10^{-6}) + 6.25(10^{-3}) + 0.4 + 0.16 + 0.04$$

$$z_m = 0.85$$

Based on the assumptions and CASE 1 and CASE 2 where z_m is roughly equal to one, the assumption that the soil gas mixtures of this study can be approximated to an ideal gas is a valid one.

DERIVATION OF PPM CONVERSION AND SAMPLE CALCULATION

DERIVATION OF EQUATION TO CONVERT $\mu\text{g/L}$ TO ppmv AND SAMPLE CALCULATION

The mass of a pollutant is expressed in μg of pollutant per L of air. Symbolically,

$$\frac{\text{Micrograms}}{\text{L}} = \frac{\mu\text{g}}{\text{L}} = \frac{M_{\text{poll}}}{V_{\text{air}}} \quad (\text{Equation 1})$$

Where:

M_{poll} = mass of pollutant in μg
 V_{air} = volume of air in liters

$\mu\text{g/L}$ can be written in terms of density as follows:

$$\frac{M_{\text{poll}}}{V_{\text{air}}} = \frac{d_{\text{poll}} V_{\text{poll}}}{V_{\text{air}}} \quad (\text{Equation 2})$$

Where:

d_{poll} = density of pollutant in $\mu\text{g/L}$
 V_{poll} = volume of pollutant in liters

The ideal gas equation is written below:

$$PV = nRT \quad (\text{Equation 3})$$

Equation 3 can be written in terms of density as follows:

$$P \times (\text{Mol Wt})_{\text{poll}} = d_{\text{poll}} RT \quad (\text{Equation 4})$$

or

$$1 = \frac{P \times (\text{Mol Wt})_{\text{poll}}}{d_{\text{poll}} RT} \quad (\text{Equation 5})$$

By multiplying Equation 2 by Equation 5, we can introduce the temperature and pressure effects into the concentration in $\mu\text{g/L}$ as follows:

$$\frac{M_{\text{poll}}}{V_{\text{air}}} = \frac{d_{\text{poll}} V_{\text{poll}}}{V_{\text{air}}} \times \frac{P \times (\text{Mol Wt})_{\text{poll}}}{d_{\text{poll}} RT} \quad (\text{Equation 6})$$

This equation can be condensed to:

$$\frac{M_{\text{poll}}}{V_{\text{air}}} = \frac{V_{\text{pol}}}{V_{\text{air}}} \times \frac{P \times (\text{Mol Wt})_{\text{Poll}}}{RT} \quad (\text{Equation 7})$$

Where:

P = Barometric Pressure in ATM

Mol Wt = Molecular Weight of Pollutant

R = Gas Constant: $\frac{\text{atm.l}}{\text{gmole.}^\circ\text{K}}$

T = Ambient Temperature in $^\circ\text{K}$

The mass of the pollutant in Equation 7 is expressed in grams. By multiplying the right side of Equation 7 by 10^6 to convert the mass to μg , and by dividing by 10^6 so that $V_{\text{poll}}/V_{\text{air}}$ can be expressed in ppm, then the equation between $\mu\text{g/L}$ and ppmv is:

$$\frac{\mu\text{g}}{\text{L}} = \text{ppmv} \times \frac{P \cdot (\text{Mol Wt})}{(0.08208) T} \quad (\text{Equation 8})$$

SAMPLE CALCULATION

Station AUI

Sample SG1-02

Benzene ($\mu\text{g/L}$) = 7400

T ($^\circ\text{K}$) = 298.56

Pressure (atm) = .988 atm

$$\begin{aligned} \text{ppmv} &= \frac{(.08208) T}{P (\text{Mol Wt})} \times \frac{\mu\text{g}}{\text{L}} \\ \text{ppmv} &= \frac{(.08208)(298.56)}{(.988)(78)} \times (7400) \\ \text{ppmv} &= 2353 \end{aligned}$$

Due to rounding errors, the value in the table indicates a value of 2352 ppm.

APPENDIX E

CONTAMINATED SITE DATA

CONTAMINATED SITE DATA - SELECTED POINTS

(All concentration values in µg/L)

<u>Site 1</u>	<u>Sample Depth</u>	<u>Methane</u>	<u>Benzene</u>	<u>Toluene</u>	<u>Ethylbenzene/ xylene</u>	<u>Total Hydrocarbons</u>
SG05	4'	14	0.9	0.5	<0.07	20
SG06	2'	650,000	25,000	5,900	<36	800,000
SG17	2'	2	.5	<0.07	<0.07	9
SG28	1.75'	70,000	7,500	3,400	<12	12,000
SG29	2'	1,200,000	100,000	68,000	61,000	2,200,000
SG41	1.5'	130,000	1,400	<19	<19	220,000

<u>Site 2</u>	<u>Sample Depth</u>	<u>Benzene</u>	<u>Toluene</u>	<u>Ethylbenzene</u>	<u>Xylenes</u>	<u>Total Hydrocarbons (Less Methane)</u>
SG02	9'	<10	1,200	<10	140	8,400
SG16	9'	<10	800	120	<10	19,000
SG21	9'	<0.2	160	<0.3	<0.2	620
SG22	8'	<1	850	60	40	5,300

<u>Site 3</u>	<u>Sample Depth</u>		<u>Toluene</u>	<u>Total Hydrocarbons</u>
SG02	-	150,000	31,000	400,000
SG03	-		15,000	400,000
SG04	-		18,000	200,000
SG11	-		8,000	130,000

<u>Site 4</u>	<u>Sample Depth</u>	<u>Benzene</u>	<u>Toluene</u>	<u>Ethylbenzene</u>	<u>Xylenes</u>	<u>Total Hydrocarbons (Less Methane)</u>
SG01	3'	130	78	10	<0.9	1,200
SG01	5'	300	140	26	<2.3	3,300
SG01	9'	530	360	20	<2.3	10,000
SG01	13'	780	620	50	<4.5	15,000
SG02	5'	4	12	<0.01	0.2	48
SG07	5'	3	6	<0.01	<0.009	34
SG08	5'	0.8	3	<0.01	<0.009	22
SG08	9'	5	5	<0.05	0.04	76
SG08	13'	45	50	<0.1	0.4	740

<u>Site 5</u>	<u>Sample Depth</u>	<u>Benzene</u>	<u>Toluene</u>	<u>Ethylbenzene</u>	<u>Xylenes</u>	<u>Total Hydrocarbons</u>
SG01	6.5'	9,500	<150	<170	<180	118,000
SG02	6.5'	26,000	11,000	<850	<900	280,000
SG03	5.5'	<0.05	0.1	-	<0.09	6
SG04	3'	0.2	0.3	-	<0.09	0.8
SG05	6'	<0.05	<0.07	-	<0.09	1
SG13	6.5'	<0.08	<0.1	-	<0.2	<0.2

<u>Site 6</u>	<u>Sample Depth</u>	<u>Benzene</u>	<u>Toluene</u>	<u>Ethylbenzene</u>	<u>Xylenes</u>	<u>Total Hydrocarbons</u>
SG01	5'	<9	94	<2	5	700
SG01	11'	<230	4,000	<58	<61	210,000
SG01	15'	<5	370	<1	<1	8,300
SG05	5'	<0.09	<0.1	<0.1	<0.1	7,000
SG06	5'	<0.09	<0.1	<0.1	<0.1	7,000
SG08	5'	<0.1	<0.1	<0.1	<0.2	<0.1

<u>Site 7</u>	<u>Sample Depth</u>	<u>Benzene</u>	<u>Toluene</u>	<u>Ethylbenzene</u>	<u>Xylenes</u>	<u>Total Hydrocarbons (Less Methane)</u>
SG06	13'	<0.6	950	<0.9	5	2,500
SG08	6'	<1	1,700	<2	14	4,100
SG08A	6'	<5	120	<8	<8	3,100
SG17	6'	<55	1,600	<80	<80	9,500

<u>Site 8</u>	<u>Sample Depth</u>	<u>Methane</u>	<u>Benzene</u>	<u>Toluene</u>	<u>Total Hydrocarbons</u>
SG6	4'	600	200	200	700
SG7	4'	20	10	5	30
SG8	2.5'	6	<0.08	0.5	2
SG08	13'	100,000	10,000	7,000	200,000
SG10	5'	70	1,000	400	10,000
SG10	9'	3,000	50,000	10,000	700,000
SG11	5'	1,000	30,000	10,000	300,000
SG11	13.5'	1,000	60,000	40,000	800,000
SG13	2'	500	2,000	700	30,000
SG13	10'	2,000	50,000	20,000	500,000
SG22	2'	6,000	2,000	1,000	20,000
SG22	13'	2,000	900	60	20,000
SG23	12'	2,000	<300	<400	100,000
SG26	2'	20	8	4	70
SG26	13'	70,000	20,000	10,000	300,000
SG27	12'	100	100	<7	2,000

<u>Site 9</u>	<u>Sample Depth</u>	<u>Methane</u>	<u>Benzene</u>	<u>Toluene</u>	<u>Ethylbenzene</u>	<u>Xylenes</u>	<u>Total Hydro- carbons (Less Methane)</u>
SG02	6'	3,400	53,000	1,600	<20	<31	160,000
SG03	6'	4,700	<78	<15	<20	<31	150,000
SG04	6'	4,800	4,400	1,200	<20	<31	250,000
SG05	6'	3,600	26,000	650	<20	<31	290,000