

**SOIL GAS SURVEY**  
**MOBIL SERVICE STATION 10-H6J**  
**1024 MAIN STREET**  
**PLEASANTON, CALIFORNIA**



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PREPARED FOR

MOBIL OIL CORPORATION  
3225 GALLOWS ROAD  
FAIRFAX, VIRGINIA 22037

PREPARED BY

TARGET ENVIRONMENTAL SERVICES, INC.  
OAKLAND CENTER  
8940-A ROUTE 108  
COLUMBIA, MARYLAND 21045  
(301) 992-6622

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## EXECUTIVE SUMMARY

On March 10, 1989, TARGET Environmental Services, Inc. (TARGET) conducted a soil gas survey on the Mobil Service Station #10-H6J at 1024 Main Street, Pleasanton, California. Analysis of the samples by GC/FID revealed the presence of hydrocarbons in the subsurface, and evaluation of chromatogram signatures identified the material as gasoline. Concentration contour patterns and relative analyte concentrations indicate that gasoline has entered the subsurface near the southern edge or southwestern corner of the fueling area. Subsequent migration appears to have been to the northeast and southeast from this location, possibly facilitated by supply line and/or utility emplacements providing zones of enhanced permeability. Analyte concentrations suggest that some liquid product may exist in the subsurface south of the fueling area and west of the tank field.

## Introduction

Mobil Oil Corporation is conducting site evaluations of service stations as part of a property transfer program with BP Oil Corporation. TARGET Environmental Services, Inc. (TARGET) was contracted as part of this program to perform soil gas surveys to determine the possible presence and extent of subsurface hydrocarbon contamination at these sites. The field phase of the soil gas survey performed at the Mobil Service Station #10-H6J, 1024 Main Street, Pleasanton, California, was conducted on March 10, 1989.

## Detectability

The soil gas survey data presented in this report are the result of precise sampling and measurement of contaminant concentrations in the vadose zone. Analyte detection at a particular location is representative of vapor, dissolved, and/or liquid phase contamination at that location. The presence of detectable levels of target analytes in the vadose zone is dependent upon several factors, including the presence of vapor-phase hydrocarbons or dissolved or liquid concentrations adequate to facilitate volatilization into the unsaturated zone.

## Terminology

In order to prevent misunderstanding of certain terms used in this report, the following clarifications are offered:

The term "feature" is used in reference to a discernable pattern in the contoured data. It denotes a contour form rather than a definite or separate chemical occurrence.

The term "occurrence" is used to indicate an area where chemical compounds are present in sufficient concentrations to be detected by the analysis of soil vapors. The term is not indicative of any specific mode of occurrence (vapor, dissolved, etc), and does not necessarily indicate or suggest the presence of "free product" or "phase-separated hydrocarbons".

The term "trace level" represents a concentration that is detectable but is less than the formal detection limit of the analytical equipment. A statistically valid quantification of trace levels is not possible.

The term "analyte" refers to any of the hydrocarbons standardized for quantification in the chromatographic analysis.

The term "vadose zone" represents the unsaturated zone between the ground water table and the ground surface.

The term "indicates" is used when evidence dictates a unique conclusion. The term "suggests" is used when multiple explanations of certain evidence are possible, but one in particular seems more likely. As a result, "indicates" carries a higher degree of confidence in a conclusion than does "suggests".

## Field Procedures

Soil gas samples were collected at a total of 13 locations at the site, as shown in Figure 1. To collect the samples a 1/2 inch hole was produced to a depth of approximately four feet by using a drive rod. Where pavement was present, an electric hammer drill was employed for penetration prior to using the drive rod. The entire sampling system was purged with ambient air drawn through a dust and organic vapor filter cartridge, and a stainless steel probe was inserted to the full depth of the hole and sealed off from the atmosphere. A sample of in-situ soil gas was then withdrawn through the probe and used to purge ambient air from the sampling system. A second sample of soil gas was withdrawn through the probe and encapsulated in a pre-evacuated glass vial at two atmospheres of pressure (15 psig). The self-sealing vial was detached from the sampling system, packaged, labeled, and stored for laboratory analysis.

Prior to the day's field activities all sampling equipment, drive bar rods, and probes were decontaminated by washing with soapy distilled water and rinsing with distilled water. Internal surfaces were flushed dry using pre-purified nitrogen, and external surfaces were wiped clean using clean paper towels.

Field control samples were collected at the beginning and the end of the day's field activities. These QA/QC samples were obtained by inserting the probe tip into a tube flushed by a 20 psi flow of pre-purified nitrogen and collecting in the same manner as described above.

## Laboratory Procedures

All of the samples collected during the field phase of the survey were analyzed according to EPA Method 602 on a gas chromatograph equipped with a flame ionization detector (GC/FID), but using direct injection instead of purge and trap. Analytes selected for standardization were:

- methyl tertiary butyl ether (MTBE)
- benzene
- toluene
- ethylbenzene
- meta- and para- xylene
- ortho-xylene

These compounds were chosen because of their utility in evaluating the presence of petroleum products such as fuels, lubricating oils, and non-halogenated solvents.

FID Total Volatiles values were generated by summing the areas of all integrated chromatogram peaks and calculating using the instrument response factor for toluene. Injection peaks, which also contain the light hydrocarbon methane, were excluded to avoid the skewing of Total Volatiles values due to injection disturbances and biogenic methane.

The analytical equipment was calibrated using an instrument-response curve and injection of known concentrations of the above standards. Retention times of the standards were used to identify the peaks in the chromatograms of the field samples, and their response factors were used to calculate the analyte concentrations. The tabulated results of the laboratory analysis of the soil gas samples are reported in micrograms per liter (ug/l) in Table 1. Map sample points with no data shown indicate that the analyte concentrations in the sample were below the detection limit.

Because MTBE and pentane co-elute, they are listed together in the table.

For QA/QC purposes, a duplicate analysis was performed on every tenth field sample. Laboratory syringe blanks of carrier gas were also analyzed after every tenth sample.



## Discussion and Interpretation of Results

In order to provide graphic presentation of the results, individual data sets in Table 1 have been mapped and contoured to produce Figures 2 through 5. Dashed contours are used where patterns are extrapolated into areas of less complete data, or as auxiliary contours.

The FID Total Volatiles data in Figure 2 show a single zone of elevated values covering almost the entire site. The feature is centered on Station 12 near the southern end of the property and extends northward across the site. The zone of highest concentrations appears to trend northwestward to the fueling area, and then to the north or northeast. Since the point of highest concentration is near the southern edge of the survey area, full delineation of the feature's southern extent was not possible.

MTBE/pentane (not shown) exhibits the same distribution pattern as the Total Volatiles data. MTBE is a synthetic compound whose primary commercial use is as an octane-boosting additive in gasoline, and this indication of the potential presence of MTBE suggests that the hydrocarbon material present in the subsurface is gasoline.

Benzene (Figure 3) displays a similar pattern of occurrence that is more restricted in areal extent, being limited primarily to samples south of the fueling area. Benzene is characteristically one of the first gasoline compounds to be stripped by the flushing action of meteoric waters, and its presence is an indication that the hydrocarbons have not undergone a high degree of weathering, particularly south of the pump islands.

Toluene (Figure 4) shows a somewhat different concentration pattern. Unlike the previously discussed compounds, where the highest concentrations were consistently in Sample 12, the highest value of toluene was measured in Sample 10, approximately forty feet to the northwest. This shift in the location of the survey "high" is also observed for the less mobile analytes ethylbenzene, m- and p-xylenes, and o-xylene, as typified by m- and p-xylenes (Figure 5).

Examination of individual sample chromatograms revealed signatures typical of gasoline, corroborating the identification of gasoline implied by the presence and relative concentrations of the individual analytes. The observed shift in the point of highest concentration to Station 10 with decreasing analyte mobility implies that the gasoline entered the subsurface near the southern edge or southwestern corner of the fueling area. Migration appears to have been to the northeast and southeast from this location, possibly facilitated by supply line and/or utility emplacements providing zones of enhanced permeability.

While soil gas analysis cannot specifically determine the presence or absence of liquid product, the high concentrations of total volatiles and xylenes in the area near Stations 10 and 12 warrant further investigation, and may reflect the limited presence of liquid gasoline.

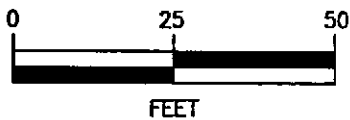
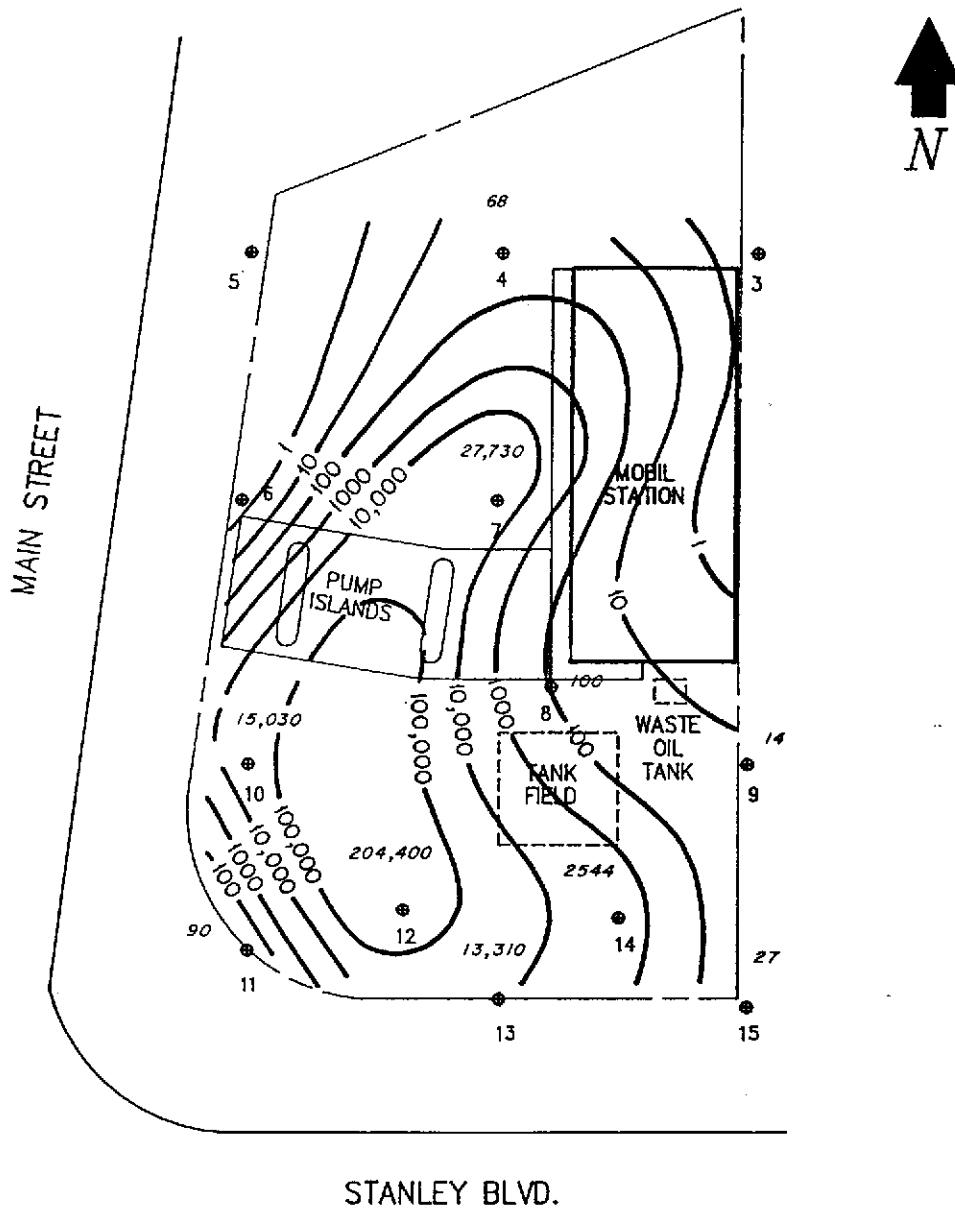
TABLE 1

LABORATORY RESULTS  
FLAME IONIZATION DETECTOR ANALYSIS  
CONCENTRATIONS IN MICROGRAMS-PER-LITER

SAMPLE	PENTANE/ MTBE <sup>1</sup>	BENZENE	TOLUENE	ETHYL- BENZENE	m- & p- XYLENE	o- XYLENE	TOTAL VOLATILES <sup>2</sup>
3	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
4	1.7	<1.0	<1.0	<1.0	<1.0	<1.0	68
5	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
6	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
7	4,974	26	483	34	29	13	50,730
8	5.7	<1.0	7.3	<1.0	<1.0	<1.0	100
9	<1.0	<1.0	2.2	<1.0	<1.0	<1.0	14
10	100	99	2,754	671	2,827	1,199	15,030
11	<1.0	<1.0	7.0	4.9	36	20	90
12	20,860	1,617	1,545	353	1,112	386	200,400
13	1,514	70	386	24	26	16	11,010
14	222	3.1	17	<1.0	<1.0	<1.0	2,544
15	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	27
<u>FIELD CONTROL SAMPLES</u>							
1	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
2	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
<u>LABORATORY SYRINGE BLANKS</u>							
BM2-1	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
<u>DUPLICATE ANALYSES</u>							
10	100	99	2,754	671	2,827	1,199	15,030
10R	84	83	2,320	562	2,329	955	12,590

<sup>1</sup>CONCENTRATIONS BASED ON RESPONSE FACTOR OF MTBE

<sup>2</sup>CALCULATED USING THE SUM OF THE AREAS OF ALL INTEGRATED CHROMATOGRAM PEAKS, AND THE INSTRUMENT RESPONSE FACTOR FOR TOLUENE



• SOIL GAS SAMPLE LOCATION

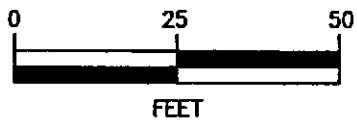
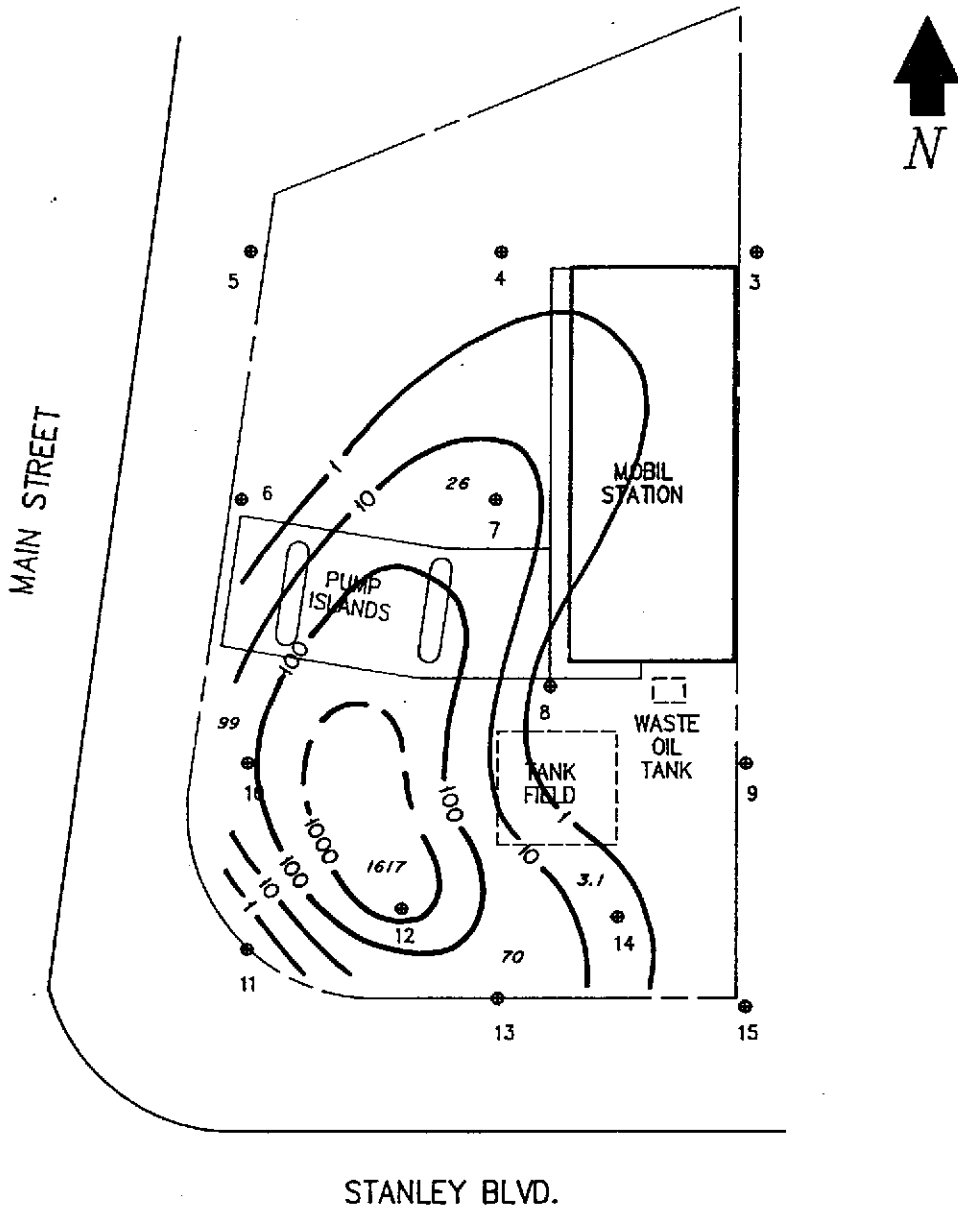
FIGURE 2. FID Total Volatiles  
(calc'd µg/l)



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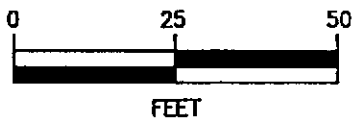
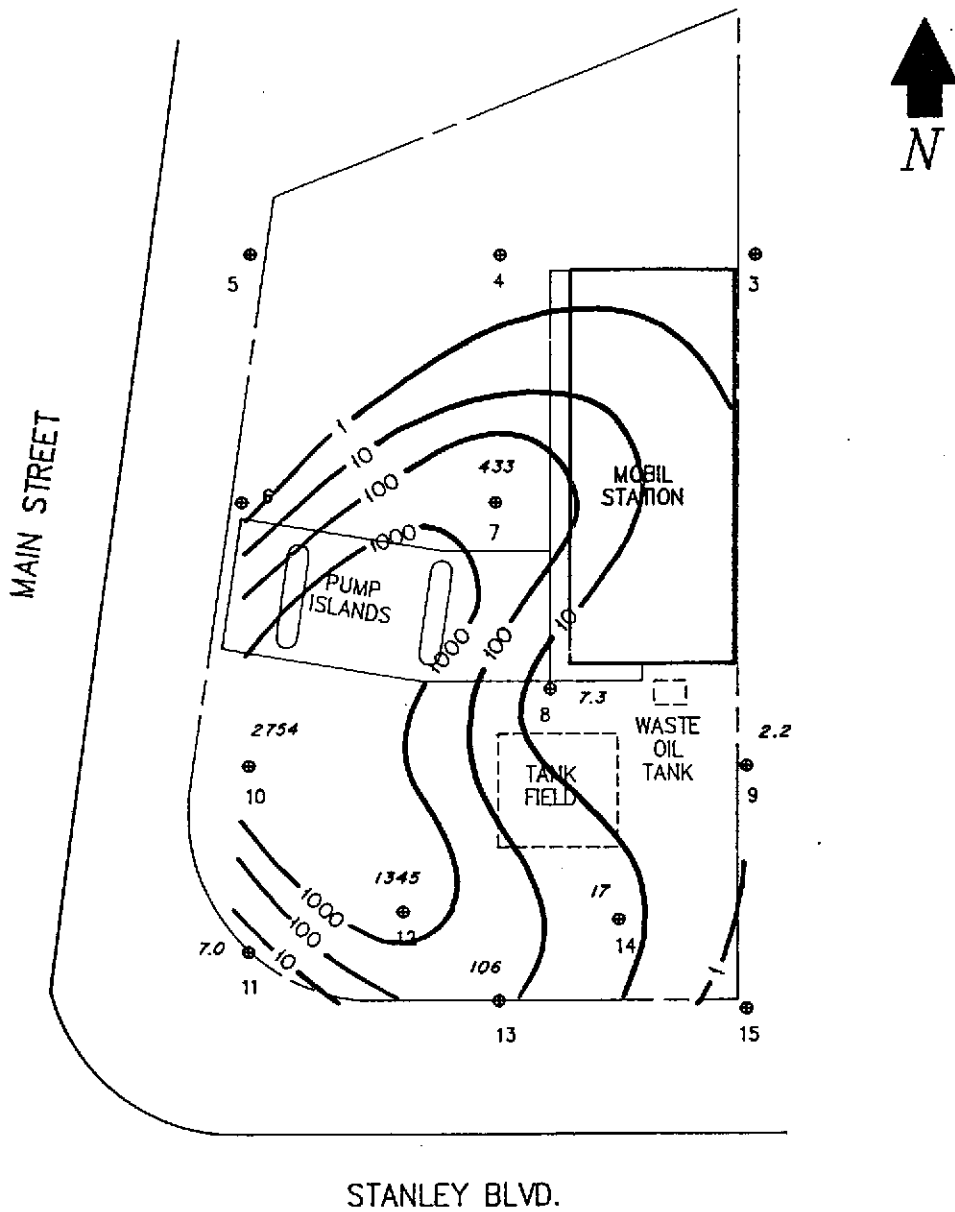
FIGURE 3. Benzene ( $\mu\text{g}/\text{l}$ )



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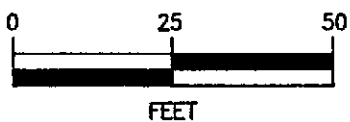
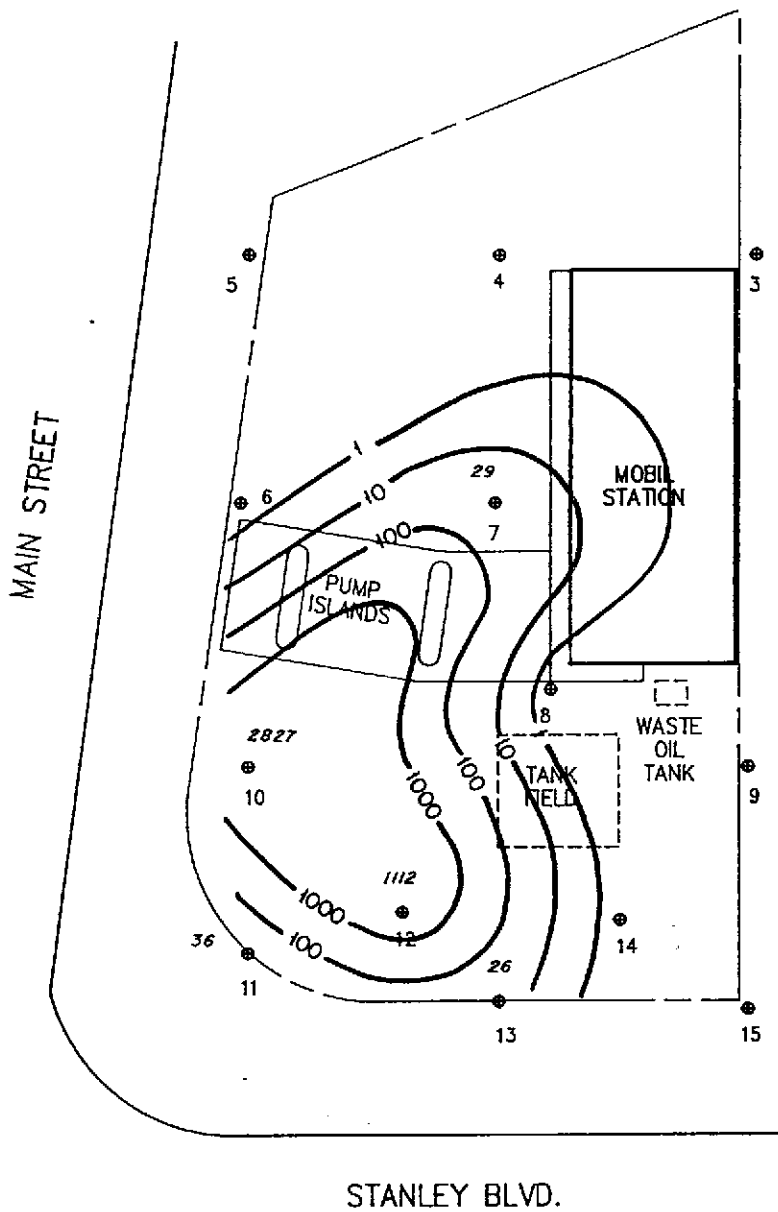
FIGURE 4. Toluene ( $\mu\text{g}/\text{l}$ )



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FIGURE 5. m- and p- Xylene ( $\mu\text{g/l}$ )



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