PHASE II

SOIL GAS SURVEY

MOBIL BULK PLANT

MERRILL, WISCONSIN

TARGET ENVIRONMENTAL SERVICES, INC.

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PREPARED FOR

MOBIL OIL CORPORATION

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EXECUTIVE SUMMARY

On February 25 and 26, 1992, **TARGET Environmental Services, Inc. (TARGET)** conducted a Phase II soil gas survey along a sewer trench that borders the southern side of the **Mobil Bulk Plant**, Merrill, Wisconsin. A total of 23 **soil gas** samples were collected from shallow (1-4 feet) and deep (6-8 feet) depths and analyzed by GC/FID for petroleum hydrocarbons. Attempted **ground water** sampling along the trench was unsuccessful as ground water was not encountered.

Moderate levels of Total FID Volatiles were present at a depth of 8 feet near the western portion of the trench. Very low levels occurred in several other deep samples and in the majority of the shallow samples. The chromatogram signature of one deep sample was typical of **relatively unweathered gasoline.** The signature of another deep sample from the same general area was suggestive of **diesel fuel.**

Soil gas data indicate that southerly migration of petroleum hydrocarbons has occurred as far as the fill soils around the sewer trench. Petroleum hydrocarbons were present at significant levels in two deep samples collected near the western portion of the trench. The full extent of this occurrence was not defined to the west. Markedly lower levels of petroleum hydrocarbons were present in the shallow samples. The presence of shallow bedrock (0 to 6 feet) south of the sewer trench prohibited the collection of the deep soil gas samples in that area. The highly impermeable nature of the bedrock south of the conduit, however, suggests that a migration path along the sewer trench may represent the path of least resistance.

Introduction

Mobil Oil Corporation contracted **TARGET Environmental Services, Inc. (TARGET)** to perform a Phase II soil gas survey along a sewer trench that borders the southern boundary of the **Mobil Bulk Plant**, Merrill, Wisconsin. **TARGET** conducted a previous soil gas survey at the plant in 1989 which revealed a linear occurrence in the shallow subsurface along the southern boundary. The purpose of the present survey was to determine whether the sewer trench is acting as an interceptor to the southerly migration of the contaminants. The site is located in an industrial area with another bulk plant to the north and an abandoned **Standard** bulk plant to the west. The depth of the trench is reported to vary from 11 to 20 feet below grade. Ground water is reported to occur between 12 and 17 feet, with flow to the south. Bedrock occurs at 0 to 6 feet and soils are reported to be fill material around the trench. The field phase of the soil gas survey was conducted on February 25 and 26, 1992.

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 discernible 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 "anomaly" refers to an area where hydrocarbons were measured in excess of what would normally be considered "natural" or "background" levels.

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 several 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."

The terms "elevated" and "significant" are used to describe concentrations of analytes which indicate the existence of a potential problem in the soil or ground water.

Field Procedures

Soil gas samples were collected at a total of 13 locations, which were selected by **Warzyn** (consultant to **Mobil Oil Corporation**). Dual depth sampling, at 4 and 8 feet, was proposed at each location. However, shallow bedrock prohibited the collection of samples at three locations and allowed only shallow (1 foot) samples at locations 16 and 17. A total of 13 shallow and 10 deep soil gas samples were collected, as shown in Figures 1A and 1B, respectively. The digits after the dash in the sample number indicate the sampling depth. Variations in sampling depth are due to probe refusal.

To collect the samples, a van-mounted hydraulic probe was used to advance connected 3 foot sections of 1 inch diameter threaded steel casing down to a depth of 4 feet. The entire sampling system was purged with ambient air drawn through an organic vapor filter cartridge. A teflon line was inserted into the casing to the bottom of the hole, and the bottom-hole line perforations were isolated from the up-hole annulus by an inflatable packer. A sample of in-situ soil gas was then withdrawn through the probe and used to purge atmospheric 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. Following the collection of the shallow sample at each location, the probe was further advance to a depth of 8 feet and a deep sample collected in the same manner.

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

Field control samples were collected at the beginning and end of each 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.

Ground water samples were attempted at several locations in the sewer trench but water was not encountered. The on-site representative of **Warzyn** (consultant for **Mobil Oil Corporation**) eliminated the requirement for ground water samples in the survey.

Laboratory Procedures

All of the samples collected during the field phase of the survey were analyzed according to EPA Method 602 (modified) 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.

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.

Total FID Volatiles values were generated by summing the areas of all integrated chromatogram peaks and calculated using the instrument response factor for toluene. Injection peaks, which also contain the light hydrocarbon methane, were excluded to avoid the skewing of Total FID Volatiles values due to injection disturbances and biogenic methane. For samples with low hydrocarbon concentrations, the calculated Total FID Volatiles concentration is occasionally lower than the sum of the individual analytes. This is because the response factor used for the Total FID Volatiles calculation is a constant, whereas the individual analyte response factors are compound specific. It is important to understand that the Total FID Volatiles levels reported are relative, not absolute, values.

The tabulated results of the laboratory analysis of the soil gas samples are reported in micrograms per liter ($\mu g/l$) in Table 1. Although "micrograms per liter" is equivalent to "parts per billion (v/v)" in water analyses, they are not equivalent in gas analyses, due to the difference in the mass of equal volumes of water and gas matrices. Because MTBE and pentane co-elute, they are listed together in the table. The xylenes concentrations reported in the data table are the sum of m- and p-xylene and o-xylene analyte values for each sample.

For QA/QC purposes, a duplicate analysis was performed on every tenth field sample. Laboratory blanks of nitrogen gas (99.999%) were also analyzed after every tenth field sample.

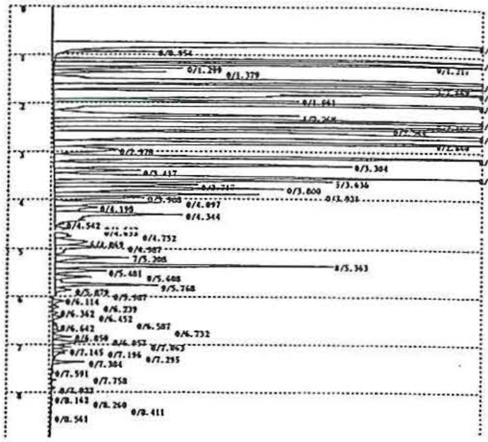
Discussion and Interpretation of Results

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 13. Meaningful contouring was limited by the linear sampling pattern. Dashed contours are used where patterns are extrapolated into areas of less complete data, or as auxiliary contours. Map sample points with no data shown indicate that the analyte concentrations in the sample were below the detection limit.

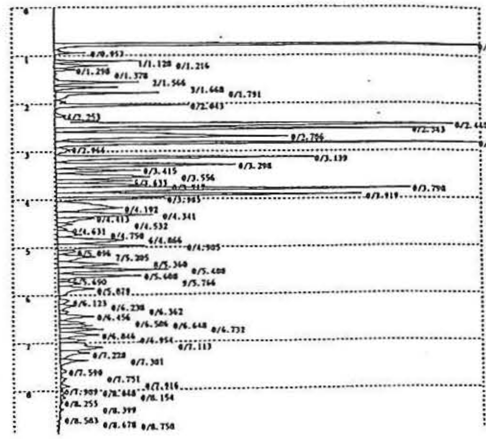
Moderate levels of Total FID Volatiles (Figure 2) were present at a depth of 8 feet near the western portion of the trench (Samples 4-8 and 7-8). Very low levels occurred at several other scattered locations. The occurrences of the individual analytes in deep soil gases are mapped in Figures 3 through 7. All the analytes were present in Samples 4-8 and 7-8. Low levels of MTBE/pentane and toluene also occurred in Sample 9-8.

At shallow depth, low to very low levels of Total FID Volatiles (Figure 8) were present at scattered locations above the trench and to the south. The highest level occurred at location 4, where the highest level was observed at depth. The occurrences of the individual analytes in shallow soil gases are mapped in Figures 8 through 13. MTBE/pentane was present where Total FID Volatiles were highest. Benzene and ethylbenzene were present only in the highest sample, Sample 4-4. Toluene and xylenes were the most extensive analytes.

The chromatogram signature of Sample 4-8 was typical of **relatively unweathered gasoline** (Chromatogram 1), while the



CHROMATOGRAM 1. GC/FID SIGNATURE OF SAMPLE 4-8



CHROMATOGRAM 2. GC/FID SIGNATURE OF SAMPLE 7-8

signature of Sample 7-8 was suggestive of **diesel fuel** (Chromatogram 2). Low levels of petroleum hydrocarbons were depicted in the signatures of the remaining samples.

Soil gas data indicate that southerly migration of petroleum hydrocarbons has occurred as far as the fill soils around the sewer trench. Petroleum hydrocarbons were present at significant levels in two deep samples collected near the western portion of the trench. The full extent of this occurrence was not defined to the west. Markedly lower levels were present in the shallow samples at the same locations. The presence of shallow bedrock (0 to 6 feet) south of the sewer area prohibited the collection of the deep soil gas samples in that area. The highly impermeable nature of the bedrock south of the conduit, however, suggests that a migration path along the sewer trench may represent the path of least resistance.

TABLE 1

ANALYTE CONCENTRATIONS VIA GC/FID (µg/l)

SAMPLE	PENTANE/ MTBE[1]	BENZENE	TOLUENE	ETHYL- BENZENE	XYLENES	TOTAL FID VOLATILES[2]
4-4	52	5.6	7.3	2.7	6.6	416
4-8	1,778	128	135	54	305	9,406
5-4	<1.0	<1.0	<1.0	<1.0	3.8	8.1
5-8	<1.0	<1.0	<1.0	<1.0	<1.0	1.5
6-4	<1.0	<1.0	1.5	<1.0	<1.0	5.8
6-8	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
7-4	<1.0	<1.0	1.5	<1.0	1.1	29
7-8	130	10	83	85	183	5,920
9-4	12	<1.0	1.2	<1.0	1.1	84
9-8	2.2	<1.0	1.7	<1.0	<1.0	37
10-4	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
10-8	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
11-4	<1.0	<1.0	<1.0	<1.0	<1.0	1.3
11-8	<1.0	<1.0	<1.0	<1.0	<1.0	1.2
12-4	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
12-8	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
13-4	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
13-8	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
14-4	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
15-4	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
15-6	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
16-1	<1.0	<1.0	<1.0	<1.0	<1.0	3.4
17-1	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
FIELD CONTROL SAMPLES						
1	<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
3	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
18	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
LABORATORY DUPLICATE ANALYSES						
7-8	130	10	83	85	183	5,920
7-8R	119	9.7	76	77	169	5,418
14-4	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
14-4R	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
18	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
18R	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
LABORATORY BLANKS						
BSMME-1	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
BSMME-2	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
BSMME-3	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0

[1] CONCENTRATIONS BASED ON RESPONSE FACTOR OF MTBE

[2] CALCULATED USING THE SUM OF THE AREAS OF ALL INTEGRATED CHROMATOGRAM PEAKS AND THE INSTRUMENT RESPONSE FACTOR FOR TOLUENE

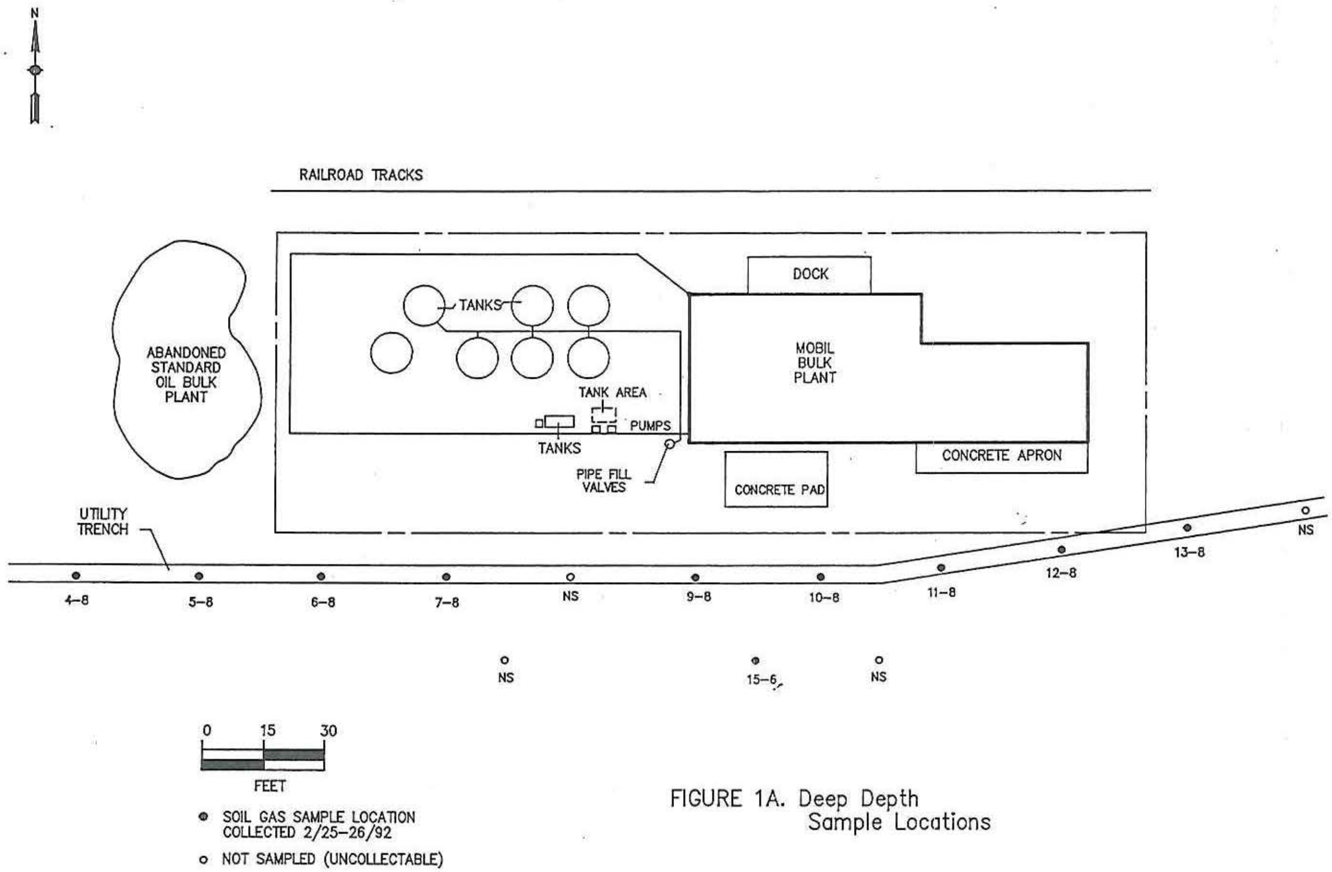


FIGURE 1A. Deep Depth Sample Locations

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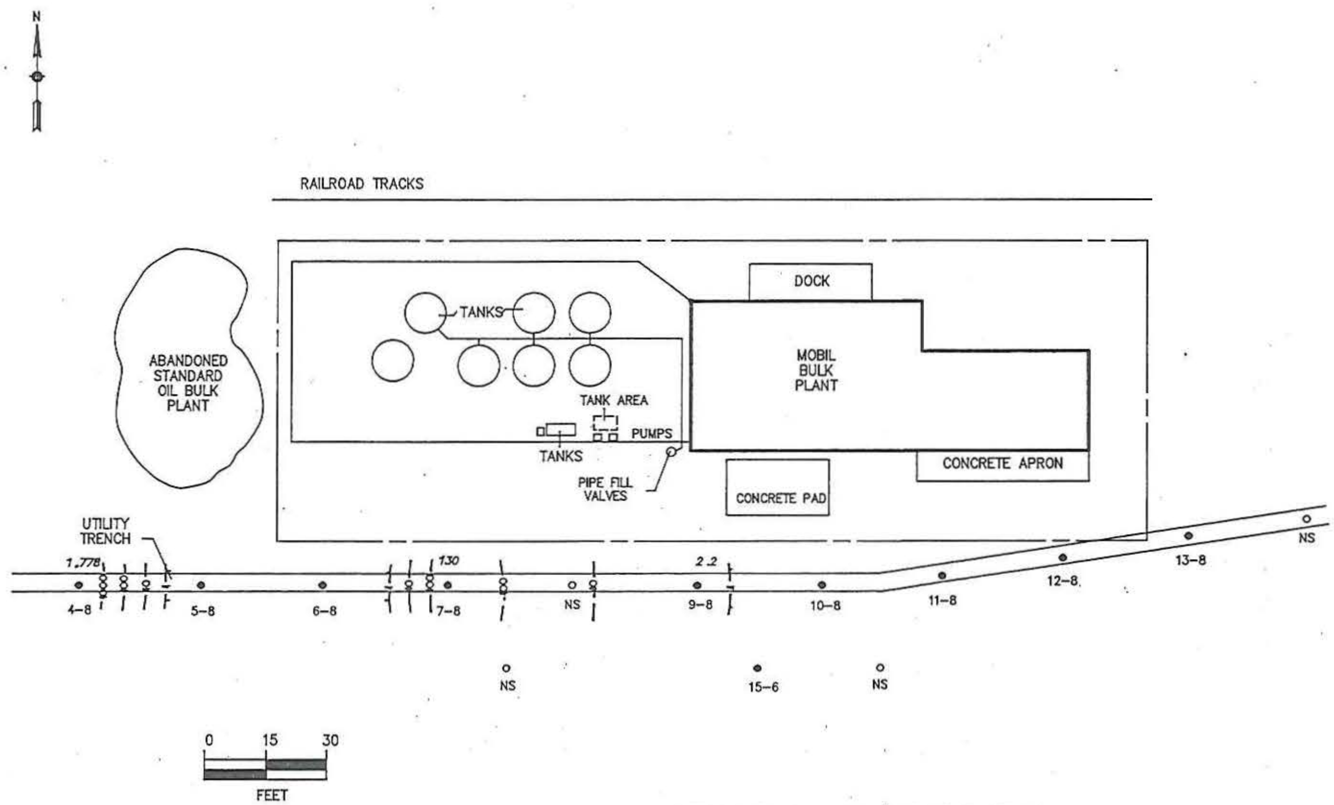
This map is integral to a written report and should be viewed in that context.



● SOIL GAS SAMPLE LOCATION COLLECTED 2/25-26/92

○ NOT SAMPLED (UNCOLLECTABLE)

FIGURE 3. Pentane/Methyl Tertiary Butyl Ether (MTBE) at Deep Depth ($\mu g/l$)

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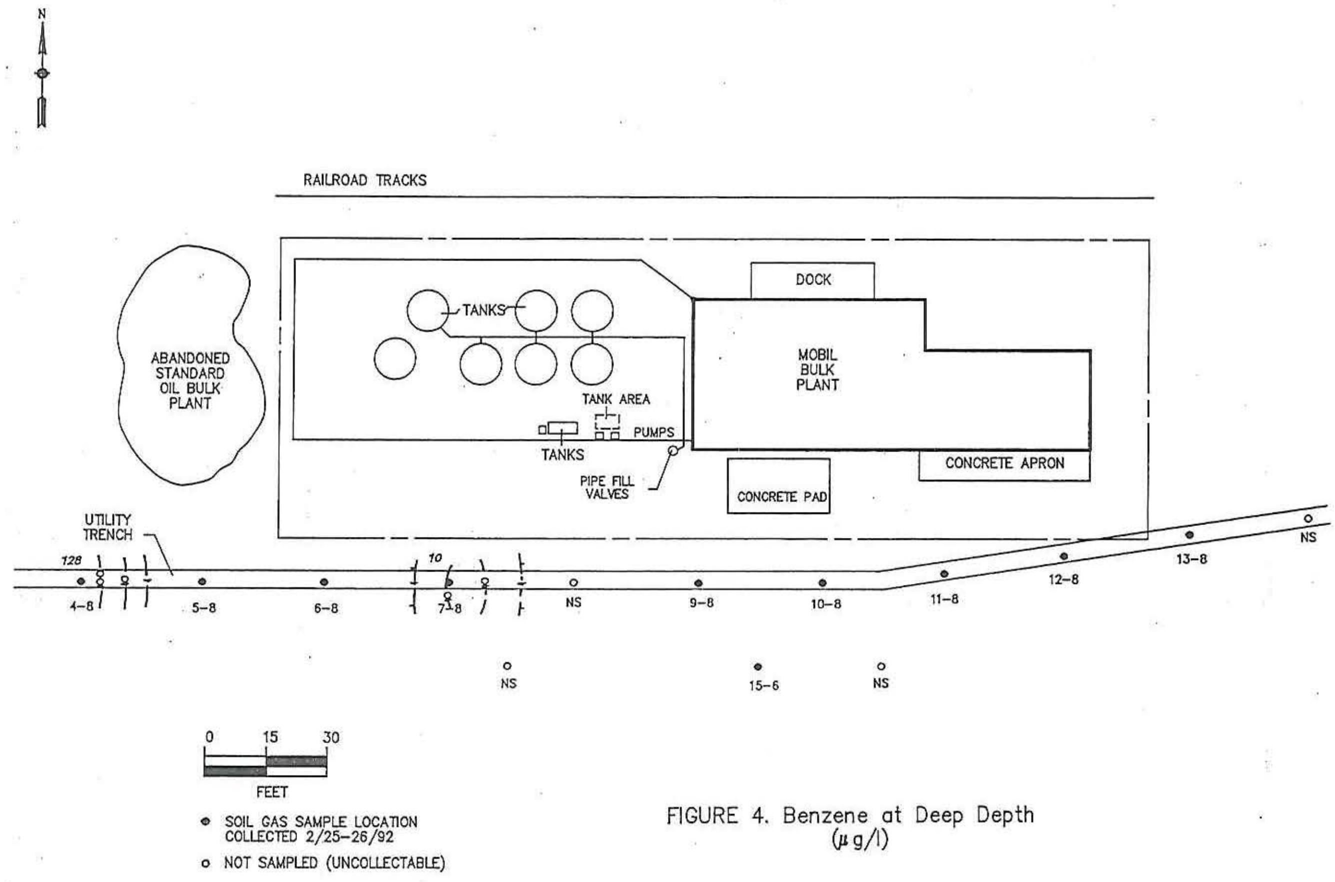

FIGURE 4. Benzene at Deep Depth (μg/l)

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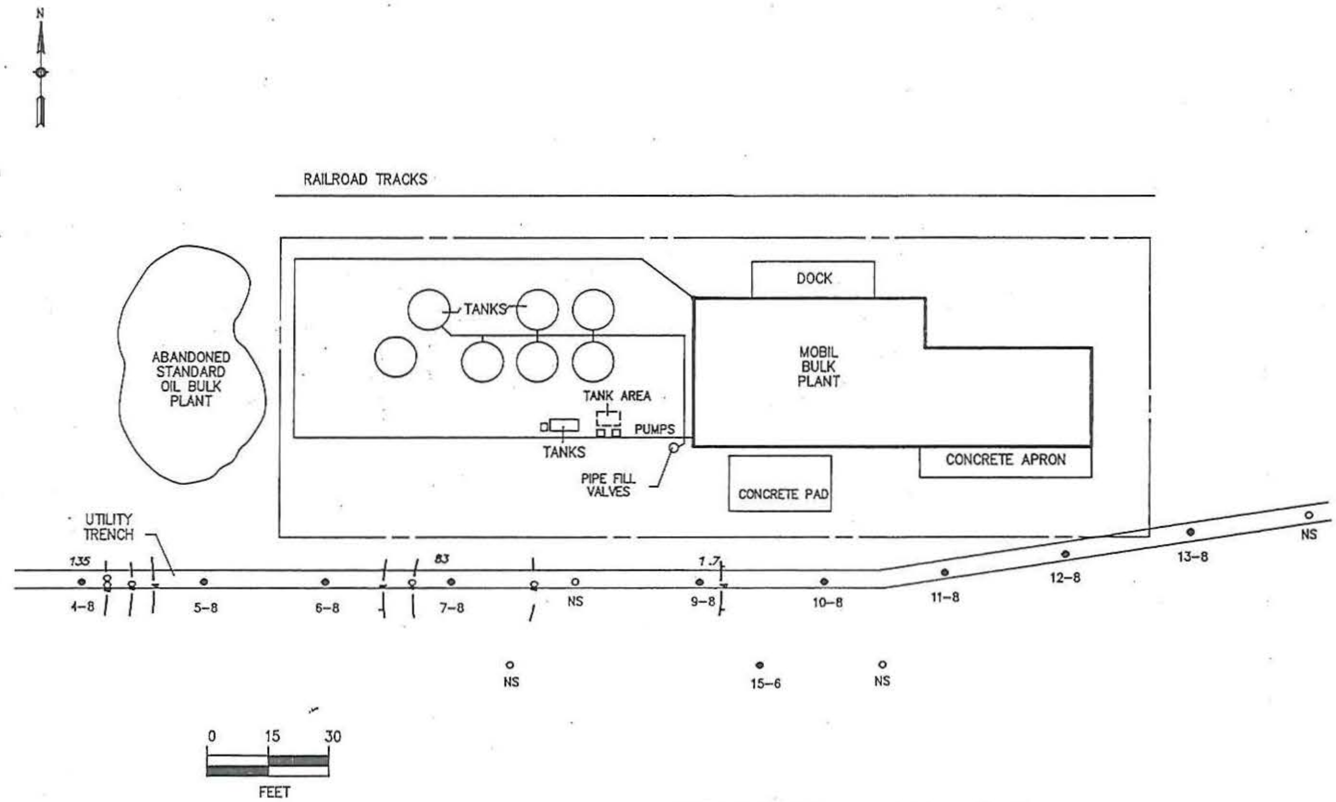

⊙ SOIL GAS SAMPLE LOCATION COLLECTED 2/25-26/92

○ NOT SAMPLED (UNCOLLECTABLE)

FIGURE 5. Toluene at Deep Depth (μg/l)

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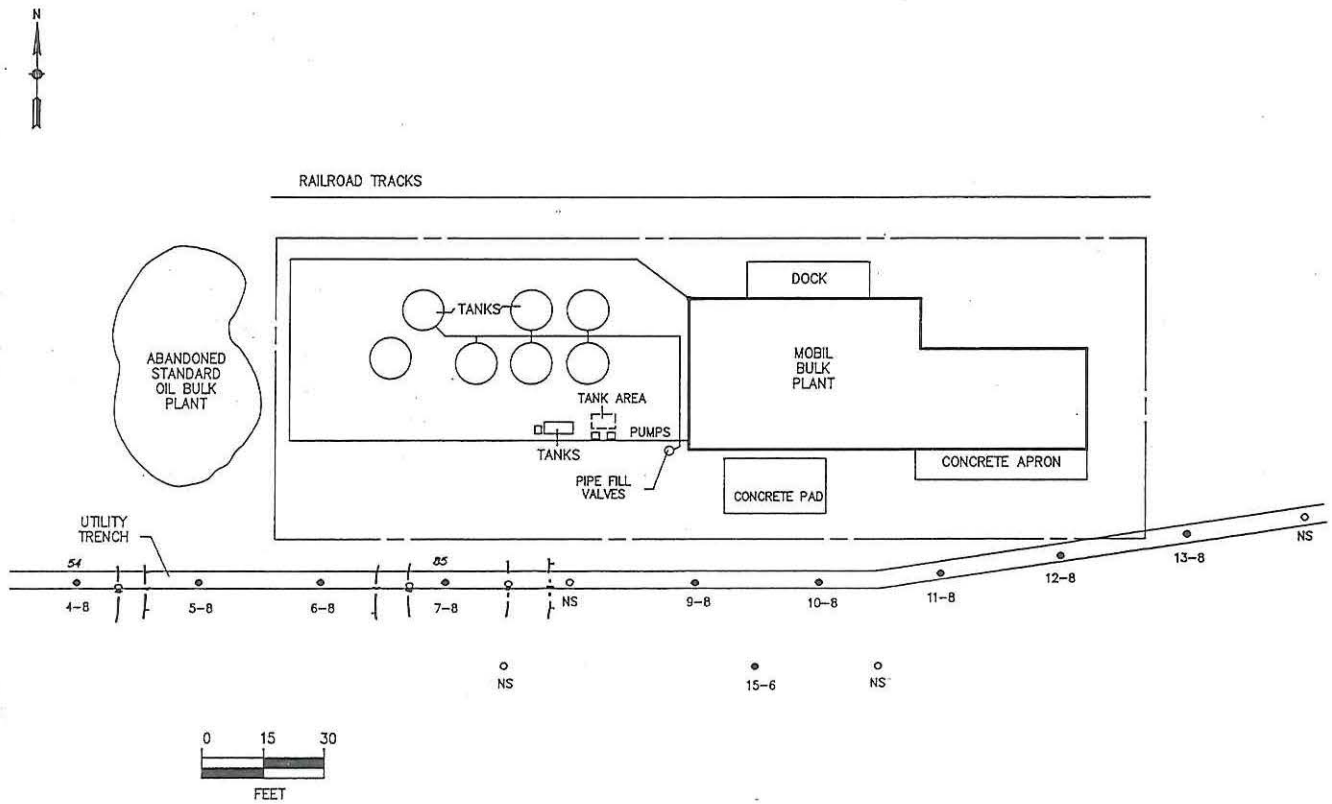

● SOIL GAS SAMPLE LOCATION COLLECTED 2/25-26/92

○ NOT SAMPLED (UNCOLLECTABLE)

FIGURE 6. Ethylbenzene at Deep Depth
(μg/l)

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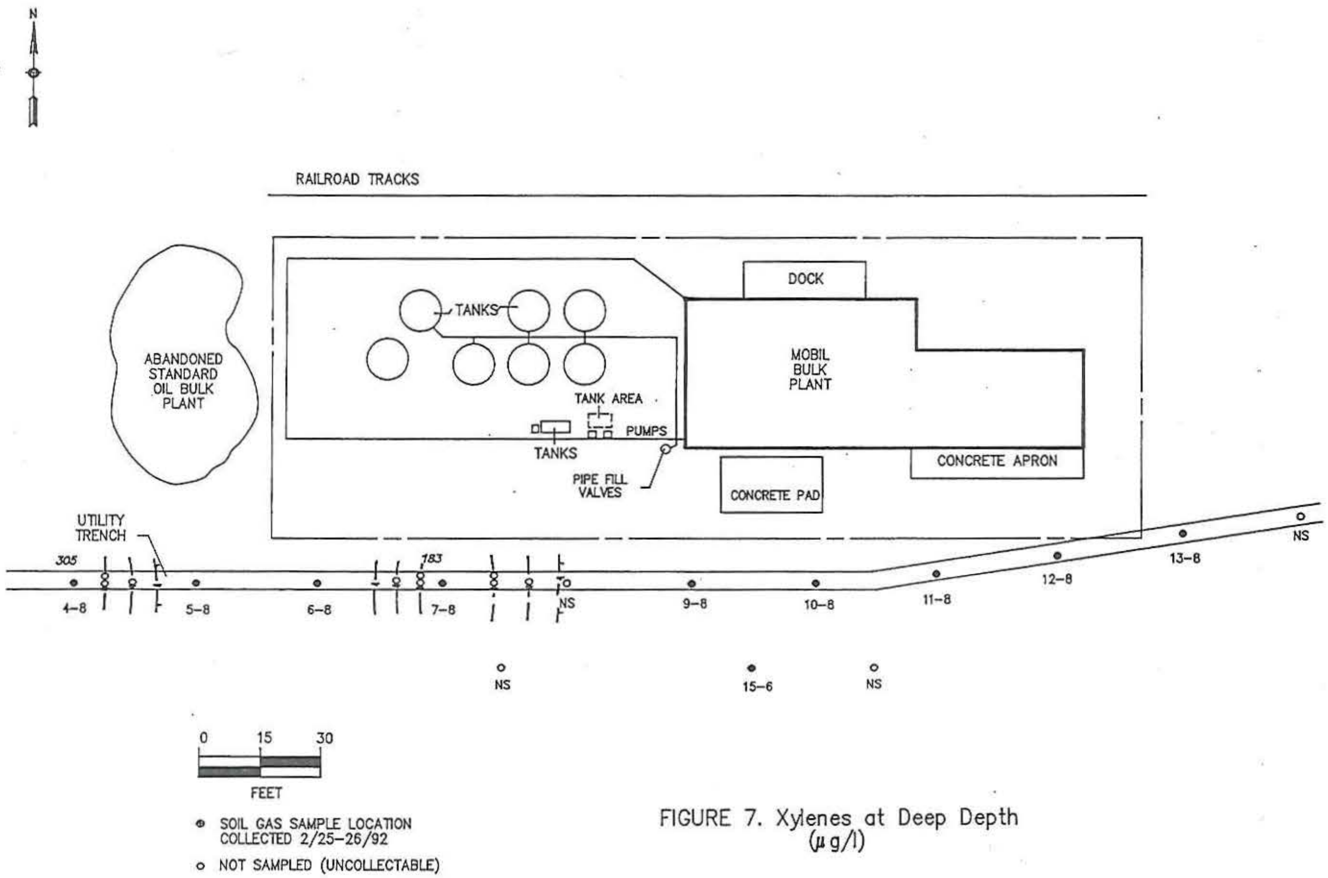

FIGURE 7. Xylenes at Deep Depth
(μg/l)

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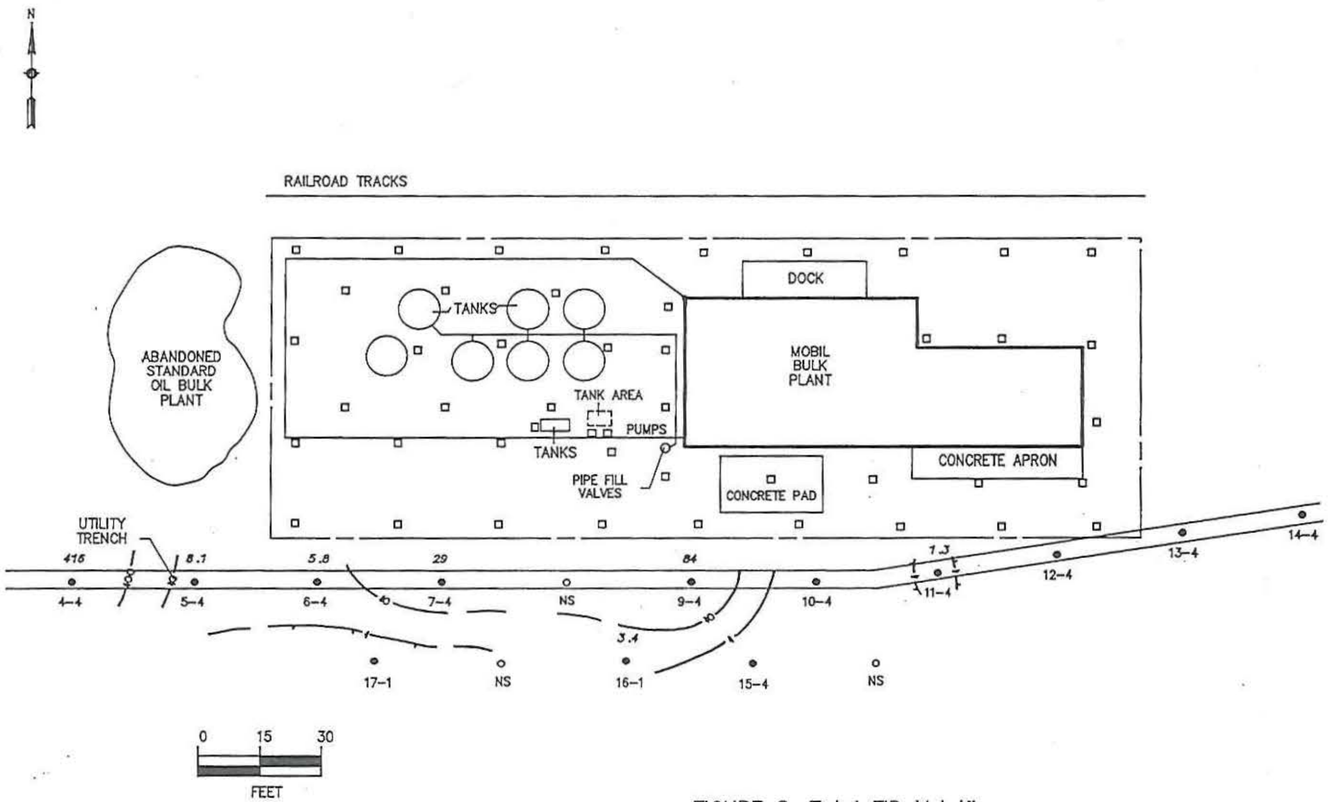

- ● SOIL GAS SAMPLE LOCATION COLLECTED 2/25-26/92
- □ SOIL GAS SAMPLE LOCATION COLLECTED 8/8/89
- o NOT SAMPLED (UNCOLLECTABLE)

FIGURE 8. Total FID Volatiles at Shallow Depth (calc'd μg/l)

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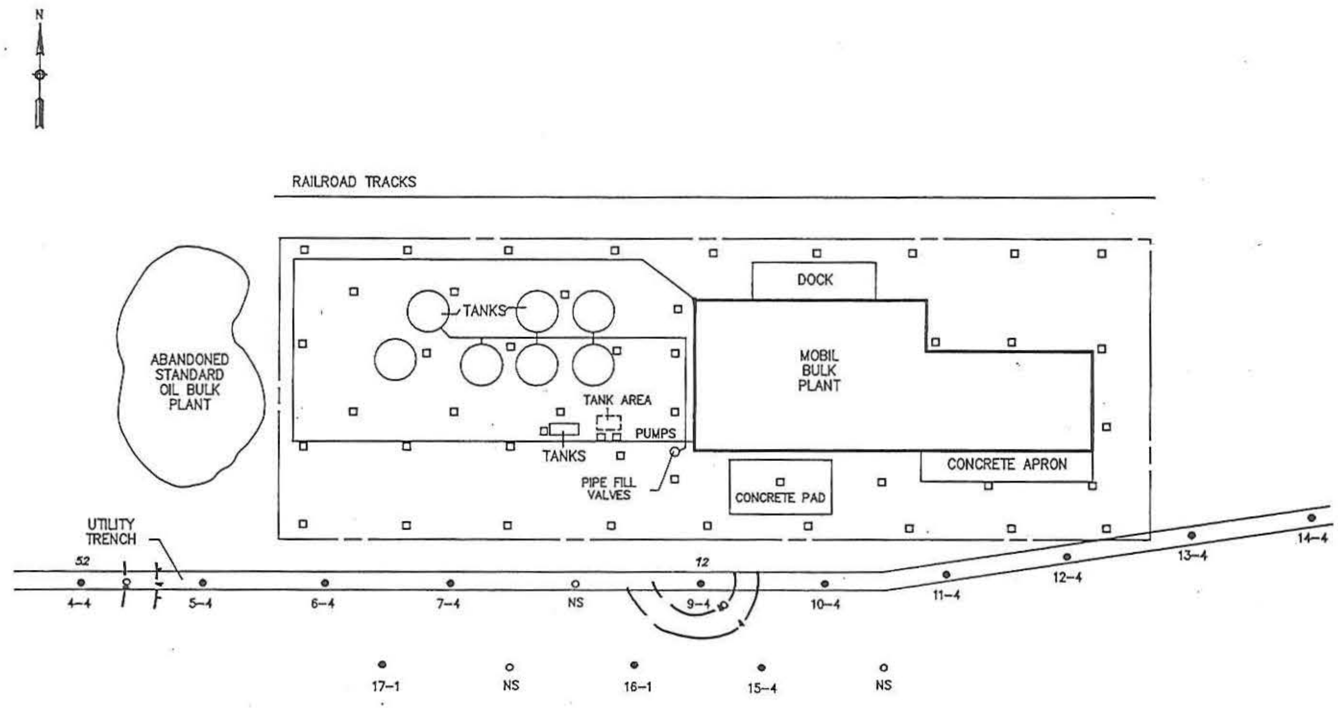

0 15 30
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- ● SOIL GAS SAMPLE LOCATION COLLECTED 2/25-26/92
- □ SOIL GAS SAMPLE LOCATION COLLECTED 8/8/89
- o NOT SAMPLED (UNCOLLECTABLE)

FIGURE 9. Pentane/Methyl Tertiary Butyl Ether (MTBE) at Shallow Depth ($\mu g/l$)

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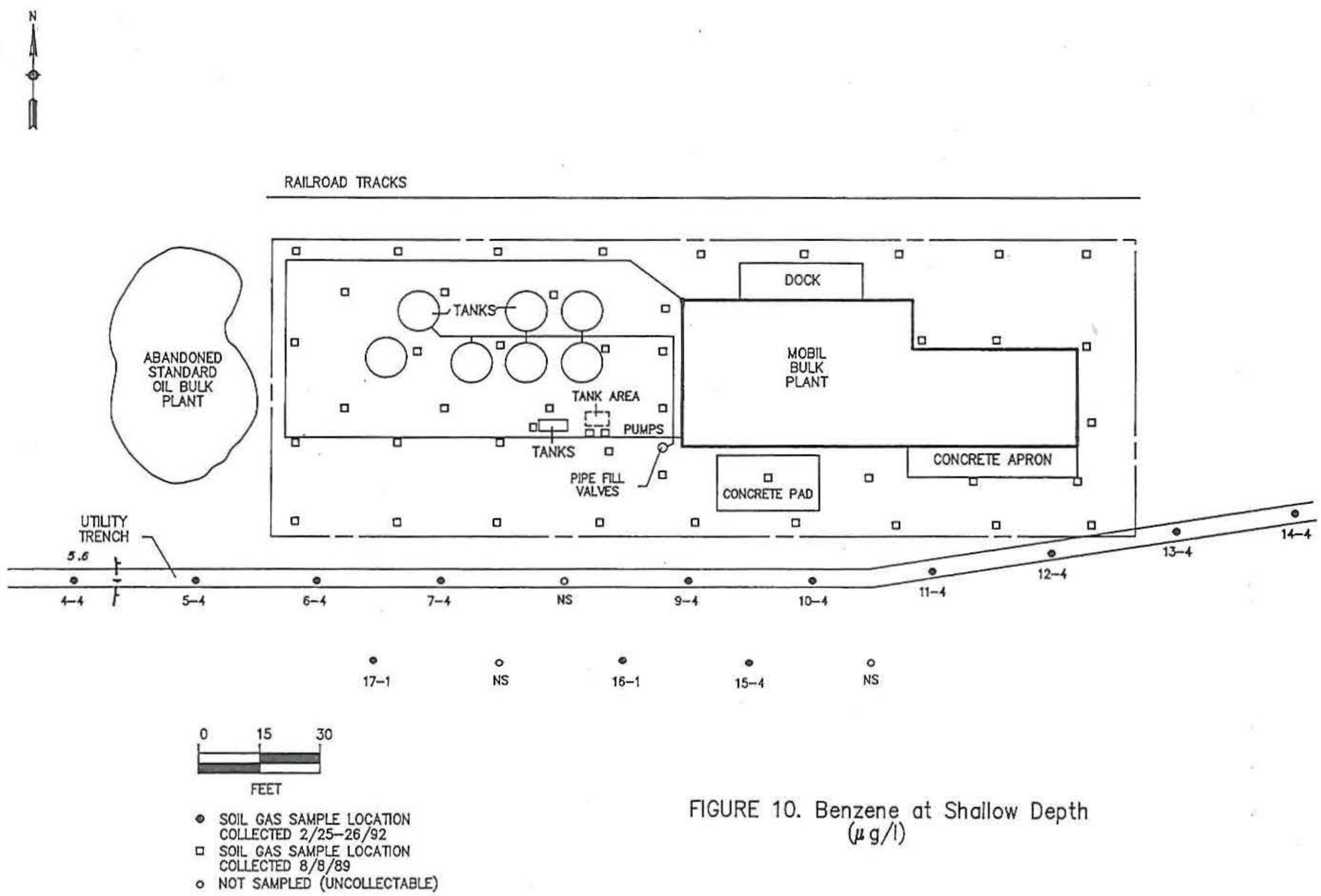

FIGURE 10. Benzene at Shallow Depth ($\mu g/l$)

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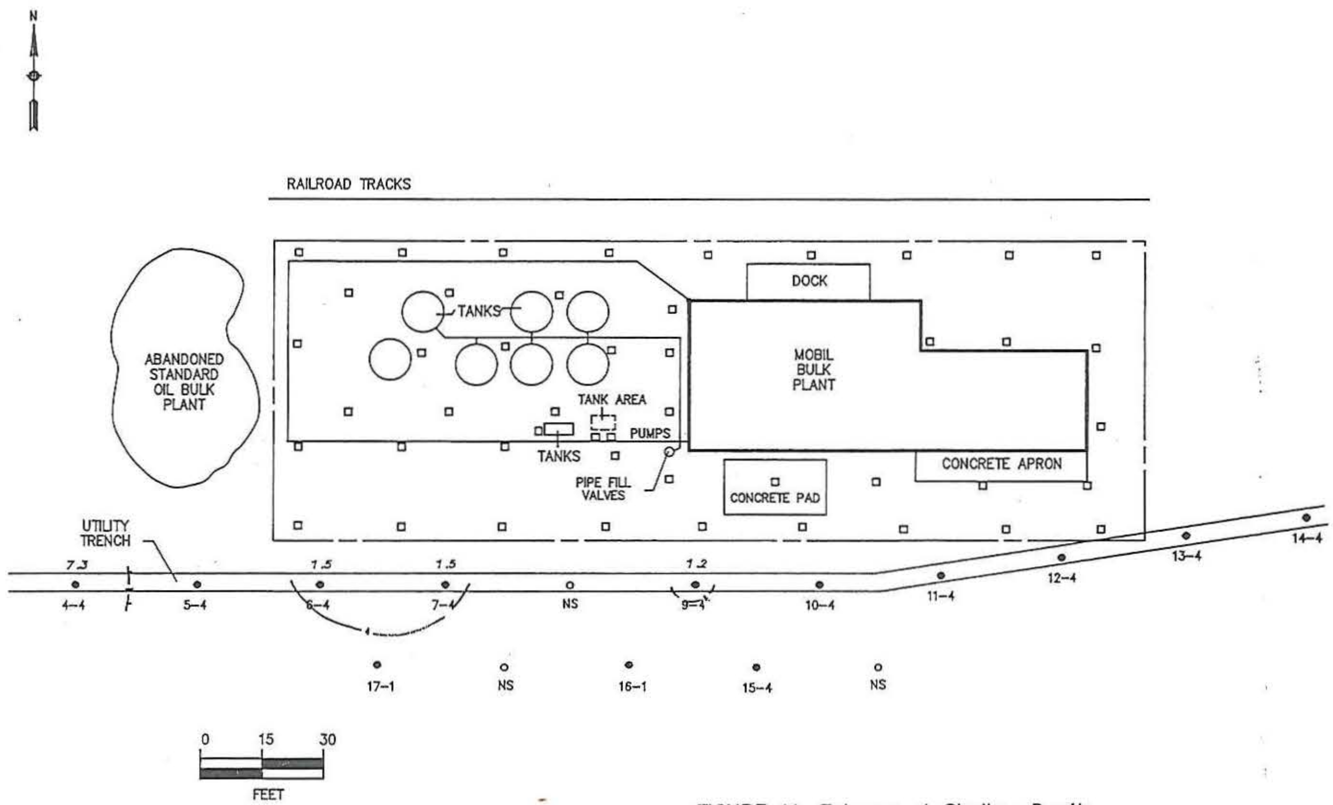

● SOIL GAS SAMPLE LOCATION COLLECTED 2/25-26/92
□ SOIL GAS SAMPLE LOCATION COLLECTED 8/8/89
○ NOT SAMPLED (UNCOLLECTABLE)

FIGURE 11. Toluene at Shallow Depth
(µg/l)

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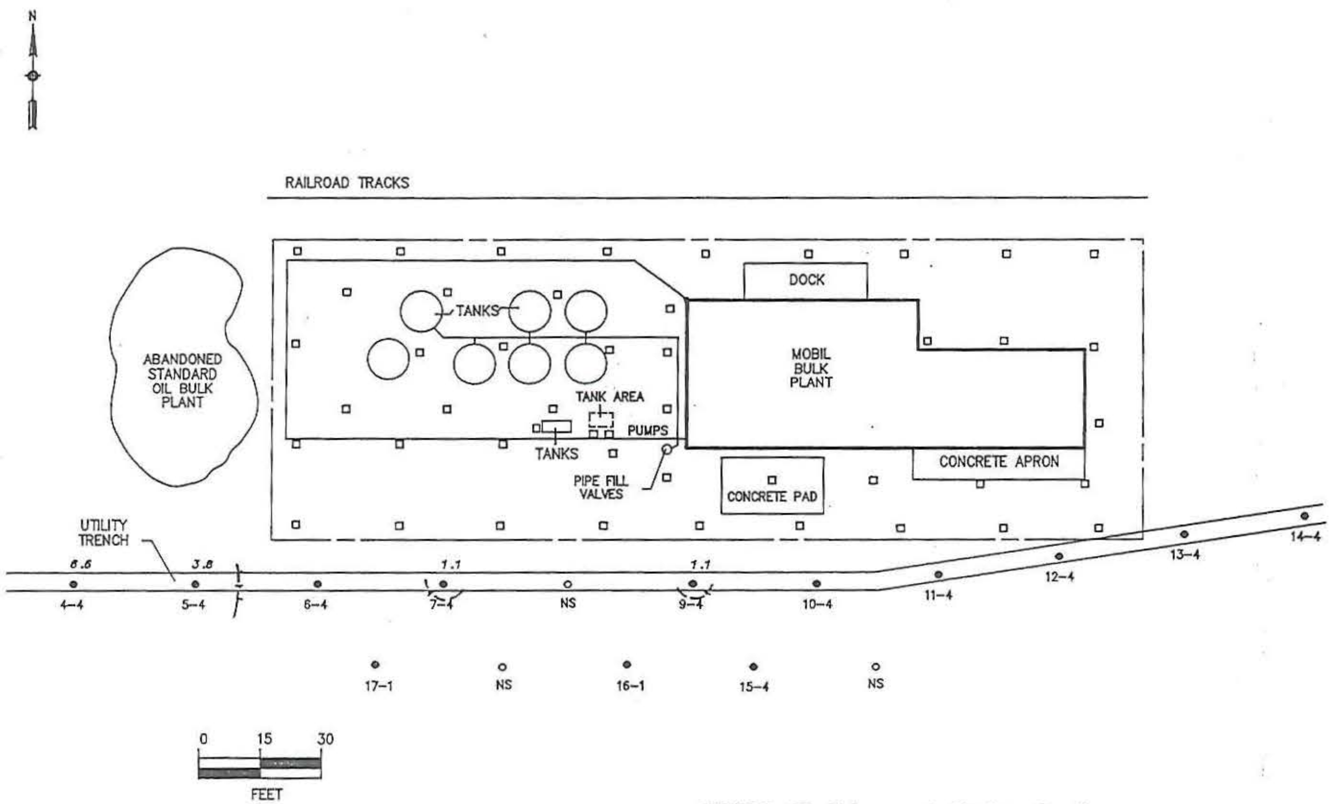

⊕ SOIL GAS SAMPLE LOCATION COLLECTED 2/25-26/92
□ SOIL GAS SAMPLE LOCATION COLLECTED 8/8/89
○ NOT SAMPLED (UNCOLLECTABLE)

FIGURE 13. Xylenes at Shallow Depth (μg/l)

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