2B GSIP Investigations Supporting Information

Benzene and Toluene Source Area Investigation (Roux Associates, 1998)

3004.023

B/T Source Inv. Results

ROUX Associates, Inc.

ENVIRONMENTAL CONSULTING & MANAGEMENT

BENZENE AND TOLUENE SOURCE AREA INVESTIGATION

Industri-Plex Site
Woburn, Massachusetts

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Prepared for:

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1.0 INTRODUCTION

A benzene and toluene source area investigation was conducted in the vicinity of the intersection of Commerce Way and Atlantic Avenue (Source Area Investigation) at the Industri-Plex Site (Site) during November and December 1997. The investigation was conducted by Roux Associates, Inc. and O'Reilly, Talbot and Okun Associates, Inc. on behalf of the Industri-Plex Site Remedial Trust (ISRT), and was performed in accordance with a work plan dated November 7, 1997 (Roux Associates 1997a) that was approved by the United States Environmental Protection Agency (USEPA) on November 7, 1997. Due to the impending redevelopment and road construction activities scheduled to begin in the area, the investigation was conducted as a fast-track study to generate screening level data from which to make prompt decisions regarding potential response actions.

The Source Area Investigation was focused around former monitoring well OW-16, which had been located northeast of the intersection of Commerce Way and Atlantic Avenue, within the southeast portion of the East-Central Hide Pile (Figure 1). From the time of its installation during the Phase 1 Remedial Investigation in 1983 until the time of its abandonment in 1993, OW-16 consistently exhibited toluene concentrations of 30,000 to 35,000 micrograms per liter (µg/L). OW-16 was screened from 15 to 35 ft beneath land surface. Depth to water at the former location of OW-16 is approximately 5 ft.

As part of the Supplemental Source Investigation (SSI) conducted in late 1996 and early 1997, a ground-water sample was collected from Geoprobe Point GW-3, located in the vicinity of former monitoring well OW-16, at a depth of 23 ft below land surface. This sample contained toluene at a concentration of 4 µg/L. Based upon these findings, the SSI Report concluded that toluene concentrations appeared to have declined significantly since the early 1990s, when GSIP Phase 1 and 2 were completed, and that these results suggested either a reduction in the strength of the toluene source in that area or a reduction in the leaching of the source area due to Site remedial measures completed since the GSIP Phase 1 and 2 (i.e., capping of the East-Central Hide Pile). However, the SSI Report cautioned that, given the limited data set developed during the SSI, the apparent dissipation of the toluene "hot spot" needed to be confirmed.

Benzene had never been detected in OW-16, nor was benzene detected in ground-water sample GW-3 during the SSI. Nonetheless, benzene was included in this Source Area Investigation at the request of USEPA based on their assertion that benzene had been detected in ground water entering a test pit excavated during a previous investigation in the same general area.

Based upon the historical data from OW-16 and the results of the SSI, the objective of the Source Area Investigation was to further investigate the potential for a continuing source of toluene or benzene in the vicinity of former monitoring well OW-16.

The subsequent sections of this report present the scope of work and the results of the Source Area Investigation.

2.0 SCOPE OF WORK

As presented in the USEPA-approved work plan, the field work completed for the Source Area Investigation included the following tasks:

- Task 1 - Soil Gas Survey;
- Task 2 - Geophysical Survey;
- Task 3 - Soil Sampling; and
- Task 4 - Ground-Water Sampling.

In addition, test pits were excavated at four locations based upon the results of Task 2 - Geophysical Survey. Descriptions of each of the above tasks, as well as the test pit excavation task, are provided below.

2.1 Task 1 - Soil Gas Survey

A soil gas survey was conducted on November 10 and 11, 1997, by Pine & Swallow Associates, Inc. (PSA) of Groton, Massachusetts, under the oversight of a Roux Associates, Inc. field geologist. Soil gas samples were collected at the 39 locations shown in Figure 2, with the exception of SG-22. As shown, the sample locations were based upon a 50-foot grid spacing over the 300 foot by 300 foot area specified in the work plan. Sample locations were modified as necessary to accommodate surface features (e.g., streams, wetlands, etc.). The soil gas samples were collected from a depth of 2 to 4 feet below land surface and analyzed in the field for benzene and toluene using a gas chromatograph (GC). There was no soil gas sample collected at SG-22 due to the presence of ground water at a depth of less than 3 ft. A sample of the ground water was collected and analyzed for benzene and toluene using the GC. There were no detections of either benzene or toluene in soil gas or ground water at concentrations exceeding the practical quantitation limit of 1 part per billion. Details regarding sampling and analysis methods and quality assurance/quality control (QA/QC) procedures are provided in Appendix A.

2.2 Task 2 - Geophysical Survey

A geophysical survey was performed using magnetometry and ground penetrating radar (GPR) technology. The survey was conducted from November 12 to 26, 1997, by Geophysics GPR International, Inc., of Needham Heights, Massachusetts, under the oversight of a Roux Associates, Inc. field geologist. As discussed in the USEPA-approved work plan, the magnetometer survey was to be conducted first to identify potential ferromagnetic anomalies within soil gas anomaly areas, and then the GPR survey was to be performed to further investigate the source(s) of any ferromagnetic anomalies identified using the magnetometer. As noted above, there were no detections of benzene or toluene during the soil gas survey; therefore, the magnetometer survey was conducted across the entire accessible portion of the initial 300 foot by 300 foot sample grid area. In addition, the magnetometer survey was expanded approximately 250 feet southward at the request of USEPA to include an additional area of reported historical detections of benzene and toluene in ground water. The GPR survey was also conducted across the entire accessible portion of the initial 300 foot by 300 foot area of investigation. Due to the fact that the GPR antenna is designed to be dragged continuously along the ground surface, rather than carried from point to point like the magnetometer, the area accessible to GPR was slightly less than the area accessible to the magnetometer. In order to enable resolution of individual anomalies which could be caused by buried drums or tanks, the magnetometer and GPR surveys were conducted along parallel transects spaced every 5-feet and 3-feet, respectively. Details regarding the geophysical survey methods are provided in Appendix B.

2.3 Task 3 - Soil Sampling

Soil boring and sampling was conducted from November 18 through November 21, 1997, using a Geoprobe™ rig at the 29 locations shown in Figure 3, with the exception of SB-EF4, SB-F3, SB-G3 and SB-I2 (these four locations were sampled only for ground water as described in Section 2.4). The work plan specified that soil boring and sampling would be performed using a Geoprobe™ in the areas exhibiting soil gas and geophysical anomalies. As noted in Section 2.1, there were no soil gas anomalies. Therefore, the 25 soil sampling locations were selected according to rationale presented below.

- The initial phase of soil boring and sampling included 10 locations based on a 100 ft grid spacing throughout the northern two-thirds of the sample grid area (the southern area was largely inaccessible to the Geoprobe™). These boring locations include SB-A2, SB-A4, SB-C2, SB-C4, SB-C6, SB-E2, SB-E4, SB-E6, SB-G2 and SB-G4.

- In response to the request of USEPA's field representatives, ten soil sampling locations were added in three specific areas: the area of a former excavation on the west bank of the Aberjona River where toluene had been detected in ground water (soil borings SB-M2 and SB-FG2); the area of former monitoring well OW-16 (soil borings SB-E3 and SB-F2); and within the area earmarked for construction of a storm water retention basin as part of road construction activities (SB-I4, SB-I6, SB-K4, SB-L6, SB-M3 and SB-M5).

- Based upon the results of the magnetometer survey, which showed numerous magnetic anomalies in the central and eastern portion of the initial 300 by 300 foot grid area, five more soil sampling locations (SB-D4, SB-D6, SB-D7, SB-E5, and SB-E7) were added in this area to investigate the anomalies. In addition, location SB-E6 was resampled.

Soil samples were collected continuously down to the water table or to the point of Geoprobe™ refusal at each location. The samples were collected with a core sampler equipped with a single-use acetate liner. Upon retrieval the liner was sliced open and the sample immediately collected from the center portion of the soil. Forty-two samples were screened in the field for the presence of benzene and toluene using MADEP-approved ENSYS Enviroguard™ BTEX-in-soil field test kits. Calculation forms for the test kits are provided in Appendix C. Five soil samples were sent to the American Environmental Network (AEN) laboratory located in North Billerica, Massachusetts for confirmatory analyses. These samples were analyzed for BTEX using USEPA Methods 8240 and 8020. The laboratory reports for the five samples are provided in Appendix D.

2.4 Task 4 - Ground-Water Sampling

Shallow ground-water samples were collected from approximately 2 feet below the water table at all soil boring locations with the exception of five locations where refusal was encountered prior to reaching the water table (locations SB-D6, SB-D7, SB-E5, SB-E6 and SB-E7). In response to the request of USEPA's field representatives, four additional sampling locations were added

(SB-EF4, SB-F3, SB-G3 and SB-I2). At these four locations, as well as at locations SB-M2, SB-E2 and SB-E3, deeper ground-water samples were collected from depths ranging from 5 to 20 feet beneath the water table.

A total of 29 ground-water samples were analyzed in the field for benzene and toluene using a GC. The samples collected on November 18, 1997, were analyzed by PSA, while the samples collected from November 19 through November 21, 1997, were analyzed by O'Reilly, Talbot & Okun Associates, Inc. (OTO) of Springfield, Massachusetts. The analytical methods used by PSA and OTO are described in Appendices A and E, respectively. Three ground-water samples were sent for confirmatory analysis to AEN. These samples were analyzed for BTEX using USEPA Method 8020. The laboratory reports for these three samples are provided in Appendix D.

2.5 Test Pit Excavations

Four test pits were excavated at the locations shown in Figure 4. These locations were selected based upon the results of the geophysical survey which indicated the potential presence of cylindrical objects such as drums or USTs.

3.0 SOURCE AREA INVESTIGATION RESULTS

The results of the Source Area Investigation are presented in the following sections.

3.1 Soil Gas Survey Results

As noted in Section 2.1 there were no detections of benzene or toluene in any of the 38 soil gas samples. Appropriate QA/QC procedures were followed during the survey to ensure that the analytical equipment was functioning correctly. Appendix A provides descriptions of the soil gas analysis and QA/QC procedures, and a tabular summary of soil gas results.

The USEPA's field representative expressed concern that rain events just prior to implementation of the soil gas survey could have prevented the effective use of this technology. However, Roux Associates believes that the soil gas results are valid because toluene was detected only at depths greater than five feet below the water table. Roux Associates does not expect toluene to be present in soil gas, since no toluene was present in the uppermost part of the saturated zone.

3.2 Geophysical Survey Results

The results of the geophysical survey are summarized below. Additional details and maps of the geophysical survey results are provided in Appendix B.

The magnetometer survey results for the central and eastern portions of the study area revealed numerous anomalies that could not be attributed to visible surface features or to known subsurface features. These anomalies are shown in Figure 4A (Appendix B). The anomalies designated with an "A" in Figure 4A (Appendix B) are the anomalies which the geophysicist considered to have some potential to be attributed to the presence of a buried drum(s) or UST. The magnetic anomalies measured in the southern and western parts of the study area were attributed to the numerous ferrous objects, such as car parts, construction debris, and discarded household items, observed in these areas. Additionally, the geophysicist indicated that a number of anomalies in the southern portion of the study area were associated with bedrock exposures.

Figure 4B (Appendix B) provides the interpretation map for the GPR survey. The anomalies designated with an "A" in Figure 4B (Appendix B) are the GPR anomalies which the geophysicist considered to have some potential to be attributed to the presence of a buried drum(s) or UST. It is important to note that correlation of maps 4A and 4B indicates that none of the anomalies designated with an "A" in Figure 4A yielded a GPR anomaly indicative of a buried drum or tank. Thus, it is highly unlikely that any such features are present at those locations.

In order to facilitate comparison of the magnetometer and GPR survey anomalies with the results from other Source Area Investigation tasks, the anomalies designated with an "A" in Figures 4A and 4B (Appendix A) have been superimposed onto the Source Area Investigation sampling grid (Figure 4).

3.3 Soil Boring and Sampling Results

The results of the soil boring and sampling are summarized on Table 1. These results include lithologic descriptions for all soil samples collected, photoionization detector (PID) readings and BTEX test kit and laboratory analytical results (where applicable). A discussion of this data is provided below.

Sample Descriptions: The soil underlying the sampling grid area is comprised predominantly of fine to medium grained sand, with lesser amounts of silt and fine to coarse gravel. The soil from 0 to 2 feet was typically brown to orange-brown in color, while deeper soils typically ranged from dark brown to grey and black in color. Strong odors were only noted in the soil samples from borings SB-A2 and SB-C2, both within the capped portion of the East-Central Hide Pile. These odors were more typical of the decaying organic matter present in the capped hide pile, rather than an aromatic hydrocarbon odor that would be associated with benzene or toluene. Slight odors were also associated with the samples from borings SB-M2 and SB-D4.

PID Readings: The PID readings obtained from the screening of soil samples ranged from 1.1 parts per million (ppm) to a maximum of 3.1 ppm (Table 1). Based on our experience at petroleum spill sites, these PID readings are one to two orders of magnitude lower than would be expected if the soil had contained benzene or toluene at "source area" concentrations.

Test Kit Results: The BTEX-in-soil test kit results ranged from less than 1 ppm at several locations, to a maximum of 60 ppm at SB-M3, 2 to 4 ft (Table 1). Twenty-five of the 42 samples exhibited BTEX-in-soil test kit results of less than 2 ppm; 11 of the 42 were between 2 and 10 ppm; and six of the 42 test kit results were greater than 10 ppm. The table below provides a comparison of the test kit results with the laboratory results for the five samples sent for confirmatory analysis.

		Laboratory Analytical Results				
Sample ID	**BTEX Test Kit Result (ppm)**	**Benzene (µg/kg)**	**Toluene (µg/kg)**	**Ethylbenzene (µg/kg)**	**Xylenes (µg/kg)**	**Total BTEX (µg/kg)**
SB-E4/4-6	12.5	<1	<2	<2	<2	ND
SB-E6/2-4	1.3	<1	3	<2	2	5
SB-F2/2-4	1.4	<1	<2	<2	2	2
SB-F2/4-6	30	<1	<2	<2	<2	ND
SB-M2/4-6	12.5	<1	<2	<2	<2	ND

The above table indicates that the BTEX-in-soil test kits yielded false positive BTEX detections and overestimated the BTEX concentrations by several orders of magnitude. The ppm-range concentrations determined by the test kits are not consistent with the field observations (i.e., no aromatic hydrocarbon odors) nor the soil gas survey results (i.e., benzene and toluene were not detected). A possible explanation for these false positives and overestimated BTEX concentrations is the potential presence of other organic matter or non-target compounds within the soil samples.

Borings at Geophysical Anomalies: As discussed in Section 3.2, there were numerous magnetometer anomalies throughout the northeast portion of the Peninsula Area. Soil Borings SB-D4, SB-D6, SB-D7, SB-E5 and SB-E7 were performed to investigate the soil conditions in this area. The shallow refusal depth and unsaturated soil conditions at each of these locations is indicative of the presence of shallow bedrock throughout this area, which is consistent with the observation of numerous bedrock outcrops. Based upon these data, as well as the absence of any impacted soil, the geophysical survey anomalies in the northeast portion of the Peninsula Area are attributed to the presence of the shallow bedrock.

3.4 Ground-Water Sampling Results

The locations and depths of ground-water samples collected during the Source Area Investigation, as well as the analytical results for toluene in the ground-water samples, are shown in Figure 3. Benzene was not detected in any of the ground-water samples. The results for toluene are discussed below.

Toluene was not detected in any of the shallow ground-water samples (i.e., those collected within five feet of the water table). Toluene was detected in 5 of the 9 ground-water samples collected from depths exceeding five feet beneath the water table (locations SB-G3, SB-F3, SB-M2, SB-E2 and SB-I2 in Figure 3). Concentrations ranged from 50 µg/L in SB-I2 (14 feet below land surface) to 20,000 µg/L at SB-G3 (13 feet below land surface). The table below provides a comparison of the field GC results with the laboratory results for the three samples sent for confirmatory analysis.

Sample ID	Benzene - Field GC	Benzene - Lab	Toluene - Field GC	Toluene - Lab
GW-C2	<1	<25	1	<25
GW-EF4	<25	<1	<25	<1
GW-F3	<25	<200	13,000	19,000

The above results indicate general agreement between the field GC and off-site laboratory results.

3.5 Test Pit Observations

Test pits were excavated at the four locations shown in Figure 4. From north to south, these excavations revealed:

- a 2-inch PVC well broken below grade and a piece of metal debris;
- a reinforced concrete drainage vault;
- a small bundle of wire; and
- the sewer connection for the trailer compound formerly located in the area.

Inspections of the test pits and the materials encountered indicate that none of these represent the source of the toluene.

4.0 SUMMARY OF FINDINGS AND CONCLUSIONS

- The results of the soil gas survey, magnetometer survey, ground-penetrating radar survey, soil sampling and analysis, ground-water sampling and analysis, and test pit excavation, combined with the results of prior investigations, conclusively demonstrate that the toluene detected in ground water north of the intersection of Commerce Way and Atlantic Avenue is not the result of leakage from buried drums or tanks and that there is no ongoing source of toluene in the study area.

- The toluene "hot spot" is currently located immediately north of the intersection of Commerce Way and Atlantic Avenue, just slightly south (approximately 50 ft) of its 1991/1992 location.

- Toluene concentrations in the "hot spot" range from 2,400 to 20,000 µg/L at depths ranging from 13 to 25 feet below land surface. Consequently, the "hot spot" is below the depth of the excavations needed to construct the Commerce Way extension and the I-93 interchange.

Respectfully Submitted,

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Table 1. Summary of Geoprobe™ Soil Boring and Sampling Data for the Benzene and Toluene Source Area Investigation, Intersection of Commerce Way and Atlantic Avenue, Industri-Plex Site, Woburn, Massachusetts

					BTEX		
Boring Designation	Sampling Date	Depth Interval (ft bls)	Lithologic Description	PID Reading (ppm)	Test Kit Results (ppm)	Laboratory Results (µg/kg)	Remarks
SB-C2	11/18/97	0 - 2	Grey F-M SAND, little F-C Gravel (fill), Dry to Moist	<1.3	---	---	No odor
	11/18/97	2 - 4	Orange-brown to light brown F-M SAND, Moist	<1.3	0	---	Slight odor
	11/18/97	4 - 6	Brown to light brown to grey SAND, little F-M Gravel; Moist	<1.3	1.3	---	Slight odor
	11/18/97	6 - 8	Brown to light brown and grey F-M SAND, followed by dark brown to black F-M SAND; Very Moist	<1.3	0	---	Strong odor
SB-A2	11/18/97	0 - 2	Grey F-M SAND; little F-C Gravel; Dry to Slightly Moist	<1.3	---	---	No odor
	11/18/97	2 - 4	Brown-orange to light brown F-M SAND; Moist	<1.3	---	---	Slight odor
	11/18/97	4 - 6	Brown to light grey SAND, little F-M Gravel; Moist	<1.3	---	---	Slight Odor
	11/18/87	6 - 8	Dark brown to grey to black SAND, little F-M Gravel; Very Moist	<1.3	---	---	Strong odor, fibrous material (hide)
SB-E2	11/18/97	0 - 2	Grey F-M SAND, little Gravel; Dry to Moist	<1.3	---	---	No odor
	11/18/97	2 - 4	Brown to orange F-M SAND, little F-M Gravel; Moist	<1.3	1.15	---	No odor
	11/18/97	4 - 6	Brown to light brown to grey SAND, Gravel (F-C) at lower level; Moist	<1.3	2.3	---	No odor
SB-G2	11/18/97	0 - 2	Grey F-M SAND, little Gravel; Dry to Moist	<1.3	---	---	No odor
	11/18/97	2 - 4	Brown to light brown to orange to grey SAND, little F-C Gravel; Moist	<1.3	2.5	---	Hit black plastic object
SB-G4	11/18/97	0 - 2	Brown F-M SAND, some Silt, little F-C Gravel; Moist to Wet	<1.3	1.1	---	No odor
	11/18/97	2 - 4	Brown F-M SAND, some Silt, little F-C Gravel; Wet at 4 ft	<1.3	1.45	---	Slight odor

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					BTEX		
Boring Designation	Sampling Date	Depth Interval (ft bls)	Lithologic Description	PID Reading (ppm)	Test Kit Results (ppm)	Laboratory Results (µg/kg)	Remarks
SB-E4	11/18/97	0 - 2	Orange-brown to brown F-M SAND, little Silt, little F-C Gravel; Moist	<1.3	---	---	No odor (fill)
	11/18/97	2 - 4	Brown to dark brown F-M SAND, some Silt, little F-C Gravel; Moist	2.5	2.4	---	Geotextile barrier at 2 ft bls, no odor
	11/18/97	4 - 6	Dark brown to black mottled F-M SAND, some Silt, little F-M Gravel; Moist	1.7	12.5	ND	No odor
	11/18/97	6 - 8	Dark brown F-M SAND, some Silt, little F-M Gravel; Wet at 6 ft, becomes grey F-M SAND, trace Silt at 7.5 ft	<1.3	---	---	
SB-C4	11/19/97	0 - 2	Grey to brown to orange F-M SAND, trace Gravel; Dry to Moist	<1.1	---	---	
	11/19/97	2 - 4	Orange-brown to black F-M SAND; Moist	1.8	---	---	Ground water at 4.5 ft bls
SB-A4	11/19/97	0 - 2	Brown F-M SAND, little Gravel; Moist	<1.1	---	---	
	11/19/97	2 - 4	Brown to dark brown SAND; Moist	1.7	1.6	---	
	11/19/97	4 - 6	Dark brown to brown to grey to black SAND, little Gravel; Moist	1.4	3.2	---	Ground water at 6.5 ft bls
SB-E3	11/19/97	0 - 2	Dark brown SAND, little Gravel; Dry to Moist	<1.1	---	---	
	11/19/97	2 - 4	Brown to dark brown F-M SAND; Moist	2.1	1.2	---	
	11/19/97	4 - 6	Dark brown to black F-M SAND, little Gravel; Very Moist	3.1	47	---	
	11/19/97	6 - 8	Black to grey F-M SAND; Very Moist	<1.1	4.4	---	Ground water at 6.5 ft bls
SB-F2	11/19/97	0 - 2	Light orange brown F-M SAND, trace Silt; Moist	<1.1	---	---	No odor, geotextile liner at 2 ft bls
	11/19/97	2 - 4	Brown to dark brown F-M SAND, Some Silt, little F-M Gravel; Moist	1.7	1.4	2	No odor
	11/19/97	4 - 6	Dark brown to black F-M SAND; Moist	1.9	30	ND	No odor
SB-I4	11/19/97	0 - 2	Brown to dark brown F-M SAND; Moist	<1.1	---	---	No odor
	11/19/97	2 - 4	Dark brown to black F-M SAND; Very Moist	1.9	1.3	---	No odor
SB-M3	11/19/97	0 - 2	Brown to dark brown F-M SAND; Moist	<1.1	---	---	Slight odor (swamp)
	11/19/97	2 - 4	Dark brown to black F-M SAND, little F-M Gravel; Very Moist	7.5	60	---	Ground water at 3 ft bls

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					BTEX		
Boring Designation	Sampling Date	Depth Interval (ft bls)	Lithologic Description	PID Reading (ppm)	Test Kit Results (ppm)	Laboratory Results (µg/kg)	Remarks
SB-M5	11/19/97	0 - 2	Dark brown F-M Sand, little F-M Gravel; Moist	<1.1	---	---	No odor
	11/19/97	2 - 4	Dark brown to black F-M SAND, little F-M Gravel; Very Moist	2.1	1.8	---	No odor, ground water at 2.5 ft bls
SB-FG2	11/19/97	0 - 2	Grey to Brown F-M SAND, little F-M Gravel	<1.1	---	---	
	11/19/97	2 - 4	Brown to orange-brown F-M SAND; Moist	2.2	1.3	---	
	11/19/97	4 - 6	Brown to orange-brown to grey F-M SAND, little F-M Gravel; Very Moist	2.4	5.8	---	No odor, ground water at 6.5 ft bls
SB-C6	11/20/97	0 - 2	Dark brown to black F-M SAND; little F-M Gravel; Very Moist	<1	---	---	
	11/20/97	2 - 4	Dark brown to black F-M SAND; Moist	1.8	3.6	---	No odor
	11/20/97	4 - 6	Black to brown SAND, little F-C Gravel; Very Moist	1.9	1.3	---	No odor, ground water at 6 to 6.5 ft bls
SB-E6	11/20/97	0 - 2	Brown F-M SAND, little F-M Gravel	<1	---	---	
	11/20/97	2 - 4	Dark brown to black F-M SAND, little Gravel, Slightly Moist	1.7	1.3	5	Geotextile barrier at 1 ft bls
	11/20/97	4 - 6	Brown to grey F-M SAND, F-C Gravel	1.7	1.25	---	No odor
SB-K4	11/20/97	0 - 2	Dark brown F-M SAND; little Gravel; Moist	<1	---	---	
	11/20/97	2 - 4	Dark brown F-M SAND, little F-M Gravel	2	1.9	---	Refusal at 3 ft, bls, ground water at 2.5 ft bls
SB-I6	11/20/97	0 - 2	Dark brown to brown F-M SAND, little Gravel	1.8	1	---	Refusal at 2.5 ft bls
SB-L6	11/20/97	0 - 2	Brown to dark brown F-M SAND, little F Gravel; Moist	<1	---	---	
SB-L6	11/20/97	2 - 4	Dark brown F-M SAND; Moist	2.1	5.8	---	
SB-L6	11/20/97	4 - 6	Dark brown to black to brown F-M SAND, little F-M Gravel; Moist	2	1.85	---	Ground water at 5 ft bls, refusal at 5.5 ft bls
SB-M2	11/20/97	0 - 2	Grey F-M SAND, little Gravel; Dry to Moist	<1	---	---	No odor
	11/20/97	2 - 4	Brown to grey to black F-M SAND; Moist	4.1	5.8	---	Odor
	11/20/97	4 - 6	Black to grey F-M SAND; Very Moist	6.2	12.5	ND	Odor

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					BTEX		
Boring Designation	Sampling Date	Depth Interval (ft bls)	Lithologic Description	PID Reading (ppm)	Test Kit Results (ppm)	Laboratory Results (µg/kg)	Remarks
SB-D4	11/21/97	0 - 2	Dark brown F-M SAND, some Silt, little F-C Gravel, becomes light brown to orange brown F-M SAND at 0.5 ft; Moist	<1	---	---	Geotextile barrier at 2 ft bls
	11/21/97	2 - 4	Dark brown to black F-M SAND, some Silt, trace Gravel; Moist to Wet	1.8	5.6	---	Slight odor
	11/21/97	4 - 6	Dark brown to black F-M SAND, some Silt; Moist to Wet at 6 ft	1.7	0.6	---	Slight odor
	11/21/97	6 - 8	Dark brown to black grades to grey-brown F-M SAND, little Silt; Wet	<1	---	---	No odor
SB-E5	11/21/97	0 - 2	Dark brown grades to orange-brown F-M SAND, little Silt; Moist	<1	---	---	No odor, geotextile barrier at 2 ft bls
	11/21/97	2 - 4	Dark brown to black F-M SAND, some Silt; Dry to Moist	2.5	5.5	---	No odor, bedrock refusal at 5 ft bls, no ground water
SB-E6	11/21/97	0 - 2	Dark brown to brown-orange F-M SAND, little Gravel	<1	---	---	
	11/21/97	2 - 4	Dark brown F-M SAND; F-M Gravel	2.1	7	---	Bedrock refusal at 3.9 ft bls
SB-E7	11/21/97	0 - 2	Dark brown to brown to orange F-M SAND, little Gravel	<1	---	---	
SB-E7	11/21/97	2 - 4	Brown to grey to light grey SAND, little F-M Gravel	1.9	1.2	---	Refusal at 4.5 ft bls
SB-D6	11/21/97	0 - 2	Brown to orange F-M SAND	<1	---	---	
	11/21/97	2 - 4	Brown to dark brown F-M SAND	1.8	4	---	Bedrock refusal at 4 ft bls
SB-D7	11/21/97	0 - 2	Dark brown to orange F-M SAND, little F-M Gravel	<1	---	---	
	11/21/97	2 - 4	Dark brown to black to grey F-M SAND, little F-M Gravel; Moist	3.2	19	---	No odor, no ground water, refusal at 4.3 ft bls

ft bls - feet below land surface
F - fine
M - medium
C - coarse
PID - photoionization detector
ppm - parts per million
BTEX - benzene, toluene, ethylbenzene and xylenes (total)
µg/kg - micrograms per kilogram
< - less than
--- - sample not analyzed