AR 1449

Memorandum

To: John Hill, CIV AFCEE/EXA
Mike Dobbs, DES-DDC-EE

From: John Sperry
Tom Holmes

Date: 5 December 2009

Re: **Off Depot Vapor Intrusion Baseline Monitoring**
Defense Depot Memphis, Tennessee

HDR|e^{2}M has prepared this report to present the results of the Off Depot Vapor Intrusion Baseline Monitoring at Defense Depot Memphis, Tennessee (DDMT). This work was performed for the Defense Logistics Agency under Contract FA8903-04-D-8722, Task Order 0064 to the Air Force Center for Engineering and the Environment.

Soil vapor sampling was described in the pre-construction activities of the *Dunn Field Off Depot Groundwater Remedial Action Work Plan* (RAWP) (HDR|e^{2}M, 2009). The purpose of the sampling is to assess potential vapor intrusion at residential structures from chlorinated volatile organic compounds (CVOCs) in groundwater within the Off-Depot CVOC plume.

Air sparging with soil vapor extraction (AS/SVE) is being implemented to volatilize CVOCs near the leading edge of the groundwater plume west of Dunn Field in order to remove CVOCs from groundwater and prevent further plume migration. Soil vapor sampling will be performed before and during AS/SVE system operation to evaluate its potential impact on indoor air quality. The RAWP identified the following tasks for soil vapor sampling:

- Identification of target areas
- Structure Survey
- Soil Sampling
- Soil Vapor Sampling
- Sub-slab pressure measurements (if warranted)

The tasks were developed from the *Sampling and Analysis Plan and Quality Assurance Plan for Indoor Air Quality Monitoring* in Appendix F of the *Off Depot Groundwater Final Remedial Design* (IAQ SAP) (CH2M HILL, 2008), *Tri-Services Handbook for the Assessment of the Vapor Intrusion Pathway* (Noblis, 2008), and *OSWER Draft Guidance for Evaluating the Vapor Intrusion to Indoor Air Pathway from Groundwater and Soils* (USEPA, 2002).

Identification of Target Areas and Structure Survey

Target areas were identified based on CVOC concentrations above the groundwater screening values in the USEPA guidance (Table 1). Analytical results for groundwater samples collected April to June 2009 were reviewed to finalize the target areas. Trichloroethylene (TCE) was the CVOC present at the highest concentrations relative to the groundwater screening value in all wells along the perimeter of the Off Depot plume. The TCE 5 µg/L isopleth and a 100 ft outer buffer are shown on Figure 1. Twelve parcels within the outer boundary were selected for review; the properties are listed on Table 2.

A structure survey was performed for each property by visual survey from the street. The features of interest were presence of a structure, and whether the foundation was constructed on or below grade or with a crawlspace. Observations were recorded separately for each property using the form in the IAQ SAP. The site information was also compared to property descriptions on the Shelby County tax assessor website.

Requests for Right of Entry (ROE) were mailed to the 12 property owners (Table 2). HDR | e^{2}m personnel met with owners of the properties selected for vapor probe installation to describe the probe installation and sampling process and to evaluate rig access and utility clearance. Based on site conditions and access, vapor probe locations were selected at four properties (Table 3). Three vapor probe locations, as called for in the RAWP, were identified on two properties (1764 Meadowhill and 1739 Regan). Only one vapor probe location was selected at each of the other two properties: 0 Rozelle is a vacant county owned property and the one location was considered representative of the area; and 1733 Regan had limited access and one vapor probe at 1739 Regan was near the common property boundary. In addition, a control location was selected on the MLGW substation property adjacent to an AS/SVE vapor monitoring point (VMP-4) and a monitoring well with high CVOC concentrations (MW-155).

FIELD ACTIVITIES

The field activities consisted of collection of soil samples for geotechnical analysis at four locations, installation of nine vapor probes with shallow and deep sample screens, and baseline vapor sampling at the vapor probes. Utility clearance at all drilling locations was performed on 3 September 2009 by Alsip Locating Service (ALS) on private properties and by Tennessee One Call services within public rights of way. Soil borings were advanced by Boart Longyear using a Geoprobe 6620DT direct push technology (DPT) drill rig. HDR|E2M staff supervised all field activities. Continuous soil cores were collected in 5-foot runs at each boring; the 2-inch diameter cores were collected in acetate liners within the DPT core barrel.

Soil Sampling

Geotechnical analysis of soil samples was performed to determine physical properties in case vapor intrusion modeling is performed. Samples were collected on 9-10 September 2009 from soil borings advanced by DPT at four vapor probe locations (VI-1, VI- 2, VI-3, and VI-6) shown on Figure 2.

At each location, three soil samples were collected over two foot intervals at 5-7, 10-12, and 15-17 feet bgs. The RAWP called for the test sample to be collected from the 6-inch section with the coarsest grain size in order to estimate conservative vapor intrusion conditions. However, 1-foot samples were submitted from VI-1 (5.5-6.5, 10.5-11.5, and 15.5-16.5 ft) and the laboratory requested that the complete 2-foot soil sample be submitted from the remaining borings in order to provide sufficient material for the tests. The soil type was consistently silty clay for the full depth of the 4 borings.

The samples were collected by cutting the acetate liners at the selected interval and sealing the ends with duct tape. HDR|e^{2}m delivered the soil samples to the laboratory, Construction Quality Consultants of Memphis, for analysis of soil bulk density (ASTM D2937), soil moisture content (ASTM D2216), grain size (ASTM D1140), and Atterberg Limits (ASTM D4318). The IAQ SAP called for analysis of grain density (API RP40), but the test was omitted due to the laboratory being unfamiliar with the procedure. The laboratory also reported the API test method had been discontinued. In addition, grain size analyses were performed by ASTM D1140 instead of D422, which was referenced in the IAQ SAP. ASTM D1140 is the appropriate method for fine-grained soils.

Soil sample boring VI-1 was used for installation of the soil vapor probe. The other three soil sample borings were filled with bentonite, hydrated and capped with grout; separate borings, approximately 1 foot away, were drilled for vapor probe installation.

Vapor Intrusion Monitoring Point Installation

Soil vapor probes with two sample screens were installed at nine locations (VI-1 to VI-9) on 9-10 September 2009. The locations are shown on Figure 2. The RAWP called for the two vapor sample screens in each probe to be placed in the coarsest soil interval from 4 to 8 feet bgs and 14 to 18 feet bgs. If the soil was homogenous, the sample screens were to be placed at 5 feet and 15 feet bgs.

Soil boring logs for each probe location are provided in Appendix A. The loess was observed to be relatively uniform silty clay at all locations except at VI-3 and VI-5. Gravelly clay was observed at 17 to 18 feet bgs in VI-3; this was not observed in the initial boring for soil samples. Fill sand, apparently from a utility trench, was observed at 5 to 6 feet bgs in VI-5. The sample screens were placed accordingly at these locations. The remaining vapor sample screens were placed at approximately 5 feet and 15 feet, except that the shallow sample screen at VI-1 was installed at 4 feet bgs due to overuse of filter sand.

The vapor sample screens are 6-inch long, 0.5-inch diameter stainless steel wire mesh (pore diameter 0.0006-inches) with a threaded fitting on the bottom for anchoring and a fitting at the top to connect to 0.25-inch diameter Teflon tubing. Once the deeper screen depth was reached, the sample screen and tubing was lowered in the open borehole and glass beads were placed in the annulus to six inches above the probe; filter sand was used above and below the screen. Fine bentonite chips were then gravity poured to create an annular seal as the DPT rod was slowly retracted. A funnel and tubing was used to hydrate the bentonite. This process was repeated for the installation of the shallow vapor probe. Bentonite-cement grout was placed from the filter sand above the shallow sample screen to the ground surface. The ends of the sample tubing were capped and clearly marked to identify the shallow and deep screens. The VI probes were completed with a well cap and 1-foot x 1-foot concrete pad. Installation diagrams are provided in Appendix B and a summary is shown on Table 4.

Soil Vapor Sampling

Baseline vapor sampling was performed by HDR|e^{2}M on 14-15 September 2009. Samples were collected from the two vapor screens at each location, except VI-5B which had excessive moisture due to the saturated sand screened by the probe. Vapor samples were also collected from VMP-4A (60-65 feet bgs) and VMP-4B (41 to 46 feet bgs) to obtain vapor concentrations in the fluvial sands above the groundwater plume.

At each VI probe location, the probes were purged of three well volumes (filter media and tubing) using the sampling pump prior to sample collection; the VMPs were purged of three tubing volumes. Multiple PID readings were collected using a dedicated Tedlar bag until three consecutive readings were within 10%. Laboratory samples were then collected in a 1-liter Summa canisters with a flow regulator at 200 milliliters per minute (ml/min). Vapor samples were also collected from VI-7A, VMP-4A and VMP-4B in 6-liter Summa canisters to evaluate potential difference in results based on sample volume. The Summa canisters were shipped from the laboratory with negative pressure and the sampling pump was not required for sample collection. Samples were submitted to Accutest Laboratories in Dayton, NJ on 15 September 2009 for analysis of VOCs by USEPA Method TO-15.

SUMMARY OF FINDINGS

Geotechnical Results

Results of the geotechnical analyses are presented on Table 5. As described on the boring logs, the soil was uniform throughout the target area and at all sample depths. All samples were at least 90% silt and clay.

Vapor Analytical Results

Soil vapor samples were collected from two screened intervals in the nine vapor probes (except VI-5B) and a VMP. The complete analytical results are presented in Appendix C, including duplicate samples and the 6L Summa canister samples. Analytical results for the 1L and 6L Summa canisters were similar.

Table 6 lists the analytical results for the primary CVOCs at Dunn Field and for other VOCs detected above the RL in one or more samples. The analytical results for the primary CVOCs are summarized below.

<u>Vapor Probe Samples - Loess</u>

Three CVOCs were detected and all concentrations were below the vapor screening levels presented in the RAWP.

TCE was reported in 5 wells with a maximum concentration of 4 $\mu g/m^3$ in VI-9B. The vapor screening value (27 $\mu g/m^3$) was not exceeded.

Tetrachoroethene (PCE) was reported in 14 samples with a maximum concentration of 16 $\mu g/m^3$ in VI-5A. The vapor screening value (34 $\mu g/m^3$) was not exceeded.

Methylene chloride was reported in 9 wells with a maximum concentration of 17 $\mu g/m^3$ in VI-3B. The vapor screening value (190 $\mu g/m^3$) was not exceeded.

<u>Vapor Monitoring Point Samples – Fluvial Sands</u>

Nine CVOCs were detected above RLs in the two VMP samples. Reported concentrations were much higher than in the vapor probe samples and 1,1,2,2-tetrachloroethane (TeCA) and TCE were detected at the highest concentrations, as in groundwater samples within the plume.

1,1,2,2-Tetrachloroethane was reported in both samples with a maximum concentration of 1420 $\mu g/m^3$ in VMP-4A.

TCE was reported in both samples with a maximum concentration of 6830 $\mu g/m^3$ in VMP-4A.

1,1,2-Trichlorothane was reported in the sample from VMP-4B at a concentration of 22 µg/m^3.

Carbon tetrachloride was reported in the sample from VMP-4B at a concentration of 14 µg/m^3.

Chloroform was reported in the sample from VMP-4B at a concentration of 15 µg/m^3.

Cis-1,2-dichloroethylene was reported in both samples with a maximum concentration of 801 µg/m^3 in VMP-4A.

Methylene Chloride was reported in the sample from VMP-4A at a concentration of 57 µg/m^3.

PCE was reported in both samples with a maximum concentration of 41 µg/m^3 in VMP-4A.

Trans-1,2-Dichloroethylene was reported in in both samples with a maximum concentration of 85.2 µg/m^3 in VMP-4A.

CONCLUSIONS AND RECOMMENDATIONS

The primary CVOCs detected in the loess vapor samples were below residential vapor screening values. Vapor concentrations in the loess were orders of magnitude lower than in the fluvial sands and the primary contaminants in the fluvial sands (TeCA and TCE) were not detected as frequently or at similar relative concentrations in the loess. In addition, the results for the vapor sample collected in the loess directly above the plume (VI-2) were very similar to results from the locations above the edge of the plume.

The results indicate the loess provides a good barrier to vertical migration of soil vapor preventing vapor intrusion problems above the groundwater plume in the Off Depot area.

The samples collected using 6L Summa canisters had higher reported concentrations than samples collected using the 1L Summa canisters. However, the results are comparable and 1-liter Summa canisters will be used in future sampling events. The next round of vapor intrusion monitoring will be performed after the AS/SVE system has been operating for three months.

TABLES

1 Screening Concentrations
2 Target Area Properties
3 Sample Probe Locations
4 Vapor Probe Installation Summary
5 Geotechnical Results
6 Analytical Results Summary

TABLE 1
SCREENING CONCENTRATIONS
OFF DEPOT VAPOR INTRUSION BASELINE MONITORING
Dunn Field - Defense Depot Memphis, Tennessee

Constituent	Groundwater Screening Value (µg/L)(a)	Soil Vapor Screening Value (µg/m3) (b)	
		Residential	Non-Residential
Carbon tetrachloride	5	31	31
Chloroform	80	24	24
1,2-Dichloroethane	230	20	20
1,1-Dichloroethene	190	11,000	15,000
cis-1,2-Dichloroethene	210	1,800	2,600
trans-1,2-Dichloroethene	180	3,600	5,100
Methylene Chloride	580	190	430
1,1,2,2-Tetrachloroethane	30	34	34
Tetrachloroethene	11	34	36
1,1,2-Trichloroethane	41	27	27
Trichloroethene	5	27	27
Vinyl chloride	2.5	13	48

Notes:
(a) □Groundwater values from USEPA guidance. Table 2b in OSWER Draft Guidance for Evaluating the Vapor Intrusion to Indoor Air Pathway from Groundwater and Soils (2002)
(b) □Soil vapor values from NJDEP website.
http://www.nj.gov/dep/srp/guidance/vaporintrusion/whatsnew.htm#200703a

TABLE 2
TARGET AREA PROPERTIES
OFF DEPOT VAPOR INTRUSION BASELINE MONITORING
Dunn Field - Defense Depot Memphis, Tennessee

Owner	Address	Structure	ROE	VI Probes
Ever And Bessie L Merriweather Henderson	1796 Rozelle St	Crawl	Yes	-
Shelby County Tax Sale 0403 #9733	0 Rozelle St	None	Yes	VI-1
Bernard Moore	1803 Rozelle St	Slab	No	-
Shelby County Tax Sale 0102 #14457	1808 Rozelle St	None	Yes	-
C D & Estella M Dotson	1595 Menager Rd	Slab	No	-
Robert P Newman	1758 Meadowhill St	Slab	No	-
W F & Verda M Lowe	1764 Meadowhill St	Slab	Yes	VI-3,4,5
Oak Hill Baptist Church (Rev A. Mayes Jr.)	1725 Ragan St	Slab	No	-
Isaac And Verzelle Kennon	1729 Ragan St	Slab	Yes	-
Laverne Osborne	1733 Ragan St	Slab	Yes	VI-9
Annet Bolden	1739 Ragan St	Slab	Yes	VI-6,7,8
Frank Jones	1743 Ragan St	Slab	No	-

TABLE 3
SAMPLE PROBE LOCATIONS
OFF DEPOT VAPOR INTRUSION BASELINE MONITORING
Dunn Field - Defense Depot Memphis, Tennessee

Probe ID	Property Address	Location on Property
VI-1	0 Rozelle St	Center of property, approx 67 feet from center of street
VI-2	MLGW Property	Adjacent to MW155 and VMP-4
VI-3	1764 Meadowhill	South side, adjacent to house.
VI-4	1764 Meadowhill	East side, 38 feet from house at property line.
VI-5	1764 Meadowhill	North side, adjacent to house.
VI-6	1739 Regan	North side, near fence line approximately 27 feet ENE of house
VI-7	1739 Regan	East side, 11 feet from house near walkway.
VI-8	1739 Regan	South side, 5 feet from house on side of driveway.
VI-9	1733 Regan	East side, 6.5 feet from house near flower bed.

TABLE 4
VAPOR PROBE INSTALLATION SUMMARY
OFF DEPOT VAPOR INTRUSION BASELINE MONITORING
Dunn Field - Defense Depot Memphis, Tennessee

Well	Date Completed	Location	Bottom of Screen A (ft,bgs)	Bottom of Screen B (ft,bgs)	Screen Length (ft)	Total Well Depth (ft, bgs)	Total Boring Depth (ft,bgs)
VI-1	9/9/2009	Off Site DF	15.3	4.0	0.5	15.4	18
VI-2	9/9/2009	Off Site DF	15.3	5.3	0.5	15.4	18
VI-3	9/9/2009	Off Site DF	18.0	5.3	0.5	18.0	18
VI-4	9/10/2009	Off Site DF	15.3	5.3	0.5	15.3	18
VI-5	9/10/2009	Off Site DF	15.0	5.0	0.5	15.2	16
VI-6	9/10/2009	Off Site DF	15.3	5.3	0.5	15.4	18
VI-7	9/10/2009	Off Site DF	15.3	5.3	0.5	15.4	16
VI-8	9/10/2009	Off Site DF	15.0	5.0	0.5	15.2	16
VI-9	9/10/2009	Off Site DF	15.3	5.0	0.5	15.4	16

TABLE 5
GEOTECHNICAL RESULTS
OFF DEPOT VAPOR INTRUSION BASELINE MONITORING
Dunn Field - Defense Depot Memphis, Tennessee

			ASTM D2216	ASTM D2937		ASTM D4318			ASTM D1140
Sample ID	VI Well	Sample Depth (ft, bgs)	Moisture Content (%)	Bulk Density (pcf)	Liquid Limit	Plastic Limit	Plasticity Limit	USC Classification	Finer than #200 Seive (%)
VI-1-A	VI-1	15.5-16.5	16.2	101.9	34	22	12	CL	93.9
VI-1-B	VI-1	10.5-11.5	14.0	95.0	31	23	8	CL/ML	97.3
VI-1-C	VI-1	5.5-6.5	11.7	86.9	32	24	8	ML/CL	98.5
VI-2-A	VI-2	51-17	24.5	98.1	33	21	12	CL	94.0
VI-2-B	VI-2	10-12	23.6	96.8	28	25	3	ML	99.8
VI-2-C	VI-2	5-7	17.8	95.1	32	25	7	ML	99.4
VI-3-A	VI-3	15-17	24.5	100.0	35	22	13	CL	92.1
VI-3-B	VI-3	10-12	25.2	95.8	32	23	9	CL/ML	95.9
VI-3-C	VI-3	5-7	28.6	89.5	31	26	5	ML	99.2
VI-6-A	VI-6	15-17	13.2	98.8	31	22	9	CL	96.5
VI-6-B	VI-6	10-12	10.5	87.5	32	25	7	ML	99.2
VI-6-C	VI-6	5-7	16.8	90.4	39	24	15	CL	96.5

Notes:
pcf : Pounds Per Cubic Foot
CL : Clay with a liquid limit less than 50 and more than 50 % passes through a # 200 Seive
ML : Silt with a liquid limit less than 50 and more than 50 % passes through a # 200 Seive
200 Seive: mesh size equal to 0.0029 inches or 74 microns

TABLE 6
ANALYTICAL RESULTS SUMMARY
OFF DEPOT VAPOR INTRUSION BASELINE MONITORING
Dunn Field - Defense Depot Memphis, Tennessee

	Sample ID / Lab ID / Date	VI-1A-BASE JA28198-1 9/14/2009	VI-1B-BASE JA28198-2 9/14/2009	VI-2A-BASE JA28198-3 9/14/2009	VI-2B-BASE JA28198-4 9/14/2009	VI-3A-BASE JA28198-9 9/15/2009	VI-3B-BASE JA28198-11 9/15/2009	VI-4A-BASE JA28198-12 9/15/2009	VI-4B-BASE JA28198-13 9/15/2009	VI-5A-BASE JA28198-14 9/15/2009	VI-6A-BASE JA28198-16 9/15/2009
Primary CVOCs (µg/m³)	Residential (a)										
1,1,2,2-Tetrachloroethane	34	<5.5	<5.5	<5.5	<5.5	<5.5	<5.5	<5.5	<5.5	<5.5	<5.5
1,1,2-Trichloroethane	27	<4.4	<4.4	<4.4	<4.4	<4.4	<4.4	<4.4	<4.4	<4.4	<4.4
1,1-Dichloroethylene	11,000	<3.2	<3.2	<3.2	<3.2	<3.2	<3.2	<3.2	<3.2	<3.2	<3.2
1,2-Dichloroethane	20	<3.2	<3.2	<3.2	<3.2	<3.2	<3.2	<3.2	<3.2	<3.2	<3.2
Carbon tetrachloride	31	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5
Chloroform	24	<3.9	<3.9	<3.9	<3.9	<3.9	<3.9	2.3 J	<3.9	<3.9	<3.9
cis-1,2-Dichloroethylene	1,800	<3.2	<3.2	<3.2	<3.2	<3.2	<3.2	<3.2	<3.2	<3.2	<3.2
Methylene chloride	190	**4.2**	**7.3**	**2.8**	2.6 J	<2.8	**17**	**9.7**	**3.3**	<2.8	<2.8
Tetrachloroethylene	34	**5**	**2.9**	**3.7**	**3.5**	<1.1	<1.1	**5.7**	<1.1	**16**	**3.5**
trans-1,2-Dichloroethylene	3,600	<3.2	<3.2	<3.2	<3.2	<3.2	<3.2	<3.2	<3.2	<3.2	<3.2
Trichloroethylene	27	<0.86	<0.86	<0.86	<0.86	<0.86	<0.86	<0.86	<0.86	<0.86	<0.86
Vinyl chloride	13	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2
Other VOCs (µg/m³)											
1,2,4-Trimethylbenzene		97.8	3 J	9.3	30	<3.9	<3.9	69.3	2.4 J	285	54.6
1,3,5-Trimethylbenzene		29	<3.9	2.6 J	12	<3.9	<3.9	25	<3.9	89.5	19
2-Hexanone		6.1	<3.3	<3.3	<3.3	<3.3	<3.3	<3.3	<3.3	3 J	<3.3
4-Ethyltoluene		13	<3.9	<3.9	3.2 J	<3.9	<3.9	12	<3.9	50.1	3.5 J
Acetone		105	42	29.2	24	15	35.4	33.7	14	72.2	37.5
Benzene		1.7 J	<2.6	<2.6	<2.6	1.6 J	4.8	1.5 J	<2.6	4.2	<2.6
Carbon disulfide		6.5	3.7	5	7.2	<2.5	1.5 J	6.9	2.6	18	<2.5
Chloromethane		<1.7	<1.7	<1.7	1.6 J	1.8	1.9	<1.7	1.3 J	1.5 J	<1.7
Dichlorodifluoromethane		2.8 J	2.9 J	3 J	2.6 J	3.1 J	3.7 J	2.9 J	3 J	3 J	2.2 J
Ethanol		30.7	53.1	<3.8	23.4	12	123	66.1	28.3	40.9	<3.8
Ethyl Acetate		<2.9	<2.9	<2.9	<2.9	<2.9	118	<2.9	<2.9	<2.9	<2.9
Ethylbenzene		15	<3.5	2.3 J	4	<3.5	1.7 J	13	<3.5	48.2	4.2
Freon 113		<6.1	<6.1	<6.1	<6.1	<6.1	9.2	<6.1	<6.1	<6.1	<6.1
Heptane		6.6	<3.3	<3.3	<3.3	<3.3	<3.3	<3.3	<3.3	2 J	<3.3
Hexane		<2.8	<2.8	<2.8	<2.8	<2.8	7.4	<2.8	<2.8	2.2 J	<2.8
Isopropyl Alcohol		<2	<2	<2	<2	72.5	25.6	7.4	4.2	8.4	<2
m,p-Xylene		59.5	3 J	12	16	<3.5	6.9	50.8	3 J	215	14
Methyl ethyl ketone		11	5.9	2.7	2.6	<2.4	3.5	4.4	<2.4	11	5
Methyl Isobutyl Ketone		25	<3.3	<3.3	<3.3	<3.3	<3.3	1.9 J	<3.3	7	2.5 J
o-Xylene		23	<3.5	3.9	9.6	<3.5	3.5	19	<3.5	71.2	7.4
p-Dichlorobenzene		10	5.7	6	5.8	<4.8	<4.8	13	<4.8	2.9 J	<4.8
Propylene		<3.4	3.6	2.4 J	<3.4	<3.4	4.6	4.1	<3.4	17	<3.4
Tertiary Butyl Alcohol		2.5	<2.4	<2.4	2.5	<2.4	<2.4	<2.4	<2.4	<2.4	1.4 J
Tetrahydrofuran		20	3.5	7.4	5.3	<2.4	<2.4	7.7	<2.4	13	4.7
Toluene		40.7	3.7	5.3	5.3	1.4 J	20	10	2 J	51.3	3.2
Trichlorofluoromethane		2.1 J	4.4 J	<4.5	<4.5	<4.5	15	4.3 J	4 J	3.6 J	<4.5
Xylenes (total)		82.5	3 J	16	26	<3.5	10	69.9	3 J	287	22

Notes:
(a) – Screening values from NJ DEP website
http://www.nj.gov/dep/srp/guidance/vaporintrusion/whatsnew.htm#200703a
Results detected above RL shown in bold; above screening value underlined
J: Estimated

TABLE 6
ANALYTICAL RESULTS SUMMARY
OFF DEPOT VAPOR INTRUSION BASELINE MONITORING
Dunn Field - Defense Depot Memphis, Tennessee

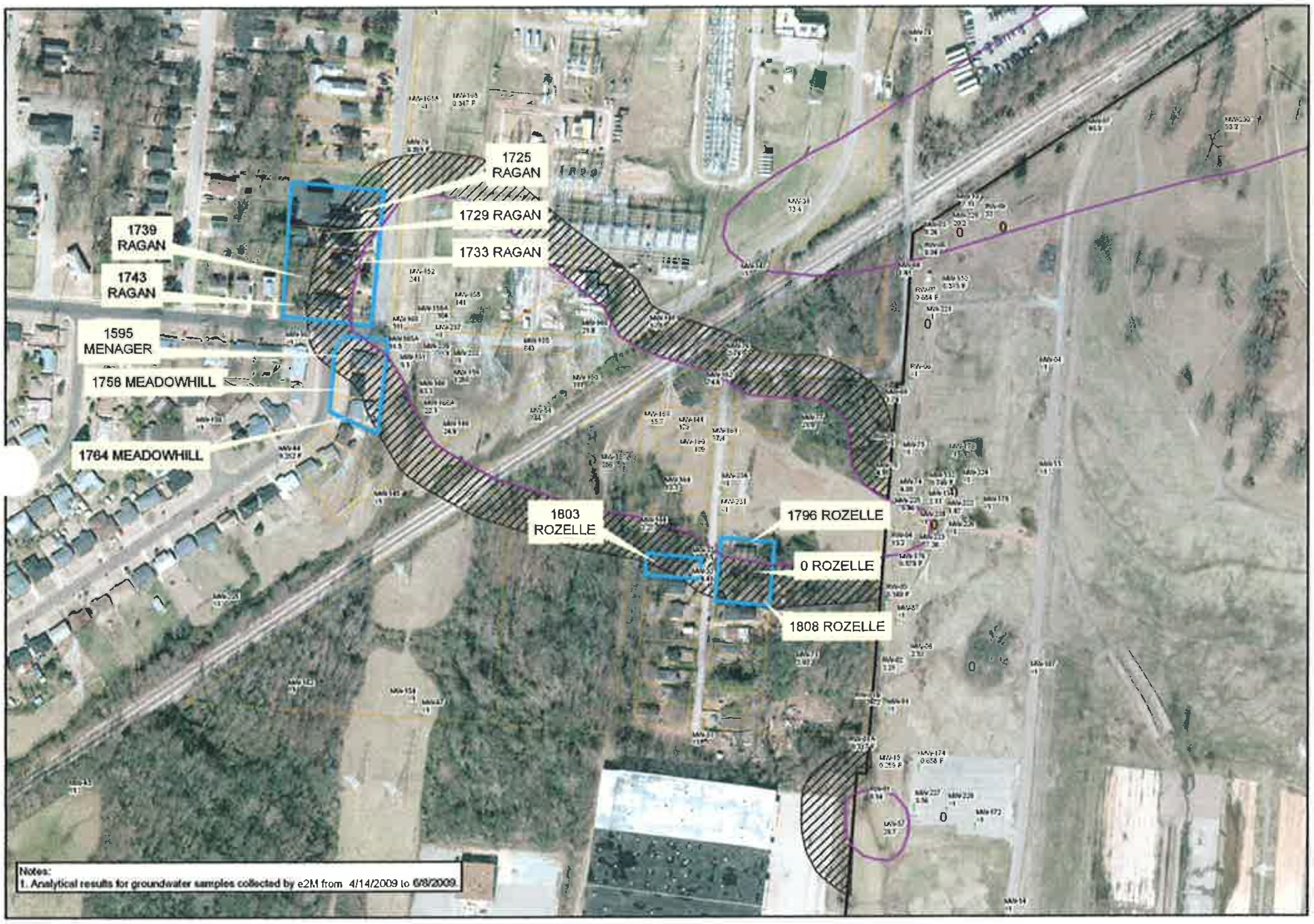
Sample ID Lab ID Date	Residential (a)	VI-6B-BASE JA28198-17 9/15/2009	VI-7A-BASE-1L JA28198-18 9/15/2009	VI-7B-BASE JA28198-20 9/15/2009	VI-8A-BASE JA28198-21 9/15/2009	VI-8B-BASE JA28198-22 9/15/2009	VI-9A-BASE JA28198-23 9/15/2009	VI-9B-BASE JA28198-24 9/15/2009	VMP-4A-BASE-1L JA28198-5 9/14/2009	VMP-4B-BASE-1L JA28198-6 9/14/2009
Primary CVOCs (µg/m³)										
1,1,2,2-Tetrachloroethane	34	<5.5	<5.5	<5.5	<5.5	<5.5	<5.5	<5.5	**1420**	**133**
1,1,2-Trichloroethane	27	<4.4	<4.4	<4.4	<4.4	<4.4	<4.4	<4.4	<49	**22**
1,1-Dichloroethylene	11,000	<3.2	<3.2	<3.2	<3.2	<3.2	<3.2	<3.2	<36	<3.2
1,2-Dichloroethane	20	<3.2	<3.2	<3.2	<3.2	<3.2	<3.2	<3.2	<36	2.6 J
Carbon tetrachloride	31	<5	<5	<5	<5	<5	<5	<5	<57	**14**
Chloroform	24	3 J	<3.9	<3.9	<3.9	<3.9	<3.9	2 J	<44	**15**
cis-1,2-Dichloroethylene	1,800	<3.2	<3.2	<3.2	<3.2	<3.2	<3.2	<3.2	**801**	**186**
Methylene chloride	190	<2.8	<2.8	**6.6**	<2.8	**11**	<2.8	<2.8	**57**	2.6 J
Tetrachloroethylene	34	**5.9**	**4**	**2.7**	**2**	**1.2**	**2.3**	**3.3**	**41**	**20**
trans-1,2-Dichloroethylene	3,600	<3.2	<3.2	<3.2	<3.2	<3.2	<3.2	<3.2	**85.2**	**31**
Trichloroethylene	27	<0.86	<0.86	**1.4**	**1**	**3.8**	**2.8**	**4**	**6830**	**2950**
Vinyl chloride	13	<2	<2	<2	<2	<2	<2	<2	<23	<2
Other VOCs (µg/m³)										
1,2,4-Trimethylbenzene		42	24	44	17	4.9	116	63.4	<44	<3.9
1,3,5-Trimethylbenzene		17	8.4	13	7.9	<3.9	31	18	<44	<3.9
2-Hexanone		<3.3	<3.3	<3.3	<3.3	<3.3	2.1 J	<3.3	<37	<3.3
4-Ethyltoluene		2.7 J	3 J	4	3.2 J	<3.9	11	5.4	<44	<3.9
Acetone		18	31.4	40.6	15	22	95	17	37.1	21
Benzene		<2.6	<2.6	2.6	2.1 J	1.9 J	1.4 J	0.99 J	<29	1.5 J
Carbon disulfide		3.1	2.6	1.6 J	4	4.7	4.7	2.8	<28	13
Chloromethane		<1.7	<1.7	2.3	<1.7	1.9	<1.7	<1.7	<19	4.1
Dichlorodifluoromethane		2.6 J	2.6 J	2.9 J	2.4 J	3.4 J	<4	2.8 J	<45	7.9
Ethanol		22.8	20.2	36.9	<3.8	98.2	<3.8	45.6	<41	13
Ethyl Acetate		<2.9	<2.9	24	<2.9	<2.9	<2.9	5.4	<32	<2.9
Ethylbenzene		3.1 J	4	4.8	3.2 J	<3.5	8.7	3.8	<39	<3.5
Freon 113		<6.1	<6.1	<6.1	<6.1	<6.1	<6.1	<6.1	<69	<6.1
Heptane		<3.3	<3.3	<3.3	<3.3	<3.3	<3.3	<3.3	<37	<3.3
Hexane		<2.8	<2.8	2 J	2 J	<2.8	<2.8	<2.8	<32	2.3 J
Isopropyl Alcohol		<2	<2	4.2	<2	9.3	<2	5.7	<22	<2
m,p-Xylene		10	18	24	13	4.8	43.9	18	<39	3.4 J
Methyl ethyl ketone		<2.4	4.1	7.1	1.9 J	<2.4	17	<2.4	<27	<2.4
Methyl Isobutyl Ketone		3.2 J	1.7 J	1.7 J	<3.3	<3.3	6.1	3.1 J	<37	<3.3
o-Xylene		6.9	5.2	9.1	3.3 J	2.1 J	16	7.8	<39	<3.5
p-Dichlorobenzene		<4.8	<4.8	6.6	7.8	<4.8	7.8	3.6 J	<54	<4.8
Propylene		<3.4	<3.4	1.3 J	<3.4	3.1 J	<3.4	<3.4	19.6 J	17
Tertiary Butyl Alcohol		3.3	<2.4	2.7	<2.4	<2.4	<2.4	2.9	<27	4.2
Tetrahydrofuran		8.8	2.4	5.9	<2.4	1.7 J	7.4	15	<27	<2.4
Toluene		3.2	6	21	4.9	5.7	12	6	<34	8.7
Trichlorofluoromethane		<4.5	<4.5	3.5 J	<4.5	15	<4.5	2.4 J	<51	5.1
Xylenes (total)		17	24	33	16	6.9	59.9	26	<39	3.4 J

Notes:
(a) – Screening values from NJ DEP website
http://www.nj.gov/dep/srp/guidance/vaporintrusion/whatsnew.htm#200703a
Results detected above RL shown in bold; above screening value underlined
J: Estimated

FIGURES

1 Target Areas

2 Vapor Probe Locations



Notes:
1. Analytical results for groundwater samples collected by e2M from 4/14/2009 to 6/8/2009.

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Figure 1

TARGET AREAS

OFF DEPOT VAPOR
INTRUSION
BASELINE MONITORING

DUNN FIELD
DEFENSE DEPOT
MEMPHIS, TENNESSEE

Legend

TCE
ug/L
- 0 - 5
- 6 - 50
- 51 - 100
- 101 - 1000
- 1001 - 2000
- TCE Non-Fluvial Wells
- TCE 5ppb
- Target Areas
- Parcels
- 100-ft Buffer
- SVE -Soil Vapor Extraction Point
- Original Dunn Field Property Boundary

0 50100 200 300 400
Feet

Installation Location
Memphis, Tennessee

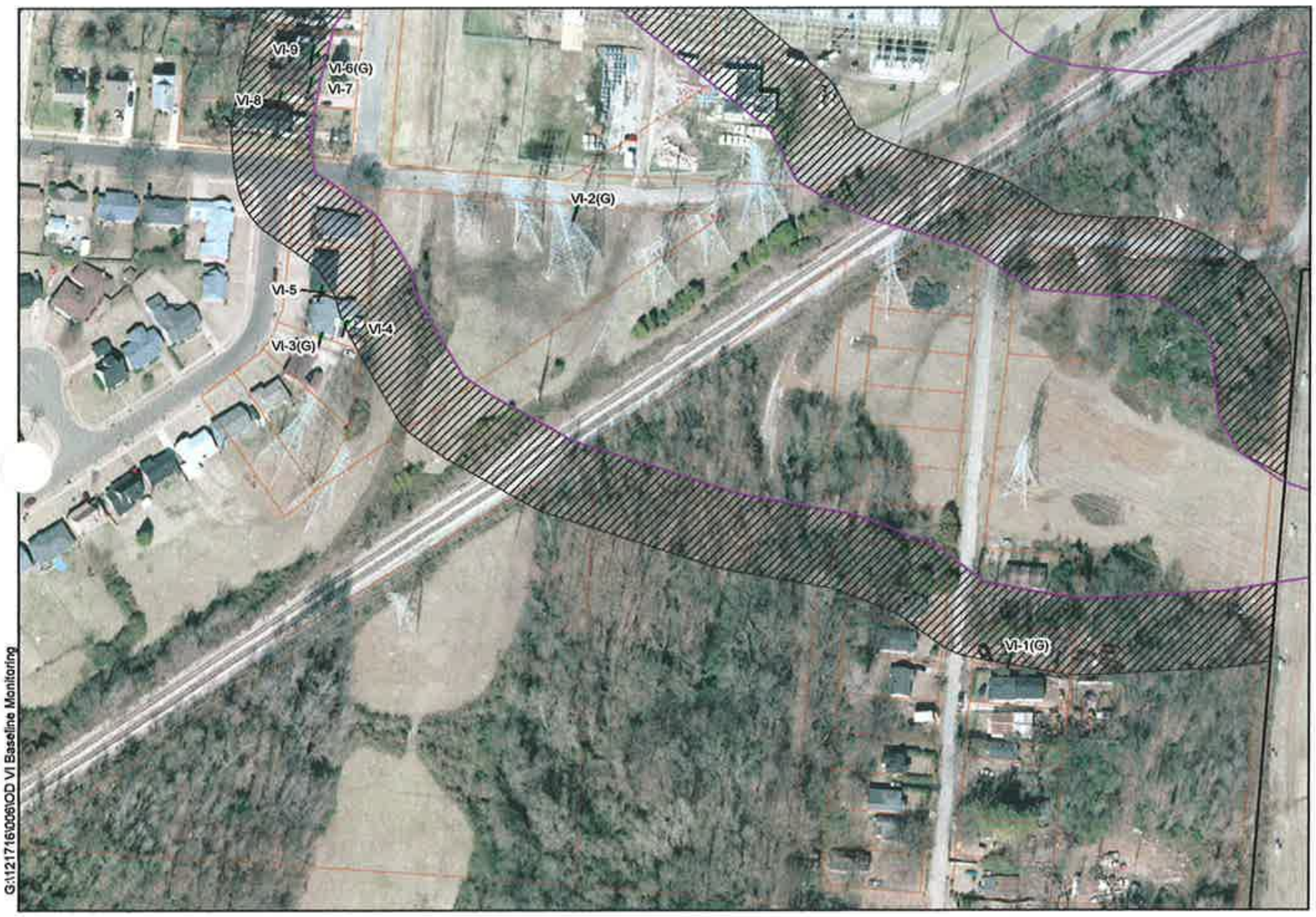

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Figure 2

VAPOR PROBE LOCATIONS

OFF DEPOT VAPOR INTRUSION BASELINE MONITORING

DUNN FIELD DEFENSE DEPOT MEMPHIS, TENNESSEE

Legend

- TCE 5ppb
- Vapor Point
- 100-ft Buffer
- Parcels

G: Geotechnical Sample Location

0 25 50 100 150 200
Feet

Installation Location
Memphis, Tennessee

HDR eM

APPENDICES

A	Well Installation Diagrams
B	Boring Logs
C	Lab Results

Appendix A

Soil Boring Logs

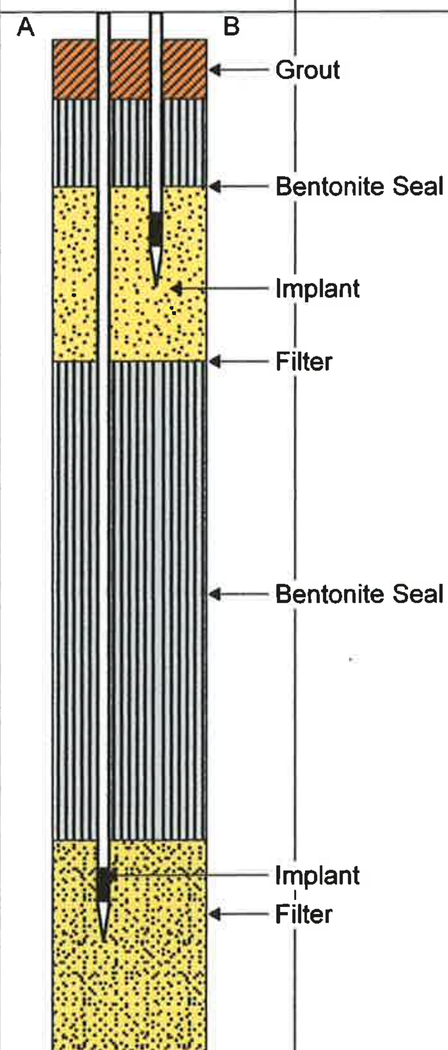
FIELD BOREHOLE LOG

BOREHOLE NO.: ODVI-1
TOTAL DEPTH: 18

PROJECT INFORMATION	DRILLING INFORMATION
PROJECT: Vapor Intrusion	DRILLING CO.: Boart Longyear
PROJECT NO.: 3200-064-01-06	DRILLER: T. Stanners
SITE LOCATION: 0 Rozelle	DRILLING METHOD/RIG: Direct Push
PROJECT MANAGER: T. Holmes	BOREHOLE DIAMETER: 2-inches
FIELD STAFF: J. Sperry	GROUND SURFACE ELEVATION: Not Surveyed
BOREHOLE STARTED: 9/10/2009	WATER DEPTH/ DATE: N/A
BOREHOLE FINISHED: 9/10/2009	BOREHOLE USE: Vapor Monitoring

NOTES:

Depth	Soil Symbol	Soil Description	Well Completion	Well Description
		asphalt		
		CL Silty Clay - bluish grey Gley (2 5/10B), low plasticity, moderately stiff		Grout Bentonite Seal
		CL Silty Clay - pink 7.5YR (7/4), stiff, dry		Implant Filter
10		CL Silty Clay - light brown 7.5YR (6/4), stiff, very dry		Bentonite Seal
		CL Silty Clay - light brown 7.5YR (6/3), stiff, dry		Implant Filter
		CL Silty Clay - light brown 7.5YR (6/4), stiff, hard, dry		
20		End of Log		



Created By: WTR
Checked By: J. Sperry

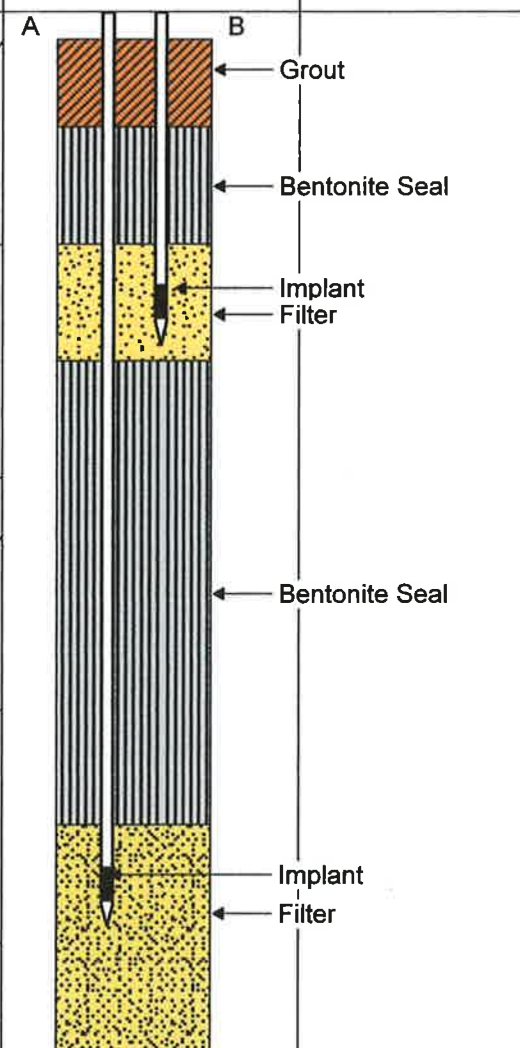
FIELD BOREHOLE LOG

BOREHOLE NO.: ODVI-2
TOTAL DEPTH: 18

PROJECT INFORMATION	DRILLING INFORMATION
PROJECT: Vapor Intrusion	DRILLING CO.: Boart Longyear
PROJECT NO.: 3200-064-01-06	DRILLER: T. Stanners
SITE LOCATION: Between VMP-4 and MW-144	DRILLING METHOD/RIG: Direct Push
PROJECT MANAGER: T. Holmes	BOREHOLE DIAMETER: 2-inches
FIELD STAFF: J. Sperry	GROUND SURFACE ELEVATION: Not Surveyed
BOREHOLE STARTED: 9/9/2009	WATER DEPTH/ DATE: N/A
BOREHOLE FINISHED: 9/9/2009	BOREHOLE USE: Vapor Monitoring

NOTES:

Depth	Soil Symbol	Soil Description	Well Completion	Well Description
		OH Topsoil - brown 7.5YR (5/2), organics.		
		CL Silty Clay - light brown 7.5YR (6/4), low plasticity, stiff		
		CL Silty Clay - light brown 7.5YR (6/4), low plasticity, stiff		
		CL Silty Clay - light brown 7.5YR (6/4), low plasticity, stiff		
10		**CL** Clay - strong brown 7.5YR (5/6), stiff, moderately plastic		
		CL Clay - strong brown 7.5YR (5/6), stiff, moderately plastic		
		CL Clay - strong brown 7.5YR (5/6), stiff, moderately plastic		
20		End of Log		



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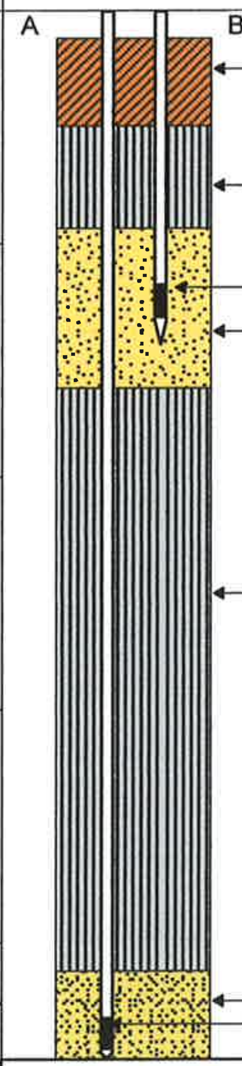
Checked By: J. Sperry

FIELD BOREHOLE LOG

BOREHOLE NO.: ODVI-3
TOTAL DEPTH: 18

PROJECT INFORMATION	DRILLING INFORMATION
PROJECT: Vapor Intrusion	DRILLING CO.: Boart Longyear
PROJECT NO.: 3200-064-01-06	DRILLER: T. Stanners
SITE LOCATION: 1764 Meadowhill	DRILLING METHOD/RIG: Direct Push
PROJECT MANAGER: T. Holmes	BOREHOLE DIAMETER: 2-inches
FIELD STAFF: J. Sperry	GROUND SURFACE ELEVATION: Not Surveyed
BOREHOLE STARTED: 9/9/2009	WATER DEPTH/ DATE: N/A
BOREHOLE FINISHED: 9/9/2009	BOREHOLE USE: Vapor Monitoring

NOTES:

Depth	Soil Symbol	Soil Description	Well Completion	Well Description
		CL Cilty Clay - strong brown 7.5YR (5/8), plastic, slightly stiff.		Grout Bentonite Seal
		CL Silty Clay - strong brown 7.5YR (5/8), plastic, slightly stiff.		Implant Filter
10		CL Silty Clay - strong brown 7.5YR (5/8), plastic, slightly stiff.		Bentonite Seal
		CL Silty Clay - strong brown 7.5YR (5/8), plastic, slightly stiff.		
		CL Silty Clay - strong brown 7.5YR (5/8), plastic, slightly stiff.		Filter Implant
20		CL Gravelly Clay - reddish brown 7.5YR (6/8), hard, gravel is subrounded End of Log		

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Checked By: J. Sperry

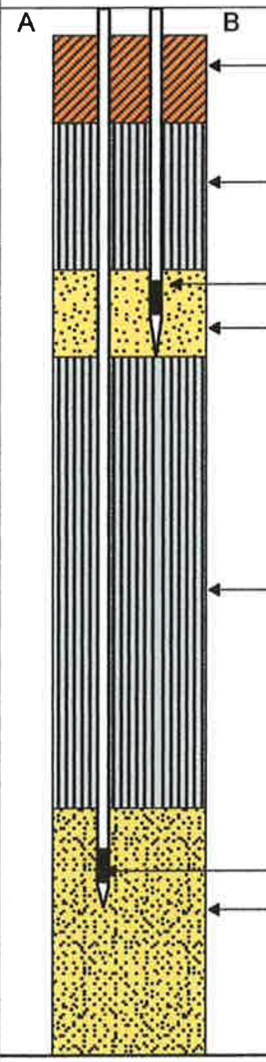
FIELD BOREHOLE LOG

BOREHOLE NO.: ODVI-4
TOTAL DEPTH: 18

PROJECT INFORMATION	DRILLING INFORMATION
PROJECT: Vapor Intrusion	DRILLING CO.: Boart Longyear
PROJECT NO.: 3200-064-01-06	DRILLER: T. Stanners
SITE LOCATION: 1764 Meadowhill	DRILLING METHOD/RIG: Direct Push
PROJECT MANAGER: T. Holmes	BOREHOLE DIAMETER: 2-inches
FIELD STAFF: J. Sperry	GROUND SURFACE ELEVATION: Not Surveyed
BOREHOLE STARTED: 9/10/2009	WATER DEPTH/ DATE: N/A
BOREHOLE FINISHED: 9/10/2009	BOREHOLE USE: Vapor Monitoring

NOTES:

Depth	Soil Symbol	Soil Description	Well Completion	Well Description
		CL Silty Clay - light brown 7.5YR (6/4), medium plasticity, slightly stiff		
		CL Silty Clay - light brown 7.5YR (6/4), medium plasticity, slightly stiff		
		CL Silty clay - light brown 7.5YR (6/4), high plasticity, stiff		
10		**CL** Silty clay - light brown 7.5YR (6/4), high plasticity, stiff		
		CL Silty clay - light brown 7.5YR (6/4), high plasticity, stiff		
		CL Silty clay - light brown 7.5YR (6/4), high plasticity, stiff		
		CL Silty Clay - strong brown 7.5YR (5/8) with pinkish grey 7.5YR (7/2) mottles		
20		End of Log		



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Checked By: J. Sperry

FIELD BOREHOLE LOG

BOREHOLE NO.: ODVI-5
TOTAL DEPTH: 16

PROJECT INFORMATION

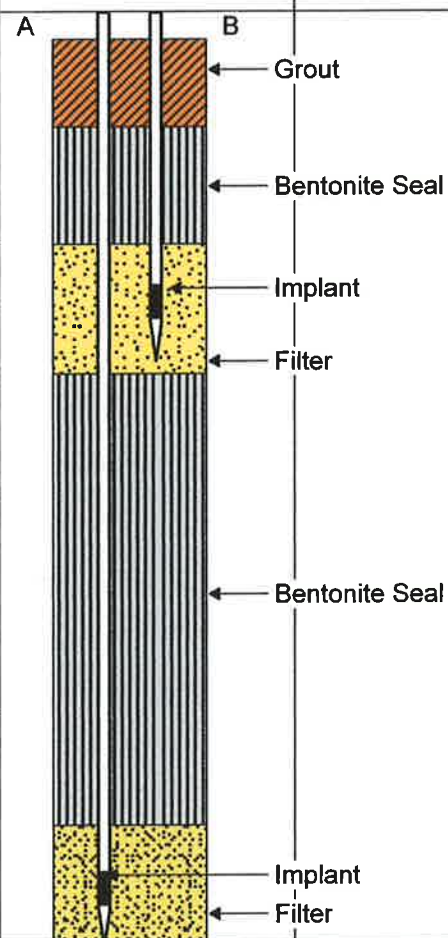
PROJECT: Vapor Intrusion
PROJECT NO.: 3200-064-01-06
SITE LOCATION: 1764 Meadowhill
PROJECT MANAGER: T. Holmes
FIELD STAFF: J. Sperry
BOREHOLE STARTED: 9/10/2009
BOREHOLE FINISHED: 9/10/2009

DRILLING INFORMATION

DRILLING CO.: Boart Longyear
DRILLER: T. Stanners
DRILLING METHOD/RIG: Direct Push
BOREHOLE DIAMETER: 2-inches
GROUND SURFACE ELEVATION: Not Surveyed
WATER DEPTH/ DATE: N/A
BOREHOLE USE: Vapor Monitoring

NOTES:

Depth	Soil Symbol	Soil Description	Well Completion	Well Description
		CL Hand augered. No recovery		
		CL Silty Clay - brown 7.5YR (5/4), stiff, moderately plastic		
		SP Sand - yellow 10YR (8/8), loose, placed in hole when installing pipe, man made.		
		CL Silty Clay - brown 7.5YR (5/3), stiff, moderately plastic		
10		**CL** Silty Clay - light brown 7.5YR (6/4), stiff, low plasticity		
		CL Silty Clay - light brown 7.5YR (6/4), stiff, low plasticity		
		End of Log		
20				



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FIELD BOREHOLE LOG

BOREHOLE NO.: ODVI-6
TOTAL DEPTH: 18

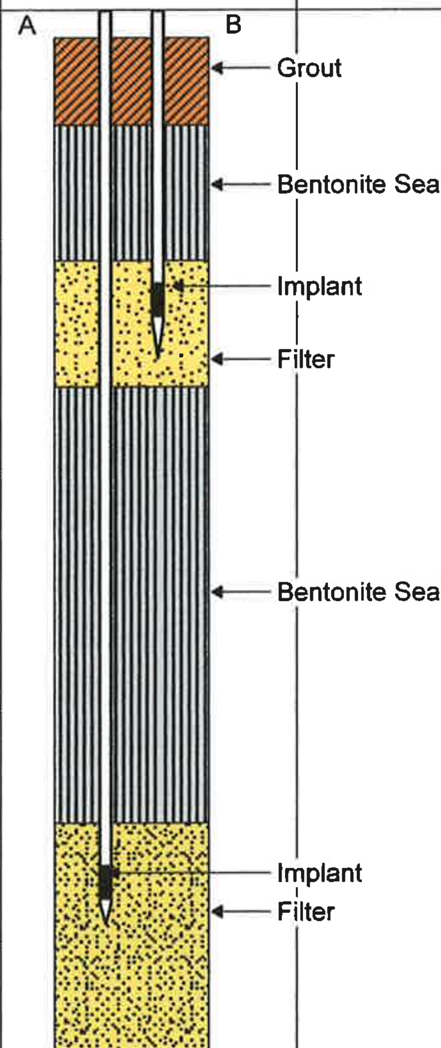
PROJECT INFORMATION

PROJECT: Vapor Intrusion
PROJECT NO.: 3200-064-01-06
SITE LOCATION: 1739 Regan
PROJECT MANAGER: T. Holmes
FIELD STAFF: J. Sperry
BOREHOLE STARTED: 9/10/2009
BOREHOLE FINISHED: 9/10/2009

DRILLING INFORMATION

DRILLING CO.: Boart Longyear
DRILLER: T. Stanners
DRILLING METHOD/RIG: Direct Push
BOREHOLE DIAMETER: 2-inches
GROUND SURFACE ELEVATION: Not Surveyed
WATER DEPTH/ DATE: N/A
BOREHOLE USE: Vapor Monitoring

NOTES:

Depth	Soil Symbol	Soil Description	Well Completion	Well Description
		Hand augered. No recovery		
		CL Silty Clay - brown 7.5YR (5/4), stiff and dry		
10		**CL** Silty Clay - brown 7.5YR (5/4), stiff and dry		
		CL Silty Clay - light brown, very dry		
		CL Silty Clay - light brown, very dry		
20		End of Log		

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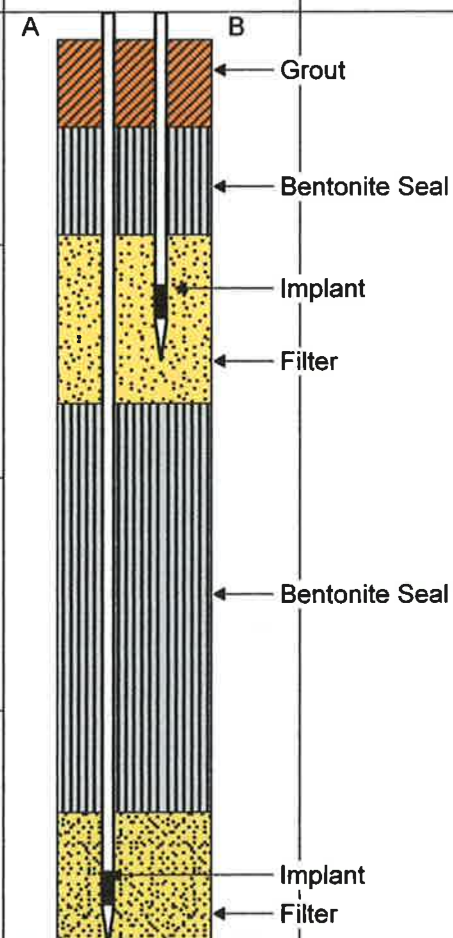
FIELD BOREHOLE LOG

BOREHOLE NO.: ODVI-7
TOTAL DEPTH: 16

PROJECT INFORMATION	**DRILLING INFORMATION**
PROJECT: Vapor Intrusion	DRILLING CO.: Boart Longyear
PROJECT NO.: 3200-064-01-06	DRILLER: T. Stanners
SITE LOCATION: 1739 Regan	DRILLING METHOD/RIG: Direct Push
PROJECT MANAGER: T. Holmes	BOREHOLE DIAMETER: 2-inches
FIELD STAFF: J. Sperry	GROUND SURFACE ELEVATION: Not Surveyed
BOREHOLE STARTED: 9/10/2009	WATER DEPTH/ DATE: N/A
BOREHOLE FINISHED: 9/10/2009	BOREHOLE USE: Vapor Monitoring

NOTES:

Depth	Soil Symbol	Soil Description	Well Completion	Well Description
		Hand augered. No recovery		
		CL Silty Clay - strong brown 7.5YR (4/6), stiff, low plasticity		
10		**CL** Silty Clay - strong brown 7.5YR (4/6), stiff, low plasticity		
		CL Silty Clay - strong brown 7.5YR (4/6), stiff, low plasticity		
20		End of Log		

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FIELD BOREHOLE LOG

HDR | e2M

BOREHOLE NO.: ODVI-8
TOTAL DEPTH: 16

PROJECT INFORMATION

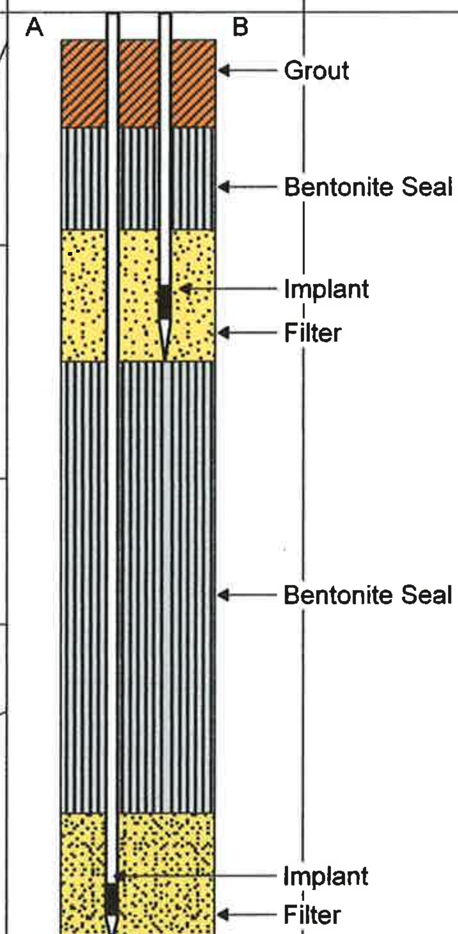
PROJECT: Vapor Intrusion
PROJECT NO.: 3200-064-01-06
SITE LOCATION: 1739 Regan
PROJECT MANAGER: T. Holmes
FIELD STAFF: J. Sperry
BOREHOLE STARTED: 9/10/2009
BOREHOLE FINISHED: 9/10/2009

DRILLING INFORMATION

DRILLING CO.: Boart Longyear
DRILLER: T. Stanners
DRILLING METHOD/RIG: Direct Push
BOREHOLE DIAMETER: 2-inches
GROUND SURFACE ELEVATION: Not Surveyed
WATER DEPTH/ DATE: N/A
BOREHOLE USE: Vapor Monitoring

NOTES:

Depth	Soil Symbol	Soil Description	Well Completion	Well Description
		OL Silty Soil - dark brown 7.5YR (3/2), lots of organic material, soft, roots		Grout
		CL Silty Clay - strong brown 7.5YR (4/6), stiff, moderately plastic		Bentonite Seal
		CL Silty Clay - strong brown 7.5YR (4/6), stiff, moderately plastic		Implant Filter
10		**CL** Silty Clay - strong brown 7.5YR (4/6), stiff, moderately plastic		Bentonite Seal
		CL Silty Clay - strong brown 7.5YR (4/6) quite stiff, high plasticity		
		CL Silty Clay - strong brown 7.5YR (4/6) quite stiff, high plasticity		Implant Filter
20		End of Log		



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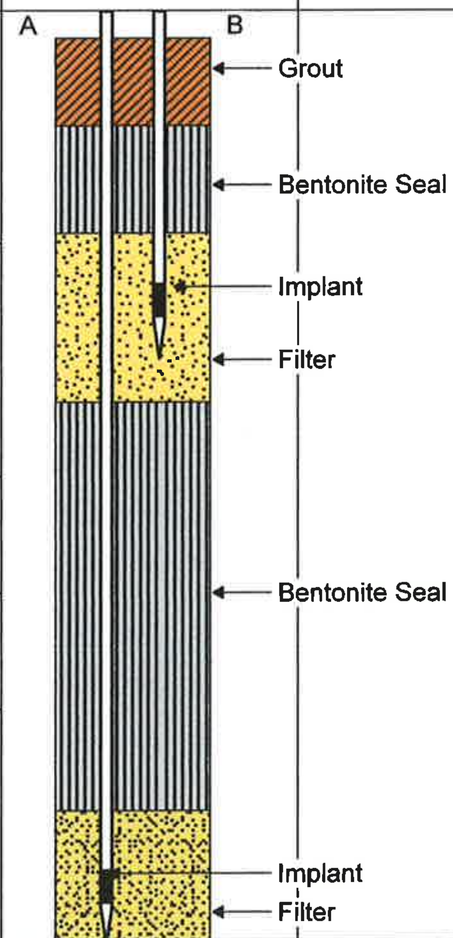
FIELD BOREHOLE LOG

BOREHOLE NO.: ODVI-9
TOTAL DEPTH: 16

PROJECT INFORMATION	DRILLING INFORMATION
PROJECT: Vapor Intrusion	DRILLING CO.: Boart Longyear
PROJECT NO.: 3200-064-01-06	DRILLER: T. Stanners
SITE LOCATION: 1733 Regan	DRILLING METHOD/RIG: Direct Push
PROJECT MANAGER: T. Holmes	BOREHOLE DIAMETER: 2-inches
FIELD STAFF: J. Sperry	GROUND SURFACE ELEVATION: Not Surveyed
BOREHOLE STARTED: 9/10/2009	WATER DEPTH/ DATE: N/A
BOREHOLE FINISHED: 9/10/2009	BOREHOLE USE: Vapor Monitoring

NOTES:

Depth	Soil Symbol	Soil Description	Well Completion	Well Description
		Hand augered. No recovery		
		CL Silty Clay - brown 7.5YR (5/4), hard, slightly plastic		
		CL Silty Clay - brown 7.5YR (5/4), hard, slightly plastic		
10		CL Silty Clay - strong brown 7.5YR (5/8), stiff, slightly plastic		
		CL SiltyClay - strong brown 7.5YR (5/8), stiff, slightly plastic		
20		End of Log		



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Checked By: J. Sperry

Appendix B

Vapor Probe Installation Diagrams

VI-1

VAPOR INTRUSION SAMPLING POINT INSTALLATION DIAGRAM
OFF DEPOT GROUNDWATER RAWP
Defense Depot Memphis, Tennessee

WELL ID: VI-1

PROJECT: VAPOR INTRUSION

E2M FIELD REP. J. Sperry

LOCATION ADDRESS: 0 Rozelle St.

LOCATION DESCRIPTION: Center of Lot

INSTALLATION DETAILS

DATE(S) 9/10/2009

START TIME 0800

END TIME 1000

DRILLING CONTRACTOR Boart Longyear

DRILLING TECHNIQUE DPT

SIZE AND TYPE 2"

ROD ADVANCEMENT TOOL USED 6620 DT

BOREHOLE DETAILS

TOTAL DEPTH: 18'

DIAMETER: 2"

TUBING DETAILS (A-DEEP, B-SHALLOW)

TUBING MATERIAL: Teflon

(A) DIAMETER: 1/4"

(A) LENGTH: 15.875

(B) DIAMETER: 1/4"

(B) LENGTH: 4.458

VAPOR IMPLANT DETAILS

MANUFACTURER: Geoprobe

MATERIAL: Stainless Steel

PORE DIAMETER: 0.0006

LENGTH: 6"

UPPER FILTER SAND DETAILS

TYPE/GRADATION: Glass Beads

AMOUNT(UNITS): 3 cups

LOWER FILTER SAND DETAILS

TYPE/GRADATION: Glass Beads

AMOUNT(UNITS): 3 cups

UPPER BENTONITE SEAL DETAILS

TYPE: # 16 Pellets

AMOUNT: 1/4 Bag

LOWER BENTONITE SEAL DETAILS

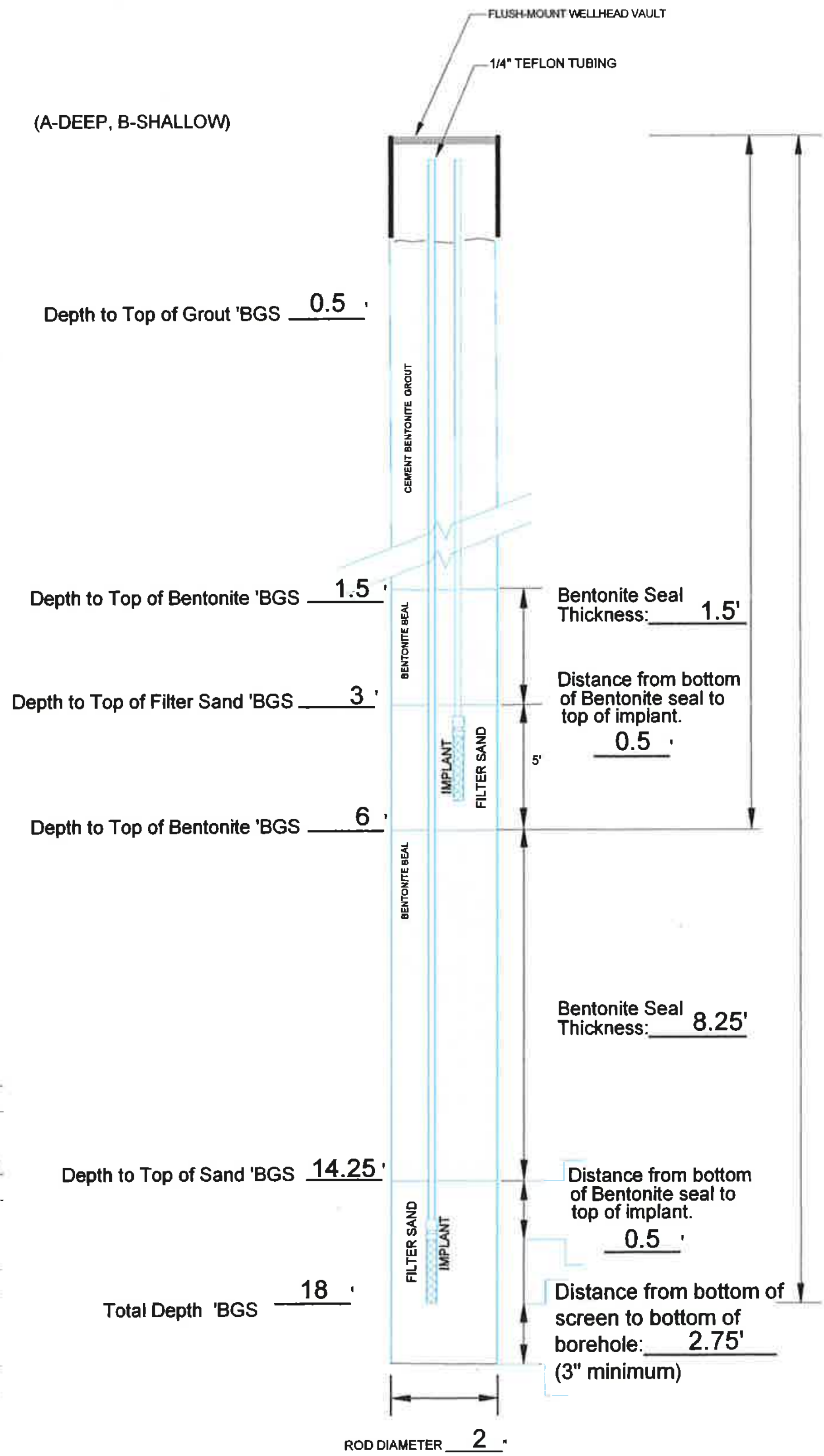
TYPE: # 16 Pellets

AMOUNT: 1/4 Bag

GROUT DETAILS

TYPE: I Portland

AMOUNT: 1/4 Bag



VI-2

VAPOR INTRUSION SAMPLING POINT INSTALLATION DIAGRAM
OFF DEPOT GROUNDWATER RAWP
Defense Depot Memphis, Tennessee

WELL ID: VI-2

PROJECT: VAPOR INTRUSION

E2M FIELD REP. J. Sperry

LOCATION ADDRESS: NA

LOCATION DESCRIPTION:

Between VMP4 and MW-144

INSTALLATION DETAILS

DATE(S) 9/9/2009

START TIME 11:00

END TIME 13:00

DRILLING CONTRACTOR Boart Longyear

DRILLING TECHNIQUE DPT

SIZE AND TYPE 2"

ROD ADVANCEMENT TOOL USED 6620 DT

BOREHOLE DETAILS

TOTAL DEPTH: 18'

DIAMETER: 2"

TUBING DETAILS (A-DEEP, B-SHALLOW)

TUBING MATERIAL: Teflon

(A) DIAMETER: 1/4"

(A) LENGTH: 16.375

(B) DIAMETER: 1/4"

(B) LENGTH: 5.708

VAPOR IMPLANT DETAILS

MANUFACTURER: Geoprobe

MATERIAL: Stainless Steel

PORE DIAMETER: 0.0006

LENGTH: 6"

UPPER FILTER SAND DETAILS

TYPE/GRADATION: Glass Beads

AMOUNT(UNITS): 3 cups

LOWER FILTER SAND DETAILS

TYPE/GRADATION: Glass Beads

AMOUNT(UNITS): 3 cups

UPPER BENTONITE SEAL DETAILS

TYPE: # 16 Pellets

AMOUNT: 1/4 Bag

LOWER BENTONITE SEAL DETAILS

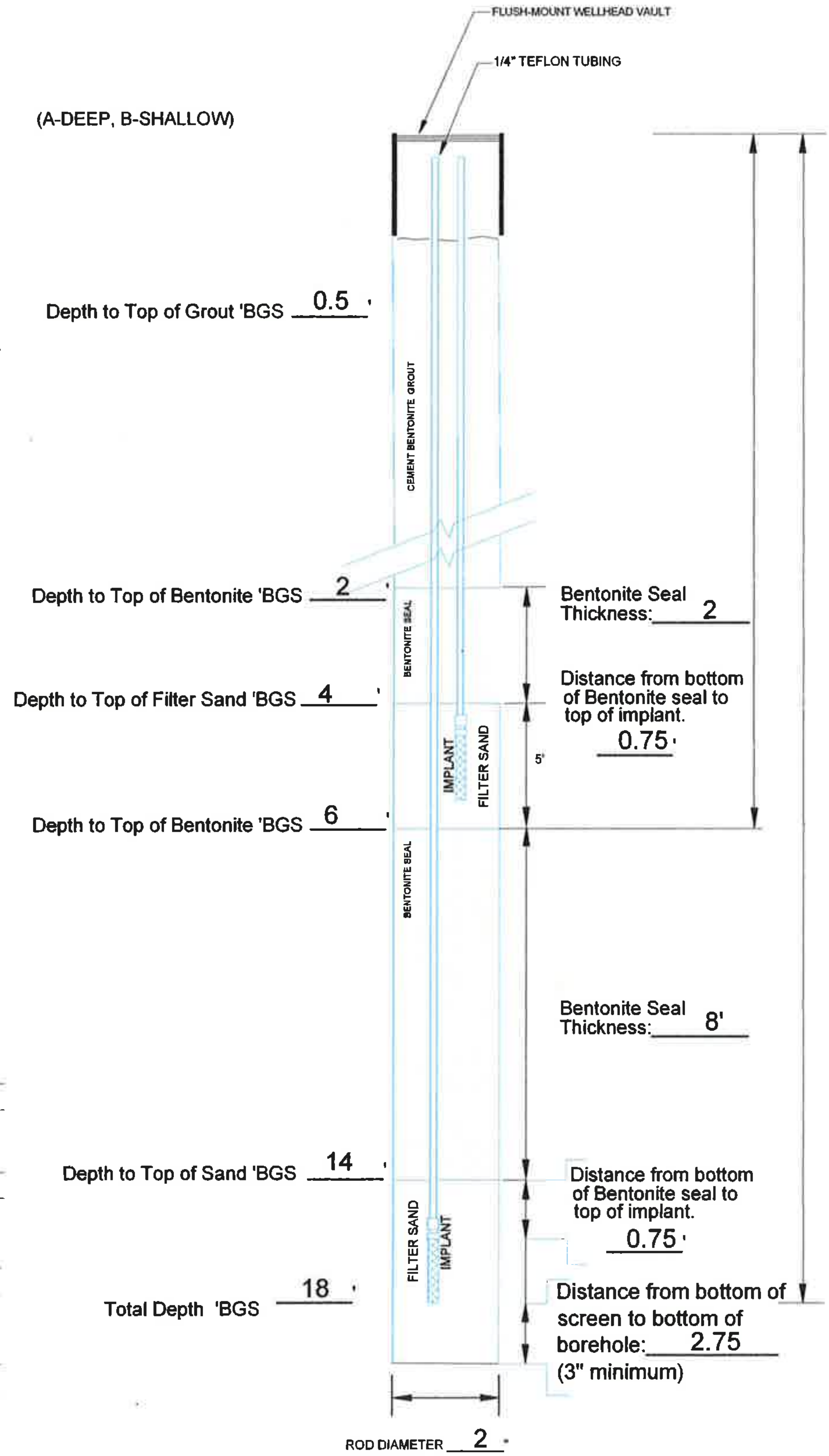
TYPE: # 16 Pellets

AMOUNT: 1/4 Bag

GROUT DETAILS

TYPE: I Portland

AMOUNT: 1/4 Bag



VI-3

VAPOR INTRUSION SAMPLING POINT INSTALLATION DIAGRAM
OFF DEPOT GROUNDWATER RAWP
Defense Depot Memphis, Tennessee

WELL ID: VI-3

PROJECT: VAPOR INTRUSION

E2M FIELD REP. J. Sperry

LOCATION ADDRESS: 1764 Meadowhill

LOCATION DESCRIPTION: South Side of home

INSTALLATION DETAILS

DATE(S) 9/9/2009

START TIME 15:00

END TIME 17:00

DRILLING CONTRACTOR Boart Longyear

DRILLING TECHNIQUE DPT

SIZE AND TYPE 2"

ROD ADVANCEMENT TOOL USED 6620 DT

BOREHOLE DETAILS

TOTAL DEPTH: 18'

DIAMETER: 2"

TUBING DETAILS (A-DEEP, B-SHALLOW)

TUBING MATERIAL: Teflon

(A) DIAMETER: 1/4"

(A) LENGTH: 18.583

(B) DIAMETER: 1/4"

(B) LENGTH: 5.700

VAPOR IMPLANT DETAILS

MANUFACTURER: Geoprobe

MATERIAL: Stainless Steel

PORE DIAMETER: 0.0006

LENGTH: 6"

UPPER FILTER SAND DETAILS

TYPE/GRADATION: Glass Beads

AMOUNT(UNITS): 3 cups

LOWER FILTER SAND DETAILS

TYPE/GRADATION: Glass Beads

AMOUNT(UNITS): 3 cups

UPPER BENTONITE SEAL DETAILS

TYPE: # 16 Pellets

AMOUNT: 1/4 Bag

LOWER BENTONITE SEAL DETAILS

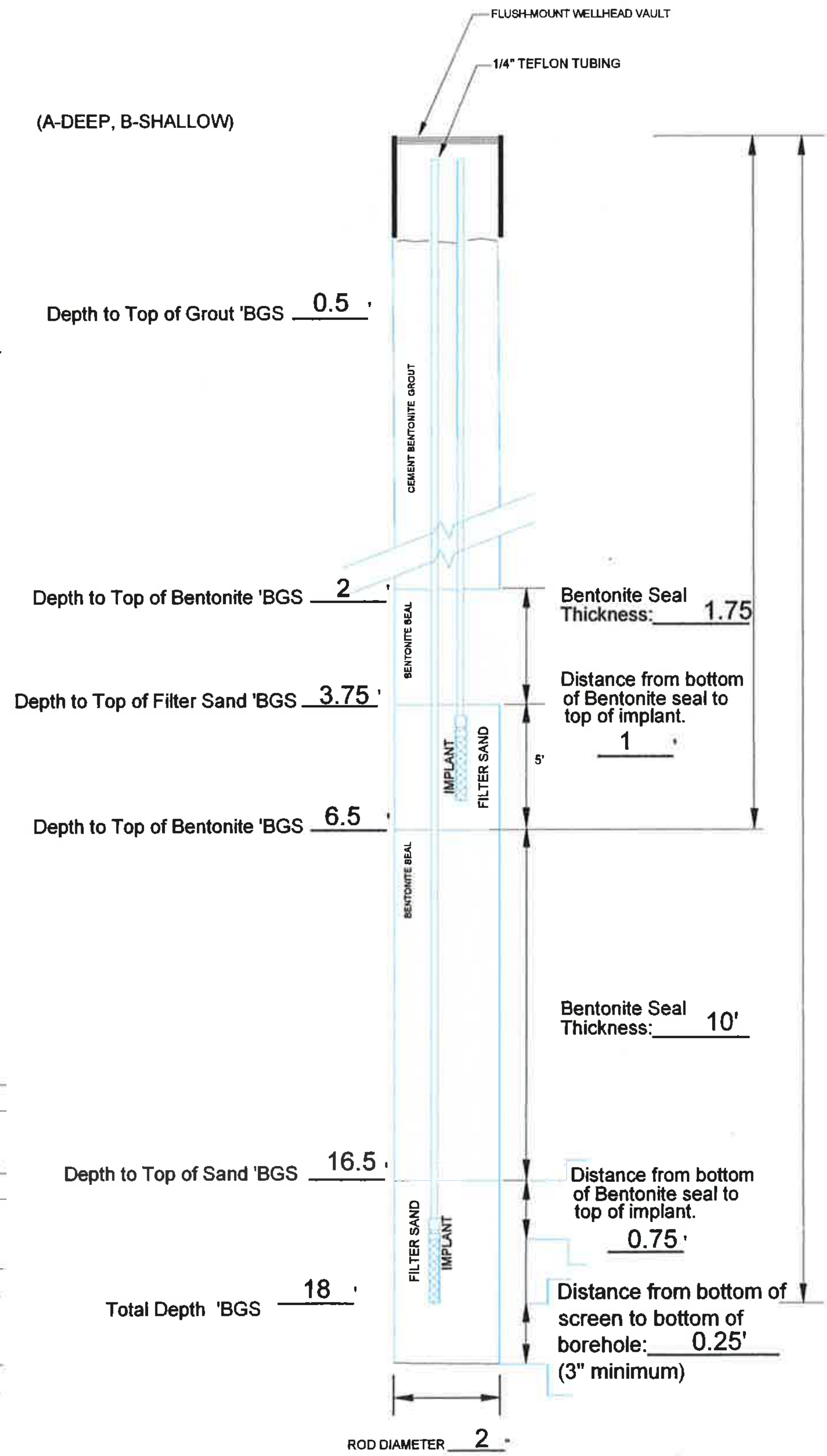
TYPE: # 16 Pellets

AMOUNT: 1/4 Bag

GROUT DETAILS

TYPE: I Portland

AMOUNT: 1/4 Bag



VI-4

VAPOR INTRUSION SAMPLING POINT INSTALLATION DIAGRAM
OFF DEPOT GROUNDWATER RAWP
Defense Depot Memphis, Tennessee

WELL ID: VI-4

PROJECT: VAPOR INTRUSION

E2M FIELD REP. J. Sperry

LOCATION ADDRESS: 1764 Meadowhill

LOCATION DESCRIPTION: Rear of home

INSTALLATION DETAILS

DATE(S) 9/10/2009

START TIME 07:55

END TIME 08:15

DRILLING CONTRACTOR Boart Longyear

DRILLING TECHNIQUE DPT

SIZE AND TYPE 2"

ROD ADVANCEMENT TOOL USED 6620 DT

BOREHOLE DETAILS

TOTAL DEPTH: 18

DIAMETER: 2"

TUBING DETAILS (A-DEEP, B-SHALLOW)

TUBING MATERIAL: Teflon

(A) DIAMETER: 1/4"

(A) LENGTH: 15.83

(B) DIAMETER: 1/4"

(B) LENGTH: 5.791

VAPOR IMPLANT DETAILS

MANUFACTURER: Geoprobe

MATERIAL: Stainless Steel

PORE DIAMETER: 0.0006

LENGTH: 6"

UPPER FILTER SAND DETAILS

TYPE/GRADATION: Glass Beads

AMOUNT(UNITS): 3 cups

LOWER FILTER SAND DETAILS

TYPE/GRADATION: Glass Beads

AMOUNT(UNITS): 3 cups

UPPER BENTONITE SEAL DETAILS

TYPE: # 16 Pellets

AMOUNT: 1/4 Bag

LOWER BENTONITE SEAL DETAILS

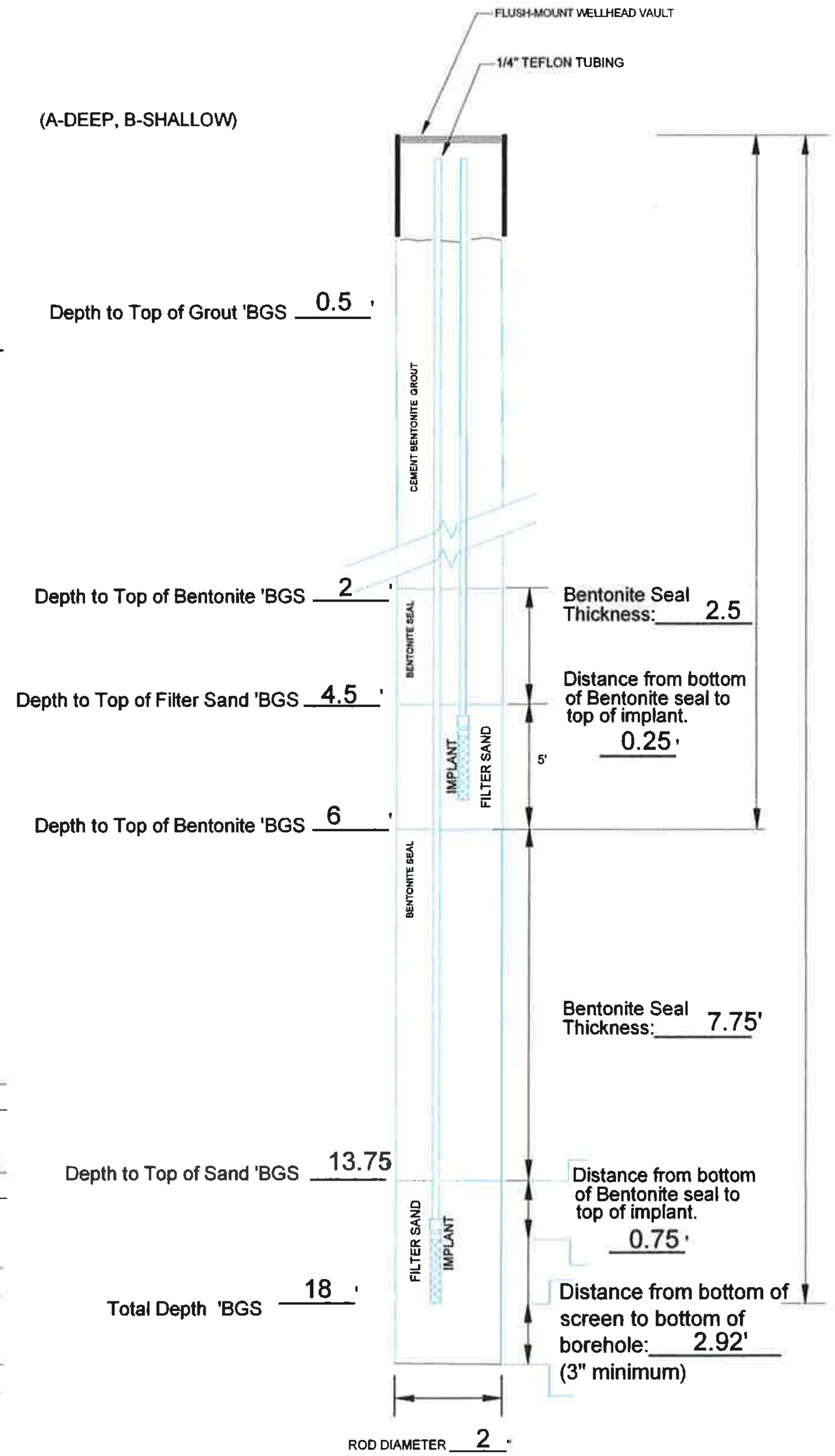
TYPE: # 16 Pellets

AMOUNT: 1/4 Bag

GROUT DETAILS

TYPE: I Portland

AMOUNT: 1/4 Bag



VI-5

VAPOR INTRUSION SAMPLING POINT INSTALLATION DIAGRAM
OFF DEPOT GROUNDWATER RAWP
Defense Depot Memphis, Tennessee

WELL ID: VI-5

PROJECT: VAPOR INTRUSION

E2M FIELD REP. J. Sperry

LOCATION ADDRESS: 1764 Meadowhill

LOCATION DESCRIPTION:
North side of home

INSTALLATION DETAILS
DATE(S) 9/10/2009
START TIME 09:00
END TIME 10:15
DRILLING CONTRACTOR Boart Longyear
DRILLING TECHNIQUE DPT
SIZE AND TYPE 2"
ROD ADVANCEMENT TOOL USED 6620 DT

BOREHOLE DETAILS
TOTAL DEPTH: 16
DIAMETER: 2"

TUBING DETAILS (A-DEEP, B-SHALLOW)
TUBING MATERIAL: Teflon
(A) DIAMETER: 1/4"
(A) LENGTH: 15.833
(B) DIAMETER: 1/4"
(B) LENGTH: 5.75

VAPOR IMPLANT DETAILS
MANUFACTURER: Geoprobe
MATERIAL: Stainless Steel

PORE DIAMETER: 0.0006
LENGTH: 6"

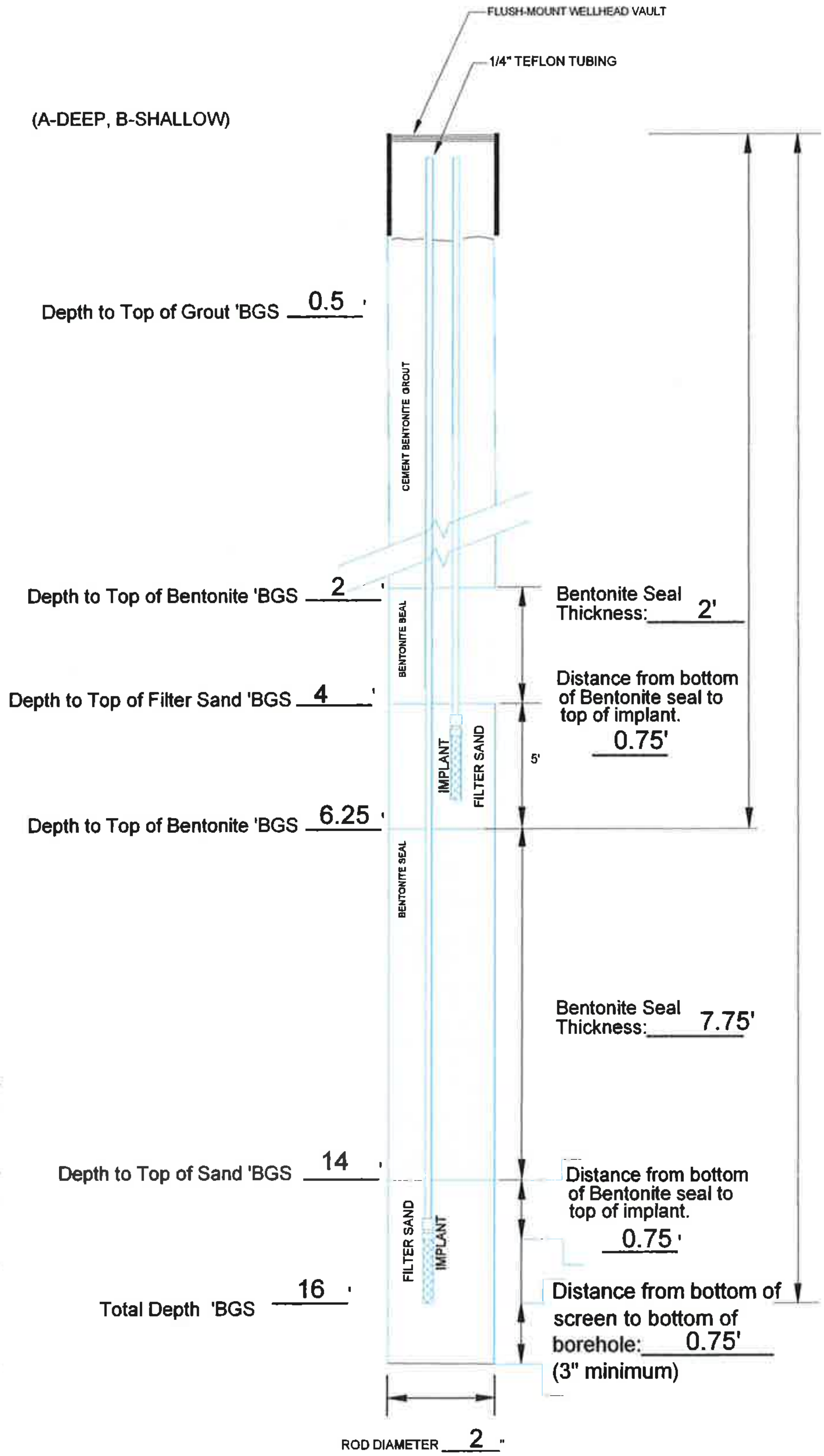
UPPER FILTER SAND DETAILS
TYPE/GRADATION: Glass Beads
AMOUNT(UNITS): 3 cups

LOWER FILTER SAND DETAILS
TYPE/GRADATION: Glass Beads
AMOUNT(UNITS): 3 cups

UPPER BENTONITE SEAL DETAILS
TYPE: # 16 Pellets
AMOUNT: 1/4 Bag

LOWER BENTONITE SEAL DETAILS
TYPE: # 16 Pellets
AMOUNT: 1/4 Bag

GROUT DETAILS
TYPE: I Portland
AMOUNT: 1/4 Bag



VI-6
VAPOR INTRUSION SAMPLING POINT INSTALLATION DIAGRAM
OFF DEPOT GROUNDWATER RAWP
Defense Depot Memphis, Tennessee

WELL ID: VI-6

PROJECT: VAPOR INTRUSION

E2M FIELD REP. J. Sperry

LOCATION ADDRESS: 1739 Regan

LOCATION DESCRIPTION:

North side along fence

INSTALLATION DETAILS

DATE(S) 9/10/2009

START TIME 11:00

END TIME 12:40

DRILLING CONTRACTOR Boart Longyear

DRILLING TECHNIQUE DPT

SIZE AND TYPE 2"

ROD ADVANCEMENT TOOL USED 6620 DT

BOREHOLE DETAILS

TOTAL DEPTH: 18'

DIAMETER: 2"

TUBING DETAILS (A-DEEP, B-SHALLOW)

TUBING MATERIAL: Teflon

(A) DIAMETER: 1/4"

(A) LENGTH: 15.875

(B) DIAMETER: 1/4"

(B) LENGTH: 5.75

VAPOR IMPLANT DETAILS

MANUFACTURER: Geoprobe

MATERIAL: Stainless Steel

PORE DIAMETER: 0.0006

LENGTH: 6"

UPPER FILTER SAND DETAILS

TYPE/GRADATION: Glass Beads

AMOUNT(UNITS): 3 cups

LOWER FILTER SAND DETAILS

TYPE/GRADATION: Glass Beads

AMOUNT(UNITS): 3 cups

UPPER BENTONITE SEAL DETAILS

TYPE: # 16 Pellets

AMOUNT: 1/4 Bag

LOWER BENTONITE SEAL DETAILS

TYPE: # 16 Pellets

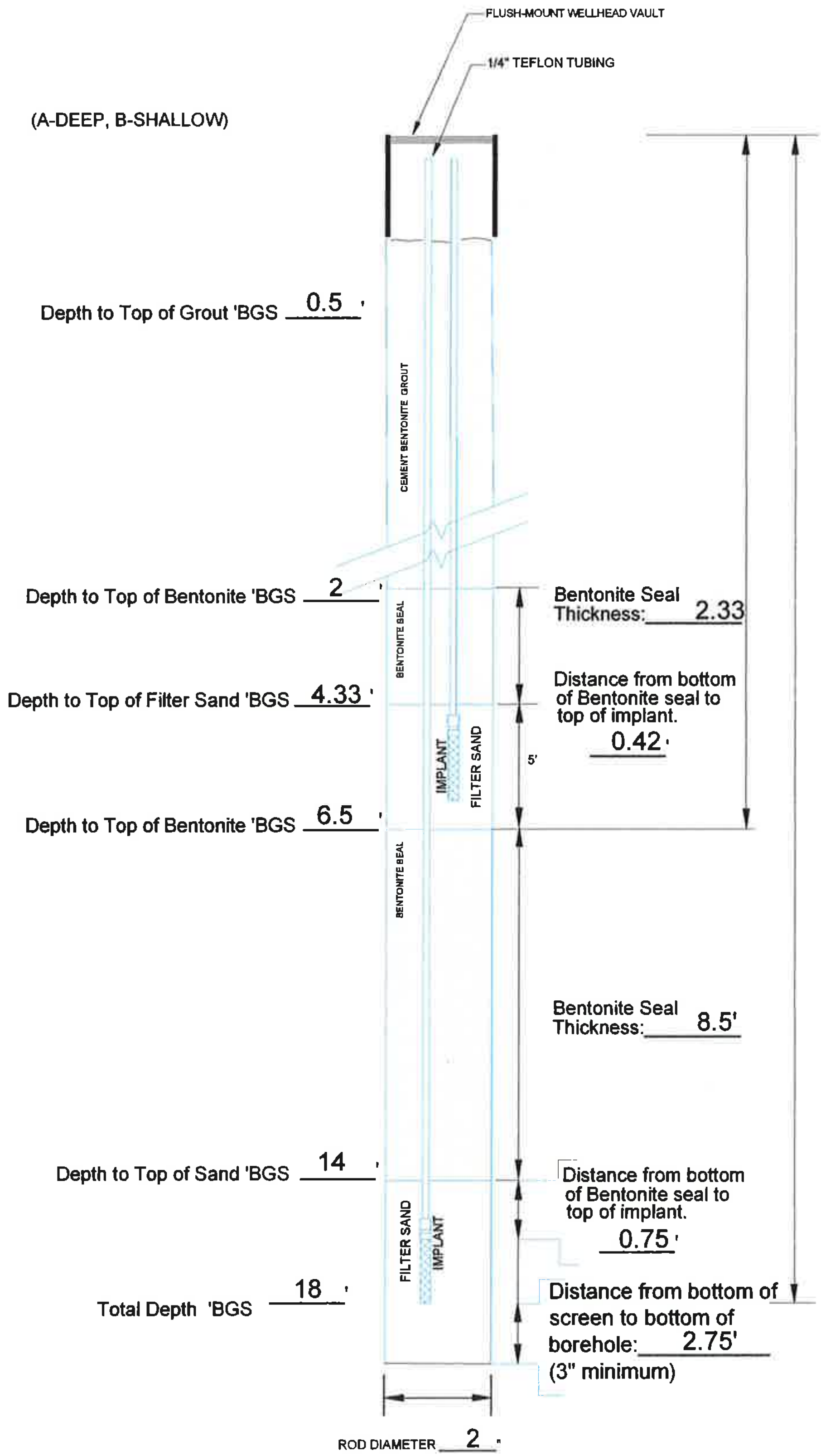
AMOUNT: 1/4 Bag

GROUT DETAILS

TYPE: I Portland

AMOUNT: 1/4 Bag

(A-DEEP, B-SHALLOW)



VI-7

VAPOR INTRUSION SAMPLING POINT INSTALLATION DIAGRAM
OFF DEPOT GROUNDWATER RAWP
Defense Depot Memphis, Tennessee

WELL ID: VI-7

PROJECT: VAPOR INTRUSION

E2M FIELD REP. J. Sperry

LOCATION ADDRESS: 1739 Regan

LOCATION DESCRIPTION: Front of home

INSTALLATION DETAILS
DATE(S) 9/10/2009
START TIME 13:30
END TIME 14:20
DRILLING CONTRACTOR Boart Longyear
DRILLING TECHNIQUE DPT
SIZE AND TYPE 2"
ROD ADVANCEMENT TOOL USED 6620 DT

BOREHOLE DETAILS
TOTAL DEPTH: 16'
DIAMETER: 2"

TUBING DETAILS (A-DEEP, B-SHALLOW)
TUBING MATERIAL: Teflon
(A) DIAMETER: 1/4"
(A) LENGTH: 15.833
(B) DIAMETER: 1/4"
(B) LENGTH: 5.666

VAPOR IMPLANT DETAILS
MANUFACTURER: Geoprobe
MATERIAL: Stainless Steel

PORE DIAMETER: 0.0006
LENGTH: 6"

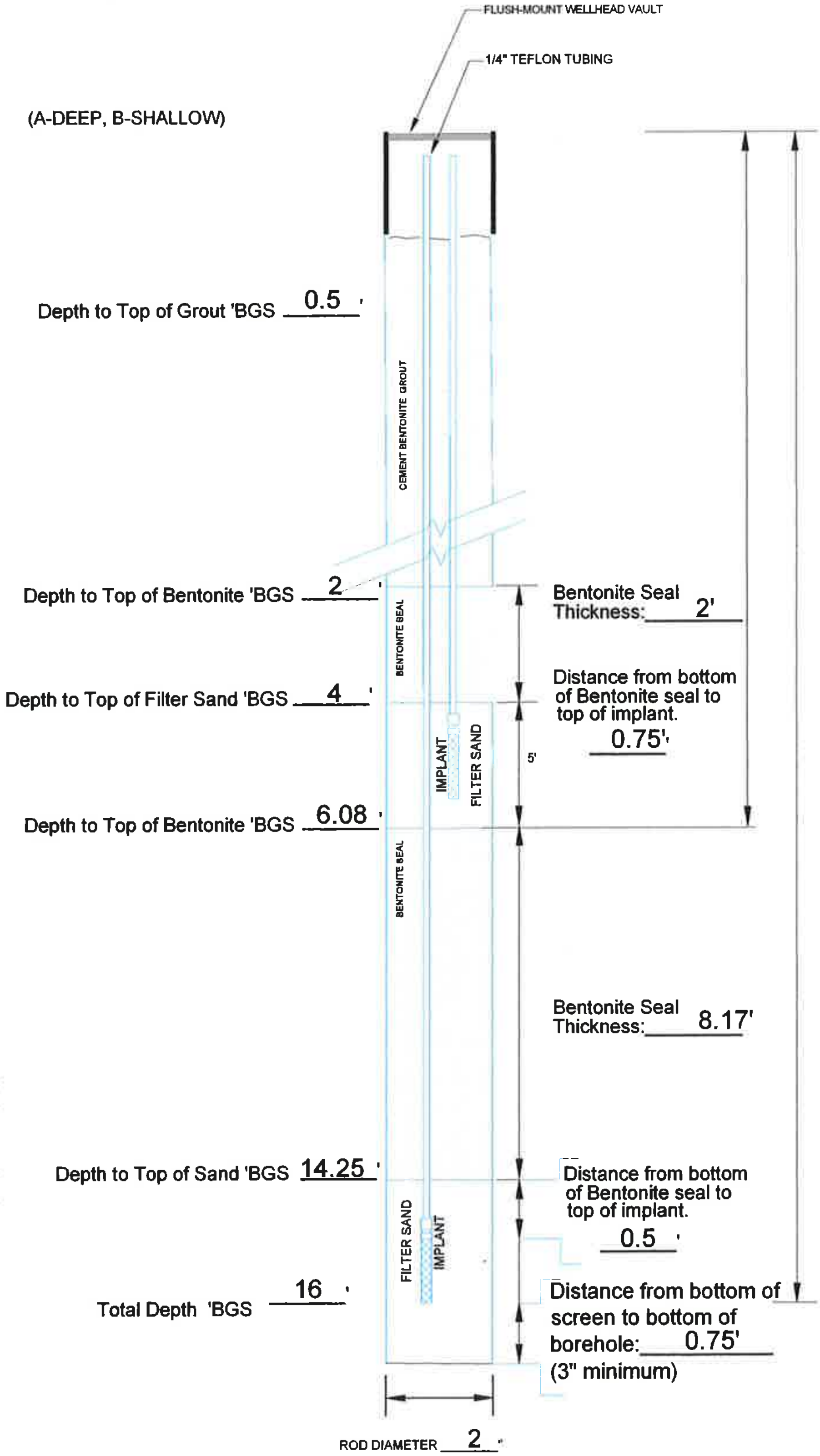
UPPER FILTER SAND DETAILS
TYPE/GRADATION: Glass Beads
AMOUNT(UNITS): 3 cups

LOWER FILTER SAND DETAILS
TYPE/GRADATION: Glass Beads
AMOUNT(UNITS): 3 cups

UPPER BENTONITE SEAL DETAILS
TYPE: # 16 Pellets
AMOUNT: 1/4 Bag

LOWER BENTONITE SEAL DETAILS
TYPE: # 16 Pellets
AMOUNT: 1/4 Bag

GROUT DETAILS
TYPE: I Portland
AMOUNT: 1/4 Bag



VI-8

VAPOR INTRUSION SAMPLING POINT INSTALLATION DIAGRAM
OFF DEPOT GROUNDWATER RAWP
Defense Depot Memphis, Tennessee

WELL ID: VI-8

PROJECT: VAPOR INTRUSION

E2M FIELD REP. J. Sperry

LOCATION ADDRESS: 1739 Regan

LOCATION DESCRIPTION:

Rear of carport

INSTALLATION DETAILS

DATE(S) 9/10/2009

START TIME 14:40

END TIME 15:45

DRILLING CONTRACTOR Boart Longyear

DRILLING TECHNIQUE DPT

SIZE AND TYPE 2"

ROD ADVANCEMENT TOOL USED 6620 DT

BOREHOLE DETAILS

TOTAL DEPTH: 16'

DIAMETER: 2"

TUBING DETAILS (A-DEEP, B-SHALLOW)

TUBING MATERIAL: Teflon

(A) DIAMETER: 1/4"

(A) LENGTH: 15.583

(B) DIAMETER: 1/4"

(B) LENGTH: 5.666

VAPOR IMPLANT DETAILS

MANUFACTURER: Geoprobe

MATERIAL: Stainless Steel

PORE DIAMETER: 0.0006

LENGTH: 6"

UPPER FILTER SAND DETAILS

TYPE/GRADATION: Glass Beads

AMOUNT(UNITS): 3 cups

LOWER FILTER SAND DETAILS

TYPE/GRADATION: Glass Beads

AMOUNT(UNITS): 3 cups

UPPER BENTONITE SEAL DETAILS

TYPE: # 16 Pellets

AMOUNT: 1/4 Bag

LOWER BENTONITE SEAL DETAILS

TYPE: # 16 Pellets

AMOUNT: 1/4 Bag

GROUT DETAILS

TYPE: I Portland

AMOUNT: 1/4 Bag

(A-DEEP, B-SHALLOW)

Depth to Top of Grout 'BGS 0.5 '

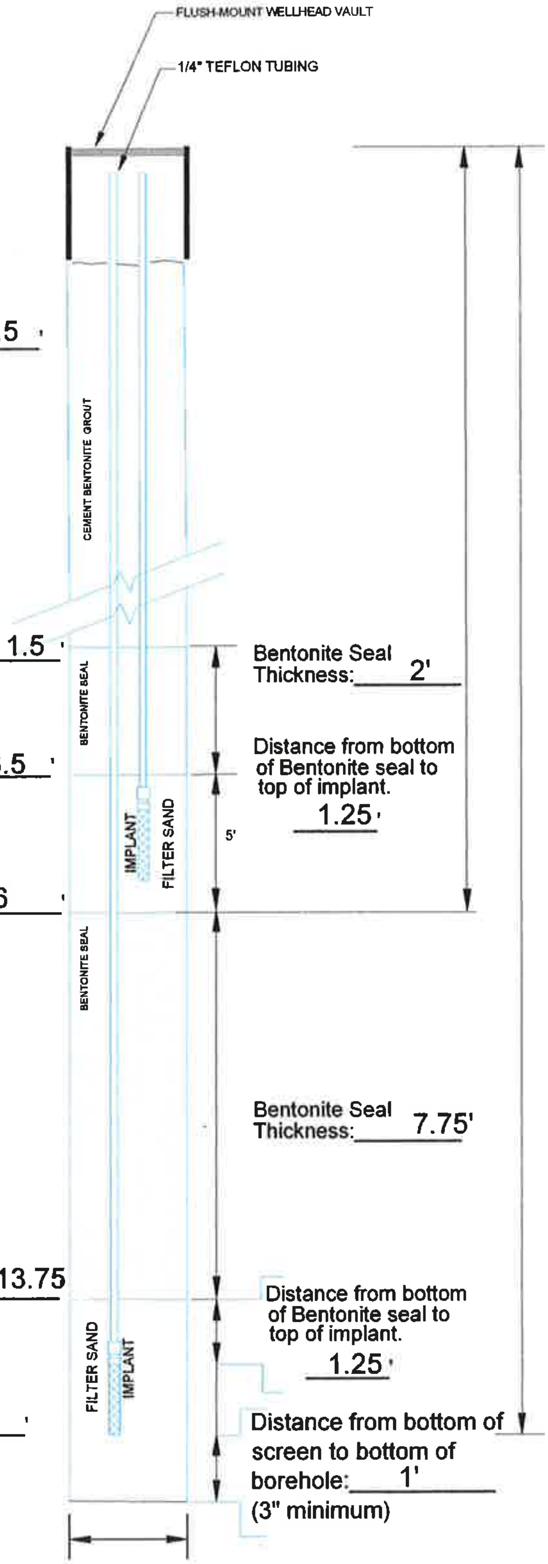
Depth to Top of Bentonite 'BGS 1.5 '

Depth to Top of Filter Sand 'BGS 3.5 '

Depth to Top of Bentonite 'BGS 6 '

Depth to Top of Sand 'BGS 13.75

Total Depth 'BGS 16 '



Bentonite Seal Thickness: 2'

Distance from bottom of Bentonite seal to top of implant. 1.25 '

Bentonite Seal Thickness: 7.75'

Distance from bottom of Bentonite seal to top of implant. 1.25 '

Distance from bottom of screen to bottom of borehole: 1' (3" minimum)

ROD DIAMETER 2 "

VI-9

VAPOR INTRUSION SAMPLING POINT INSTALLATION DIAGRAM
OFF DEPOT GROUNDWATER RAWP
Defense Depot Memphis, Tennessee

WELL ID: VI-9

PROJECT: VAPOR INTRUSION

E2M FIELD REP. J. Sperry

LOCATION ADDRESS: 1733 Regan

LOCATION DESCRIPTION: Front of home

INSTALLATION DETAILS

DATE(S) 9/10/2009

START TIME 16:15

END TIME 17:15

DRILLING CONTRACTOR Boart Longyear

DRILLING TECHNIQUE DPT

SIZE AND TYPE 2"

ROD ADVANCEMENT TOOL USED 6620 DT

BOREHOLE DETAILS

TOTAL DEPTH: 16'

DIAMETER: 2"

TUBING DETAILS (A-DEEP, B-SHALLOW)

TUBING MATERIAL: Teflon

(A) DIAMETER: 1/4"

(A) LENGTH: 15.708

(B) DIAMETER: 1/4"

(B) LENGTH: 5.833

VAPOR IMPLANT DETAILS

MANUFACTURER: Geoprobe

MATERIAL: Stainless Steel

PORE DIAMETER: 0.0006

LENGTH: 6"

UPPER FILTER SAND DETAILS

TYPE/GRADATION: Glass Beads

AMOUNT(UNITS): 3 cups

LOWER FILTER SAND DETAILS

TYPE/GRADATION: Glass Beads

AMOUNT(UNITS): 3 cups

UPPER BENTONITE SEAL DETAILS

TYPE: # 16 Pellets

AMOUNT: 1/4 Bag

LOWER BENTONITE SEAL DETAILS

TYPE: # 16 Pellets

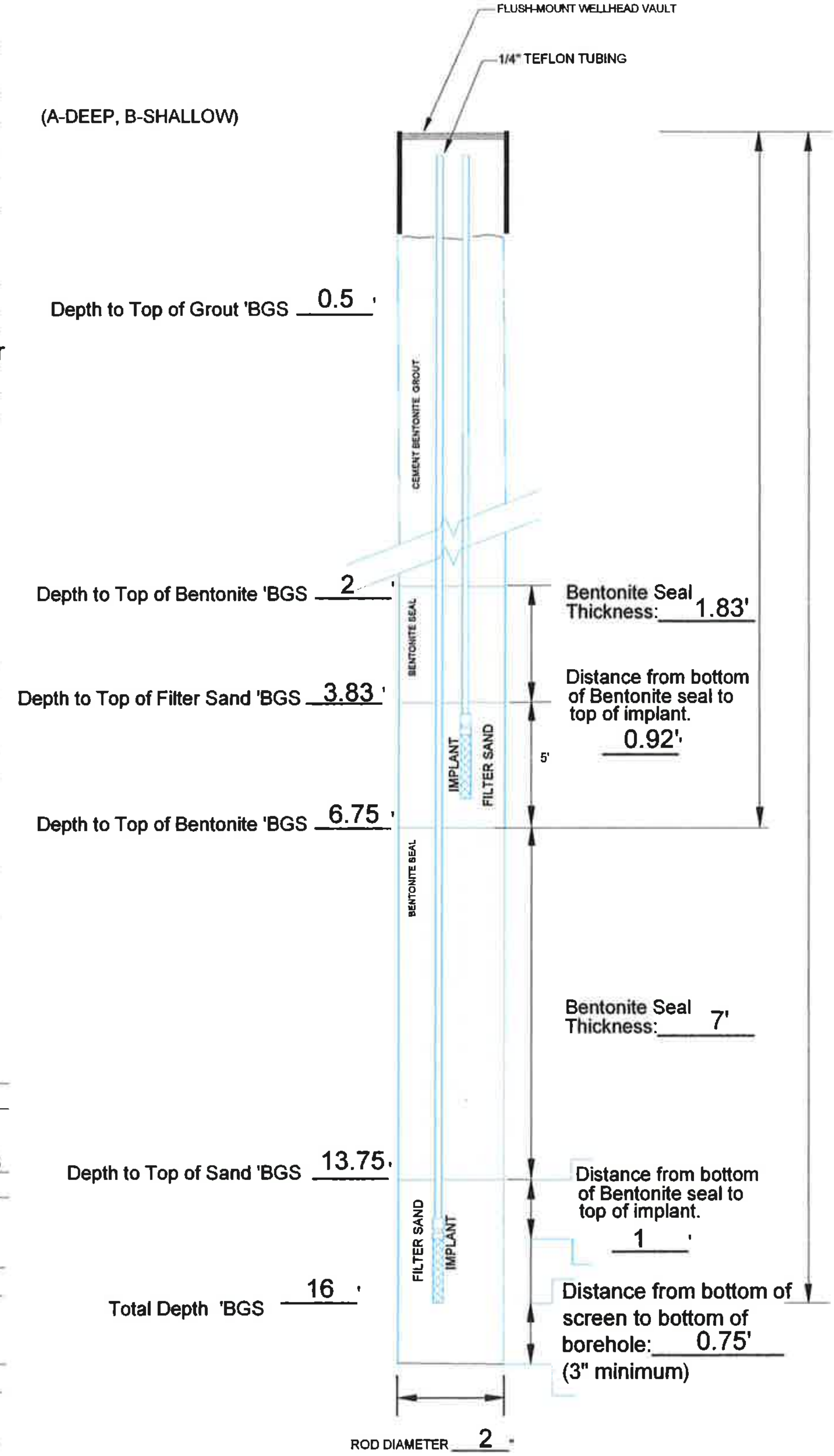
AMOUNT: 1/4 Bag

GROUT DETAILS

TYPE: I Portland

AMOUNT: 1/4 Bag

(A-DEEP, B-SHALLOW)



Appendix C

Analytical Results

TABLE C-1
ANALYTICAL RESULTS
OFF DEPOT VAPOR INTRUSION BASELINE MONITORING
Dunn Field - Defense Depot Memphis, Tennessee

Sample ID	VI-1A-BASE	VI-1B-BASE	VI-2A-BASE	VI-2B-BASE	VI-3A-BASE	VI-3A-BASE DUP	VI-3B-BASE
Lab ID	JA28198-1	JA28198-2	JA28198-3	JA28198-4	JA28198-9	JA28198-10	JA28198-11
Date	9/14/2009	9/14/2009	9/14/2009	9/14/2009	9/15/2009	9/15/2009	9/15/2009
Constituent (μg/m³)							
1,1,1-Trichloroethane	<4.4	<4.4	<4.4	<4.4	<4.4	<4.4	<4.4
1,1,2,2-Tetrachloroethane	<5.5	<5.5	<5.5	<5.5	<5.5	<5.5	<5.5
1,1,2-Trichloroethane	<4.4	<4.4	<4.4	<4.4	<4.4	<4.4	<4.4
1,1-Dichloroethane	<3.2	<3.2	<3.2	<3.2	<3.2	<3.2	<3.2
1,1-Dichloroethylene	<3.2	<3.2	<3.2	<3.2	<3.2	<3.2	<3.2
1,2,4-Trichlorobenzene	<5.9	<5.9	<5.9	<5.9	<5.9	<5.9	<5.9
1,2,4-Trimethylbenzene	97.8	3 J	9.3	30	<3.9	<3.9	<3.9
1,2-Dibromoethane	<6.1	<6.1	<6.1	<6.1	<6.1	<6.1	<6.1
1,2-Dichloroethane	<3.2	<3.2	<3.2	<3.2	<3.2	<3.2	<3.2
1,2-Dichloropropane	<3.7	<3.7	<3.7	<3.7	<3.7	<3.7	<3.7
1,3,5-Trimethylbenzene	29	<3.9	2.6 J	12	<3.9	<3.9	<3.9
1,3-Butadiene	<1.8	<1.8	<1.8	<1.8	<1.8	<1.8	<1.8
1,4-Dioxane	<2.9	<2.9	<2.9	<2.9	<2.9	<2.9	<2.9
2,2,4-Trimethylpentane	<3.7	<3.7	<3.7	<3.7	<3.7	<3.7	<3.7
2-Chlorotoluene	<4.1	<4.1	<4.1	<4.1	<4.1	<4.1	<4.1
2-Hexanone	6.1	<3.3	<3.3	<3.3	<3.3	<3.3	<3.3
3-Chloropropene	<2.5	<2.5	<2.5	<2.5	<2.5	<2.5	<2.5
4-Ethyltoluene	13	<3.9	<3.9	3.2 J	<3.9	<3.9	<3.9
Acetone	105	42	29.2	24	15	15	35.4
Benzene	1.7 J	<2.6	<2.6	<2.6	1.6 J	<2.6	4.8
Benzyl Chloride	<4.1	<4.1	<4.1	<4.1	<4.1	<4.1	<4.1
Bromodichloromethane	<5.4	<5.4	<5.4	<5.4	<5.4	<5.4	<5.4
Bromoethene	<3.5	<3.5	<3.5	<3.5	<3.5	<3.5	<3.5
Bromoform	<8.3	<8.3	<8.3	<8.3	<8.3	<8.3	<8.3
Bromomethane	<3.1	<3.1	<3.1	<3.1	<3.1	<3.1	<3.1
Carbon disulfide	6.5	3.7	5	7.2	<2.5	<2.5	1.5 J
Carbon tetrachloride	<5	<5	<5	<5	<5	<5	<5
Chlorobenzene	<3.7	<3.7	<3.7	<3.7	<3.7	<3.7	<3.7
Chloroethane	<2.1	<2.1	<2.1	<2.1	<2.1	<2.1	<2.1
Chloroform	<3.9	<3.9	<3.9	<3.9	<3.9	<3.9	<3.9
Chloromethane	<1.7	<1.7	<1.7	1.6 J	1.8	2	1.9
cis-1,2-Dichloroethylene	<3.2	<3.2	<3.2	<3.2	<3.2	<3.2	<3.2
cis-1,3-Dichloropropene	<3.6	<3.6	<3.6	<3.6	<3.6	<3.6	<3.6
Cyclohexane	<2.8	<2.8	<2.8	<2.8	<2.8	<2.8	<2.8
Dibromochloromethane	<6.8	<6.8	<6.8	<6.8	<6.8	<6.8	<6.8
Dichlorodifluoromethane	2.8 J	2.9 J	3 J	2.6 J	3.1 J	3.3 J	3.7 J
Ethanol	30.7	53.1	<3.8	23.4	12	58.6	123
Ethyl Acetate	<2.9	<2.9	<2.9	<2.9	<2.9	<2.9	118
Ethylbenzene	15	<3.5	2.3 J	4	<3.5	<3.5	1.7 J
Freon 113	<6.1	<6.1	<6.1	<6.1	<6.1	<6.1	9.2
Freon 114	<5.6	<5.6	<5.6	<5.6	<5.6	<5.6	<5.6
Heptane	6.6	<3.3	<3.3	<3.3	<3.3	<3.3	<3.3
Hexachlorobutadiene	<8.5	<8.5	<8.5	<8.5	<8.5	<8.5	<8.5
Hexane	<2.8	<2.8	<2.8	<2.8	<2.8	<2.8	7.4
Isopropyl Alcohol	<2	<2	<2	<2	72.5	7100 E	25.6
m,p-Xylene	59.5	3 J	12	16	<3.5	<3.5	6.9
m-Dichlorobenzene	<4.8	<4.8	<4.8	<4.8	<4.8	<4.8	<4.8
Methyl ethyl ketone	11	5.9	2.7	2.6	<2.4	<2.4	3.5
Methyl Isobutyl Ketone	25	<3.3	<3.3	<3.3	<3.3	<3.3	<3.3
Methyl Tert Butyl Ether	<2.9	<2.9	<2.9	<2.9	<2.9	<2.9	<2.9
Methylene chloride	4.2	7.3	2.8	2.6 J	<2.8	7.3	17
o-Dichlorobenzene	<4.8	<4.8	<4.8	<4.8	<4.8	<4.8	<4.8
o-Xylene	23	<3.5	3.9	9.6	<3.5	<3.5	3.5
p-Dichlorobenzene	10	5.7	6	5.8	<4.8	<4.8	<4.8
Propylene	<3.4	3.6	2.4 J	<3.4	<3.4	5.2	4.6
Styrene	<3.4	<3.4	<3.4	<3.4	<3.4	<3.4	<3.4
Tertiary Butyl Alcohol	2.5	<2.4	<2.4	2.5	<2.4	<2.4	<2.4
Tetrachloroethylene	5	2.9	3.7	3.5	<1.1	<1.1	<1.1
Tetrahydrofuran	20	3.5	7.4	5.3	<2.4	<2.4	<2.4
Toluene	40.7	3.7	5.3	5.3	1.4 J	2.9 J	20
trans-1,2-Dichloroethylene	<3.2	<3.2	<3.2	<3.2	<3.2	<3.2	<3.2
trans-1,3-Dichloropropene	<3.6	<3.6	<3.6	<3.6	<3.6	<3.6	<3.6
Trichloroethylene	<0.86	<0.86	<0.86	<0.86	<0.86	1.8	<0.86
Trichlorofluoromethane	2.1 J	4.4 J	<4.5	<4.5	<4.5	9	15
Vinyl Acetate	<2.8	<2.8	<2.8	<2.8	<2.8	<2.8	<2.8
Vinyl chloride	<2	<2	<2	<2	<2	<2	<2
Xylenes (total)	82.5	3 J	16	26	<3.5	<3.5	10

J: Estimated

TABLE C-1
ANALYTICAL RESULTS
OFF DEPOT VAPOR INTRUSION BASELINE MONITORING
Dunn Field - Defense Depot Memphis, Tennessee

Sample ID Lab ID Date Constituent (µg/m³)	VI-4A-BASE JA28198-12 9/15/2009	VI-4B-BASE JA28198-13 9/15/2009	VI-5A-BASE JA28198-14 9/15/2009	VI-5A-BASE DUP JA28198-15 9/15/2009	VI-6A-BASE JA28198-16 9/15/2009	VI-6B-BASE JA28198-17 9/15/2009	VI-7A-BASE-1L JA28198-18 9/15/2009
1,1,1-Trichloroethane	<4.4	<4.4	<4.4	<4.4	<4.4	<4.4	<4.4
1,1,2,2-Tetrachloroethane	<5.5	<5.5	<5.5	<5.5	<5.5	<5.5	<5.5
1,1,2-Trichloroethane	<4.4	<4.4	<4.4	<4.4	<4.4	<4.4	<4.4
1,1-Dichloroethane	<3.2	<3.2	<3.2	<3.2	<3.2	<3.2	<3.2
1,1-Dichloroethylene	<3.2	<3.2	<3.2	<3.2	<3.2	<3.2	<3.2
1,2,4-Trichlorobenzene	<5.9	<5.9	<5.9	<5.9	<5.9	<5.9	<5.9
1,2,4-Trimethylbenzene	69.3	2.4 J	285	492	54.6	42	24
1,2-Dibromoethane	<6.1	<6.1	<6.1	<6.1	<6.1	<6.1	<6.1
1,2-Dichloroethane	<3.2	<3.2	<3.2	<3.2	<3.2	<3.2	<3.2
1,2-Dichloropropane	<3.7	<3.7	<3.7	<3.7	<3.7	<3.7	<3.7
1,3,5-Trimethylbenzene	25	<3.9	89.5	184	19	17	8.4
1,3-Butadiene	<1.8	<1.8	<1.8	<1.8	<1.8	<1.8	<1.8
1,4-Dioxane	<2.9	<2.9	<2.9	<2.9	<2.9	<2.9	<2.9
2,2,4-Trimethylpentane	<3.7	<3.7	<3.7	<3.7	<3.7	<3.7	<3.7
2-Chlorotoluene	<4.1	<4.1	<4.1	<4.1	<4.1	<4.1	<4.1
2-Hexanone	<3.3	<3.3	3 J	2.7 J	<3.3	<3.3	<3.3
3-Chloropropene	<2.5	<2.5	<2.5	<2.5	<2.5	<2.5	<2.5
4-Ethyltoluene	12	<3.9	50.1	105	3.5 J	2.7 J	3 J
Acetone	33.7	14	72.2	67.9	37.5	18	31.4
Benzene	1.5 J	<2.6	4.2	6.1	<2.6	<2.6	<2.6
Benzyl Chloride	<4.1	<4.1	<4.1	<4.1	<4.1	<4.1	<4.1
Bromodichloromethane	<5.4	<5.4	<5.4	<5.4	<5.4	<5.4	<5.4
Bromoethene	<3.5	<3.5	<3.5	<3.5	<3.5	<3.5	<3.5
Bromoform	<8.3	<8.3	<8.3	<8.3	<8.3	<8.3	<8.3
Bromomethane	<3.1	<3.1	<3.1	<3.1	<3.1	<3.1	<3.1
Carbon disulfide	6.9	2.6	18	27	<2.5	3.1	2.6
Carbon tetrachloride	<5	<5	<5	<5	<5	<5	<5
Chlorobenzene	<3.7	<3.7	<3.7	<3.7	<3.7	<3.7	<3.7
Chloroethane	<2.1	<2.1	<2.1	<2.1	<2.1	<2.1	<2.1
Chloroform	2.3 J	<3.9	<3.9	<3.9	<3.9	3 J	<3.9
Chloromethane	<1.7	1.3 J	1.5 J	<1.7	<1.7	<1.7	<1.7
cis-1,2-Dichloroethylene	<3.2	<3.2	<3.2	<3.2	<3.2	<3.2	<3.2
cis-1,3-Dichloropropene	<3.6	<3.6	<3.6	<3.6	<3.6	<3.6	<3.6
Cyclohexane	<2.8	<2.8	<2.8	<2.8	<2.8	<2.8	<2.8
Dibromochloromethane	<6.8	<6.8	<6.8	<6.8	<6.8	<6.8	<6.8
Dichlorodifluoromethane	2.9 J	3 J	3 J	2.7 J	2.2 J	2.6 J	2.6 J
Ethanol	66.1	28.3	40.9	69.7	<3.8	22.8	20.2
Ethyl Acetate	<2.9	<2.9	<2.9	<2.9	<2.9	<2.9	<2.9
Ethylbenzene	13	<3.5	48.2	98.2	4.2	3.1 J	4
Freon 113	<6.1	<6.1	<6.1	<6.1	<6.1	<6.1	<6.1
Freon 114	<5.6	<5.6	<5.6	<5.6	<5.6	<5.6	<5.6
Heptane	<3.3	<3.3	2 J	2.1 J	<3.3	<3.3	<3.3
Hexachlorobutadiene	<8.5	<8.5	<8.5	<8.5	<8.5	<8.5	<8.5
Hexane	<2.8	<2.8	2.2 J	2.3 J	<2.8	<2.8	<2.8
Isopropyl Alcohol	7.4	4.2	8.4	5.9	<2	<2	<2
m,p-Xylene	50.8	3 J	215	416	14	10	18
m-Dichlorobenzene	<4.8	<4.8	<4.8	<4.8	<4.8	<4.8	<4.8
Methyl ethyl ketone	4.4	<2.4	11	11	5	<2.4	4.1
Methyl Isobutyl Ketone	1.9 J	<3.3	7	5.7	2.5 J	3.2 J	1.7 J
Methyl Tert Butyl Ether	<2.9	<2.9	<2.9	<2.9	<2.9	<2.9	<2.9
Methylene chloride	9.7	3.3	<2.8	<2.8	<2.8	<2.8	<2.8
o-Dichlorobenzene	<4.8	<4.8	<4.8	<4.8	<4.8	<4.8	<4.8
o-Xylene	19	<3.5	71.2	129	7.4	6.9	5.2
p-Dichlorobenzene	13	<4.8	2.9 J	4.1 J	<4.8	<4.8	<4.8
Propylene	4.1	<3.4	17	9.3	<3.4	<3.4	<3.4
Styrene	<3.4	<3.4	<3.4	<3.4	<3.4	<3.4	<3.4
Tertiary Butyl Alcohol	<2.4	<2.4	<2.4	<2.4	1.4 J	3.3	<2.4
Tetrachloroethylene	5.7	<1.1	16	27	3.5	5.9	4
Tetrahydrofuran	7.7	<2.4	13	11	4.7	8.8	2.4
Toluene	10	2 J	51.3	91.6	3.2	3.2	6
trans-1,2-Dichloroethylene	<3.2	<3.2	<3.2	<3.2	<3.2	<3.2	<3.2
trans-1,3-Dichloropropene	<3.6	<3.6	<3.6	<3.6	<3.6	<3.6	<3.6
Trichloroethylene	<0.86	<0.86	<0.86	<0.86	<0.86	<0.86	<0.86
Trichlorofluoromethane	4.3 J	4 J	3.6 J	3.6 J	<4.5	<4.5	<4.5
Vinyl Acetate	<2.8	<2.8	<2.8	<2.8	<2.8	<2.8	<2.8
Vinyl chloride	<2	<2	<2	<2	<2	<2	<2
Xylenes (total)	69.9	3 J	287	543	22	17	24

J: Estimated

TABLE C-1
ANALYTICAL RESULTS
OFF DEPOT VAPOR INTRUSION BASELINE MONITORING
Dunn Field - Defense Depot Memphis, Tennessee

Sample ID Lab ID Date Constituent (µg/m³)	VI-7A-BASE-6L JA28198-19 9/15/2009	VI-7B-BASE JA28198-20 9/15/2009	VI-8A-BASE JA28198-21 9/15/2009	VI-8B-BASE JA28198-22 9/15/2009	VI-9A-BASE JA28198-23 9/15/2009	VI-9B-BASE JA28198-24 9/15/2009	VMP-4A-BASE-1L JA28198-5 9/14/2009
1,1,1-Trichloroethane	<4.4	<4.4	<4.4	<4.4	<4.4	<4.4	<49
1,1,2,2-Tetrachloroethane	<5.5	<5.5	<5.5	<5.5	<5.5	<5.5	1420
1,1,2-Trichloroethane	<4.4	<4.4	<4.4	<4.4	<4.4	<4.4	<49
1,1-Dichloroethane	<3.2	<3.2	<3.2	<3.2	<3.2	<3.2	<36
1,1-Dichloroethylene	<3.2	<3.2	<3.2	<3.2	<3.2	<3.2	<36
1,2,4-Trichlorobenzene	<5.9	<5.9	<5.9	<5.9	<5.9	<5.9	<67
1,2,4-Trimethylbenzene	37	44	17	4.9	116	63.4	<44
1,2-Dibromoethane	<6.1	<6.1	<6.1	<6.1	<6.1	<6.1	<69
1,2-Dichloroethane	<3.2	<3.2	<3.2	<3.2	<3.2	<3.2	<36
1,2-Dichloropropane	<3.7	<3.7	<3.7	<3.7	<3.7	<3.7	<42
1,3,5-Trimethylbenzene	14	13	7.9	<3.9	31	18	<44
1,3-Butadiene	<1.8	<1.8	<1.8	<1.8	<1.8	<1.8	<20
1,4-Dioxane	<2.9	<2.9	<2.9	<2.9	<2.9	<2.9	<32
2,2,4-Trimethylpentane	<3.7	<3.7	3.1 J	<3.7	<3.7	<3.7	<42
2-Chlorotoluene	<4.1	<4.1	<4.1	<4.1	<4.1	<4.1	<47
2-Hexanone	<3.3	<3.3	<3.3	<3.3	2.1 J	<3.3	<37
3-Chloropropene	<2.5	<2.5	<2.5	<2.5	<2.5	<2.5	<28
4-Ethyltoluene	4.7	4	3.2 J	<3.9	11	5.4	<44
Acetone	25.9	40.6	15	22	95	17	37.1
Benzene	<2.6	2.6	2.1 J	1.9 J	1.4 J	0.99 J	<29
Benzyl Chloride	<4.1	<4.1	<4.1	<4.1	<4.1	<4.1	<46
Bromodichloromethane	<5.4	<5.4	<5.4	<5.4	<5.4	<5.4	<60
Bromoethene	<3.5	<3.5	<3.5	<3.5	<3.5	<3.5	<39
Bromoform	<8.3	<8.3	<8.3	<8.3	<8.3	<8.3	<93
Bromomethane	<3.1	<3.1	<3.1	<3.1	<3.1	<3.1	<35
Carbon disulfide	3.1	1.6 J	4	4.7	4.7	2.8	<28
Carbon tetrachloride	<5	<5	<5	<5	<5	<5	<57
Chlorobenzene	<3.7	<3.7	<3.7	<3.7	<3.7	<3.7	<41
Chloroethane	<2.1	<2.1	<2.1	<2.1	<2.1	<2.1	<24
Chloroform	2.3 J	<3.9	<3.9	<3.9	<3.9	2 J	<44
Chloromethane	<1.7	2.3	<1.7	1.9	<1.7	<1.7	<19
cis-1,2-Dichloroethylene	<3.2	<3.2	<3.2	<3.2	<3.2	<3.2	801
cis-1,3-Dichloropropene	<3.6	<3.6	<3.6	<3.6	<3.6	<3.6	<41
Cyclohexane	<2.8	<2.8	<2.8	<2.8	<2.8	<2.8	<31
Dibromochloromethane	<6.8	<6.8	<6.8	<6.8	<6.8	<6.8	<77
Dichlorodifluoromethane	<4	2.9 J	2.4 J	3.4 J	<4	2.8 J	<45
Ethanol	<3.8	36.9	<3.8	98.2	<3.8	45.6	<41
Ethyl Acetate	<2.9	24	<2.9	<2.9	<2.9	5.4	<32
Ethylbenzene	5.2	4.8	3.2 J	<3.5	8.7	3.8	<39
Freon 113	<6.1	<6.1	<6.1	<6.1	<6.1	<6.1	<69
Freon 114	<5.6	<5.6	<5.6	<5.6	<5.6	<5.6	<63
Heptane	<3.3	<3.3	<3.3	<3.3	<3.3	<3.3	<37
Hexachlorobutadiene	<8.5	<8.5	<8.5	<8.5	<8.5	<8.5	<96
Hexane	<2.8	2 J	2 J	<2.8	<2.8	<2.8	<32
Isopropyl Alcohol	<2	4.2	<2	9.3	<2	5.7	<22
m,p-Xylene	26	24	13	4.8	43.9	18	<39
m-Dichlorobenzene	<4.8	<4.8	<4.8	<4.8	<4.8	<4.8	<54
Methyl ethyl ketone	<2.4	7.1	1.9 J	<2.4	17	<2.4	<27
Methyl Isobutyl Ketone	<3.3	1.7 J	<3.3	<3.3	6.1	3.1 J	<37
Methyl Tert Butyl Ether	<2.9	<2.9	<2.9	<2.9	<2.9	<2.9	<32
Methylene chloride	<2.8	6.6	<2.8	11	<2.8	<2.8	57
o-Dichlorobenzene	<4.8	<4.8	<4.8	<4.8	<4.8	<4.8	<54
o-Xylene	7.4	9.1	3.3 J	2.1 J	16	7.8	<39
p-Dichlorobenzene	5.9	6.6	7.8	<4.8	7.8	3.6 J	<54
Propylene	<3.4	1.3 J	<3.4	3.1 J	<3.4	<3.4	19.6 J
Styrene	<3.4	<3.4	<3.4	<3.4	<3.4	<3.4	<38
Tertiary Butyl Alcohol	<2.4	2.7	<2.4	<2.4	<2.4	2.9	<27
Tetrachloroethylene	5.1	2.7	2	1.2	2.3	3.3	41
Tetrahydrofuran	<2.4	5.9	<2.4	1.7 J	7.4	15	<27
Toluene	7.2	21	4.9	5.7	12	6	<34
trans-1,2-Dichloroethylene	<3.2	<3.2	<3.2	<3.2	<3.2	<3.2	85.2
trans-1,3-Dichloropropene	<3.6	<3.6	<3.6	<3.6	<3.6	<3.6	<41
Trichloroethylene	<0.86	1.4	1	3.8	2.8	4	6830
Trichlorofluoromethane	<4.5	3.5 J	<4.5	15	<4.5	2.4 J	<51
Vinyl Acetate	<2.8	<2.8	<2.8	<2.8	<2.8	<2.8	<32
Vinyl chloride	<2	<2	<2	<2	<2	<2	<23
Xylenes (total)	33	33	16	6.9	59.9	26	<39

J: Estimated

TABLE C-1
ANALYTICAL RESULTS
OFF DEPOT VAPOR INTRUSION BASELINE MONITORING
Dunn Field - Defense Depot Memphis, Tennessee

Sample ID	VMP-4A-BASE-6L	VMP-4B-BASE-1L	VMP-4B-BASE-6L
Lab ID	JA28198-7	JA28198-6	JA28198-8
Date	9/14/2009	9/14/2009	9/14/2009
Constituent (µg/m^3)			
1,1,1-Trichloroethane	<55	<4.4	<7.6
1,1,2,2-Tetrachloroethane	2130	133	309
1,1,2-Trichloroethane	205	22	46
1,1-Dichloroethane	<40	<3.2	<5.7
1,1-Dichloroethylene	<40	<3.2	<5.6
1,2,4-Trichlorobenzene	<74	<5.9	<10
1,2,4-Trimethylbenzene	<49	<3.9	<6.9
1,2-Dibromoethane	<77	<6.1	<11
1,2-Dichloroethane	<40	2.6 J	4.9 J
1,2-Dichloropropane	<46	<3.7	<6.5
1,3,5-Trimethylbenzene	<49	<3.9	<6.9
1,3-Butadiene	<22	<1.8	<3.1
1,4-Dioxane	<36	<2.9	<5
2,2,4-Trimethylpentane	<47	<3.7	<6.5
2-Chlorotoluene	<52	<4.1	<7.2
2-Hexanone	<41	<3.3	<5.7
3-Chloropropene	<31	<2.5	<4.4
4-Ethyltoluene	<49	<3.9	<6.9
Acetone	42.3	21	70.8
Benzene	<32	1.5 J	<4.5
Benzyl Chloride	<52	<4.1	<7.2
Bromodichloromethane	<67	<5.4	<9.4
Bromoethene	<44	<3.5	<6.1
Bromoform	<100	<8.3	<14
Bromomethane	<39	<3.1	<5.4
Carbon disulfide	<31	13	18
Carbon tetrachloride	<63	14	26
Chlorobenzene	<46	<3.7	<6.4
Chloroethane	<26	<2.1	<3.7
Chloroform	29 J	15	29
Chloromethane	<21	4.1	4.7
cis-1,2-Dichloroethylene	1070	186	354
cis-1,3-Dichloropropene	<45	<3.6	<6.4
Cyclohexane	<34	<2.8	<4.8
Dibromochloromethane	<85	<6.8	<12
Dichlorodifluoromethane	<49	7.9	12
Ethanol	91.8	13	29.2
Ethyl Acetate	<36	<2.9	<5
Ethylbenzene	<43	<3.5	<6.1
Freon 113	<77	<6.1	<11
Freon 114	<70	<5.6	<9.8
Heptane	<41	<3.3	<5.7
Hexachlorobutadiene	<110	<8.5	<15
Hexane	<35	2.3 J	3.5 J
Isopropyl Alcohol	<25	<2	16
m,p-Xylene	<43	3.4 J	4.2 J
m-Dichlorobenzene	<60	<4.8	<8.4
Methyl ethyl ketone	<29	<2.4	6.8
Methyl Isobutyl Ketone	<41	<3.3	<5.7
Methyl Tert Butyl Ether	<36	<2.9	<5
Methylene chloride	35	2.6 J	<4.9
o-Dichlorobenzene	<60	<4.8	<8.4
o-Xylene	<43	<3.5	<6.1
p-Dichlorobenzene	<60	<4.8	<8.4
Propylene	26.6 J	17	24.9
Styrene	<43	<3.4	<6
Tertiary Butyl Alcohol	<30	4.2	6.4
Tetrachloroethylene	58	20	48
Tetrahydrofuran	<29	<2.4	<4.1
Toluene	<38	8.7	12
trans-1,2-Dichloroethylene	113	31	59.1
trans-1,3-Dichloropropene	<45	<3.6	<6.4
Trichloroethylene	9570	2950	6610
Trichlorofluoromethane	<56	5.1	9
Vinyl Acetate	<35	<2.8	<4.9
Vinyl chloride	<26	<2	<3.6
Xylenes (total)	<43	3.4 J	4.2 J

J: Estimated