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THE MEMPHIS DEPOT
TENNESSEE

ADMINISTRATIVE RECORD
COVER SHEET

AR File Number 1034

HDR | e²M

Memorandum

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

From: John Sperry
Tom Holmes

Date: 23 April 2010

Re: **Off Depot Vapor Intrusion Monitoring, March 2010**
Dunn Field - Defense Depot Memphis, Tennessee

HDR|e²M has prepared this report to present results of the off depot vapor intrusion (VI) 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.

VI monitoring is being performed to evaluate the potential impact on indoor air quality of chlorinated volatile organic compounds (CVOCs) in the off depot groundwater plume. This monitoring is being conducted as part of the Off Depot remedial action, which includes air sparging with soil vapor extraction (AS/SVE) near the leading edge of the off depot groundwater plume to remove CVOCs from groundwater and prevent further plume migration.

Selection of VI sample locations and initial vapor sample results were described in *Off Depot Vapor Intrusion Baseline Monitoring* dated 5 December 2009. Target areas were identified based on CVOC concentrations above the groundwater screening values in *OSWER Draft Guidance for Evaluating the Vapor Intrusion to Indoor Air Pathway from Groundwater and Soils* (USEPA, 2002). The screening values for the primary CVOCs detected in groundwater at Dunn Field are shown on 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.

Soil vapor probes were installed at nine locations (VI-1 to VI-9) shown on Figure 1. Eight vapor probes were installed on four residential properties and one vapor probe (VI-2) was installed 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). Each soil vapor probe has two 6-inch vapor sample screens at depths of approximately 5 feet and 15 feet below ground surface (bgs). Summary data for the vapor probes are shown on Table 2.

Baseline vapor samples were collected on 14-15 September 2009. The primary CVOCs detected in the loess vapor samples were below residential vapor screening values and

the concentrations were orders of magnitude lower than the concentrations in the VMP samples from the fluvial sands. The residential screening values, shown on Table 1, are from the New Jersey Department of Environmental Protection (NJDEP) as set forth in 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).

Baseline samples were collected in 1-liter (1-L) Summa canisters at all locations; a few samples were also collected in 6-liter Summa canisters to evaluate the potential for differences in results based on sample volume. The samples were analyzed for VOCs by USEPA Method TO-15. The reporting limits (RLs) achieved with the 1-L canisters were well below the screening levels; sample volume was less than half the 1-L container volume at two locations (VI-3B and VI-8B) due to tight soils, and the laboratory was still able to achieve standard RLs for these samples. The report included a recommendation that future samples be collected in 1-L Summa canisters based on the approved IAQ SAP, the guidance documents, the tight soils and the baseline results. Following discussion at the February 2010 BRAC Cleanup Team (BCT) meeting, the BCT agreed that future analyses of vapor intrusion samples could focus on the contaminants of concern, which are the primary CVOCs detected in the groundwater plume.

AS-SVE operations began on 21 December 2009. This round of vapor samples was collected to confirm the findings from the baseline samples and to evaluate impacts from AS-SVE operations on vapor concentrations.

SOIL VAPOR SAMPLING

Vapor sampling was performed by HDR|e^{2}M on 8-9 March 2010. 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). 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 for analysis of the primary CVOCs by USEPA Method TO-15.

Samples were collected from the two vapor screens at each location, where possible. Vapor samples could not be collected at six VI probe screens: VI-3A, VI-3B, VI-4A, VI-5A, VI-7B and VI-8B. The probes could not be purged because of the fine-grained soils and moisture content, even with two sampling pumps to boost the vacuum. Vapor samples were collected from VMP-4A (62-67 feet bgs) and VMP-4B (47 to 52 feet bgs), as in baseline sampling, to obtain CVOC concentrations in the fluvial sands above the groundwater plume.

VAPOR ANALYTICAL RESULTS

Fourteen soil vapor samples were collected from the VI probes and VMPs. The analytical results are shown on Table 3 with the NJDEP residential screening values; the results are summarized below.

Vapor Probe Samples - Loess

Three CVOCs were detected above the RLs and all concentrations were below the residential screening levels. The same CVOCs were reported in the baseline samples.

TCE was reported in two samples with a maximum concentration of 8.6 micrograms per cubic meter (µg/m^3) in VI-5B. The vapor screening value (27 µg/m^3) was not exceeded.

Tetrachoroethene (PCE) was reported in four samples with a maximum concentration of 8.1 µg/m^3 in VI-2B. The vapor screening value (34 µg/m^3) was not exceeded.

Methylene chloride was reported in VI-7A with a concentration of 4.2 µg/m^3. The vapor screening value (190 µg/m^3) was not exceeded.

Vapor Monitoring Point Samples – Fluvial Sands

The same three CVOCs were detected above the RLs in the two VMP samples. Reported concentrations were only slightly higher than in the vapor probe samples.

TCE was reported in both samples with a maximum concentration of 28 µg/m^3 in VMP-4B.

Methylene chloride was reported in the sample from VMP-4B at a concentration of 10 µg/m^3.

PCE was reported in the sample from VMP-4B at a concentration of 10 µg/m^3.

CONCLUSIONS AND RECOMMENDATIONS

The analytical results for samples from the vapor probes installed in the loess were similar to the baseline results; the same three CVOCs (TCE, PCE and methylene chloride) were detected at low concentrations below residential vapor screening values.

The CVOC concentrations in samples from the VMPs were significantly less than the baseline results. The sample from the deeper VMP (4A) contained only one CVOC above the RL, TCE at 1.6 µg/m^3. The baseline sample from VMP-4A contained several CVOCs with TCE at 6830 µg/m^3. The latest sample from the shallower VMP (4B) contained TCE, PCE and methylene chloride with the highest concentration being TCE at 28 µg/m^3. The baseline sample from VMP-4B contained several CVOCs with TCE at 2950 µg/m^3. The results demonstrate the success of the SVE system in removing CVOCs from the fluvial vadose zone, even with the increase in CVOCs from air sparging in the fluvial aquifer.

The results indicate that AS-SVE operations have significantly reduced CVOC concentrations in the fluvial sands and that the CVOCs in the groundwater plume do not present a VI problem for nearby residences.

The IAQ SAP provided for baseline VI sampling and, at minimum, a second round of soil vapor sampling within three months of startup of the AS/SVE system with the results used to determine requirements for additional vapor sampling and frequency. Based on the analytical results for the baseline and March 2010 samples, VI above the Off Depot plume is not a significant concern. It is recommended that no further VI monitoring be performed and that the vapor probes be abandoned.

TABLES

TABLE 1
SCREENING CONCENTRATIONS
OFF DEPOT VAPOR INTRUSION MONITORING, MARCH 2010
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 NJ DEP website.
http://www.nj.gov/dep/srp/guidance/vaporintrusion/whatsnew.htm#200703a

TABLE 2
VAPOR PROBE INSTALLATION SUMMARY
OFF DEPOT VAPOR INTRUSION MONITORING, MARCH 2010
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 3
ANALYTICAL RESULTS
OFF DEPOT VAPOR INTRUSION MONITORING, MARCH 2010
Dunn Field - Defense Depot Memphis, Tennessee

Primary CVOCs (µg/m3)	Location Lab Sample ID Date Field Sample ID Residential (a)	VI-1A JA41416-1 3/8/2010 VI-1A-1Q10	VI-1B JA41416-2 3/8/2010 VI-1B-1Q10	VI-2A JA41416-3 3/8/2010 VI-2A-1Q10	VI-2B JA41416-19 3/8/2010 VI-2B-1Q10	VI-4B JA41416-7 3/9/2010 VI-4B-1Q10	VI-5B JA41416-9 3/9/2010 VI-5B-1Q10	VI-6A JA41416-10 3/8/2010 VI-6A-1Q10	VI-6A JA41417-1 3/8/2010 DUP-1
1,1,2,2-Tetrachloroethane	34	<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
1,1-Dichloroethylene	11,000	<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
Carbon tetrachloride	31	<5	<5	<5	<5	<5	<5	<5	<5
Chloroform	24	2.6 J	<3.9	<3.9	<3.9	<3.9	<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
Methylene chloride	190	<2.8	<2.8	<2.8	<2.8	<2.8	<2.8	<2.8	<2.8
Tetrachloroethylene	34	**4.7**	**1.2**	<1.1	**8.1**	<1.1	<1.1	<1.1	<1.1
trans-1,2-Dichloroethylene	3,600	<3.2	<3.2	<3.2	<3.2	<3.2	<3.2	<3.2	<3.2
Trichloroethylene	27	<0.86	<0.86	<0.86	0.75 J	<0.86	**8.6**	<0.86	<0.86
Vinyl chloride	13	<2	<2	<2	<2	<2	<2	<2	<2

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

TABLE 3
ANALYTICAL RESULTS
OFF DEPOT VAPOR INTRUSION MONITORING, MARCH 2010
Dunn Field - Defense Depot Memphis, Tennessee

Primary CVOCs (µg/m3)	Location Lab Sample ID Date Field Sample ID Residential (a)	VI-6B JA41416-11 3/9/2010 VI-6B-1Q10	VI-7A JA41416-12 3/8/2010 VI-7A-1Q10	VI-8A JA41416-14 3/8/2010 VI-8A-1Q10	VI-9A JA41416-16 3/8/2010 VI-9A-1Q10	VI-9B JA41416-20 3/9/2010 VI-9B-1Q10	VMP-4A JA41416-17 3/8/2010 VMP-4A-1Q10	VMP-4A JA41417-2 3/8/2010 DUP-2	VMP-4B JA41416-18 3/8/2010 VMP-4B-1Q10
1,1,2,2-Tetrachloroethane	34	<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
1,1-Dichloroethylene	11,000	<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
Carbon tetrachloride	31	<5	<5	<5	<5	<5	<5	<5	<5
Chloroform	24	<3.9	<3.9	<3.9	<3.9	<3.9	<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	1.9 J
Methylene chloride	190	<2.8	**4.2**	<2.8	<2.8	<2.8	<2.8	<2.8	**10**
Tetrachloroethylene	34	<1.1	**1.8**	<1.1	<1.1	1 J	<1.1	<1.1	**2.5**
trans-1,2-Dichloroethylene	3,600	<3.2	<3.2	<3.2	<3.2	<3.2	<3.2	<3.2	<3.2
Trichloroethylene	27	<0.86	<0.86	<0.86	**5.9**	<0.86	**11**	**1.6**	**28**
Vinyl chloride	13	<2	<2	<2	<2	<2	<2	<2	<2

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

FIGURES

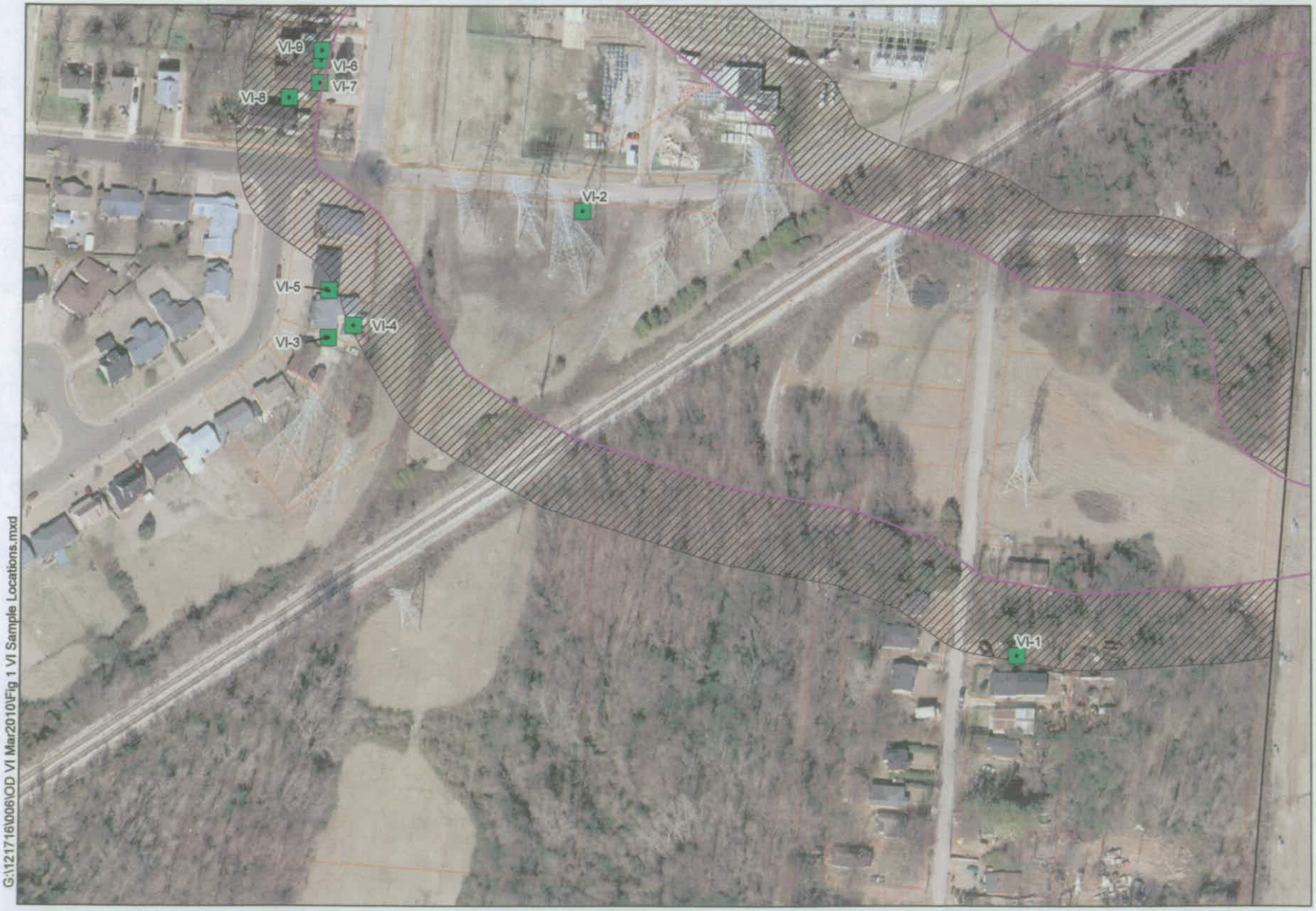

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Figure 1

VAPOR PROBE LOCATIONS

OFF DEPOT VAPOR INTRUSION MONITORING, MARCH 2010

DUNN FIELD
DEFENSE DEPOT
MEMPHIS, TENNESSEE

Legend

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

0 25 50 100 150 200
Feet

Installation Location
Memphis, Tennessee

Date: April 2010
Edition: Rev 0

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