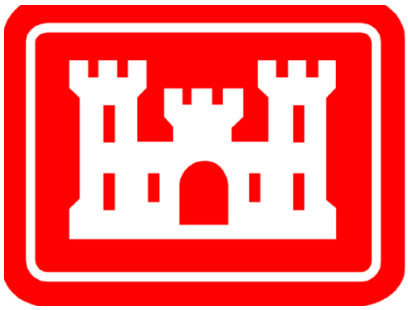
# OFF DEPOT AIR SPARGE - SOIL VAPOR EXTRACTION SYSTEM
# ANNUAL OPERATIONS REPORT, YEAR FOUR

## Dunn Field - Defense Depot Memphis, Tennessee

**Prepared for:**


**Department of the Army**



**USACE Contract No. W90FYQ-09-D-0005**
**Task Order No. DS01**

**August 2014**
**Revision 1**

# OFF DEPOT AIR SPARGE - SOIL VAPOR EXTRACTION SYSTEM

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## Dunn Field - Defense Depot Memphis, Tennessee

Prepared for:

U.S. Army Corps of Engineers, Tulsa District
Contract No. W90FYQ-09-D-0005
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Prepared by:

HDR
9781 S. Meridian Blvd,
Suite 400
Englewood, Colorado 80112

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## LIST OF ACRONYMS AND ABBREVIATIONS

| | |
|---|---|
| acfm | actual cubic feet per minute |
| AS/SVE | air sparging and soil vapor extraction |
| AWS | air/water separator |
| bgs | below ground surface |
| BRAC | Base Realignment and Closure |
| cfm | cubic feet per minute |
| CVOC | chlorinated volatile organic compound |
| DDMT | Defense Depot Memphis, Tennessee |
| DQE | data quality evaluation |
| DQO | data quality objectives |
| IAQ | intermediate aquifer |
| in. $H_2O$ | inches of water |
| in. Hg. | inches of mercury |
| IRACR | Interim Remedial Action Completion Report |
| lb/hr | pounds per hour |
| LTM | long-term monitoring |
| µg/L | micrograms per liter |
| MI | Main Installation |
| MLGW | Memphis Light, Gas and Water |
| MSCHD | Memphis/Shelby County Health Department |
| O&M | operations and maintenance |
| PID | photoionization detector |
| PLC | programmable logic controller |
| ppbv | parts per billion by volume |
| ppm | parts per million |
| psi | pounds per square inch |
| QAPP | Quality Assurance Project Plan |
| RA | remedial action |
| RAWP | Remedial Action Work Plan |
| RA SAP | Remedial Action Sampling and Analysis Plan |
| RD | remedial design |
| RL | reporting limit |
| scfm | standard cubic feet per minute |
| SVE | soil vapor extraction |

## LIST OF ACRONYMS AND ABBREVIATIONS
## (CONTINUED)

| | |
|---|---|
| TCE | trichloroethene |
| TDEC | Tennessee Department of Environment and Conservation |
| TeCA | 1,1,2,2-tetrachloroethane |
| U.S. | United States |
| USACE | United States Army Corps of Engineers |
| USEPA | United States Environmental Protection Agency |
| VFD | variable frequency drive |
| VMP | vapor monitoring point |
| VOC | volatile organic compound |

# 1.0 INTRODUCTION

HDR has prepared this Annual Operations Report for the Off Depot air sparging and soil vapor extraction (AS/SVE) system under Contract W90FYQ-09-D-0005, Task Order DS01 to the United States Army Corps of Engineers (USACE), Tulsa District. This report summarizes the operations and maintenance (O&M) activities and the results of system monitoring for Year Four AS/SVE operations at the Off Depot groundwater plume west of Dunn Field at Defense Depot Memphis, Tennessee (DDMT). The report covers operations from 1 January through 31 December 2013.

Tennessee Department of Environment and Conservation (TDEC) approved the Year 4 AS/SVE Operations Report, Rev.0 on 11 July. U.S. Environmental Protection Agency (USEPA) Region 4 provided comments on 18 July; the comments were a resubmission of Agency comments on the 2013 Long-Term Monitoring (LTM) Report (general and specific for Dunn Field) with the Army's final responses to those comments. Since the Army responses were incorporated, additional response was not requested. The TDEC approval and the USEPA correspondence and re-submitted comment-response are included in Appendix A.

## 1.1 SITE DESCRIPTION AND BACKGROUND

DDMT, which originated as a military facility in the early 1940s, received, warehoused, and distributed supplies common to all United States (U.S.) military services and some civil agencies located primarily in the southeastern U.S., Puerto Rico, and Panama. Stocked items included food, clothing, petroleum products, construction materials, and industrial, medical, and general supplies. In 1995, DDMT was placed on the list of the Department of Defense facilities to be closed under Base Realignment and Closure (BRAC). Storage and distribution of material continued until the facility closed in September 1997.

DDMT is located in southeastern Memphis, Shelby County, Tennessee approximately five miles east of the Mississippi River and two miles north of Memphis International Airport. The property consists of approximately 632 acres and includes the Main Installation (MI) and Dunn Field. The MI contains approximately 567 acres used for open storage areas, warehouses, military family housing, and outdoor recreational areas. Dunn Field, located across Dunn Avenue from the north-northwest portion of the MI, covers approximately 65 acres with former mineral storage and waste disposal areas.

In 1992, DDMT was added to the National Priorities List; the facility identification number is TN4210020570. Responsibility for environmental restoration at DDMT transferred from the Defense

Logistics Agency to the Department of the Army, BRAC Division in December 2010. The regulatory oversight agencies are the USEPA Region 4 and the TDEC.

## 1.2 SITE GEOLOGY AND HYDROGEOLOGY

The geologic units of interest at Dunn Field are (from youngest to oldest): loess, including surface soil; fluvial deposits; Jackson Formation/Upper Claiborne Group; and Memphis Sand.

The loess consists of wind-blown and deposited brown to reddish-brown, low plasticity clayey silt to silty clay. The loess deposits are about 20 to 30 feet thick and are continuous throughout the Dunn Field area.

The fluvial (terrace) deposits consist of two general layers. The upper layer is a silty, sandy clay that transitions to a clayey sand and ranges from about 10 to 36 feet thick. The lower layer is composed of interlayered sand, sandy gravel, and gravelly sand, and has an average thickness of approximately 40 feet. The uppermost aquifer is the unconfined fluvial aquifer, consisting of saturated sands and gravelly sands in the lower portion of the deposits. The saturated thickness of the fluvial aquifer ranges from 3 to 50 feet and is controlled by the configuration of the uppermost clay in the Jackson Formation/Upper Claiborne Group. The groundwater in the fluvial aquifer is not a drinking water source for area residents.

The Jackson Formation/Upper Claiborne Group consists of clays, silts, and sands. The uppermost clay unit appears to be continuous, except in the southwestern area of Dunn Field. Off site, to the west and northwest of Dunn Field, there are possible gaps in the clay. Where present, these gaps create connections to the underlying intermediate aquifer (IAQ) from the fluvial deposits. The IAQ is locally developed in deposits of the Jackson Formation/Upper Claiborne Group.

The Memphis Sand primarily consists of thick bedded, white to brown or gray, very fine grained to gravelly, partly argillaceous and micaceous sand. The Memphis Sand ranges from 500 to 890 feet in thickness, and begins at a depth below ground surface (bgs) of 120 to 300 feet. The Memphis aquifer is confined by overlying clays and silts in the Cook Mountain Formation (part of the Jackson/Upper Claiborne Group) and contains groundwater under strong artesian (confined) conditions regionally. The City of Memphis obtains the majority of its drinking water from this unit. The Allen Well Field, which is operated by Memphis Light, Gas & Water (MLGW), is located approximately two miles west of Dunn Field.

## 1.3 OFF DEPOT REMEDIAL ACTION

The *Memphis Depot Dunn Field Off Depot Groundwater Final Remedial Design, Revision 1* (Off Depot RD) (CH2M HILL, 2008) was approved by USEPA and TDEC in October 2008. The *Dunn Field Off Depot Groundwater Remedial Action Work Plan, Revision 2* (Off Depot RAWP) ($e^2$M, 2009) was submitted to USEPA and TDEC 15 April 2009. TDEC approved Revision 0 of the Off Depot RAWP on 18 October 2008 and USEPA approved Revision 1 on 18 March 2009. In the approval letter, USEPA suggested two revisions regarding reporting requirements and contingency actions; those changes were made in the final version. The Off Depot remedial action (RA) included the following components:

- Installation of an AS/SVE system across the core of the plume near the downgradient end.
- Monitored natural attenuation and long-term groundwater monitoring to document remedy performance as indicated by changes in chlorinated volatile organic compound (CVOC) concentrations and/or changes in the lateral or vertical extent of the CVOC plume.
- Institutional controls to prevent access to contaminated groundwater.

The RA construction activities and Year 1 operations were described in the *Off Depot Groundwater Interim Remedial Action Completion Report, Revision 1* (Off Depot IRACR) (HDR, 2011a), which was submitted to USEPA and TDEC on 29 July 2011. The Off Depot IRACR was approved by USEPA on 29 August 2011 and by TDEC on 15 November 2011.

## 1.4 AS/SVE SYSTEM DESCRIPTION

AS/SVE is being conducted near the leading edge of the groundwater plume west of Dunn Field to remove CVOCs from groundwater and prevent further plume migration. The AS/SVE system was designed to intercept the majority of the Off-Depot CVOC plume and to reduce individual CVOC concentrations below 50 micrograms per liter (µg/L). AS/SVE operations began 21 December 2009 and are expected to continue up to 5 years in order to meet remedial action objectives.

AS/SVE operations were incorporated in the Memphis/Shelby County Health Department (MSCHD) Permit #01030-01P issued for the fluvial soil vapor extraction system on Dunn Field. Permit conditions include maintaining volatile organic compound (VOC) emissions below 5.71 pounds per hour (lb/hr) or 25 tons per year with documentation provided in an annual emissions report.

The AS/SVE system consists of 90 AS wells, 12 SVE wells, 10 pairs of vapor monitoring points (VMPs) and control buildings for the AS compressor, SVE blowers and system controls. The system layout is shown on Figure 1.

The AS system is powered by a Kaeser CSD 100 rotary screw air compressor specified at 500 standard cubic feet per minute (scfm) at 125 pounds per square inch (psi); air filters minimize oil particles in the air stream from the compressor. The other AS components are receiving tank, refrigerated dryer, pressure regulator and relief valve, solenoid panel and sparge manifold, and AS wells. Each AS well was installed at the base of the fluvial aquifer at depths of 82 to 115 feet bgs. Compressed air is fed to each solenoid bank (each containing 20 solenoid valves) via 3/8-inch tubing; a second 3/8-inch air line was added to each solenoid bank during start-up. As each solenoid valve opens, compressed air travels through individual 5/16-inch tubing to a manifold leg (one leg for each AS well). Each manifold leg consists of a check valve, speed control valve, rotameter and pressure regulator.

The SVE system consists of two Kaeser positive displacement rotary blowers (Model 420C/53P) installed in parallel configuration; each 40-horsepower blower is specified for 485 scfm at 10 inches of mercury (in. Hg). The blowers are connected to 12 SVE wells with 30-foot screens beginning at depths of 35 to 45 feet bgs. The SVE wells were installed on roughly 50-foot centers to capture the vapors from the AS wells; the maximum separation between an AS well and the nearest SVE well (SVE-12 and AS-90) is approximately 60 feet. Extracted vapor from the individual wells combine in a single 6-inch header at the piping manifold outside the SVE building; the SVE wells are adjusted at the manifold to balance individual flow rates. The vapor stream passes through the air/water separator (AWS) tank to remove entrained vapor and debris from the air stream. No other treatment is performed prior to discharge.

VMPs were installed to monitor the radius of influence of the SVE wells and the CVOC concentrations in the vadose zone. There are 10 pairs of nested VMPs with 5-foot screens located 20 to 60 feet from the nearest SVE well; the shallow (‘B’) VMPs are screened at an average depth of 49 feet bgs and the deep (‘A’) VMPs are screened at an average depth of 64 feet bgs.

The amount of air required for the 90 AS wells was calculated at 450 scfm based on a maximum injection rate of 15 scfm and pulsed operation with 1/3 of the AS wells operating at any one time. Pulsed operation was selected to decrease the required system injection flow capacity, optimize air distribution by limiting the formation of permanent air channels, and minimize the likelihood that groundwater will bypass the AS barrier due to permeability reductions caused by the air injection.

The AS wells and SVE wells are connected via buried piping to two equipment buildings; one housing the compressor for the sparge points and the other housing two blowers for the SVE wells. The AS-SVE system is operated through programmable logic controllers (PLCs) in the AS and SVE control buildings. The AS PLC operates the solenoids to direct air to the individual AS wells for the programmed daily schedule, to monitor operations and to trigger alarms or shut downs as necessary. The SVE PLC monitors blower operations and sends alarm notifications or shuts down the system if necessary. The AS compressor has a separate controller to monitor operations and trigger alarms or shut downs as necessary.

The standard system design operations have the 12 SVE wells operating with 1/3 of the 90 AS wells. The design air injection rate is 15 cubic feet per minute (cfm) at each AS well for a total of 450 cfm and the design vapor extraction rate is 1.5 times the air injection rate, 675 cfm or approximately 55 cfm per well. The AS PLC operates the wells in three groupings (A: AS-1, AS-4, AS-7...; B: AS-2, AS-5, AS-8...; and C: AS-3, AS-6, AS-9...). Each AS group is operated for four hours before the system switches to the next group.

Condensate from SVE operations is collected in a 160-gallon cylindrical AWS, which separates entrained liquid and debris within the air stream. Condensate is transferred from the AWS to a 505-gallon polyethylene tank outside the SVE building. Once the exterior tank nears capacity, water is pumped to a trailer-mounted transfer tank and transferred to a condensate storage tank on Dunn Field for analysis prior to discharge.

## 1.5 PREVIOUS OPERATIONS AND MONITORING RESULTS

### 1.5.1 System Operations and Monitoring

#### 1.5.1.1 Year One

Year 1 system operations were described in the Off Depot IRACR. The SVE system was initially operated with two blowers during the day and one blower on nights and weekends due to noise complaints from a nearby resident during system startup. Following modifications to reduce noise, the SVE system began operations with both blowers full-time on 7 May 2010. System uptime during Year One from startup on 21 December 2009 through 31 December 2010 was 97%. Downtime was due to equipment maintenance and sampling activities.

Groundwater monitoring results in September 2010 indicated the plume may be partially diverted around the southern edge of the AS/SVE system, possibly due to decreased permeability from the air injection.

On 24 November 2010, normal operations with the AS compressor and both SVE blowers was reduced to two days per week with a single blower operated at other times.

AS injection rates averaged 285 scfm from December 2009 through December 2010; the average AS injection rate increased to 344 scfm after adjustments were completed in May 2010. SVE flow rate and vacuum averaged 1093 scfm at 9.8 in. Hg with both blowers and 693 scfm at 5.8 in. Hg with a single blower. Average flow rates at individual wells ranged from 49 actual cubic feet per minute (acfm) to 148 acfm. Average vacuum at VMPs ranged from 18.2 to 34.4 inches of water (in. $H_2O$) with both blowers operating.

Total primary CVOCs in the system effluent decreased from 1201 parts per billion by volume (ppbv) at start-up in December 2009 to 58.4 ppbv in December 2010. The CVOCs detected at the highest concentrations were trichloroethene (TCE) and 1,1,2,2 tetrachloroethane (TeCA); TCE was 40% to 70% of total CVOCs, while TeCA was 10% to 35% of total CVOCs. VOC mass removal was estimated from system operating hours, flow rates and VOC concentrations in the effluent sample, based on the primary constituent (TCE). VOC emission rates decreased from 0.025 lb/hr at startup to 0.001 lb/hr in December 2010. The emissions were below the de minimus standard of 0.1 lb/hr for the MSCHD operating permit. The AS/SVE system removed approximately 71 pounds of VOCs from startup through December 2010.

#### 1.5.1.2 Year Two

Year 2 system operations were described in the *Off Depot AS/SVE System Annual Operations Report, Year Two, Revision 0* (HDR, 2012). Standard system operations with the AS compressor and SVE blowers were limited to two days per week until 14 March and three to four days per week for the remainder of the year. When the AS system was off-line, the SVE system operated with a single blower. Problems with Blower #1 resulted in system operation with the AS compressor and a single blower after August 2011. System uptime during Year Two (2011) was 94%. The primary causes of downtime were normal equipment maintenance and power outages from storms.

AS injection rates averaged 300 scfm during Year 2. SVE vacuum and flow rate averaged 1004 scfm at 13.0 in. Hg with both blowers and 655 scfm at 8.0 in. Hg with a single blower. Average flow rates at individual wells ranged from 64 to 104 acfm with both blowers in operation and 22 to 78 acfm with one blower. Average vacuum at VMPs ranged from 13 to 28 in. $H_2O$ with both blowers operating and 3.7 to 16 in. $H_2O$ with one blower.

Total primary CVOCs in the system effluent decreased from 58.4 ppbv in December 2010 to 26.4 ppbv in December 2011. The CVOC detected at the highest concentration was TCE at 47% to 71% of the total primary CVOC concentration. VOC emission rates were 0.001 lb/hr throughout Year 2 and the AS/SVE system removed approximately four pounds of VOCs.

#### 1.5.1.3 Year Three

Year 3 system operations were described in the *Off Depot AS/SVE System Annual Operations Report, Year Three, Revision 0* (HDR, 2013a). Standard system operations with the AS compressor and SVE blowers were limited to three to four days per week until 10 July. A single SVE blower was operated when the AS compressor was off-line. The system was operated with a single blower much of the time with and without the AS compressor due to problems with Blower #1.

Following review of groundwater monitoring results from April 2012, systems operations were modified to target areas with higher CVOC concentrations. On 14 June 2012, air sparging was stopped at 24 AS wells and reduced to half-time (4 hours per day at 18 AS wells); air sparging remained 8 hours per day (at the other 48 AS wells; and two SVE wells, SVE-8 and SVE-12, were closed to increase vapor extraction near the operating AS wells. An additional change was made on 10 July to reduce time required for adjusting system operations; the AS compressor was set to operate 7 days per week with the AS wells operating 12 hours per day from 08:00 to 20:00 and individual AS wells in the three groups operating 4 hours per day (at the 48 full-time AS wells) or 2 hours per day (at the 18 half-time AS wells); the other 24 AS wells remained closed. A single SVE blower was set to operate 7 days per week with the two blowers alternating on a 12-hr cycle. On 24 October, the two closed SVE wells, SVE-8 and SVE-12, were re-opened because of increased PID readings at SVE wells.

System uptime during Year Three (2012) was 97%. The primary causes of downtime were power outages during storms and utility maintenance, and system maintenance.

AS injection rates averaged 268 scfm prior to closing AS wells in June and 192 scfm afterward. SVE vacuum and flow rate averaged 652 scfm at 8.2 in. Hg with a single blower and average flow rates at individual wells ranged from 21 to 67 acfm. Average vacuum at VMPs ranged from 5.0 to 14.4 in. $H_2O$ with a single blower.

Total primary CVOCs in the system effluent ranged from 21.3 to 33.1 ppbv in Year 3. The CVOC detected at the highest concentration was TCE at 59% to 69% of the total primary CVOC concentration. VOC emission rates were 0.0004 to 0.0021 lb/hr during Year 3; the higher emission rates was due to an

anomalous toluene concentration in June. The AS/SVE system removed approximately five pounds of VOCs.

### 1.5.2 Groundwater Monitoring

LTM results are used to assess the overall effectiveness of the AS-SVE system. The treatment goal for the AS/SVE system is to reduce groundwater concentrations downgradient of AS/SVE barrier below 50 µg/L for individual CVOCs. The goal was met in the 5 performance monitoring wells immediately downgradient of the AS/SVE barrier in June 2010.

In October 2012, CVOC concentrations in the Off Depot plume met the treatment goal of 50 µg/L for individual CVOCs in all but one LTM well, MW-159, near the center of the off depot plume and upgradient of the AS/SVE system. Additional information is provided in the *Annual Long-Term Monitoring Report – 2012, Revision 0* (HDR, 2013b).

## 1.6 SCOPE OF WORK

HDR has performed O&M activities for the AS/SVE system since system startup in December 2009. The goals for O&M are to:

- Maintain system operations through regular field inspections, maintenance, and repairs; and
- Monitor system effectiveness through air injection and vapor extraction flow rates, vacuum measurements, photoionization detector (PID) measurements, and laboratory analysis of system effluent samples.

O&M activities follow procedures described in the *Dunn Field Off Depot Groundwater Air Sparge and Soil Vapor Extraction System Operations and Maintenance Manual* (AS/SVE O&M Manual) (HDR, 2011b).

The scope for Year 4 AS/SVE operations included the following activities:

- Monthly system inspections with
  - Repair or replacement of components, as required;
  - Readings at AS compressor, SVE wells and system effluent for flow rate, vacuum, temperature, and operating hours;
  - PID measurements at SVE wells and system effluent;

- PID and vacuum measurements at VMPs;

- Quarterly laboratory samples from system effluent analyzed for VOCs and reports to describe O&M activities, system status, performance and monitoring results; and

- Annual operations report to summarize system operations and monitoring results with data validation and to provide recommendations for future operations.

# 2.0 SYSTEM OPERATIONS

No changes to system operations were made in Year Four. The AS compressor was operated 7 days per week with the AS wells operating 12 hours per day from 08:00 to 20:00 and individual AS wells in the three groups operating 4 hours per day (at the 48 full-time AS wells) or 2 hours per day (at the 18 half-time AS wells); 24 AS wells remained closed. A single SVE blower operated 7 days per week; the two blowers alternated on a 12-hr cycle when both were working. The current system plan is shown on Figure 1.

## 2.1 SYSTEM PERFORMANCE

AS/SVE system uptime during Year Four was approximately 91%. The primary cause of downtime was a broken coupler in the AS compressor. Blower #2 shutdown in April 2013 due to a variable frequency drive (VFD) fault, and Blower #1 operated full-time until Blower #2 was returned to operation in November 2013. The AS/SVE system did not operate for most of July due to the broken coupler.

## 2.2 SYSTEM FLOW RATES AND VACUUMS

Operating conditions were recorded during site visits at least monthly in Year Four. The AS parameters include pressure and air temperature at the AS compressor and the manifold, maximum and minimum air flow rates at the manifold, and pressure and flow rate at each operating AS well. The SVE parameters include vacuum and air temperature for each blower and the system effluent, and vacuum and flow rate for each SVE well. Operating hours for each blower and the compressor are also recorded. SVE system effluent flow rates are measured using a pitot tube and flow rates at individual wells are measured by vane-type meters at the well manifold. Vacuum measurements are made using a digital manometer. Operating conditions are recorded on forms provided in the AS/SVE O&M Manual. Remote system monitoring was used to augment the site visits, although not all parameters are available remotely.

AS injection rates, listed on Table 1, ranged from 164 to 213 scfm and averaged 193 scfm. Air extraction rates and vacuum measurements at SVE wells and system effluent are also shown on Table 1. The system was operated with a single blower and all 12 SVE wells during Year 4; average flow rates at individual SVE wells were 48 to 79 acfm, except for SVE-7 which averaged 33 acfm. SVE-7 has had a lower average flow rate since installation and is assumed to be in an area of locally tighter soils. Combined flow from all SVE wells averaged 696 scfm at 8.2 in. Hg.

The design combined flow rate with both blowers in operation was 675 scfm, or 1.5 times the target injection rate of 450 scfm. Based on the average AS injection rate of 193 scfm and the average combined

SVE flow rate of 696 scfm, the SVE system extracted approximately 3.6 times the injection rate during Year Four.

## 2.3 SYSTEM MAINTENANCE

General preventative maintenance, performed after weekly system readings are recorded, includes: checking the oil level in the compressor and adding oil as necessary, checking and cleaning air filter mats in the compressor control panel, and checking automatic drains in the refrigerated dryer. Monthly preventative maintenance includes cleaning the compressor and dryer heat exchange radiators, emptying moisture from the compressor vacuum line, checking air intake filters for the AS building, checking and tightening blower v-belts, and checking SVE blower oil levels and adding oil as necessary. Field notes are recorded on maintenance and inspection forms. General housekeeping of the AS and SVE buildings and equipment compound is performed as needed.

Maintenance activities and system shutdowns during Year Four are listed below:

- The AS/SVE system shut down due to "AWS High Level" alarm at 00:12 on 23 February. The AWS pump was checked but no problem was found. The system was restarted at 11:07 on 24 February.
- The system shut down due to "SVE Blower #2 VFD Default" alarm on 17 April at 10:26. The system was inspected on 18 April; Blower #2 could not be started and Blower #1 was set to run full-time at 16:50. The following actions were taken:
  - Blower #2 was inspected by a Kaeser technician on 13 May; problems with motor bearings and an oil leak from a broken seal were observed.
  - Blower #2 motor was removed on 30 May and delivered to TriState Armature for repair. The rebuilt motor was installed on 20 June but would not start. The blower compressor was not operating and, upon further inspection, was found to have been the cause of the motor failure.
  - Blower #2 compressor was removed on 28 August and delivered to Kaeser for inspection and repair. The repaired compressor was installed on 23 October; during testing, an air leak was found at a gasket near the blower motor. Blackwell Enterprises installed a custom gasket and Blower #2 was re-started on 11 November. The two blowers were set to alternate every 12 hours.
- The AS compressor shut down prior to remote monitoring on 23 July. The compressor was inspected on 25 July and found to have a broken coupling and to have shut down at 11:39 on July

2. The blower was turned off until the compressor could be repaired. The coupling was replaced, and the compressor and the blower were restarted at 10:12 on 1 August.

- The water column gauge on the air/water separator tank was cleaned on 25 July to improve visibility for water volume readings. The flow rate gauge needle for SVE-2 was not visible during readings on 8 August; the gauge was disassembled and cleaned prior to readings on 28 August.
- The AS compressor shut down on 9 August at 01:44, apparently due to a power surge. The compressor was restarted at 11:30 on the same day.
- Repairs to AS wells 03, 22, 24, 34, 51, 52, 54 and 59 were completed by Tri-State Testing Services in September. The well pads were removed, the area excavated, and the sparge connections repaired; new well pads were then installed and the AS wells were jetted with a side discharge tremie pipe lowered to the bottom of the well. The wells were tested and returned to operation in October.
- Sparge points AS-05 and AS-09 were observed to have broken connections during the site visit on 25 September. The air flow to these points was closed through the system computer.
- The internet connection for the laptop computer running the AS/SVE system interface went down on 11 October. AT&T repaired the DSL connection on 16 October. HDR IT re-established the remote connection on 5 November.
- A water leak from the compressor condensate ProTank™ was observed 11 December. The condensate drain line was cleared of sediment.
- The analog temperature gauge on blower #2 was repaired on 13 December by Blackwell Enterprises. The anode had apparently oxidized during replacement of the blower.
- Year 4 annual maintenance was performed by Kaeser technicians on 28 January 2014. All required maintenance was performed and the system was reported to be in good working order. The maintenance report is included as Appendix B.

# 3.0 SYSTEM MONITORING

AS/SVE system monitoring consists of vacuum measurements at VMPs; PID readings at the system effluent, SVE wells and VMPs; and laboratory analysis of vapor samples from the system effluent. PID readings at the SVE well manifold and the system effluent are made weekly; PID readings and vacuum measurements at VMPs are made monthly; and vapor samples from the system effluent are collected quarterly for laboratory analysis. The monitoring activities are performed in accordance with the *Remedial Action Sampling and Analysis Plan, Revision 1* (RA SAP) (MACTEC, 2005) and the *Remedial Action Operations and Long Term Monitoring Quality Assurance Project Plan, Revision 0* (QAPP) (HDR, 2011c). The QAPP is consistent with the RA SAP but has not received final approval.

## 3.1 VACUUM MEASUREMENTS

Vacuum measurements are collected at VMPs by connecting a digital manometer (Dwyer Series 475 Mark 3) to a quick-connect fitting in the sealed cap of each VMP well casing. The vacuum measurements are shown on Table 2. The measured vacuum increased at all VMPs in March and remained at the higher levels; there was no change in operations to account for the increase. Individual measurements at VMPs ranged from 4.5 to 33 inches of water and the average at each VMP was 10 to 23 inches of water. The measurements demonstrate air injected during sparging is captured throughout the treatment area by the SVE wells.

## 3.2 PID MEASUREMENTS

VOC concentrations are estimated through field measurements at individual SVE wells, system effluent, and VMPs with a MiniRae 2000 (10.6 eV lamp) PID. The PID is calibrated with a 100 parts per million (ppm) concentration of isobutylene prior to use. At each location, vapor is collected in a dedicated Tedlar® bag, the PID meter is connected to the Tedlar® bag and the maximum reading is recorded. For measurements at the SVE wells and VMPs, an oil-less high vacuum sampling pump is used to draw the vapor stream into a tedlar bag. No pump is needed at the system effluent as it is under positive pressure.

Measurements at SVE wells and system effluent are shown on Table 3. PID readings measured 0 to 3.4 ppm at the system effluent and 0 to 9.1 ppm at SVE wells. PID readings were higher in January, April, June, late August and September, but were at 0 ppm for all SVE wells and system effluent in November and December. The average PID readings at the SVE wells were similar, ranging from 0.7 to 2.5 ppm.

The VMPs are first purged of three tubing volumes using the sampling pump. Multiple PID readings are collected at each VMP using a dedicated Tedlar bag until three consecutive readings are within 10%. The VMP PID readings are shown on Table 4. The VMP readings were variable during Year 4, ranging from 0 to 25 ppm. Only nine readings exceeded 10 ppm and all were recorded in the March and April measurements. Elevated readings were also recorded in June, October and early November; readings were near 0 ppm at other times. The higher readings were generally observed at VMPs pairs 7, 8, 9 and 10, which are located in the western section of the AS/SVE system where all AS wells are in use.

### 3.3 VAPOR SAMPLES

Vapor samples were collected from the system effluent during Year Four to monitor system performance and to confirm treatment system compliance with permitted discharge limits. Quarterly vapor samples were collected in March, June, September and December 2013. The analytical results for the initial 3rd quarter sample collected on 25 September were not consistent with past results and, although there were no apparent problems with system operations or with sampling and analytical procedures, a second sample was collected on 22 October. Vapor samples were collected in 6-liter Summa canisters without a flow regulator. The Summa canisters were shipped from the laboratory with negative pressure; a sampling pump was not required for sample collection. Samples were submitted to Columbia Analytical Services Inc. in Simi Valley, CA for analysis of VOCs by USEPA Method TO-15.

Complete analytical results for the effluent vapor samples are presented in Appendix C, Table C-1. Table 5 lists the analytical results for the primary CVOCs historically detected at Dunn Field and for other VOCs detected above the reporting limit (RL) in a sample. The totals for primary CVOCs and for all VOCs detected above the RL are also listed. The results for the September sample are not considered representative of site conditions and were not used in evaluation of the results are in the mass calculations for this report.

Total primary CVOCs in the system effluent ranged from 32.4 to 39.3 ppbv in Year 4. The CVOC detected at the highest concentrations was TCE at 60% to 65% of the total primary CVOC concentration. Total VOCs in the system effluent ranged from 46.7 to 54.5 ppbv. System effluent concentration trends from PID measurements and analytical results are shown on Figure 2.

### 3.4 DATA QUALITY EVALUATION

Analytical results for vapor samples collected from the AS/SVE effluent in 2013 were reviewed to qualify the data relative to the data quality objectives (DQOs) described in the RA SAP and the QAPP. Data

review was performed by an independent data validation contractor, Diane Short and Associates, Inc. The complete analytical results with data quality evaluation (DQE) flags are presented for each sample in Appendix C.

Overall, the VOC data from the vapor samples met project DQOs and were determined to be sufficient to support the evaluation of SVE system performance. The complete DQE for Year 4 samples is provided in Appendix D. The main findings from the DQE are summarized separately below.

- Any result reported below the RL but above the MDL was flagged "J" and considered an estimated result.
- Methylene chloride was additionally qualified "B" due to the presence of methylene chloride in the method blank in the sample collected in March 2013.
- Carbon disulfide was additionally qualified "B" due to the presence of carbon disulfide in the method blank in the sample collected in September 2013.
- Propene was qualified as estimated "J" due to interference in the sample collected in October 2013.
- Allyl chloride (3-chloro-1-propene) was non-detect and qualified as non-detect estimated "UJ" due to a low laboratory control sample recovery in the sample collected in December 2013.

## 3.5 MASS REMOVAL ESTIMATE

The VOC mass removed by the AS/SVE system is estimated from the total VOC concentrations in the effluent sample (based on TCE), system operating hours and flow rates. System operating hours are based on operation of the AS compressor and the SVE blower(s); operating hours for the SVE blower without the AS compressor were not included in the mass removal estimate. The mass emission calculations are shown on Table 6.

Estimated VOC emission rates in the effluent ranged from 0.0006 to 0.0008 lb/hr during Year Four. The emissions remained well below the de minimus standard of 0.1 lb/hr for the air permit. The AS/SVE system removed approximately 3 pounds of VOCs in Year Four and 82.5 pounds of VOCs since startup (Table 6).

# 4.0 CONCLUSIONS AND RECOMMENDATIONS

## 4.1 SYSTEM OPERATIONS

The AS/SVE system uptime was approximately 91% during Year Four (1 January to 31 December 2013). The only significant down time was due to a broken coupler in the AS compressor in July. System operations were not changed from Year Three.

The SVE system extracted approximately 3.6 times the injection rate during Year Four based on the average AS injection rate of 193 scfm and the average SVE flow rate of 696 scfm. Vacuum measurements at VMPs demonstrated vapor capture throughout the AS/SVE treatment area. PID measurements at SVE wells and VMPs were variable but generally low (<2 ppm) throughout Year 4. The average PID readings were similar at SVE wells but were higher at VMP pairs located in the western section of the AS/SVE system where all AS wells are in use.

Total VOC concentrations were 47 to 55 ppbv, with omission of results from the September sample. Estimated VOC emission rates in the effluent were 0.0006 to 0.0008 lb/hr during Year Four, below the de minimus standard of 0.1 lb/hr for the air permit. Approximately 83 pounds of VOCs have been removed since startup in 2009.

## 4.2 RECOMMENDATIONS

The AS/SVE system is to continue operations until the upgradient concentrations from the Dunn Field plume do not exceed 50 µg/L for individual CVOCs; the estimated period of operation was five years, which will be completed in December 2014. Only TCE in one LTM well, MW-159, has exceeded that standard since April 2012, as discussed in *Annual Long-Term Monitoring Report-2013, Revision 0* (HDR, 2014). MW-159 is located immediately upgradient of the system (Figure 1). The 2013 LTM report recommended the AS/SVE system be operated in alternating months to restore the northerly groundwater flow observed prior to system operation. That will allow groundwater to flow from MW-159 into the treatment zone and if necessary extend the operating period without additional cost.

# 5.0 REFERENCES

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# TABLES

TABLE 1
FLOW RATE AND VACUUM READINGS AT SVE WELLS AND SYSTEM EFFLUENT
OFF DEPOT AS-SVE SYSTEM
ANNUAL OPERATIONS REPORT, YEAR FOUR
Dunn Field - Defense Depot Memphis, Tennessee

| Date | Number of Blowers in Operation | AS Compressor Flow rate (scfm) | SVE Effluent | | SVE-1 | | SVE-2 | | SVE-3 | | SVE-4 | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Flow rate (scfm) | Vacuum (in. Hg.) | Flow rate (acfm) | Vacuum (in. $H_2O$) | Flow rate (acfm) | Vacuum (in. $H_2O$) | Flow rate (acfm) | Vacuum (in. $H_2O$) | Flow rate (acfm) | Vacuum (in. $H_2O$) |
| 1/5/2013 | 1 | 205 | 644 | 8.5 | 50 | 55 | 50 | 43 | 50 | 52 | 60 | 47 |
| 1/11/2013 | 1 | 201 | 656 | 8.4 | 50 | 56 | 50 | 44 | 50 | 51 | 60 | 48 |
| 1/18/2013 | 1 | 195 | 640 | 8.3 | 50 | 55 | 50 | 44 | 50 | 53 | 60 | 49 |
| 2/1/2013 | 1 | 208 | 568 | 8.0 | 50 | 58 | 50 | 46 | 50 | 52 | 60 | 47 |
| 2/22/2013 | 1 | 207 | 664 | 8.5 | 50 | 56 | 60 | 48 | 50 | 51 | 60 | 47 |
| 3/2/2013 | 1 | 206 | 561 | 8.1 | 50 | 56 | 60 | 49 | 50 | 52 | 60 | 49 |
| 3/7/2013 | 1 | 189 | 649 | 8.5 | 50 | 57 | 70 | 50 | 50 | 54 | 60 | 49 |
| 3/13/2013 | 1 | 174 | 640 | 8.6 | 120 | 61 | 60 | 55 | 60 | 57 | 70 | 52 |
| 4/9/2013 | 1 | 201 | 784 | 8.0 | 50 | 59 | 60 | 52 | 50 | 56 | 60 | 50 |
| 4/26/2013 | 1 | 181 | 846 | 8.1 | 50 | 60 | 50 | 50 | 50 | 58 | 70 | 53 |
| 5/13/2013 | 1 | 213 | 708 | 8.2 | 50 | 55 | 50 | 51 | 50 | 55 | 65 | 49 |
| 6/19/2013 | 1 | 181 | 701 | 7.7 | 50 | 57 | 50 | 45 | 50 | 56 | 65 | 50 |
| 8/8/2013 | 1 | 181 | 593 | 7.6 | 50 | 54 | NR | 44 | 50 | 55 | 70 | 48 |
| 8/28/2013 | 1 | 175 | 689 | 8.0 | 50 | 46 | 60 | 43 | 60 | 55 | 60 | 48 |
| 9/25/2013 | 1 | 170 | 703 | 7.8 | 50 | 52 | 60 | 46 | 50 | 53 | 70 | 47 |
| 10/11/2013 | 1 | 164 | 685 | 8.0 | 50 | 46 | 70 | 46 | 60 | 54 | 60 | 47 |
| 10/22/2013 | 1 | 213 | 714 | 8.3 | 50 | 53 | 70 | 46 | 60 | 52 | 70 | 47 |
| 11/4/2013 | 1 | 209 | 695 | 8.3 | 50 | 52 | 70 | 48 | 60 | 54 | 70 | 39 |
| 11/19/2013 | 2 | 167 | 720 | 8.3 | 50 | 48 | 80 | 33 | 60 | 53 | 60 | 47 |
| 12/11/2013 | 1 | 202 | 909 | 8.6 | 50 | 54 | 80 | 48 | 70 | 52 | 70 | 41 |
| 1/15/2014 | 2 | 214 | 856 | 8.7 | 50 | 52 | 70 | 42 | 60 | 46 | 70 | 49 |

Notes
1) System was down in July.
scfm: standard cubic feet per minute
acfm: actual cubic feet per minute
in. Hg: inches of mercury
in. $H_2O$: inches of water
NR: No reading

TABLE 1
FLOW RATE AND VACUUM READINGS AT SVE WELLS AND SYSTEM EFFLUENT
OFF DEPOT AS-SVE SYSTEM
ANNUAL OPERATIONS REPORT, YEAR FOUR
Dunn Field - Defense Depot Memphis, Tennessee

| Date | Number of Blowers in Operation | SVE-5 | | SVE-6 | | SVE-7 | | SVE-8 | | SVE-9 | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Flow rate (acfm) | Vacuum (in. $H_2O$) | Flow rate (acfm) | Vacuum (in. $H_2O$) | Flow rate (acfm) | Vacuum (in. $H_2O$) | Flow rate (acfm) | Vacuum (in. $H_2O$) | Flow rate (acfm) | Vacuum (in. $H_2O$) |
| 1/5/2013 | 1 | 50 | 60 | 80 | 43 | 20 | 72 | 60 | 50 | 50 | 72 |
| 1/11/2013 | 1 | 50 | 60 | 80 | 45 | 20 | 72 | 60 | 54 | 50 | 72 |
| 1/18/2013 | 1 | 50 | 60 | 80 | 43 | 20 | 72 | 60 | 53 | 50 | 73 |
| 2/1/2013 | 1 | 50 | 60 | 80 | 46 | 20 | 72 | 60 | 50 | 50 | 72 |
| 2/22/2013 | 1 | 50 | 63 | 80 | 44 | 20 | 72 | 60 | 52 | 60 | 74 |
| 3/2/2013 | 1 | 50 | 64 | 80 | 44 | 50 | 72 | 60 | 50 | 50 | 74 |
| 3/7/2013 | 1 | 50 | 62 | 80 | 45 | 50 | 74 | 60 | 53 | 60 | 74 |
| 3/13/2013 | 1 | 60 | 65 | 80 | 48 | 50 | 75 | 60 | 57 | 60 | 76 |
| 4/9/2013 | 1 | 50 | 64 | 90 | 50 | 50 | 75 | 50 | 55 | 60 | 75 |
| 4/26/2013 | 1 | 40 | 67 | 80 | 52 | 50 | 78 | 60 | 55 | 70 | 77 |
| 5/13/2013 | 1 | 50 | 63 | 90 | 48 | 30 | 75 | 60 | 51 | 60 | 75 |
| 6/19/2013 | 1 | 40 | 65 | 70 | 41 | 30 | 78 | 50 | 54 | 65 | 77 |
| 8/8/2013 | 1 | 40 | 64 | 70 | 42 | 20 | 76 | 60 | 54 | 70 | 75 |
| 8/28/2013 | 1 | 50 | 64 | 70 | 42 | 20 | 76 | 55 | 54 | 60 | 75 |
| 9/25/2013 | 1 | 50 | 63 | 80 | 41 | 20 | 74 | 60 | 53 | 70 | 73 |
| 10/11/2013 | 1 | 40 | 63 | 75 | 41 | 50 | 45 | 55 | 53 | 66 | 50 |
| 10/22/2013 | 1 | 50 | 62 | 70 | 38 | 20 | 53 | 60 | 52 | 60 | 68 |
| 11/4/2013 | 1 | 40 | 60 | 80 | 41 | 20 | 52 | 60 | 53 | 60 | 53 |
| 11/19/2013 | 2 | 50 | 68 | 80 | 40 | 50 | 42 | 70 | 53 | 60 | 69 |
| 12/11/2013 | 1 | 50 | 66 | 90 | 43 | 30 | 36 | 60 | 54 | 70 | 73 |
| 1/15/2014 | 2 | 50 | 68 | 80 | 24 | 50 | 42 | 60 | 49 | 60 | 54 |

Notes

1) System was down in July.

scfm: standard cubic feet per minute

acfm: actual cubic feet per minute

in. Hg: inches of mercury

in. $H_2O$: inches of water

NR: No reading

TABLE 1
FLOW RATE AND VACUUM READINGS AT SVE WELLS AND SYSTEM EFFLUENT
OFF DEPOT AS-SVE SYSTEM
ANNUAL OPERATIONS REPORT, YEAR FOUR
Dunn Field - Defense Depot Memphis, Tennessee

| Date | Number of Blowers in Operation | SVE-10 Flow rate (acfm) | SVE-10 Vacuum (in. $H_2O$) | SVE-11 Flow rate (acfm) | SVE-11 Vacuum (in. $H_2O$) | SVE-12 Flow rate (acfm) | SVE-12 Vacuum (in. $H_2O$) |
|---|---|---|---|---|---|---|---|
| 1/5/2013 | 1 | 50 | 43 | 60 | 36 | 70 | 35 |
| 1/11/2013 | 1 | 50 | 42 | 60 | 37 | 70 | 35 |
| 1/18/2013 | 1 | 50 | 43 | 60 | 38 | 70 | 35 |
| 2/1/2013 | 1 | 50 | 42 | 60 | 37 | 70 | 36 |
| 2/22/2013 | 1 | 60 | 43 | 60 | 36 | 70 | 35 |
| 3/2/2013 | 1 | 60 | 45 | 60 | 34 | 70 | 38 |
| 3/7/2013 | 1 | 60 | 45 | 70 | 36 | 90 | 44 |
| 3/13/2013 | 1 | 70 | 47 | 60 | 40 | 80 | 45 |
| 4/9/2013 | 1 | 60 | 46 | 60 | 38 | 70 | 39 |
| 4/26/2013 | 1 | 70 | 48 | 70 | 40 | 70 | 38 |
| 5/13/2013 | 1 | 50 | 44 | 60 | 37 | 65 | 45 |
| 6/19/2013 | 1 | 60 | 46 | 60 | 38 | 60 | 35 |
| 8/8/2013 | 1 | 60 | 45 | 60 | 37 | 60 | 36 |
| 8/28/2013 | 1 | 60 | 44 | 70 | 37 | 60 | 35 |
| 9/25/2013 | 1 | 60 | 43 | 60 | 36 | 60 | 34 |
| 10/11/2013 | 1 | 44 | 60 | 36 | 70 | 35 | 65 |
| 10/22/2013 | 1 | 60 | 42 | 65 | 34 | 70 | 34 |
| 11/4/2013 | 1 | 60 | 43 | 70 | 36 | 70 | 36 |
| 11/19/2013 | 2 | 60 | 46 | 70 | 35 | 80 | 39 |
| 12/11/2013 | 1 | 60 | 47 | 60 | 31 | 60 | 42 |
| 1/15/2014 | 2 | 60 | 43 | 70 | 20 | 70 | 34 |

Notes
1) System was down in July.
scfm: standard cubic feet per minute
acfm: actual cubic feet per minute
in. Hg: inches of mercury
in. $H_2O$: inches of water
NR: No reading

TABLE 2
VACUUM READINGS AT VMPs
OFF DEPOT AS-SVE SYSTEM
ANNUAL OPERATIONS REPORT, YEAR FOUR
Dunn Field - Defense Depot Memphis, Tennessee

| Date | 1/31/2013 | 2/20/2013 | 3/14/2013 | 4/26/2013 | 6/7/2013 | 6/20/2013 | 8/8/2013 | 8/28/2013 | 10/10/2013 | 11/5/2013 | 11/19/2013 | 12/12/2013 | 1/16/2014 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Blowers | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 2 | 2 | 1 |
| Sparge | Y | Y | Y | Y | Y | Y | Y | Y | Y | Y | Y | Y | Y |
| VMP1A | 8.0 | 8.4 | 12.2 | 13.1 | 16.7 | 14.9 | 11.1 | 11.1 | 8.7 | 11.0 | 13.0 | - | 12.0 |
| VMP1B | 6.2 | 4.5 | 12.1 | 13.2 | 11.3 | 14.8 | 10.7 | 9.1 | 8.4 | 12.7 | 12.9 | 10.7 | 8.2 |
| VMP2A | 7.1 | 7.9 | 17.9 | 15.4 | 13.5 | 22.5 | 19.1 | 16.1 | 12.5 | 16.2 | 16.8 | 14.5 | 11.4 |
| VMP2B | 6.8 | 6.4 | 15.7 | 16.7 | 7.0 | 22.0 | 18.5 | 15.9 | 12.7 | 14.7 | 14.0 | 12.3 | 10.6 |
| VMP3A | 9.0 | 10.2 | 16.9 | 14.2 | 21.1 | 23.5 | 18.8 | 17.5 | 13.1 | 17.4 | 16.9 | 14.7 | 14.0 |
| VMP3B | 7.9 | 6.3 | 17.7 | 17.0 | 20.9 | 23.0 | 18.3 | 17.1 | 13.4 | 17.3 | 16.9 | 14.7 | 14.5 |
| VMP4A | 10.1 | 10.3 | 20.1 | 28.9 | 25.3 | 25.8 | 26.0 | 25.0 | 21.5 | 33.0 | 28.6 | 25.5 | 17.9 |
| VMP4B | 9.6 | 11.2 | 22.8 | 19.3 | 25.0 | 19.0 | 19.6 | 19.0 | 13.7 | 19.2 | 16.9 | 16.0 | 16.2 |
| VMP5A | 7.6 | 9.8 | 19.0 | 18.7 | 16.5 | 18.3 | 19.0 | 17.4 | 13.9 | 17.7 | 16.0 | 14.2 | 13.9 |
| VMP5B | 9.1 | 10.5 | 19.9 | 20.0 | 23.3 | 19.7 | 20.3 | 18.5 | 15.1 | 19.2 | 17.4 | 15.6 | 15.1 |
| VMP6A | 10.1 | 10.1 | 15.7 | 16.4 | 24.5 | 19.5 | 17.0 | 15.0 | 19.8 | 18.5 | 16.3 | 15.7 | 14.0 |
| VMP6B | 10.8 | 11.2 | 15.8 | 16.6 | 27.5 | 19.1 | 16.8 | 14.8 | 19.6 | 18.5 | 16.3 | 15.3 | 14.2 |
| VMP7A | 12.3 | 13.5 | 17.2 | 16.2 | 24.0 | 19.8 | 16.0 | 17.0 | 18.7 | 18.7 | 16.4 | 15.4 | 11.9 |
| VMP7B | 6.8 | 14.5 | 17.8 | 14.6 | 27.9 | 17.5 | 11.9 | 13.7 | 15.2 | 18.5 | 11.0 | 6.8 | 9.6 |
| VMP8A | 10.8 | 12.9 | 18.0 | 17.6 | 23.1 | 20.1 | 18.9 | 17.0 | 19.5 | 17.4 | 15.8 | 16.8 | 17.5 |
| VMP8B | 11.4 | 11.6 | 18.1 | 17.7 | 19.7 | 20.3 | 18.5 | 16.8 | 19.3 | 18.6 | 16.0 | 16.8 | 17.8 |
| VMP9A | 15.4 | 16.3 | 21.2 | 19.6 | 28.1 | 23.0 | 20.3 | 19.8 | 18.7 | 21.2 | 17.8 | 18.2 | 19.4 |
| VMP9B | 15.2 | 15.2 | 21.4 | 19.9 | 28.2 | 23.2 | 19.9 | 19.8 | 18.8 | 21.2 | 17.9 | 18.4 | 19.5 |
| VMP10A | 11.8 | 14.5 | 18.5 | - | 12.6 | 19.3 | 18.1 | 18.4 | 21.6 | 19.3 | 17.2 | 16.8 | 17.1 |
| VMP10B | 12.9 | 15.6 | 22.7 | - | 27.3 | 23.0 | 19.2 | 16.8 | 20.5 | 19.1 | 19.4 | 26.0 | 18.6 |

Notes:

1) Vacuum measurements made with a digital manometer; units are in inches of water
2) No measurements at VMP-10A/B on 4/26 due to thunderstorm.
3) No VMP measurements were made in July due to compressor shut down.
4) No measurement at VMP-1A on 12/12 due to broken quick-connect.

TABLE 3
PID MEASUREMENTS AT SVE WELLS AND SYSTEM EFFLUENT
OFF DEPOT AS-SVE SYSTEM
ANNUAL OPERATIONS REPORT, YEAR FOUR
Dunn Field - Defense Depot Memphis, Tennessee

| Date | Time | Blowers | Sparge | Sparge Group | SVE1 | SVE2 | SVE3 | SVE4 | SVE5 | SVE6 | SVE7 | SVE8 | SVE9 | SVE10 | SVE11 | SVE12 | Effluent |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1/5/2013 | 12:05 | 1 | Y | A | 1.0 | 1.4 | 0.9 | 1.0 | 7.4 | 9.0 | 8.9 | 2.2 | 9.1 | 8.1 | 8.2 | 0.8 | 3.4 |
| 1/11/2013 | 11:23 | 1 | Y | A | 1.0 | 1.0 | 0.7 | 0.9 | 3.4 | 5.1 | 8.3 | 1.5 | 8.2 | 7.6 | 7.2 | 1.0 | 2.3 |
| 1/18/2013 | 9:45 | 1 | Y | C | 0.9 | 0.8 | 1.1 | 1.0 | 2.0 | 4.3 | 7.1 | 1.6 | 3.4 | 5.1 | 2.2 | 0.8 | 1.5 |
| 2/1/2013 | 14:25 | 1 | Y | A | 0.4 | 0.8 | 0.7 | 0.8 | 2.4 | 0.4 | 0.5 | 0.1 | 0.1 | 0.1 | 0.4 | 0.7 | 1.2 |
| 2/22/2013 | 15:00 | 1 | Y | B | 0.5 | 0.5 | 0.9 | 0.7 | 1.2 | 0.5 | 0.5 | 0.3 | 0.2 | 0.2 | 0.5 | 0.8 | 0.8 |
| 3/2/2013 | 12:01 | 1 | Y | A | 0.6 | 0.4 | 0.5 | 0.6 | 0.8 | 0.1 | 0.2 | 0.0 | 0.1 | 0.1 | 0.3 | 0.5 | 0.6 |
| 3/7/2013 | 12:47 | 1 | Y | A | 0.1 | 0.2 | 2.2 | 1.4 | 1.0 | 0.0 | 0.3 | 0.0 | 0.1 | 0.1 | 0.0 | 0.0 | 0.5 |
| 3/13/2013 | 946 | 1 | Y | C | 0.6 | 0.2 | 0.2 | 0.3 | 0.2 | 0.2 | 0.1 | 0.1 | 0.1 | 0.0 | 0.4 | 0.2 | 0.3 |
| 4/26/2013 | 9:03 | 1 | Y | C | 1.0 | 2.8 | 2.5 | 5.5 | 5.4 | 1.4 | 1.5 | 1.4 | 3.0 | 4.2 | 4.6 | 3.3 | 2.0 |
| 5/13/2013 | 13:00 | 1 | Y | A | 0.2 | 0.0 | 0.3 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.4 | 0.0 | 0.0 |
| 6/19/2013 | 10:08 | 1 | Y | A | 2.5 | 5.2 | 4.1 | 3.0 | 3.8 | 2.5 | 5.0 | 2.4 | 3.4 | 3.5 | 3.7 | 2.7 | 3.4 |
| 8/8/2013 | 11:14 | 1 | Y | A | 0.0 | 0.3 | 0.0 | 0.0 | 0.3 | 0.0 | 0.7 | 0.2 | 0.4 | 0.2 | 0.3 | 0.1 | 0.6 |
| 8/28/2013 | 10:21 | 1 | Y | A | 4.4 | 5.2 | 5.4 | 4.9 | 4.7 | 3.8 | 5.0 | 3.3 | 3.7 | 3.4 | 1.8 | 1.3 | 1.7 |
| 9/25/2013 | 10:29 | 1 | Y | A | 4.5 | 6.3 | 6.5 | 5.8 | 4.6 | 3.1 | 5.2 | 2.6 | 3.8 | 2.0 | 0.8 | 0.9 | 1.4 |
| 10/11/2013 | 11:00 | 1 | Y | A | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| 10/22/2013 | 12:50 | 1 | Y | A | 0.0 | 1.1 | 1.0 | 0.8 | 0.8 | 0.7 | 1.8 | 1.2 | 0.5 | 0.1 | 0.8 | 0.6 | 0.2 |
| 11/4/2013 | 15:20 | 1 | Y | A | 0.9 | 1.6 | 3.0 | 3.8 | 2.0 | 2.4 | 4.0 | 2.4 | 1.3 | 2.0 | 1.9 | 1.0 | 0.8 |
| 11/19/2013 | 9:40 | 1 | Y | C | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| 12/11/2013 | 15:00 | 1 | Y | B | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| 1/15/2014 | 11:43 | 1 | Y | A | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |

Notes:

1) PID measurements made with a MiniRae 2000 (10.6 ev lamp); units are in parts per million

TABLE 4
PID MEASUREMENTS AT VMPs
OFF DEPOT AS-SVE SYSTEM
ANNUAL OPERATIONS REPORT, YEAR FOUR
Dunn Field - Defense Depot Memphis, Tennessee

| Date | 1/31/2013 | 2/20/2013 | 3/14/2013 | 4/26/2013 | 6/7/2013 | 6/20/2013 | 8/8/2013 | 8/28/2013 | 10/10/2013 | 11/5/2013 | 11/19/2013 | 12/12/2013 | 1/16/2014 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Blowers | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 2 | 1 |
| Sparge | Y | Y | Y | Y | Y | Y | Y | Y | Y | Y | Y | Y | Y |
| VMP1A | 0.2 | 0.1 | 1.2 | 0.1 | 1.0 | 0.0 | 0.0 | 0.0 | 0.1 | 2.0 | 0.0 | - | 0.0 |
| VMP1B | 0.2 | 0.3 | 1.4 | 0.2 | 0.8 | 0.0 | 0.0 | 0.0 | 0.4 | 1.7 | 0.0 | 0.0 | 0.0 |
| VMP2A | 0.1 | 0.1 | 1.0 | 0.3 | 1.5 | 0.0 | 0.0 | 0.0 | 0.3 | 1.8 | 0.0 | 0.0 | 0.0 |
| VMP2B | 0.2 | 0.3 | 1.0 | 0.0 | 0.9 | 0.7 | 0.0 | 0.0 | 0.5 | 1.5 | 0.0 | 0.0 | 0.0 |
| VMP3A | 0.3 | 0.4 | 1.7 | 0.7 | 6.5 | 0.0 | 2.0 | 0.0 | 3.7 | 3.4 | 0.0 | 0.0 | 0.0 |
| VMP3B | 0.2 | 0.2 | 1.9 | 0.7 | 3.5 | 0.0 | 1.6 | 0.0 | 2.8 | 2.7 | 0.0 | 0.0 | 0.0 |
| VMP4A | 0.1 | 0.2 | 1.8 | 2.6 | 4.7 | 0.0 | 5.8 | 0.0 | 5.1 | 2.5 | 0.0 | 0.0 | 0.0 |
| VMP4B | 0.1 | 0.2 | 2.0 | 3.3 | 1.8 | 0.0 | 3.8 | 2.1 | 4.0 | 2.2 | 0.0 | 0.0 | 0.0 |
| VMP5A | 0.2 | 0.2 | 0.7 | 2.6 | 1.3 | 0.0 | 0.0 | 0.0 | 0.1 | 0.8 | 0.0 | 0.4 | 0.0 |
| VMP5B | 0.1 | 0.1 | 1.0 | 0.3 | 0.8 | 0.0 | 0.0 | 0.0 | 0.0 | 2.4 | 0.0 | 0.5 | 0.0 |
| VMP6A | 0.0 | 0.0 | 7.8 | - | 3.4 | 0.0 | 0.0 | 0.0 | 0.4 | 0.0 | 0.0 | 0.0 | 0.0 |
| VMP6B | 0.2 | 0.1 | 14 | - | 1.2 | 0.0 | 0.0 | 0.0 | 0.4 | 0.0 | 0.0 | 0.0 | 0.0 |
| VMP7A | 0.1 | 0.2 | 21 | 0.5 | 4.9 | 0.0 | 0.0 | 0.0 | 9.1 | 0.0 | 0.2 | 0.0 | 0.0 |
| VMP7B | 0.2 | 0.3 | 17 | 0.3 | 1.5 | 8.6 | 8.4 | 0.0 | 8.5 | 3.2 | 0.0 | 0.0 | 0.0 |
| VMP8A | 0.4 | 0.3 | 11 | 12 | 6.0 | 0.0 | 0.0 | 0.0 | 3.2 | 0.4 | 0.0 | 0.0 | 1.0 |
| VMP8B | 0.3 | 0.5 | 3.6 | 11 | 3.5 | 0.0 | 0.0 | 0.0 | 2.6 | 0.0 | 0.0 | 0.0 | 1.0 |
| VMP9A | 0.5 | 0.2 | 1.9 | 9.1 | 4.1 | 0.0 | 0.0 | 0.0 | 2.0 | 2.0 | 0.0 | 0.0 | 0.0 |
| VMP9B | 0.1 | 0.6 | 1.9 | 12 | 1.8 | 0.0 | 0.0 | 0.0 | 0.0 | 1.1 | 0.0 | 0.0 | 0.0 |
| VMP10A | 0.1 | 0.1 | 12 | - | 4.6 | 0.0 | 0.0 | 0.4 | 6.7 | 0.3 | 0.0 | 0.0 | 0.0 |
| VMP10B | 0.5 | 0.2 | 25 | - | 1.5 | 0.0 | 0.0 | 0.0 | 0.1 | 0.2 | 0.0 | 0.0 | 0.0 |

Notes:

1) PID measurements made with a MiniRae 2000 (10.6 eV lamp); units are in parts per million
2) No measurements at VMPs 6A/B and 10A/B on 4/26 due to thunderstorm.
3) No VMP measurements were made in July due to compressor shut down.
4) No measurement at VMP-1A in December due to broken quick-connect.

TABLE 5
ANALYTICAL RESULTS SUMMARY - SVE EFFLUENT
OFF DEPOT AS-SVE SYSTEM
ANNUAL OPERATIONS REPORT, YEAR FOUR
Dunn Field - Defense Depot Memphis Tennessee

| Analyte | Location<br>Lab ID<br>Date<br>Units | ODSVE-EFF<br>P1301045-001<br>13-Mar-13 | ODSVE-EFF<br>P1302661-001<br>20-Jun-13 | ODSVE-EFF<br>P1304297-001<br>25-Sep-13 | ODSVE-EFF<br>P1304722-001<br>22-Oct-13 | ODSVE-EFF<br>P1305542-001<br>12-Dec-13 |
|---|---|---|---|---|---|---|
| 1,1,2,2-Tetrachloroethane | ppbv | 1.3 | 1 | <0.093 | 0.77 | <0.1 |
| 1,1,2-Trichloroethane | ppbv | 0.036 J | 0.041 J | <0.12 | <0.11 | <0.13 |
| 1,1-Dichloroethene | ppbv | 2.3 | 2.2 | <0.16 | 1.7 | 1.1 |
| 1,2-Dichloroethane | ppbv | <0.15 | <0.16 | <0.16 | <0.15 | <0.17 |
| Carbon Tetrachloride | ppbv | 0.42 | 0.7 | <0.1 | 0.52 | 0.45 |
| Chloroform | ppbv | 3.5 | 4.5 | <0.13 | 4.3 | 3.5 |
| cis-1,2-Dichloroethene | ppbv | 1.9 | 2.9 | <0.16 | 3.9 | 3.6 |
| Dichloromethane (Methylene Chloride) | ppbv | 0.099 JB | <0.18 | <0.18 | 0.071 J | <0.2 |
| Tetrachloroethene | ppbv | 3.3 | 3.5 | <0.094 | 3 | 2.2 |
| trans-1,2-Dichloroethene | ppbv | 0.48 | 0.45 | <0.16 | 0.56 | 0.46 |
| Trichloroethene | ppbv | 23 | 24 | <0.12 | 23 | 21 |
| Vinyl Chloride | ppbv | <0.23 | <0.25 | <0.25 | 0.13 J | 0.1 J |
| **Total CVOCs** | | **36.3** | **39.3** | **0.0** | **38.0** | **32.4** |
| 1,1,1-Trichloroethane (TCA) | ppbv | 0.71 | 0.65 | <0.12 | 0.88 | 0.73 |
| 1,1,2-Trichlorotrifluoroethane | ppbv | 6 | 7.1 | <0.083 | 4.6 | 3 |
| 1,1-Dichloroethane (1,1-DCA) | ppbv | 0.8 | 0.76 | <0.16 | 0.64 | 0.46 |
| 2-Hexanone | ppbv | 0.077 J | 0.24 | <0.16 | 0.12 J | <0.17 |
| Acetone | ppbv | <2.5 | 4.2 | 1.6 J | 3.6 | <3 |
| Dichlorodifluoromethane (CFC 12) | ppbv | 0.91 | 0.84 | <0.13 | 1.2 | 16 |
| m,p-Xylenes | ppbv | <0.27 | 0.38 | <0.29 | <0.29 | <0.32 |
| Propene | ppbv | 1.6 | 0.44 | 0.12 J | 0.46 J | <0.41 |
| Toluene | ppbv | 0.072 J | 0.25 | <0.17 | <0.17 | <0.19 |
| Trichlorofluoromethane (CFC 11) | ppbv | 0.3 | 0.33 | <0.11 | 0.36 | 0.55 |
| **Total VOCs** | | **46.7** | **54.5** | **0.0** | **49.2** | **53.2** |

Notes:
ppbv: part per billion volume
RL: Reporting Limit
<: Result is less than RL
J: Estimated
B: Blank contamination

TABLE 6
MASS REMOVAL CALCULATIONS
OFF DEPOT AS-SVE SYSTEM
ANNUAL OPERATIONS REPORT, YEAR FOUR
Dunn Field – Defense Depot Memphis, Tennessee

| Start Date | End Date | Hours Operating Between Dates | Average Flow rate (scfm) | Laboratory Total VOC Influent Concentration (ppbv) | Average Influent VOC Concentration (ppbv) | Influent Emission Rate (lb/hr) | Estimated VOC Mass Removal During Period (lbs) | Cumulative Mass Removed From Fluvial Subsurface (lbs) |
|---|---|---|---|---|---|---|---|---|
| 11/12/2009 | 12/11/2009 | 92 | 977 | 1240 | 1240 | 0.025 | 2.3 | 2.3 |
| 12/11/2009 | 1/25/2010 | 1074 | 1054 | 447 | 844 | 0.018 | 19.9 | 22.2 |
| 1/25/2010 | 2/23/2010 | 665 | 926 | 351 | 399 | 0.008 | 5.1 | 27.3 |
| 2/23/2010 | 3/31/2010 | 890 | 916 | 267 | 309 | 0.006 | 5.2 | 32.5 |
| 3/31/2010 | 6/17/2010 | 1854 | 1119 | 633 | 450 | 0.010 | 19.4 | 51.9 |
| 6/17/2010 | 9/16/2010 | 1958 | 1114 | 73.8 | 353 | 0.008 | 16.0 | 68.0 |
| 9/16/2010 | 12/7/2010 | 1695 | 1006 | 68.9 | 71.4 | 0.001 | 2.5 | 70.5 |
| 12/7/2010 | 3/24/2011 | 872 | 965 | 60.4 | 64.7 | 0.001 | 1.1 | 71.6 |
| 3/24/2011 | 6/17/2011 | 783 | 974 | 66.0 | 63.2 | 0.001 | 1.0 | 72.6 |
| 6/17/2011 | 9/16/2011 | 1042 | 958 | 50.8 | 58.4 | 0.001 | 1.2 | 73.8 |
| 9/16/2011 | 12/22/2011 | 1148 | 724 | 38.2 | 44.5 | 0.0007 | 0.8 | 74.6 |
| 12/22/2011 | 2/16/2012 | 759 | 719 | 27.6 | 32.9 | 0.0005 | 0.4 | 75.0 |
| 2/16/2012 | 3/31/2012 | 437 | 660 | 36.0 | 31.8 | 0.0004 | 0.2 | 75.2 |
| 3/31/2012 | 6/30/2012 | 969 | 834 | 208 | 122 | 0.002 | 2.1 | 77.2 |
| 6/30/2012 | 9/30/2012 | 1124 | 612 | 42.8 | 125 | 0.002 | 1.8 | 79.0 |
| 9/30/2012 | 12/31/2012 | 1061 | 628 | 38.5 | 40.7 | 0.0005 | 0.6 | 79.6 |
| 12/31/2012 | 3/31/2013 | 1070 | 628 | 46.7 | 42.6 | 0.0006 | 0.6 | 80.2 |
| 3/31/2013 | 6/30/2013 | 1070 | 760 | 54.5 | 50.6 | 0.0008 | 0.9 | 81.0 |
| 6/30/2013 | 9/30/2013 | 730 | 662 | 49.7 | 52.1 | 0.0007 | 0.5 | 81.6 |
| 9/30/2013 | 12/31/2013 | 1104 | 763 | 53.2 | 51.5 | 0.0008 | 0.9 | 82.5 |

Notes:
lbs: pounds
lb/hr: pounds per hour
ppbv: parts per billion by volume
scfm: standard cubic feet per minute

Constants:
Mass of TCE: 131.4 lb/lb mol
Molar Vol Air 379 $ft^3$/lbmol (@ 60 deg F)

# FIGURES

Path: G:\DDMT\Off Depot\AS-SVE System\Annual Op Reports\Year 4\Figure 1 -AS-SVE SYSTEM.mxd

# Figure 1

## AS-SVE SYSTEM PLAN MAP

OFF DEPOT AS/SVE SYSTEM
ANNUAL OPERATIONS REPORT, YEAR FOUR

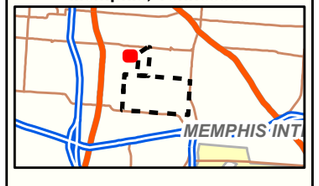
DUNN FIELD
DEFENSE DEPOT
MEMPHIS, TENNESSEE

**Legend**

- Monitoring Well Screened in the Fluvial Aquifer
- Monitoring Well Screened in the Intermediate Aquifer
- AS Location (full time)
- AS Location (1/2 time)
- AS Location (closed)
- VMP Location
- SVE Location
- Conveyance Lines
- SVE Compound

0 25 50 75 100
Feet

Installation Location
**Memphis, Tennessee**




**Date:** February 2014
**Edition:** Rev 0

HDR

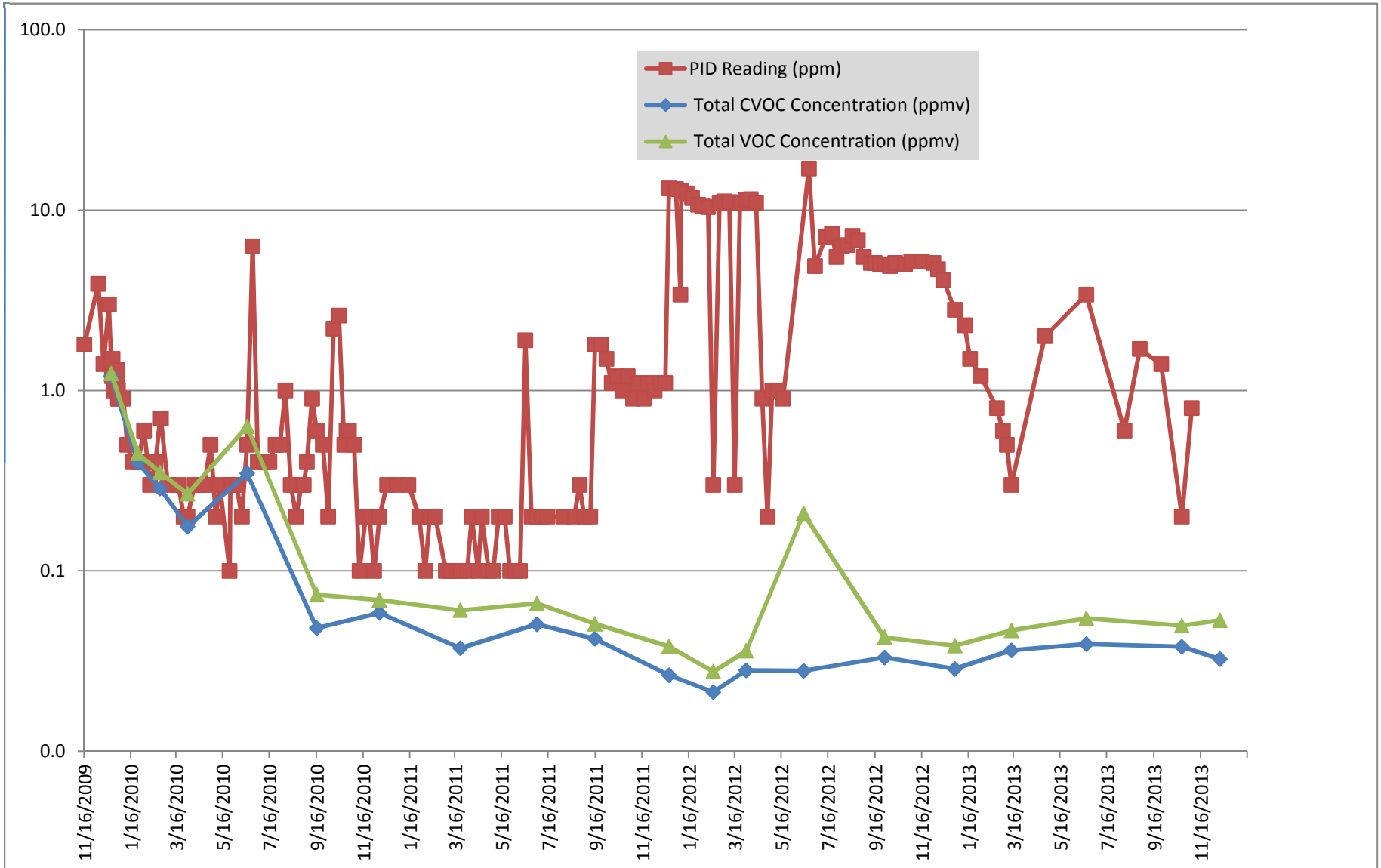



**Figure 2**
**EFFLUENT CONCENTRATION TREND - ANALYTICAL RESULTS AND FIELD PID MEASUREMENTS**
**OFF DEPOT AS-SVE SYSTEM**
**ANNUAL OPERATIONS REPORT, YEAR 4,**
**Dunn Field – Defense Depot Memphis, Tennessee**

# APPENDIX A

# AGENCY COMMENTS

**TENNESSEE DEPARTMENT OF ENVIRONMENT AND CONSERVATION**
**MEMPHIS ENVIRONMENTAL FIELD OFFICE**
**8383 WOLF LAKE DRIVE**
**BARLETT, TN 38133-4119**
**PHONE (901) 371-3000 STATEWIDE 1-888-891-8332 FAX (901) 371-3170**

July 11, 2014

Carolyn Jones
Program Manager
Office of the Chief of Staff for Installation Management
Attn: BRAC Division (DAIM-ODB)
2530 Crystal Drive (Taylor Bldg.), Room 5000
Arlington, VA 22202-3940

**Subject:** **Off-Depot AS/SVE, Year 4 Annual Operations Report (Rev. 0)**
**Defense Depot Memphis, Tennessee**
**TDoR ID # 79-736**
**EPA ID # TN 4210020570**

Dear Ms. Jones,

TDEC-DoR has reviewed the Off-Depot AS/SVE, Year 4 Annual Operations Report (Rev. 0), as submitted by T. Holmes (HDRInc) on 3/30/14, and approves the document. If there are questions or concerns, please contact me at (901) 371-3041 or at jamie.woods@tn.gov .

Regards,

Jamie A. Woods, P.G.
Project Manager
Division of Remediation
Memphis Environmental Field Office

cc: Thomas C. Holmes (HDRInc)
Julie Corkran (EPA-PM)
Ben Bentkowski (EPA R4 Technical Services Section)
Joan Hutton (CALIBRE)
TDoR NCO: file 79-736
TDoR MEFO: file 79-736

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION 4
ATLANTA FEDERAL CENTER
61 FORSTYH STREET
ATLANTA, GEORGIA 30303-8960

July 18, 2014

**United Parcel Service**

Ms. Carolyn Jones
Program Manager
Office of the Chief of Staff for Installation Management
Attn: BRAC Division (DAIM-ODB)
2530 Crystal Drive (Taylor Bldg.), Room 5000
Arlington, VA 22202-3940

Subject: Dunn Field - Off Depot Air Sparge-Soil Vapor Extraction System Annual Operations Report, Year 4, Defense Depot Memphis, Tennessee, Revision 0 (March 2014): EPA Comments

Dear Ms. Jones:

This correspondence transmits EPA Region 4's comments on the draft March 2014 Dunn Field Off-Depot Air Sparge-Soil Vapor Extraction (AS/SVE) Year 4 Report for the Defense Depot Memphis, Tennessee (DDMT), U.S. EPA ID Number TN4210020570, in Shelby County, Tennessee.

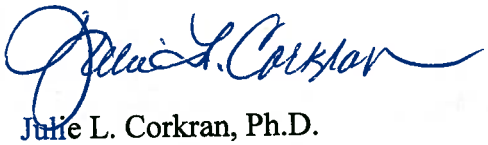
Subsequent to submission of this report in March of 2014 for Agency review, EPA provided comments (dated May 5, 2014) on the Annual 2013 Long Term Monitoring (LTM) Report for DDMT, including general and specific comments (dated May 5, 2014) regarding the status of the off-site Dunn Field groundwater contamination, the off-site AS/SVE treatment system, and the northeast off-site inbound contamination described in the 2002 Remedial Investigation Report, 2004 Record of Decision (ROD), and 2009 ROD Amendment for Dunn Field.

- In response to EPA comments on the Draft 2013 LTM Report, the Army requested a 30 day extension to evaluate and respond to EPA's comments on Dunn Field.
- EPA, TDEC and the Army discussed Dunn Field technical and schedule issues, and conducted an off-Depot potential source area tour, during our team meeting held in Memphis on May 29, 2014.
- On June 20, 2014, the Army provided amended responses to EPA comments on the Draft 2013 LTM Report, including the general and specific comments regarding Dunn Field.
- On June 27, 2014, the EPA Remedial Project Manager received courtesy copies from the Tennessee Department of Environment and Conservation (TDEC) of four (4) CERCLA pre-screening and site investigation reports that are part of a broader long-term State evaluation of potential sources for the observed northeast off-site inbound (Person Ave) contamination at Dunn Field. EPA understands that a work plan is under development in 2014 for State investigation of a fifth possible source.

EPA is resubmitting our May 5, 2014, Dunn Field general and specific comments on the Draft LTM Report (including the Army's June 2014 responses) as this Agency's comments on the Dunn Field AS/SVE Year 4 Annual Report. The EPA comments and Army's June 2014 responses to comments are provided as an enclosure to this letter to serve as a baseline for continuing discussions in 2014 regarding the technical and regulatory issues impacting the projected schedules for meeting remedial action objectives and constituent-specific remedial goals for completing the Dunn Field groundwater cleanup. EPA anticipates that the Dunn Field discussions will occur in conjunction with review and approval of the upcoming Fiscal Year 2015 annual update to the Site Management Plan for DDMT.

If you have any questions about this correspondence, please do not hesitate to contact me at 404-562-8547 or via electronic mail at corkran.julie@epa.gov.

Sincerely,



Julie L. Corkran, Ph.D.
Senior Remedial Project Manager
Federal Facilities Branch
Superfund Division

Enclosure: Army Amended Responses (June 20, 2014) to EPA Comments (May 5, 2014) on the Annual 2013 Long-Term Monitoring Report for DDMT (March 2014)

cc: Jamie Woods, TDEC
Ben Bentkowski, EPA R4 Technical Services Section

## Corkran, Julie

**From:** Hutton, Joan <Joan.Hutton@calibresys.com>
**Sent:** Friday, June 20, 2014 12:48 PM
**To:** Corkran, Julie; Bentkowski, Ben; Jamie Woods (Jamie.Woods@tn.gov)
**Cc:** 'carolyn.a.jones28.civ@mail.mil'; delight.d.balducci.civ@mail.mil; Tyler.P.Jones@usace.army.mil; thomas.holmes@hdrinc.com
**Subject:** Amended Response to EPA Comments _ Annual LTM Report - 2013, Defense Depot Mempis, TN, Rev. 0 _ EPA ID Number TN4210020570
**Attachments:** 140620 2013 LTM RTC to EPA-TDEC.pdf; 20140619 Memphis Depot RTCs - Final.pdf

Julie / Ben / Jamie,

On behalf of Ms. Carolyn Jones of the Army BRAC Office, attached are the Amended RTCs for EPA comments on the Annual Long-Term Monitoring Report – 2013, Defense Depot Memphis, TN, Rev. 0. The RTCs were initially submitted on May 21, 2014 and did not address Dunn Field comments. The attached RTCs is the complete response package.

Thank you for the additional submittal time.

Respectfully,
Joan

Joan G. Hutton
BRAC Environmental Coordinator
CALIBRE
Tel: 571-403-3308
Cell: 770-317-4323
www.calibresys.com

ENCLOSURE TO:

EPA Comments on the Dunn Field OU Depot Air Sparge - Soil Vapor Extraction System Annual Operations Report, Year 4, DDMT, Rev 0 (March 2014)

EPA Correspondence dated July 18, 2014 J. Corkran (EPA) to C. Jones (DAIM-ODB)

May 19, 2014

**Responses to Comments from**
**U.S. Environmental Protection Agency (EPA) Region 4**
**Annual Long-Term Monitoring Report – 2013**
**Defense Depot Memphis, Tennessee**
**Revision 0, February 2014**
**Memphis, Shelby County**
**U.S. EPA ID Number TN4210020570**

## General Comments

1. Please revise the report cover page, the Introduction, and the CD label to include the EPA ID No. for DDMT: U.S. EPA ID Number TN4210020570.

   Army Response: The Army will include "U.S. EPA ID Number TN4210020570" on the report cover page and CD label and will move the sentence providing the ID from Section 1.1 to Section 1.0.

2. Section 1.2, Page 1-2, Para. 3. For clarity, please revise the last sentence in this paragraph to state the current State groundwater classification and EPA groundwater classification for DDMT.

   Army Response: The Army will add a final sentence to the referenced paragraph stating "The current Tennessee groundwater classification for DDMT is General Use (TDEC Chapter 1200-04-03).

3. This report focuses on post-implementation monitoring of the remedial actions at the Main Installation (MI) and Dunn Field (DF) portions of the Defense Depot Memphis, Tennessee (DDMT). The MI employs enhanced bioremediation treatment (EBT) and DF employs (most recently) an air sparge/soil vapor extraction (AS/SVE) system. Both areas have a relatively long history of groundwater monitoring of the progress of the remedial actions; approximately 6 years of semi-annual sampling. With this history of monitoring, EPA was able to evaluate the trends of the contaminant migration and contaminant attenuation. All the monitoring well installations have provided lithologic data to aid in understanding the layering of the sands and clays (the aquifer units and the confining layers). Water levels from the numerous monitoring wells provides a picture of the groundwater flow directions both horizontal and vertical. Because of this relatively large data set, EPA was able to evaluate the hydrogeology and the contaminant fate and transport and identify data gaps regarding (i) where the contaminants are not degrading and attenuating, and (ii) where up-gradient sources have not been identified. Annotated maps from the report are provided to illustrate the physical locations of the data gaps.

   Army Response: Comment noted.

4. EPA agrees with the Department of Army interpretation of the groundwater data presented in the 2013 LTM Report that contaminated groundwater migration is not stabilized at DDMT. For example, on the MI, PCE and TCE have migrated from the fluvial aquifer to the intermediate aquifer (IAQ) at concentrations above constituent-specific Maximum Contaminant Levels (MCLs). The IAQ plume extends to the northwest property boundary based on reported concentrations in MW-256 (Section 3.4.1, Page 3-6). Further, data from wells MW-141 and MW-202B in the IAQ "*demonstrate long-term increasing trends for PCE, from approximately 5*

*ug/L to 25 ug/L*" (page 3-10) and concentrations in MW-107, a transition zone well located in the "window" in the uppermost clay unit between the fluvial and intermediate aquifers in the northwest corner of the MI, "*increased significantly in 2011 and remain at elevated levels above the MCL....in April...and in October of 2013*" (page 3-10). PCE and TCE have been detected since 2012 above the MCL in MW-256, an IAQ sentinel well, and "*TCE was detected at 3.13 ug/L in April and 2.7 ug/L in October*" of 2013 in MW-254 (page 3-10), a sentinel well located in the Memphis Aquifer (MAQ).

Army Response: The first sentence in Section 4.1 states that the "Groundwater concentrations on the MI are generally stable …"; this was based on consideration of overall concentrations and plume extent. Thus, the comment that "Army interpretation … that contaminated groundwater migration is not stabilized at DDMT" is not accurate. However, the later statements in the comment regarding the plume extending to the northwest boundary and the wells with increasing concentrations are not disputed.

With regard to migration into the IAQ, PCE and TCE have been detected at concentrations above the MCL in the IAQ since the initial sample from MW-90 in 2002 (See: *Appendix H – Historical CVOC Results – MI LTM*). The conceptual site model was that contamination in the IAQ resulted from migration from the fluvial aquifer through the 'window'. When the ROD was completed in 2001, the consensus of the Defense Logistics Agency (DLA), USEPA and TDEC was that groundwater remediation in the fluvial aquifer would reduce contaminant concentrations in the IAQ and that only the higher contaminant concentrations in TTA-1 and TTA-2 warranted treatment. The Army will re-evaluate this position in 2014.

(EPA Comment 4, continued) Superfund Environmental Indicators (EI) under the Government Performance and Results Act (GPRA; 1993) are evaluated and updated by October 15 of each year for each Superfund site, or at any time when site conditions change. Based on the information presented in the 2013 LTM Report, EPA proposes changing the Contaminated Groundwater EI for DDMT to *Contaminated ground water migration not under control* – indicating that the migration of contaminated ground water at DDMT is not stabilized.

Army Response: Comment noted.

5. Unless stated otherwise in the body of this letter, EPA concurs with the Army recommendations for changes in well-specific long-term monitoring frequencies and well designations proposed in the 2013 LTM Report. EPA notes, however, that many of the wells involved in the long term monitoring program do not show much change or variation over the last several monitoring periods. EPA recommends a groundwater monitoring well program optimization effort in 2014: it may be reasonable to lengthen the period of time between sampling events for certain wells, resulting in a cost savings with minimal loss of understanding of contaminant behavior in the area around the well.

   Army Response: The Army agrees that many monitoring wells show little variation over time. We will include this as an agenda item for discussion during the regulatory meeting on May 29, 2014, including a discussion of revised criteria for sampling frequency.

6. It is EPA's view that the Mann-Kendall (M-K) test analyses are of limited usefulness in evaluating the DDMT data. The M-K analysis can tell a conflicting story when compared to visual examinations of the trend graphs.

- For the DF graphs, concentrations are decreasing and plain to see absent M-K analysis.
- In the MI, the picture is not as simple. For example, MW-92 is listed as 'probably decreasing' in Table 23, the Mann Kendall Trend Analysis. Examination of the graph shows that the PCE decreased, the DCE increased and then the PCE rebounded with minimal vinyl chloride produced. This extra detail is not captured in the M-K designation 'probably decreasing' and is highly relevant to developing a path forward for additional treatment and secondary source investigation/mitigation, as appropriate.

Army Response: Mann-Kendall analysis has been performed in accordance with the LTM plan in the 2004 MI Remedial Design report. The Army agrees that at this juncture this analysis is of limited use and will discontinue its usage in future reports, pending regulatory concurrence.

Main Installation (See: Figures 19 & 20, annotated by EPA)

1. There are numerous wells where the data indication that relatively small secondary source areas are nearby that require identification and mitigation in order to reach Remedial Action Objectives and Remedial Goals in a timely fashion. This is indicated by concentrations that have remained steady or have increased through time and data sets which do not show complete breakdown of the PCE. These wells are listed in the comments below and shown on the attached annotated figures. Starting in the southwest corner of the site, going clockwise:

Army Response: Investigation of source areas based on wells with relatively low level contamination is not likely to provide useful results. In 2008, the DLA conducted a comprehensive data review to identify potential source areas in soil on the MI. Based on this information, a field investigation including a membrane interface probe survey and related soil confirmation sampling was performed to identify areas of soil contamination impacting the shallow groundwater and resulting in the observed groundwater plumes. Although areas of impacted soil were identified, the residual CVOC concentrations were low and not considered sufficient to warrant remedial action. See: *Main Installation Source Area Evaluation* ($e^2$M, 2008) and *Main Installation Source Area Investigation, Rev. 0* ($e^2$M, 2008). Since the soil investigations were conducted in the areas with higher groundwater concentrations, additional investigations in areas with lower groundwater concentrations are not likely to provide actionable information.

a. NE of MW-101B – What is the well number of the pink well? This spot indicates concentrations between 100 and 300 ug/L and it may not be delineated directly up gradient.

Army Response: The wells referenced are DR1-6/6A. These wells were sampled most recently on November 9, 2013 with the following results:

- DR1-6: 148 µg/L PCE, 1.69 µg/L TCE, 8.42 µg/L cDCE and <1 µg/L VC
- DR1-6A: 1.49 µg/L PCE, 2.12 µg/L TCE, 132 µg/L cDCE and 0.398 µg/L VC.

Monitoring wells MW-22 and MW-102B are considered upgradient of DR1-6/6A. No CVOCs were detected above method detection limits in the most recent groundwater samples collected on October 19, 2012 or in previous sampling rounds.

b. MW-219 – VOCs in this well have been trending up over the last three years. There is no directly up gradient delineation of the source of these increasing concentrations.

Army Response: An upgradient well (for TTA-1N) was recommended in Section 4.1.2. The Army will include this as an agenda item for discussion during the regulatory meeting on May 29, 2014.

c. MW-256 – The source of the VOCs in this most up gradient location in the northwest corner of the site is not defined. Upon review of the A-A' cross section, the contamination in this well is connected to MW-202B and these plumes should be drawn as one.

Army Response: As noted above, contaminant migration from the fluvial aquifer is considered to be the source of VOCs in the IAQ. The Army agrees that VOCs in MW-256 and MW-202B are connected. Isopleths will be redrawn and a note added regarding the screen depth at MW-140.

d. MW-140 – This is an area where groundwater flow direction, and hence VOC migration, is unclear. Shallower portions of the aquifer could be flowing to the southeast. Deeper portions of the aquifer could be flowing to the northwest. There are distinct downward hydraulic gradients: as much as 2' in adjacent wells. Larger scale figures may help in future evaluations of this area.

Army Response: MW-140 is screened in the deeper section of the IAQ and groundwater flow is to the west-northwest (toward MW-255 and MW-254). The shallow fluvial aquifer is dry due to the elevation of the uppermost clay. The Army will consider using larger-scale figures for future work.

e. MW-258 – This well has increasing PCE concentrations without an obvious up gradient source.

Army Response: An additional well(s) in the North-central area was recommended in Section 4.1.2. The Army will include this as an agenda item for discussion during the regulatory meeting on May 29, 2014.

f. MW-104 – Concentrations of TCE in this well have been holding steady at +/- 20 ug/L. The source of this TCE is not defined up gradient.

Army Response: Agree, additional well(s) in the North-central area were recommended in Section 4.1.2. The Army will include this as an agenda item for discussion during the regulatory meeting on May 29, 2014.

g. MW-64 and MW-218 have steady concentrations of PCE and TCE. These locations are side gradient from the hot spot associated with DR 2-1 to the east. The up gradient source of these concentrations should be identified so it can be remediated.

Army Response: Agree, additional well(s) in TTA-2 area were recommended in Section 4.1.2. The Army will include this as an agenda item for discussion during the regulatory meeting on May 29, 2014.

h. DR 2-1 – Concentrations in this well have rebounded indicating that treatment was insufficient to remediate this portion of the MI aquifer.

Army Response: Agree, current injection well IW-92-01 is adjacent to DR2-1and the lack of apparent effect is surprising. Additional action in this area should be discussed following regulatory review of the Year 3 EBT Report dated April 2014. The Army will include this as an agenda item for discussion during the regulatory meeting on May 29, 2014.

i. PMW92-02 – The trend graph of the data indicates that the contamination has not degraded further past cis-DCE and additional treatment is warranted.

Army Response: The Army agrees that additional action is warranted where degradation of cDCE is not observed. Future actions will be determined as the Army re-evaluates the current remedial action on the MI.

j. MW-26 – Increasing concentrations in this well are likely from incomplete treatment in the area of DR 2-1.

Army Response: The Army agrees that additional action in this area is warranted. Future actions will be determined as the Army re-evaluates the current remedial action on the MI.

k. MW-52 – Concentrations of PCE are low, but still above the MCL. The source of the VOCs in this area has not been identified.

Army Response: The Army agrees that additional delineation is needed in this area. The Army will include this as an agenda item for discussion during the regulatory meeting on May 29, 2014, including the criteria for remedial action.

2. Section 3.5.1.2, *Boundary Wells* (Page 3-9), describes trends in PCE contamination concentrations at MW-219: this well is located immediately upgradient of TTA-1 North at the eastern property boundary. Specifically, PCE concentrations have fluctuated, but current levels in October 2013 (53.6 ug/L) are not significantly different from the previous high detection of 48 ug/L five (5) years ago in 2008. The 2013 LTM Report concludes that there is the potential for plume migration onto the MI. It is not clear, however, whether all possible on-site sources for the sustained levels of PCE have been investigated and mitigated. Please revise the 2013 LTM report to discuss possible on-site and off-site sources for the contamination observed in MW-219 and the proposed path forward for remediating this contamination to meet RAOs and RGs for the MI.

Army Response: Source investigation was performed in the TTA-1N area during the 2008 source area investigation, as referenced in Main Installation Comment 1 (page 3). Although areas of impacted soil were identified, the residual CVOC concentrations were low and not considered sufficient to warrant remedial action. See: *Main Installation Source Area Evaluation* ($e^2$M, 2008) and *Main Installation Source Area Investigation, Rev. 0* ($e^2$M, 2008). There were no reported releases along the western boundary of DDMT. MW-219 was installed in 2007 to further delineate TTA-1N groundwater contamination. Results were well below the pretreatment concentrations in MW-21 and other downgradient wells. As stated above, an upgradient well (for TTA-1N) was recommended in Section 4.1.2.

Discussion of a path forward for the MI as a whole is envisioned following regulatory review of the Year 3 EBT report dated April 2014. Revision of the LTM report addressing this area alone

is not considered appropriate. The Army will include this as an agenda item for discussion during the regulatory meeting on May 29, 2014.

3. EPA agrees with the Department of Army recommendation that the natural attenuation study and groundwater modeling should be reviewed to determine if the modeling assumptions are still valid, to determine whether additional response action may be warranted, and to develop new estimated date for achieving RAOs and RGs. The evaluation should include a re-evaluation of the potential for VOC transport within the MAQ beneath the MI to the nearest pumping well at the Allen Well Field (and confirm the current location of the nearest pumping well).

   Army Response: The scope of additional investigation, consistent with this comment, is being planned by the Army. Discussions with USEPA and TDEC following regulatory review of the Year 3 EBT Report dated April 2014 and Year 4 Off Depot AS/SVE Operations Report dated March 2014 will be helpful. The Army will include this as an agenda item for discussion during the regulatory meeting on May 29, 2014.

   (EPA Comment 3, continued) As noted during our Site Management Plan discussions, EPA forecasts that, depending on the findings in the 2013 LTM Report and the annual EBT Report (currently under review by EPA), there will be a need for an MI ROD Amendment or Explanation of Significant Differences to update the RAOs and RGs to address: the need for response action in the IAQ; to clarify selection of monitored natural attenuation as an MI remedy component for fluvial groundwater; to address potential on-site impacts from a possible southeast off-site location; and possibly to select response actions in addition to, or other than, EBT in the fluvial aquifer at the MI.

   Army Response: The Army agrees that these issues warrant discussion and will include this as an agenda item for discussion during the regulatory meeting on May 29, 2014.

Dunn Field

1. The FY2014 Site Management Plan for DDMT projects a September 2015 date for abandonment of the treatment systems at DF. The contaminant distribution seen in Figures 31-37 of the report and the associated tables and graphs tells a good story of decreasing concentrations in response to AS/SVE treatment. EPA is less confident than the Army in the 2014 SMP schedule projecting that DF RAOs will be achieved in 2019 with AS/SVE system abandonment in September 2015. The 2013 LTM Report notes that a further 60% decrease is required to meet the active treatment objective (reduce individual CVOC concentrations to 50 ug/L or less). Although not captured as an explicit recommendation in the recent Third Five year Review, re-evaluation of the schedule for meeting RAOs and RGs for Dunn Field is needed in 2014 in conjunction with review of this 2013 LTM Report and the Year 4 AS/SVE Report. Regardless, EPA concurs with the recommendation to operate the AS/SVE system in alternating months to restore the northerly groundwater flow from MW-159 to the treatment zone, extending the operating period without additional cost.

   Army Response: The Army agrees that re-evaluation of the schedule for meeting RAOs at DF is appropriate at this time.

2. In addition to the contaminant concentrations at MW-159, the schedule for the DF groundwater remedial action appears to be impacted by imminent co-mingling of the inbound off-site plume

(originating northeast of Dunn Field in the general vicinity of the railroad right of way/Mclean Road/Persons Road area) with the central plume at DF. PCE and TCE contamination migrating in from the northeast has contaminated the fluvial aquifer underlying DF and is migrating westerly toward the general area of the AS/SVE system. The 2013 LTM Report notes (page 4-7) that the increase in contamination in MW-03 in the northwest corner of DF is attributed to the northeast off-site plume.

Army Response: While groundwater contamination does migrate on to the northeast corner of DF from an off-site source, there is little apparent co-mingling of contaminants. The contaminant source areas for the plumes originating on DF are located west of the north-south access road. See: *Enclosure 1, Site Management Plan, Figure 13 – Dunn Field Disposal Sites, Source Areas and Off-Depot Groundwater Remedial Actions* (attached).

Total CVOC plume maps prepared by HDR from 2006 to 2013 and more recent TCE and 1,1-dichloroethene (DCE) plume maps from 2011 to 2013 are attached. See: *Enclosure 2A, Total CVOC Plume Maps (2006-2013)* and *Enclosure 2B, TCE and DCE Plume Maps (2011-2013).* These maps show the reduction in groundwater concentrations following startup of the SVE system in 2007. The earlier maps show the off-site plume with the highest concentration upgradient of DF and decreasing concentrations as it moves on to DF. The earlier maps also show higher contaminant concentrations near the northwest corner of DF resulting primarily from on-site sources. Later maps show concentrations in the northwest corner reduced below MCLs while only the wells impacted by the off-site plume and upgradient of the remediated Source Areas exceed MCLs (MW-07, MW-08 and MW-230). In addition, all of these wells with higher concentrations have a significant concentration of DCE in comparison to other VOCs detected; DCE has not been detected in the DF Source Areas. The current situation appears to be due solely to contaminant migration from an off-site source rather than co-mingling of plumes. In regard to the recent increase at MW-03, concentrations did not increase at any other wells monitoring rebound from FSVE shutdown. The increased concentrations for TCE, PCE and DCE may be indicative of migration of the off-site plume alone.

(EPA Comment 2, continued) The **2004 Record of Decision** (ROD) for DF acknowledged the northeast off-site plume situation and includes the following language (page 2-55):

*"DLA, EPA, and TDEC believe that the contamination in the northeast upgradient plume will be adequately addressed by groundwater treatment components of the selected remedy. In the meantime, TDEC has initiated the process of locating the source(s) of the upgradient contamination in light of identifying the responsible party. A contingency plan may be implemented to further address remediation of the offsite VOC groundwater plume entering the northeast portion of Dunn Field in the even the parties determine the on-site remedy is inadequate and poses unacceptable risk to human health and the environment."*

Further, the 2004 ROD states (page 2-59) that, with respect to deed and or lease restrictions on the Northeast Open Area at DF, *"...due to groundwater contamination from an upgradient offsite source, the northern-most portion of his area will be subject to groundwater use restrictions until remediation goals are achieved."*

The **2009 ROD Amendment** for DF revises the remedy language to strike the contingency language as follows (page 4):

*"DLA, EPA, and TDEC believe that the contamination in the northeast upgradient plume will be adequately addressed by groundwater treatment components of the selected remedy. In the meantime, TDEC has initiated the process of locating the source(s) of the upgradient contamination in light of identifying the responsible party. ~~A contingency plan may be implemented to further address remediation of the offsite VOC groundwater plume entering the northeast portion of Dunn Field in the even the parties determine the on-site remedy is inadequate and poses unacceptable risk to human health and the environment.~~"*

The November 2012 Third Five Year Review for DDMT appears to re-interpret the 2009 ROD language stating "The AS/SVE system will continue to operate until the upgradient concentrations from the Dunn Field plume do not exceed 50 ug/L for individual CVOCs for twelve months." This language does not address the expectation that the active treatment will also address the Northeast Plume contamination in the same manner.

Army Response: "… the system will continue to operate until the influent (upgradient) concentrations from the DF plume do not exceed 50 ug/L for individual CVOCs" is from page 21 of the 2009 ROD Amendment and was added at EPA's request. The period of twelve months was added per the Off Depot RD Section 6.4.6.

Concentrations from the off-site plume do not currently exceed that concentration beyond MW-07. Earlier maps also indicate MW-07 is the downgradient extent of the higher concentrations from the off-site plume and that the plume extent is relatively stable.

(EPA Comment 2, continued) In 2014, the DLA, EPA and TDEC plan of action regarding the northeast plume at DF requires re-evaluation and clarification to ensure that all parties on are the same page moving forward. As written, the selected remedy for Dunn Field groundwater states the expectation that the DLA treatment activities will remediate the off-site northeast plume that has migrated, and continues to migrate, onto the Superfund site. To support discussions in 2014, the 2013 LTM Report should consider the following:

Army Response: While Army accepts an invitation to discuss a plan of action regarding the off-site plume, including TDEC's investigation to find the source of contamination, Army continues to evaluate whether it has any obligation with respect to the off-site plume. It remains Army's position that the 2004 ROD and 2009 ROD Amendment do not assign liability for remediation of the off-site plume to DLA/Army. As such, to the extent that Army agrees to provide any of the following requested information, it is not an admission of liability or responsibility with respect to remediation of the off-site plume.

a. The 2013 LTM Report should evaluate, and draw conclusions regarding, whether the well coverage between the northeast corner of Dunn Field and across the upper half of Dunn Field is sufficient to know with reasonable certainty whether the northeast plume is, in fact, migrating to the AS/SVE system and is likely to be treated by that system pending source mitigation at some point in the future (TBD). Preliminary, it appears to EPA that the three largest detections in the NE plume would likely flow north of AS/SVE capture zones. Well MW-220 is on the southwest edge of the NE plume and it is also in the close vicinity of the two northern most units of the SVE system. A small portion of the NE plume would likely be captured by the northern-most parts of the AS/SVE system, were it running. Detections in MW-31 are past (to the west of) the capture zone and influence of the AS/SVE system. This preliminary analysis is inconsistent with the

2004 and 2009 ROD language that "*...that the contamination in the northeast upgradient plume will be adequately addressed by groundwater treatment components of the selected remedy*" and requires discussion among the parties regarding path forward.

Army Response: The extent of the off-site plume on DF is well defined by existing LTM wells. The northern extent of the off-site plume has also been delineated although several of the off-site wells have been abandoned. The isopleth maps for 2013 and earlier indicate the southern portion of the off-site plume migrates off DF near the mid-point of the northern boundary, before reaching the on-site Source Areas or the western boundary. Assuming that is the case, it is likely that the majority of the off-site plume would not reach the AS/SVE system's area of influence, whether it passed through a portion of DF or remained to the north. MW-79 located north of the AS/SVE system has had concentrations of DCE, PCE and TCE in excess of MCLs since the initial sample in 2001. MW-51, located north of DF on the 2011 map, contained similar concentrations of DCE and TCE above MCLs in samples from 1997 to 2011; it was abandoned in 2013.

b. Concurrently, efforts to identify and mitigate the off-site source(s) have been ongoing or planned since at least 2004. The status of those activities, including relevant TDEC investigation reports, need to be summarized in the revised 2013 LTM report in support of determining a path forward.

Army Response: The Army will request that TDEC provide a summary of the status of its investigations to date. Reviewing TDEC reports and developing a new summary are outside of the scope of this LTM report.

c. The 2013 LTM Report requires revision to include updated projections for AS/SVE treatment, or other treatment as necessary, of the northeast plume.

Army Response: Development of an updated projection for treatment of the off-site plume requires knowledge of the source and a schedule for source removal that is outside the scope of this LTM report. Moreover, Army continues to evaluate whether it has any responsibility for the off-site plume.

**Specific Comments**

Main Installation

1. Sections 1.4.1 and 3.5.1.4; Figure 2 - Please revise Figure 2, and other figures of the report as appropriate, to illustrate the new sixth and seventh plumes described for the MI in the current but not currently captured on the figures. The "North Central" plume (associated with MW-258) is introduced in Section 1.4.1 (Page 1-6) and the "South Central" plume (associated with MW-97) is introduced in Section 3.5.1.4 (pages 3-10 through 11). Also, evaluate the plume table on page 1-6 (describing six plumes) and revise as needed for consistency with the plume table on page 3-11 (describing seven plumes).

Army Response: Figure 2 is only intended to show areas/plumes where EBT is underway per discussion of remedial action in Section 1.2.1. No other figures call out the plume names. The Army will include a new Figure 38 that will show TCE and PCE contours and identify each of the designated plumes; the figure will be introduced following the table in Section 3.5.1.4.

Section 1.4 discusses previous groundwater monitoring results. The six fluvial aquifer plumes and the Sentinel well plume, as listed on the table in Section 1.4.1, were initially described in the first LTM report (MACTEC, 2006). The names for the West-Central and North-Central plumes were changed in the 2007 LTM report (HDR, 2010) and have remained the same until this current LTM report. As noted, the South-Central plume is added in Section 3.5.1.4 based on the review performed for the current report; the table on the following page therefore includes it as the seventh fluvial aquifer plume. No change is considered necessary.

2. Section 4.1.2, Page 4-4, 1st bullet – MW-66 is not directly up gradient of MW-219: EPA recommends installation of an appropriately located well.

   Army Response: The Army agrees that a new well upgradient of MW-219 would be helpful. That location and several others are noted in the two paragraphs at the end of Section 4.1.2. The Army will include this as an agenda item for discussion during the regulatory meeting on May 29, 2014, including well locations and data quality objectives.

Dunn Field

1. A figure illustrating the AS/SVE location, the FSVE location, key monitoring wells associated with the two treatment systems, the "background wells" that are associated with the Northeast Plume originating off-site, the plume itself, the off-site geographic area to the northeast with roads and features (such as the railroad right of way) labeled, would support a path forward discussion in 2014 for the Northeast Plume.

   Army Response: As noted in our response to DF General Comment 2, while Army accepts EPA's invitation to discuss a path forward for the off-site plume, Army continues to evaluate whether it has any responsibility with respect to the off-site plume.

   Notwithstanding the foregoing, other than the off-site area, the information is provided on figures in the LTM report. Figure 6 identifies the Background-NE wells and the performance wells selected for monitoring potential rebound following the FSVE shutdown. A new figure with the well classification symbols from Figure 6 can be prepared on an aerial photo base with addition of the AS/SVE area and FSVE system and recent isopleths. Addition of the figure to the LTM report is not considered necessary.

**ENCLOSURE 1**

**SITE MANAGEMENT PLAN, FIGURE 13**

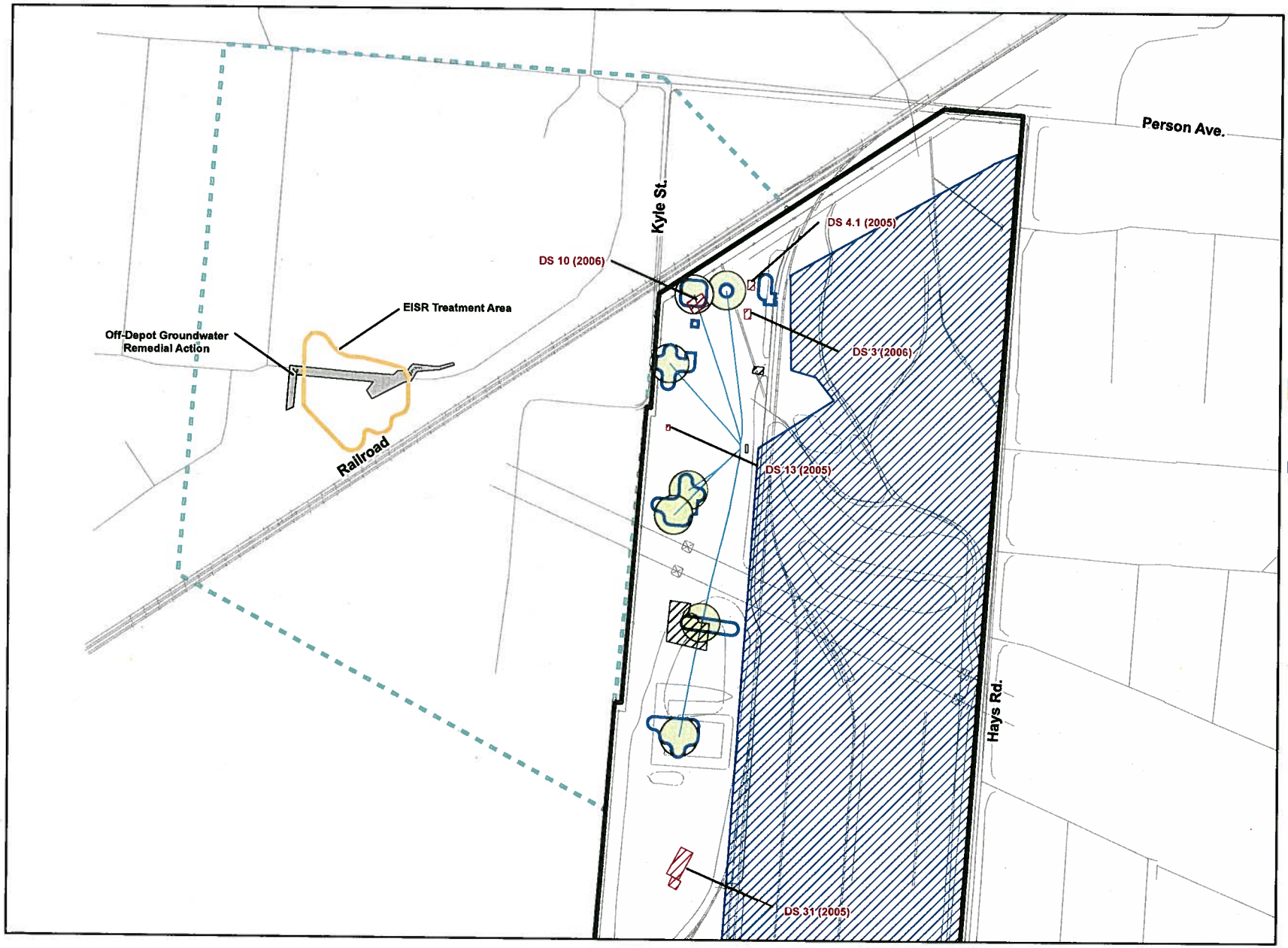



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**Figure 13**

**DUNN FIELD DISPOSAL SITES, SOURCE AREAS AND OFF-DEPOT GROUNDWATER REMEDIAL ACTIONS**

2014 SITE MANAGEMENT PLAN

DEFENSE DEPOT
MEMPHIS, TENNESSEE

Legend
- Original Dunn Field Perimeter
- Unrestricted Use Area from ROD
- Off-Site Treatment Area
- EISR Treatment Area
- Disposal Sites Excavation Area
- Fluvial SVE Well - 60-foot radius of influence
- Fluvial SVE Conveyance Line
- SVE Control Building
- Loess Excavation Areas
- Loess Thermal-Enhanced SVE Treatment Areas
- Air Sparge-SVE Area

Projection: NAD 1927 StatePlane Tennessee
Units: Feet

Aerial Photo Date: 2006

0 100 200 400
Feet

Installation Location
Memphis, Tennessee

Date: November 2013
Edition: Rev 0

HDR

Path: G:\DDMT\2014 SMP\GIS\Figure 13.mxd

**ENCLOSURE 2A**

**TOTAL CVOC PLUME MAPS (2006 – 2013)**

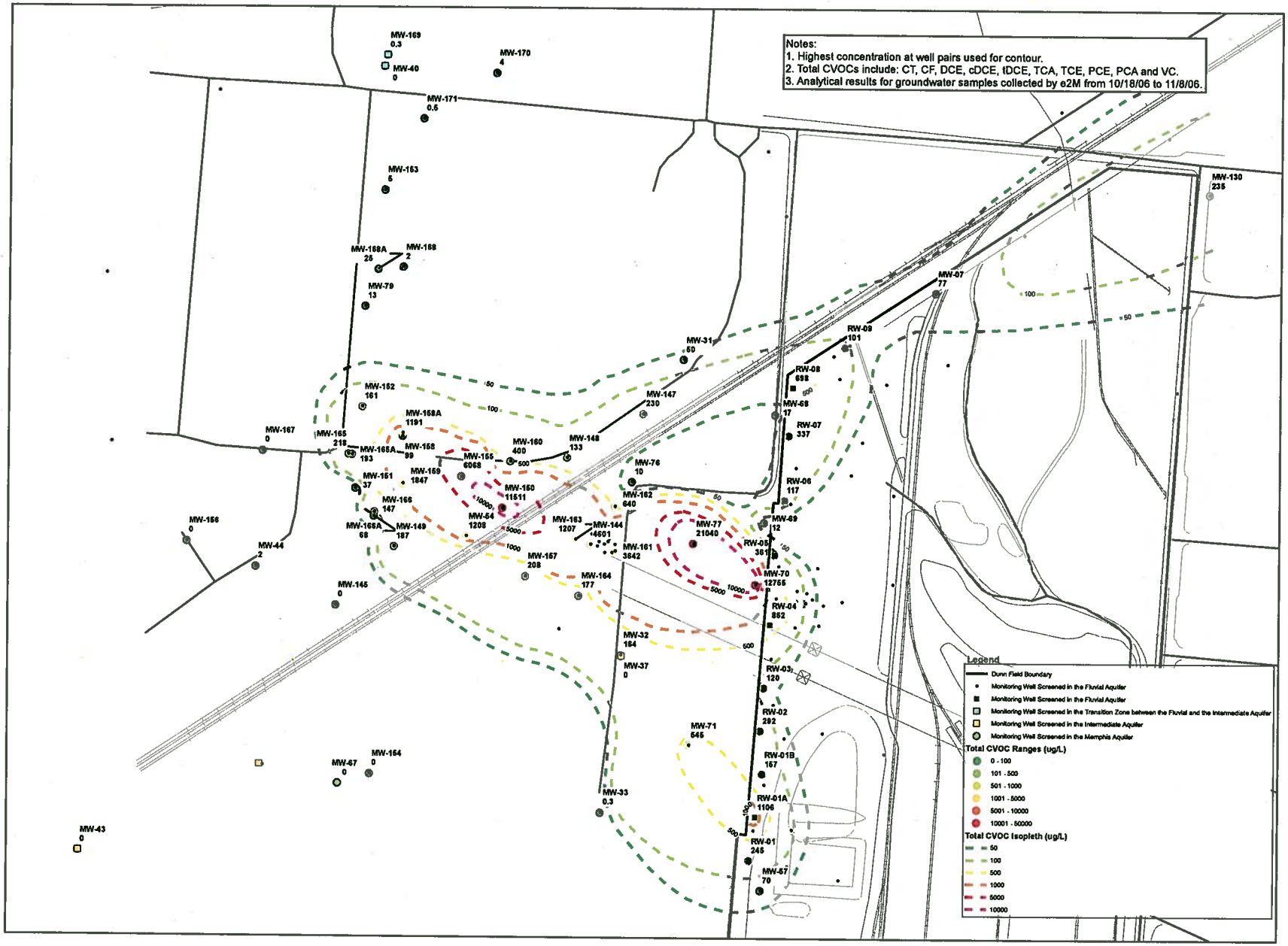


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**Figure 4-4**

**TOTAL CVOC CONCENTRATIONS, OCTOBER 2006**

ANNUAL OPERATIONS REPORT 2006

DUNN FIELD GROUNDWATER IRA YEAR EIGHT

DEFENSE DEPOT MEMPHIS, TENNESSEE

Projection: NAD 1927 StatePlane Tennessee
Datum : WGS 84
Units: Feet

1:3,200

0 50 100 150 Feet
0 10 20 30 Meters

Installation Location
Memphis, Tennessee

Date: January 2007
Edition:DRAFT

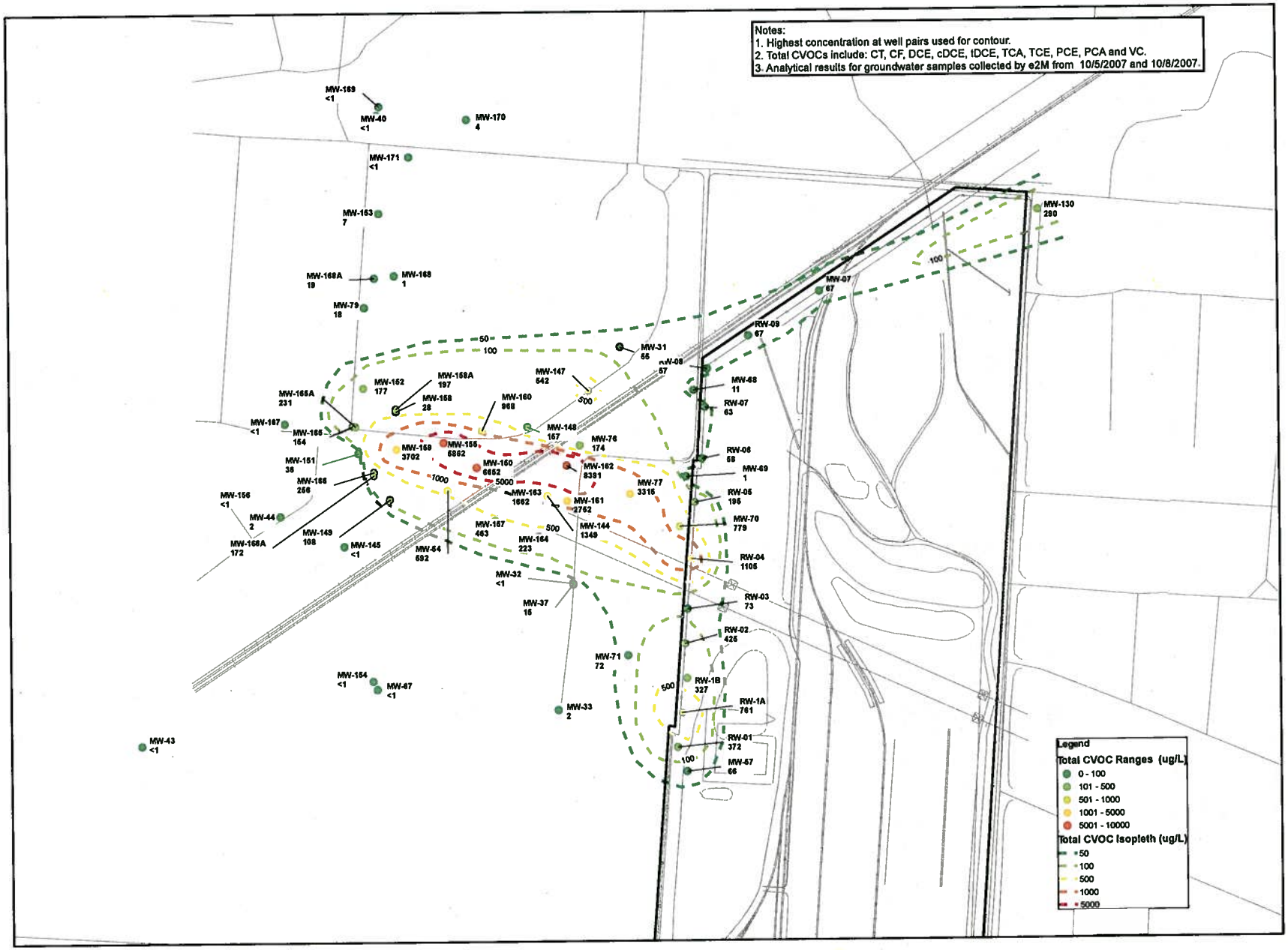


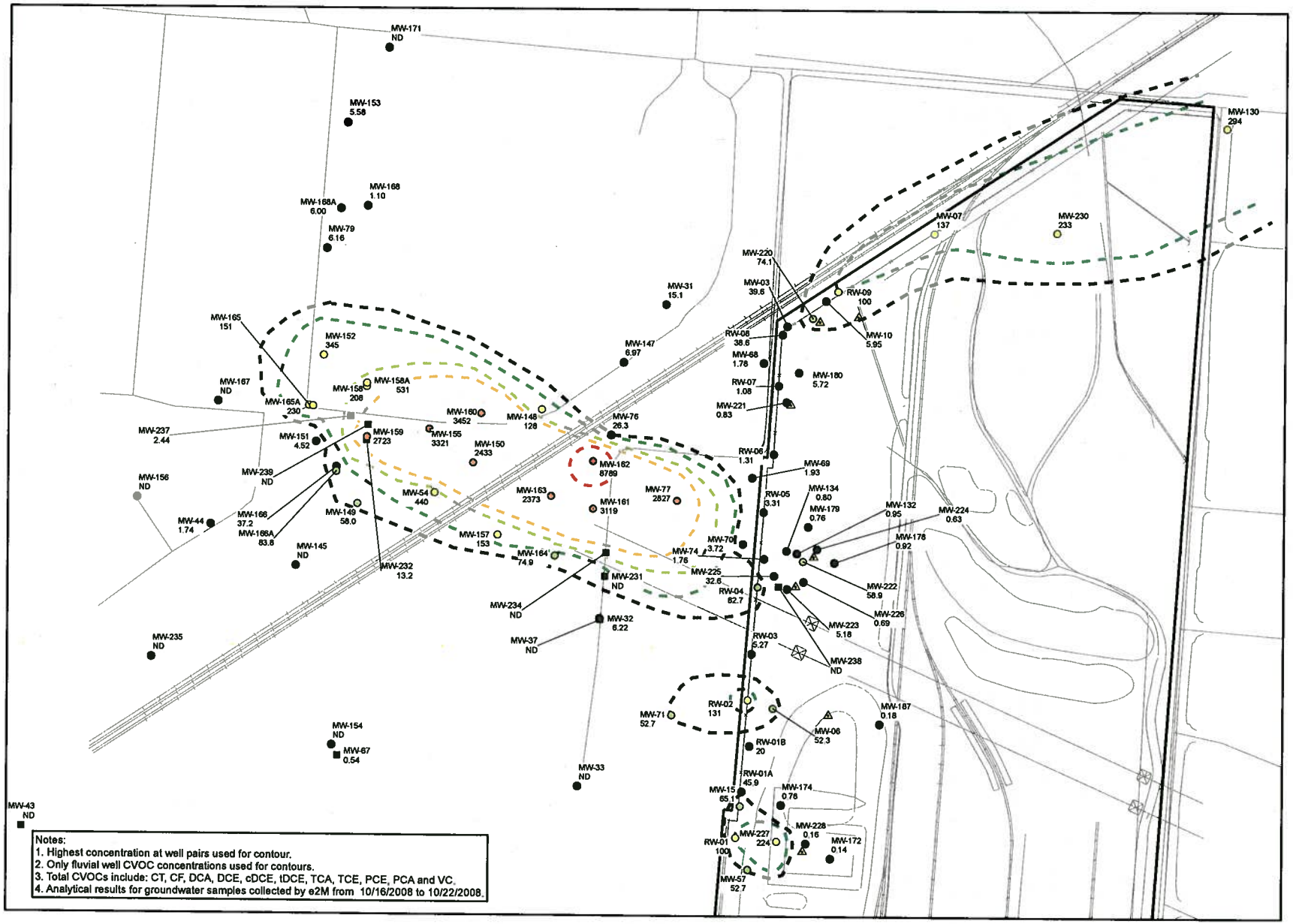

**Figure 4-4**

**TOTAL CVOC CONCENTRATIONS, OCTOBER 2007**

ANNUAL OPERATIONS REPORT 2007

DUNN FIELD GROUNDWATER IRA YEAR NINE

DEFENSE DEPOT MEMPHIS, TENNESSEE




Notes:
1. Highest concentration at well pairs used for contour.
2. Only fluvial well CVOC concentrations used for contours.
3. Total CVOCs include: CT, CF, DCA, DCE, cDCE, tDCE, TCA, TCE, PCE, PCA and VC.
4. Analytical results for groundwater samples collected by e2M from 10/16/2008 to 10/22/2008.

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**Figure 4-4**

**TOTAL CVOC CONCENTRATIONS, OCTOBER 2008**

ANNUAL OPERATIONS REPORT - 2008

DUNN FIELD GROUNDWATER IRA YEAR TEN

DEFENSE DEPOT MEMPHIS, TENNESSEE

**Legend**

**CVOCs Fluvial Wells**
ug/L
- 0 - 50
- 51 - 100
- 101 - 500
- 501 - 1000
- 1001 - 5000
- 5001 - 10000

**CVOCs Non-Fluvial Wells**
ug/L
- 0 - 50

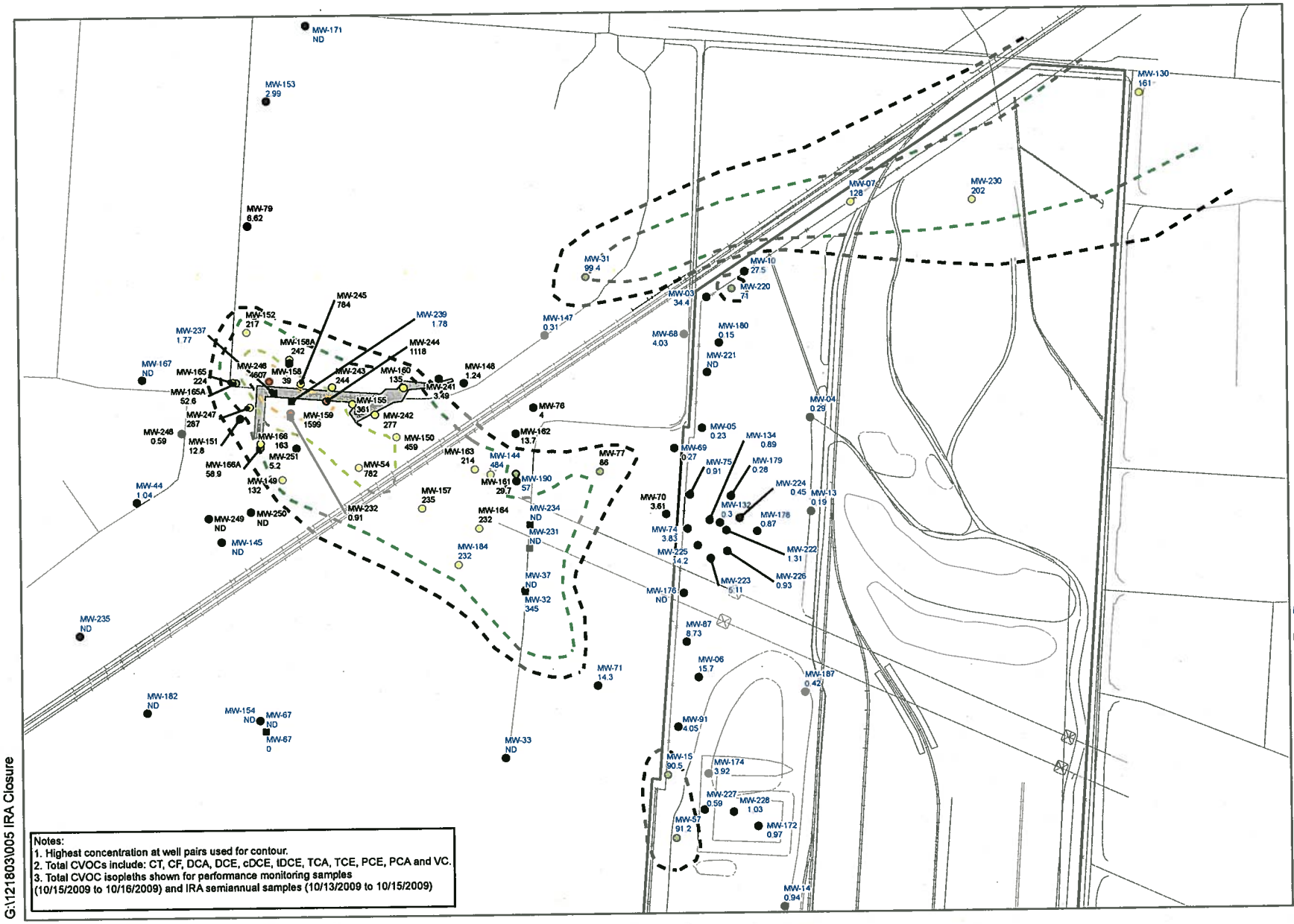
**Total CVOC Isopleth (ug/L)**
- 50
- 100
- 500
- 1000
- 5000

▲ SVE -Soil Vapor Extraction Point

0 50100 200 300 400
Feet

Installation Location
Memphis, Tennessee

Date: February 2009
Edition: Rev 0




Notes:
1. Highest concentration at well pairs used for contour.
2. Total CVOCs include: CT, CF, DCA, DCE, cDCE, tDCE, TCA, TCE, PCE, PCA and VC.
3. Total CVOC isopleths shown for performance monitoring samples (10/15/2009 to 10/16/2009) and IRA semiannual samples (10/13/2009 to 10/15/2009)

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**Figure 7**

**TOTAL CVOC CONCENTRATIONS, OCTOBER 2009**

2009 OPERATIONS AND CLOSURE REPORT
DUNN FIELD GROUNDWATER INTERIM REMEDIAL ACTION

DEFENSE DEPOT
MEMPHIS, TENNESSEE

**Legend**

**CVOCs Fluvial Wells**
ug/L
- 0 - 50
- 50 - 100
- 100 - 500
- 500 - 1000
- 1000 - 5000

**Total CVOC Isopleth (ug/L)**
- 50
- 100
- 500
- 1000

**CVOCs Non-Fluvial Wells**
ug/L
- 0 - 50

AS-SVE Area

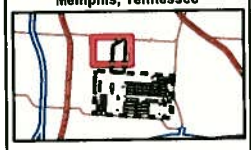
Original Dunn Field Property Boundary

MW-05 100 Blue: IRA Sample Event

MW-249 100 Black: Off Depot Performance Monitoring Sample Event

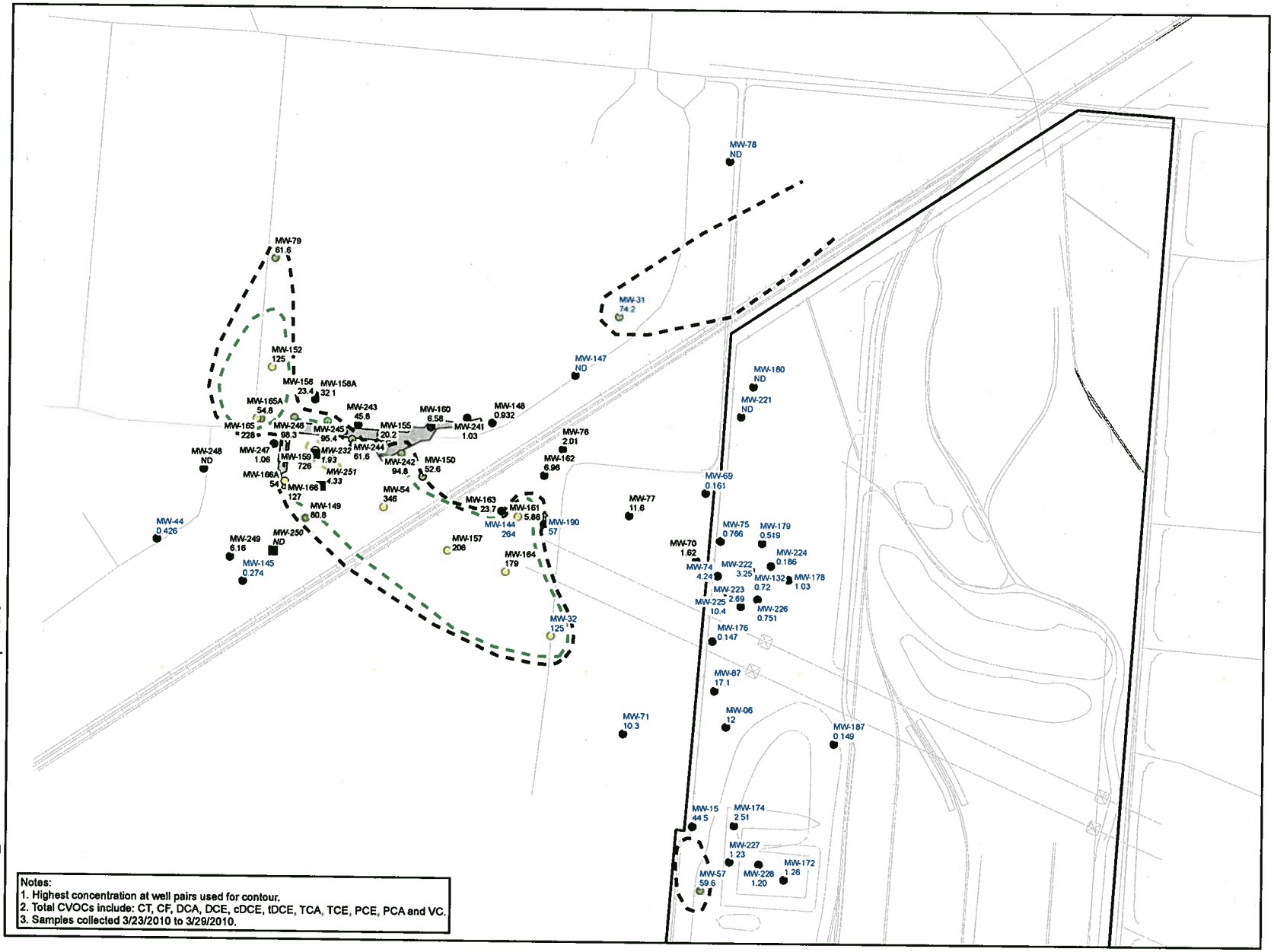
0 100 200 300 400
Feet

Installation Location
Memphis, Tennessee



Date: December 2010
Edition: Rev 0

HDR




Notes:
1. Highest concentration at well pairs used for contour.
2. Total CVOCs include: CT, CF, DCA, DCE, cDCE, tDCE, TCA, TCE, PCE, PCA and VC.
3. Samples collected 3/23/2010 to 3/29/2010.

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**Figure 5**

**TOTAL CVOC CONCENTRATIONS, MARCH 2010**

OFF DEPOT GROUNDWATER ANNUAL LONG TERM MONITORING REPORT - 2010

DUNN FIELD
DEFENSE DEPOT
MEMPHIS, TENNESSEE

**Legend**

**CVOCs Fluvial Wells**
ug/L
- 0 - 50
- 50 - 100
- 100 - 500
- 500 - 1000

**Total CVOC Isopleth (ug/L)**
- 50
- 100
- 500

**CVOCs Non-Fluvial Wells**
ug/L
- 0 - 50
- SVE -Soil Vapor Extraction Point
- Original Dunn Field Property Boundary

MW-05 100 Blue: Off Depot LTM Sample Event

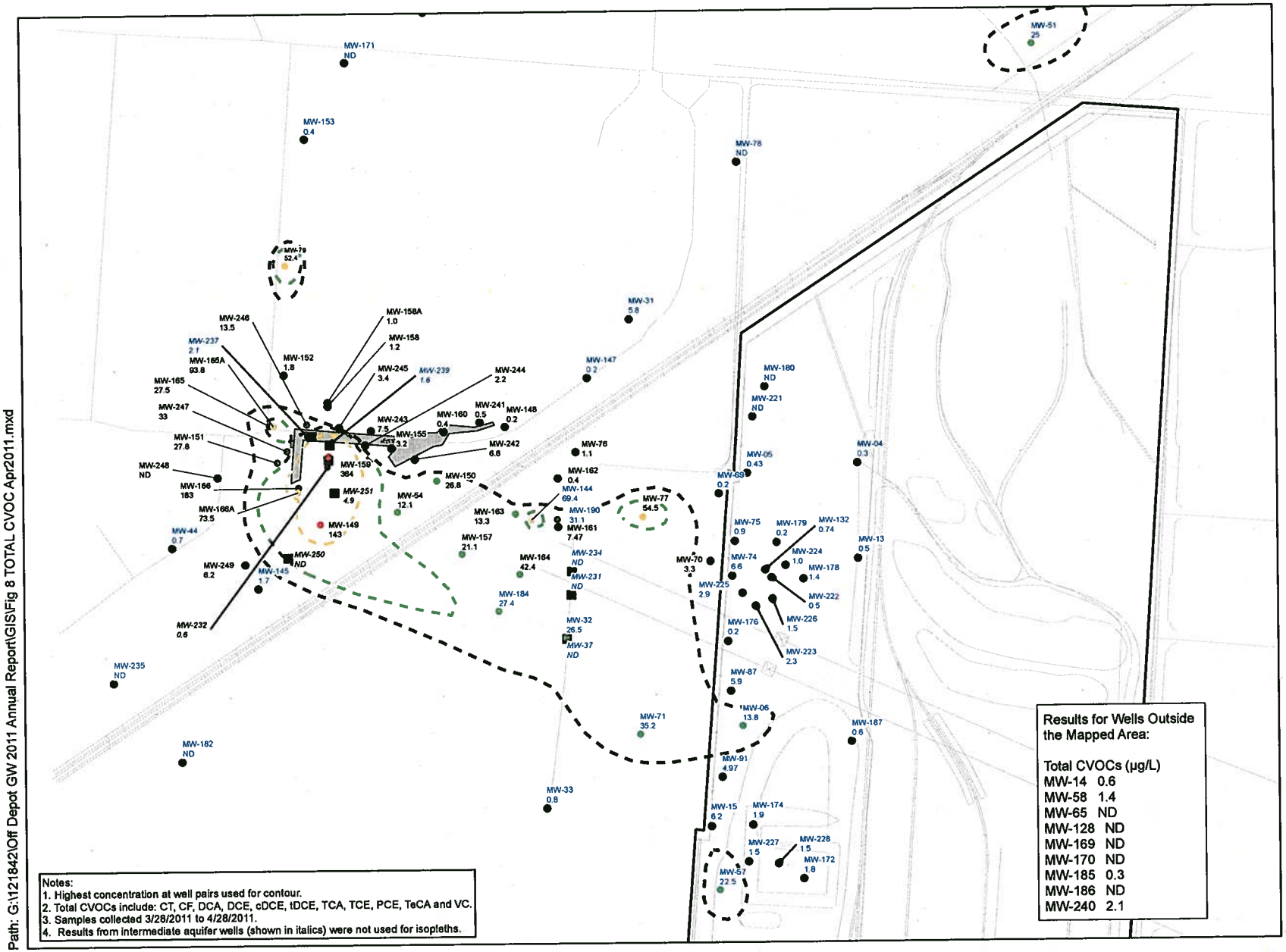
MW-249 100 Black: Off Depot Performance Monitoring Sample Event (Non-Fluvial Wells - Italics)

0 100 200 300
Feet

Installation Location
Memphis, Tennessee

Date: January 2011
Edition: Rev 0

HDR




Path: G:\121842\Off Depot GW 2011 Annual Report\GIS\Fig 8 TOTAL CVOC Apr2011.mxd

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**Figure 8**

## TOTAL CVOC CONCENTRATIONS, MARCH - APRIL 2011

OFF DEPOT
ANNUAL GROUNDWATER
MONITORING REPORT – 2011

DUNN FIELD
DEFENSE DEPOT
MEMPHIS, TENNESSEE

**Legend**

**Total CVOC Ranges (ug/L)**

- 0 - 10
- 10 - 50
- 50 - 100
- 100 - 500

**Total CVOC Isopleth (ug/L)**

- 10
- 50
- 100

Air Sparge Well Area

Original Dunn Field Property Boundary

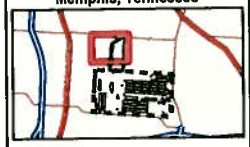
MW-05 100 Blue: Off Depot LTM Sample Event

MW-249 100 Black: Off Depot Performance Monitoring Sample Event (Non-Fluvial Wells - Italics)

0 100 200 300

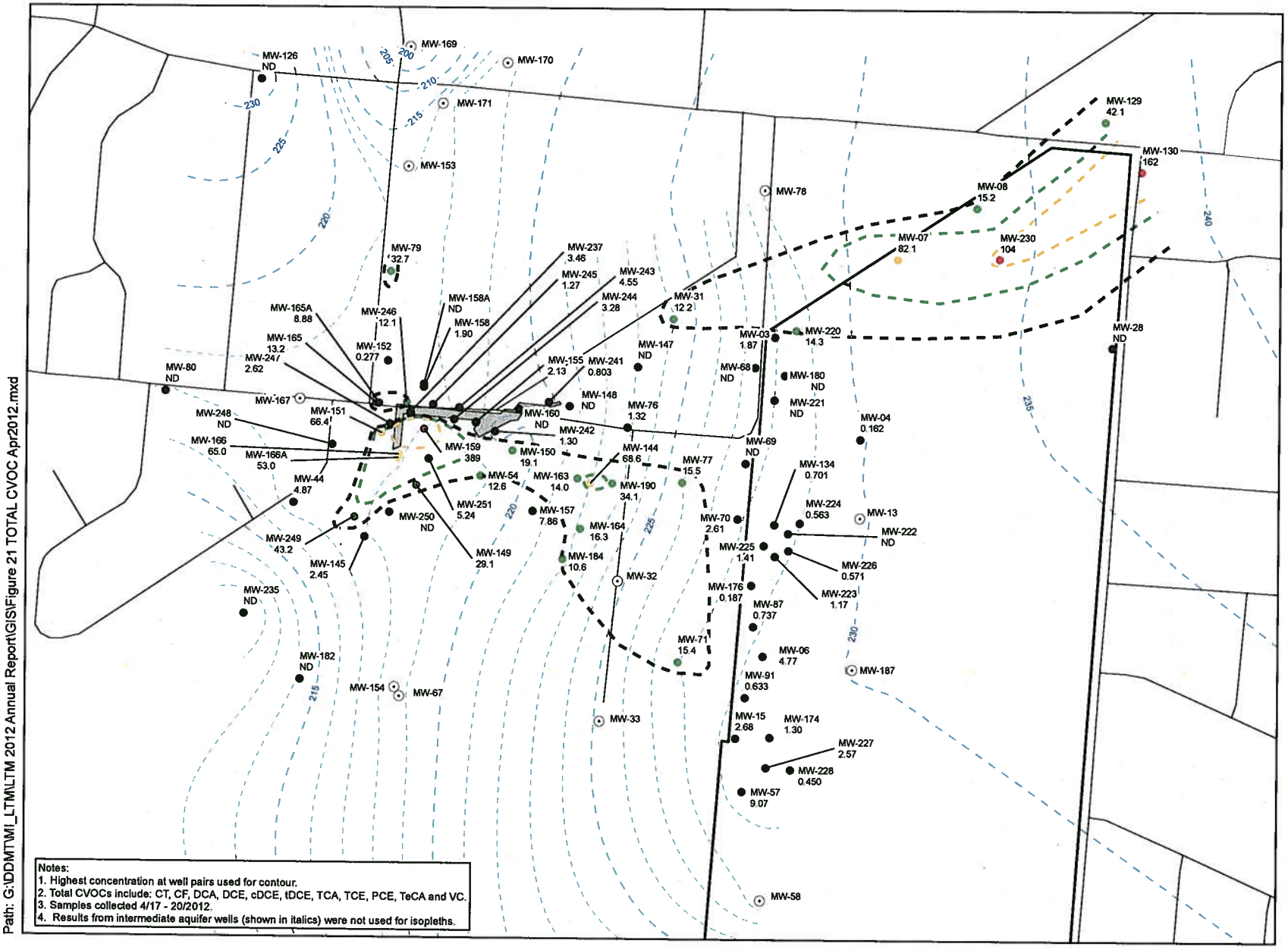
Feet

Installation Location
Memphis, Tennessee



Date: March 2012
Edition: Rev 0

HDR




Notes:
1. Highest concentration at well pairs used for contour.
2. Total CVOCs include: CT, CF, DCA, DCE, cDCE, tDCE, TCA, TCE, PCE, TeCA and VC.
3. Samples collected 4/17 - 20/2012.
4. Results from intermediate aquifer wells (shown in italics) were not used for isopleths.

Path: G:\DDMT\MI_LTM\LTM 2012 Annual Report\GIS\Figure 21 TOTAL CVOC Apr2012.mxd

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**Figure 21**

**DUNN FIELD TOTAL CVOC CONCENTRATIONS, APRIL 2012**

ANNUAL LONG TERM MONITORING REPORT - 2012

DEFENSE DEPOT MEMPHIS, TENNESSEE

**Legend**

**Total CVOC Ranges (ug/L)**
- 0 - 10
- 10 - 50
- 50 - 100
- 100 - 500
- Not Sampled

**Total CVOC Isopleth (ug/L)**
- 10
- 50
- 100

Air Sparge Well Area

Original Dunn Field Property Boundary

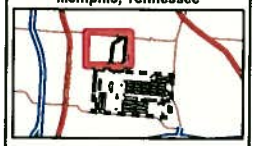
Potentiometric surface of the Fluvial Aquifer 1-ft. contour

Potentiometric surface of the Fluvial Aquifer 5-ft. contour

0 100 200 300

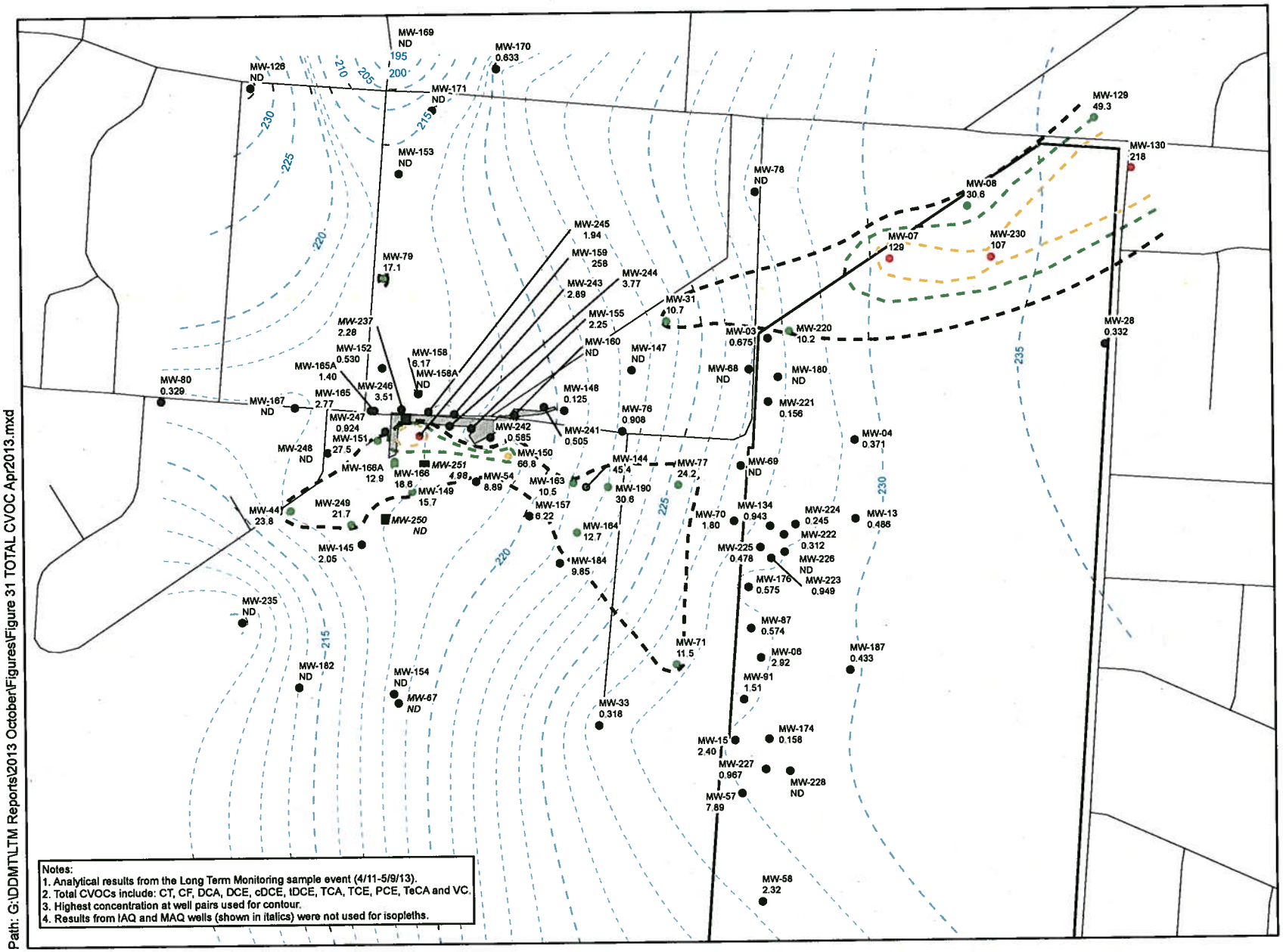
Feet

Installation Location
Memphis, Tennessee



Date: December 2012
Edition: Rev 0

HDR




Notes:
1. Analytical results from the Long Term Monitoring sample event (4/11-5/9/13).
2. Total CVOCs include: CT, CF, DCA, DCE, cDCE, tDCE, TCA, TCE, PCE, TeCA and VC.
3. Highest concentration at well pairs used for contour.
4. Results from IAQ and MAQ wells (shown in italics) were not used for isopleths.

Path: G:\DDMT\LTM Reports\2013 October\Figures\Figure 31 TOTAL CVOC Apr2013.mxd

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Figure 31

DUNN FIELD
TOTAL CVOC
CONCENTRATIONS,
APRIL 2013

ANNUAL LONG
TERM MONITORING
REPORT - 2013

DEFENSE DEPOT
MEMPHIS, TENNESSEE

Legend

Total CVOC Ranges (ug/L)
- 0 - 10
- 10 - 50
- 50 - 100
- 100 - 500

Total CVOC Isopleth (ug/L)
- 10
- 50
- 100

Air Sparge Well Area

Original Dunn Field Property Boundary

Potentiometric surface of the Fluvial Aquifer 1-ft. contour

Potentiometric surface of the Fluvial Aquifer 5-ft. contour

0 100 200 300
Feet

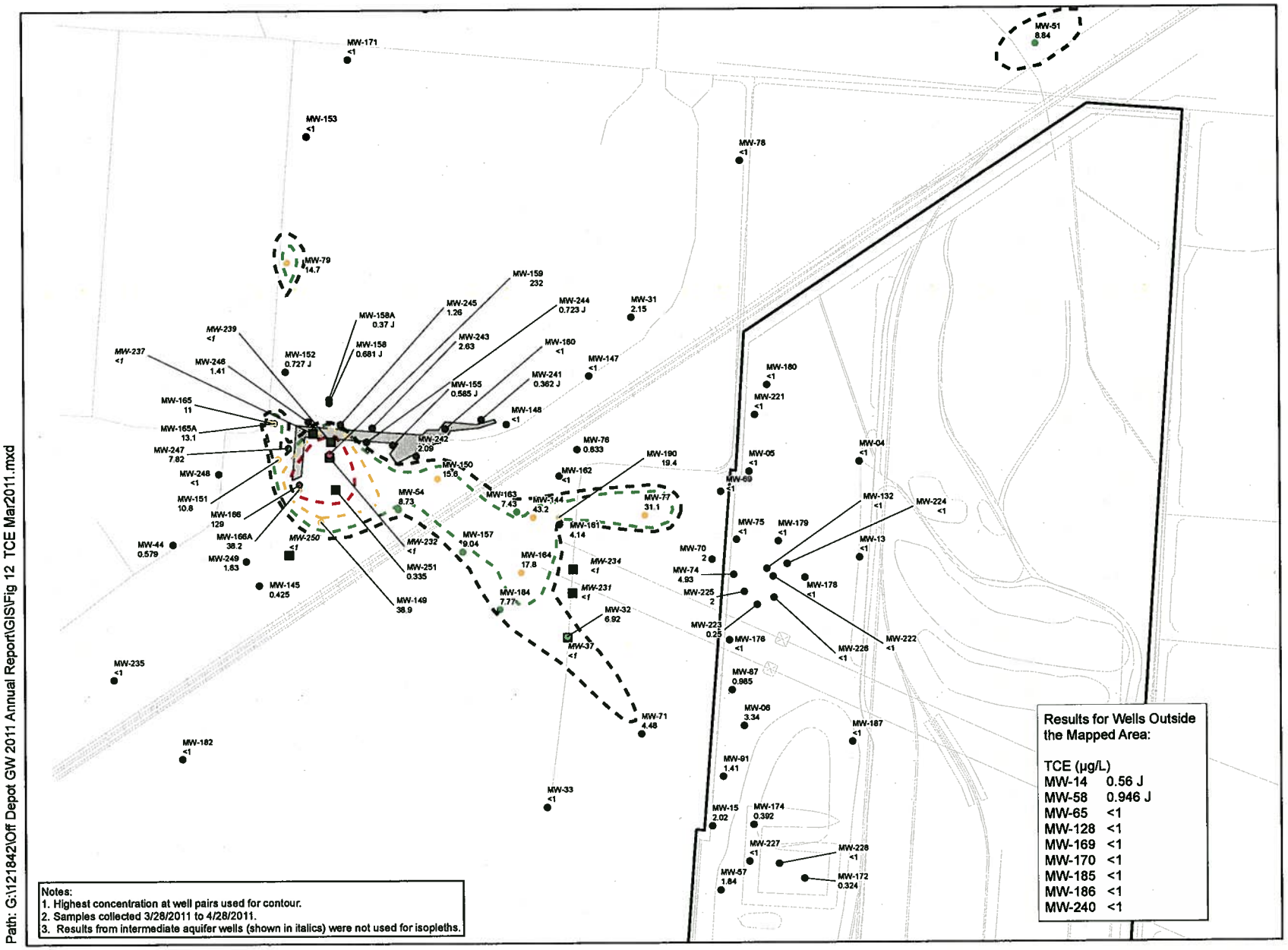
Installation Location
Memphis, Tennessee

Date: December 2013
Edition: Rev 0

HDR

**ENCLOSURE 2B**

**TCE AND DCE PLUME MAPS (2011 – 2013)**




Notes:
1. Highest concentration at well pairs used for contour.
2. Samples collected 3/28/2011 to 4/28/2011.
3. Results from intermediate aquifer wells (shown in italics) were not used for isopleths.

Results for Wells Outside the Mapped Area:

TCE (µg/L)

| | |
|---|---|
| MW-14 | 0.56 J |
| MW-58 | 0.946 J |
| MW-65 | <1 |
| MW-128 | <1 |
| MW-169 | <1 |
| MW-170 | <1 |
| MW-185 | <1 |
| MW-186 | <1 |
| MW-240 | <1 |

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**Figure 12**

**TCE CONCENTRATIONS, MARCH - APRIL 2011**

OFF DEPOT
ANNUAL GROUNDWATER
MONITORING REPORT – 2011

DUNN FIELD
DEFENSE DEPOT
MEMPHIS, TENNESSEE

**Legend**

**TCE Ranges (ug/L)**
- 0-5
- 5-10
- 10-50
- 50-100
- 100-250

**TCE Isopleth (ug/L)**
- 5
- 10
- 50
- 100

Air Sparge Well Area

Original Dunn Field Property Boundary

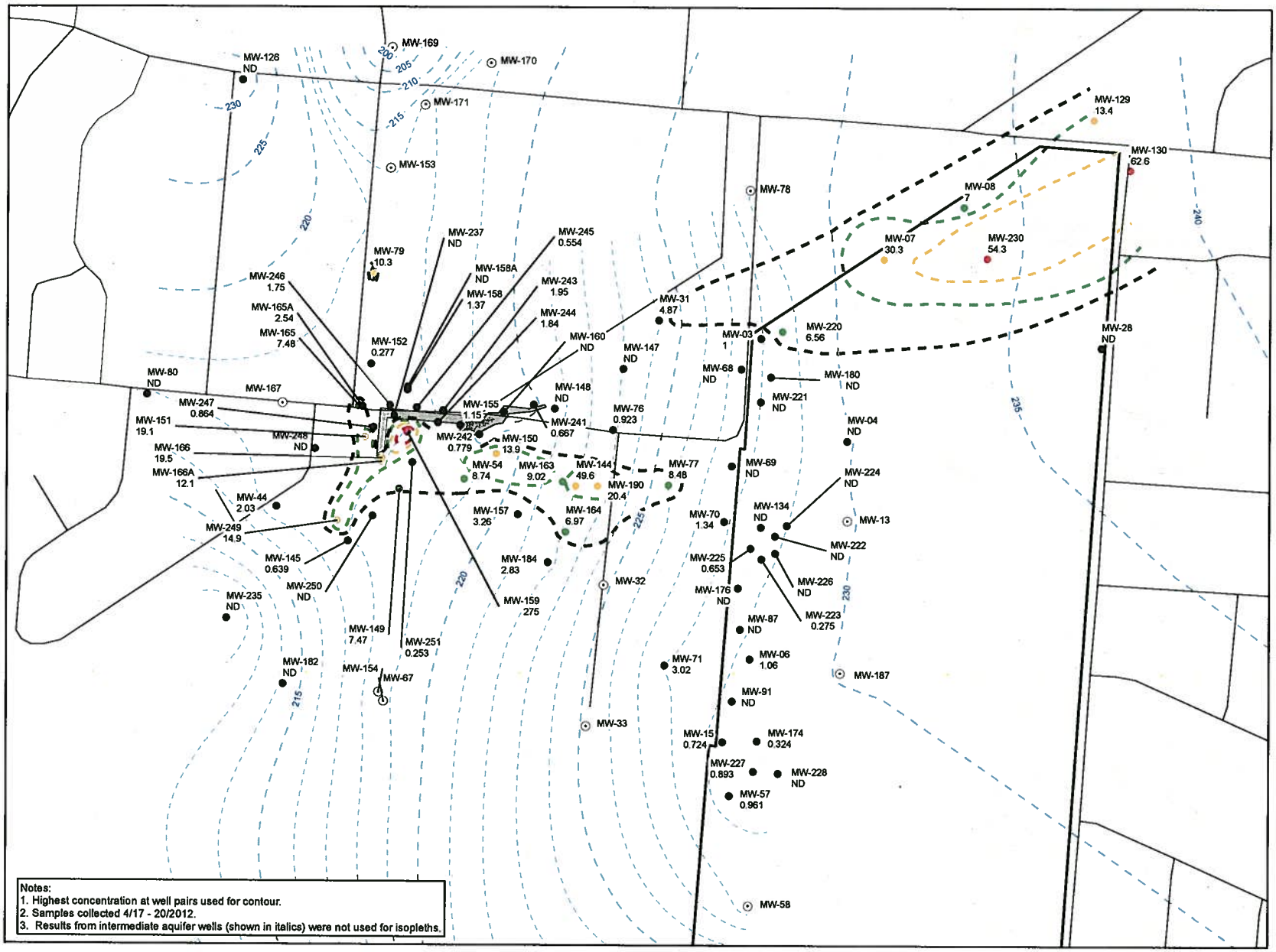
0 100 200 300
Feet

Installation Location
Memphis, Tennessee

Date: March 2012
Edition: Rev 0

HDR

Path: G:\121842\Off Depot GW 2011 Annual Report\GIS\Fig 12 TCE Mar2011.mxd




Notes:
1. Highest concentration at well pairs used for contour.
2. Samples collected 4/17 - 20/2012.
3. Results from intermediate aquifer wells (shown in italics) were not used for isopleths.

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**Figure 25**

**DUNN FIELD TCE CONCENTRATIONS, APRIL 2012**

ANNUAL LONG TERM MONITORING REPORT - 2012

DEFENSE DEPOT MEMPHIS, TENNESSEE

**Legend**

**TCE Ranges (ug/L)**
- 0-5
- 5-10
- 10-50
- 50-100
- 100-300
- Not Sampled

**TCE Isopleth (ug/L)**
- 5
- 10
- 50
- 100

Air Sparge Well Area

Original Dunn Field Property Boundary

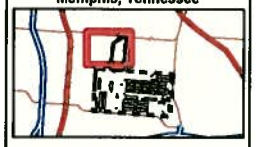
Potentiometric surface of the Fluvial Aquifer 1-ft. contour

Potentiometric surface of the Fluvial Aquifer 5-ft. contour

0 100 200 300

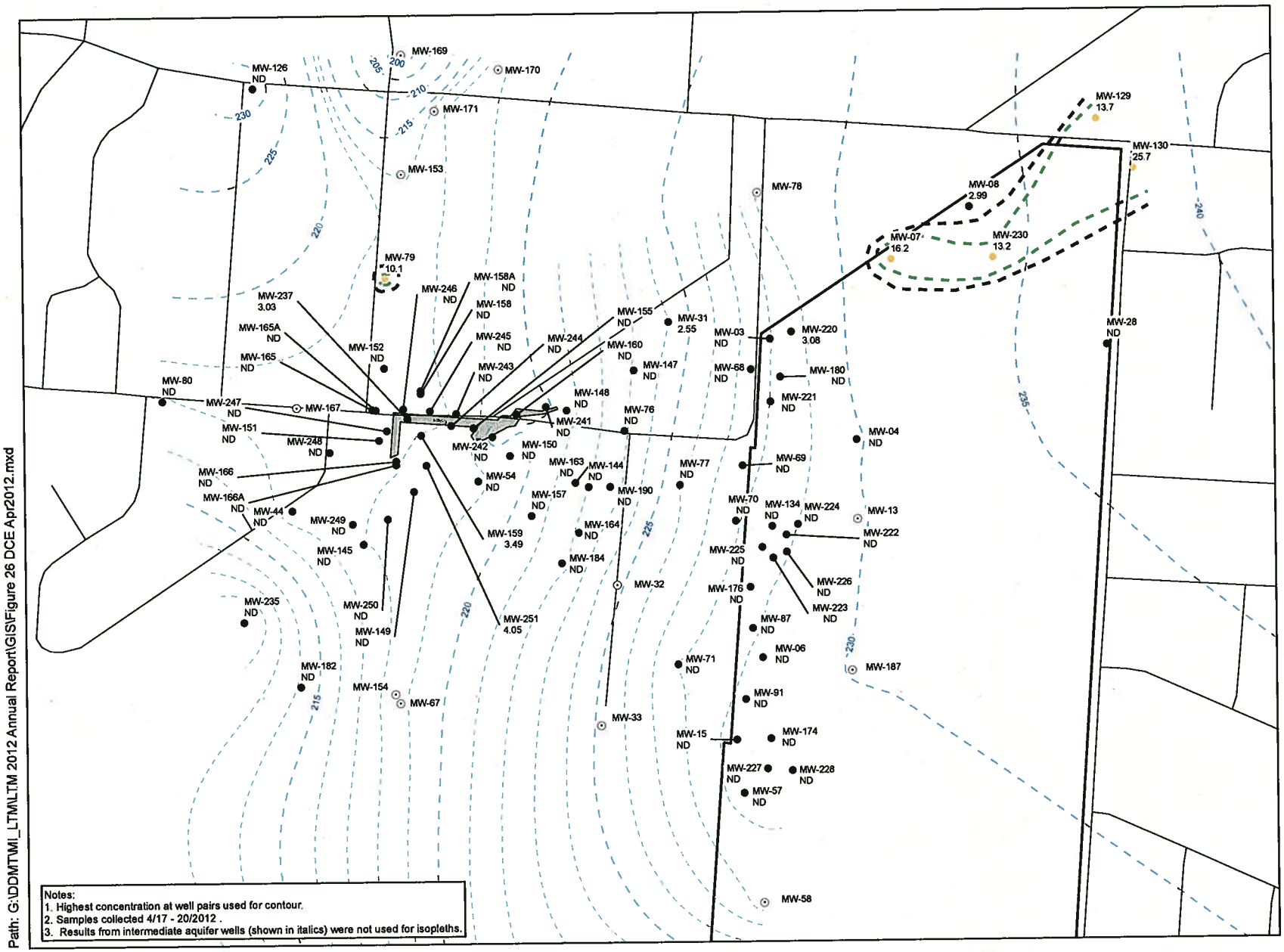
Feet

Installation Location
Memphis, Tennessee



Date: December 2012
Edition: Rev 0

HDR




Notes:
1. Highest concentration at well pairs used for contour.
2. Samples collected 4/17 - 20/2012 .
3. Results from intermediate aquifer wells (shown in italics) were not used for isopleths.

Path: G:\DDMTM_LTM\LTM 2012 Annual Report\GIS\Figure 26 DCE Apr2012.mxd

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**Figure 26**

**DUNN FIELD DCE CONCENTRATIONS, APRIL 2012**

ANNUAL LONG TERM MONITORING REPORT - 2012

DEFENSE DEPOT MEMPHIS, TENNESSEE

**Legend**

**DCE Ranges (ug/L)**

- 0-7
- 7-10
- 10-50
- Not Sampled

**DCE Isopleth (ug/L)**

- 7
- 10

Air Sparge Well Area

Original Dunn Field Property Boundary

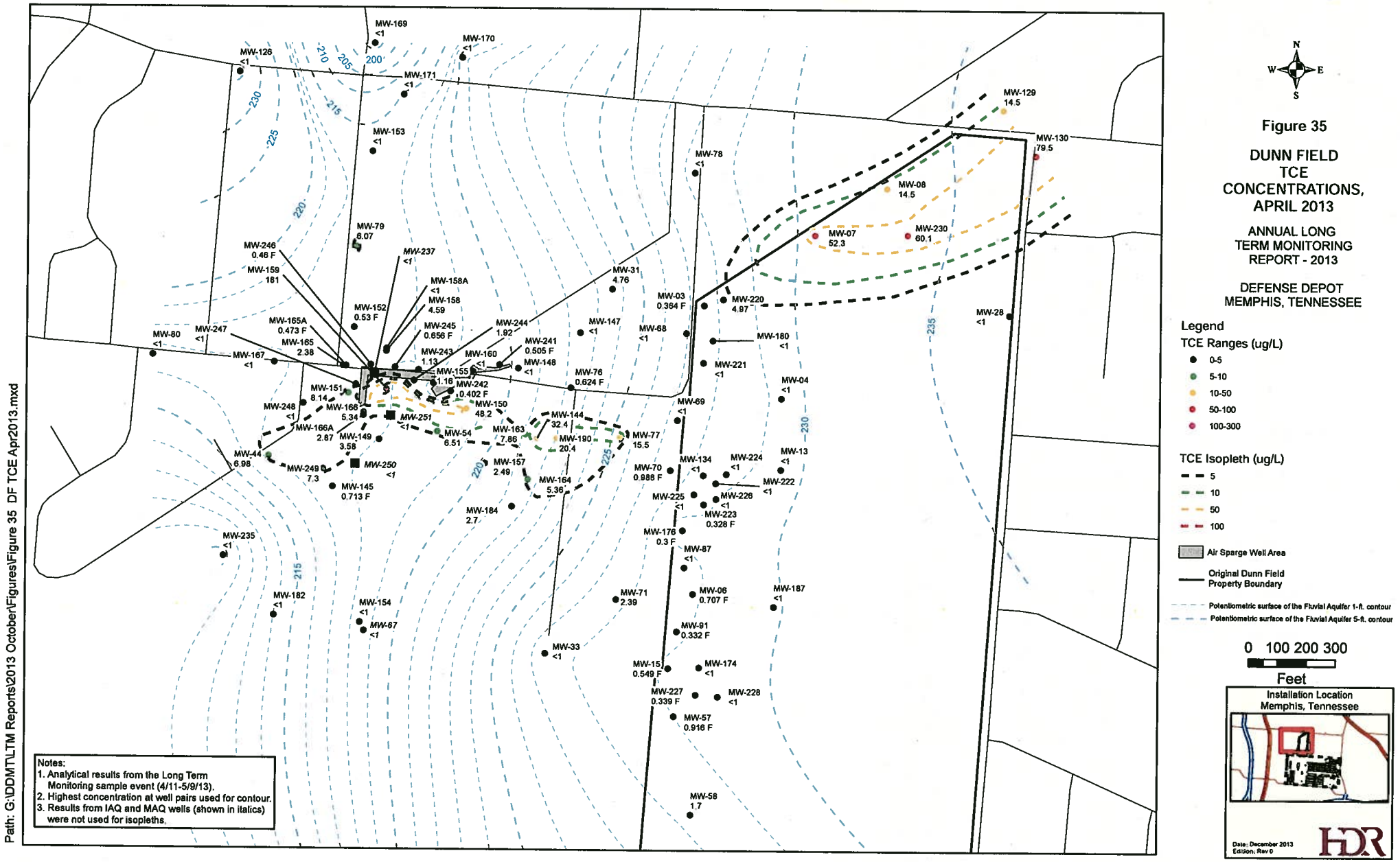
0 100 200 300

Feet

Installation Location
Memphis, Tennessee

Date: December 2012
Edition: Rev 0

HDR




Notes:
1. Analytical results from the Long Term Monitoring sample event (4/11-5/9/13).
2. Highest concentration at well pairs used for contour.
3. Results from IAQ and MAQ wells (shown in italics) were not used for isopleths.

Path: G:\DDMT\LTM Reports\2013 October\Figures\Figure 35 DF TCE Apr2013.mxd

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Figure 35

DUNN FIELD
TCE
CONCENTRATIONS,
APRIL 2013

ANNUAL LONG
TERM MONITORING
REPORT - 2013

DEFENSE DEPOT
MEMPHIS, TENNESSEE

Legend

TCE Ranges (ug/L)
- 0-5
- 5-10
- 10-50
- 50-100
- 100-300

TCE Isopleth (ug/L)
- 5
- 10
- 50
- 100

Air Sparge Well Area

Original Dunn Field Property Boundary

Potentiometric surface of the Fluvial Aquifer 1-ft. contour

Potentiometric surface of the Fluvial Aquifer 5-ft. contour

0 100 200 300
Feet

Installation Location
Memphis, Tennessee



Date: December 2013
Edition: Rev 0

HDR

# APPENDIX B

# ANNUAL MAINTENANCE RECORD

# SERVICE ORDER 71246068 Page1/15

KAESER COMPRESSORS
*Built for a lifetime.*

| | | | |
|---|---|---|---|
| **Location** | HDR Engineering/e2m | **Customer** | HDR Engineering/e2m |
| 538086 | 2241 Truitt St | | 2241 Truitt St |
| | Memphis TN 38114-4893 | | Memphis TN 38114-4893 |
| **Responsible** | Jamey Elliott | **Order** | 0000120866 |
| | | **Service point** | Memphis |
| **Start (approx.)** | Tuesday, 1/28/14 / 9:00 AM | **Pers.in charge** | Larry Morton |
| **Service techn.** | Erric Crutcher | | |
| **Service techn.** | Roderick Harvey | | |

**Attachments** Add attachment

## PM Service

CSD 100 s/n: 1234 Major PM
EB 420 C s/n: 2138 Major PM; EB 420 C s/n: 2140 Major PM
Refrig Dryer TE 141 s/n: 1343 EcoDrain 21 and EcoDrain 31 Kits
KCF-100 s/n: 10900584 Cartridge; KPF-485.2 s/n: 1025 Element/Drain
KOR-485.2 s/n: 1055 Element/Drain

## Label all returned goods!

| Reason for return | Returned goods | to oper. | Pc | Material No. | Serial No. | Returned by |
|---|---|---|---|---|---|---|
| | | | | | | ○ Customer ○ Technician ○ Waste contractor |

| Set up time | | | Wrap up time | | |
|---|---|---|---|---|---|
| **Date** | **Duration** | **Service technician** | **Date** | **Duration** | **Service technician** |
| 1/28/14 | 15 Min | Erric Crutcher | 1/28/14 | 15 Min | Roderick Harvey |

| Start of work | End of work | Breaks | Date / Weekday | Service technician |
|---|---|---|---|---|
| 8:30 AM | 2:15 PM | 0 Min | Tuesday, 1/28/14 | Roderick Harvey |



Kaeser Compressors, Inc. P.O.Box 946, Fredericksburg, VA 22404, Phone: (540)-898-5500 Fax: (540)-898-5520 www.kaeser.com
A Company with Certified Quality and Environmental Management Systems ISO 9001-2008 and 14001-2004

KAESER COMPRESSORS
*Built for a lifetime.*

**Work performed acc. to work plan.**
**Any outstanding deficiencies?** ○ Yes ◉ No

**Work accepted.**
**Confirmed work and material of work plan.**

E-mail service manager*(for confirmation)*
larry.morton@kaeser.com

Customer e-mail*(for confirmation)*
diann.keating@hdrinc.com

Service technician's signature

PN: Kaeser Field Service

Digitally signed by PN: Kaeser Field Service
DN: c=DE, o=KAESER Kompressoren GmbH, ou=esigia.com, ou=eANV-ZKS, ou=Kaeser Field Service, cn=PN: Kaeser Field Service, email=kaeserfieldservice@kaeser.com, serialNumber=1
Date: 2014.01.28 14:07:12 -06'00'

☒ Signature unavailable

Remark:

Remark:

Had to leave.

**Oper. 4400** **Maintain screw compressor**

| | | | |
|---|---|---|---|
| **Type** | CSD 100 125 psi 460/60 US | | |
| **Material No.** | 100818.1 | **Year** | **2009** |
| **Serial No.** | 1234 | **EMR** | **3498678** |

**Previous service hours** 22,646 h **Current service hours** 26,959 h

| | Work to be done | Comment |
|---|---|---|
| | >Tasks to be completed and current condition recorded: OK | |
| ☒ | -Ensure safe working conditions as described in the manual | |
| ☒ | -Check motor-airend power transmission | |
| ☒ | -Change filter mat(s) in compressor/control cabinet/SFC cabinet | |
| ☒ | -Change air filter | |
| ☒ | -Change oil filter | |
| ☒ | -Maintain valves and proportional regulator | |
| ☒ | -Check cooler and clean if necessary/check fan blades and guarding | |
| ☒ | -Maintain condensate drain | |
| ☒ | -Check hose lines and change as necessary | |
| ☒ | -Check electrical cables and cable inlets | |
| ☒ | -Tighten mains terminals and check for oxidation | |
| ☐ | -Check shutdown function when separator air outlet temp. too high | |
| ☐ | -Check overcurrent relays and motor protection switches | |
| ☒ | -Check door and guard interlocks and emergency stop function | |
| ☒ | -Check coolant and change if necessary | |
| ☒ | -Check motor bearings, re-grease (Unirex N3 only) as needed/change | |
| ☒ | -Check oil sep. cartridge diff. pressure 1 psi, change as needed | |
| ☐ | -Check nominal press. shutdown function, shutdown at \| psi | |
| ☐ | -Check shutdown function when airend discharge temp. too high | |
| ☒ | -Check control voltage: L1 129.3 V | |
| ☒ | -Check power consumption: Line U1 128.3 A V1 129.7 A W1 130.3 A | |
| ☒ | -Check pressure relief valve(s) | |
| ☒ | -Check airend discharge temperature 174 °F | |
| ☒ | -Test run, check conditions: start, idle, load and shut-down | |
| ☒ | -Check oil level, for leaks (compr.air./oil/water), idling press. | |
| ☒ | -Register service: stick label/service manual/controller | |
| | Total h 26959 Load h 13904 Ambient temp. 28 °F | |
| | Coolant type M460 Control mode Dual | |
| | Existing safety deficiencies? ☒ No Yes: | |
| | Cause(s): | na |
| | Arising danger: | none |

| | Work to be done | Comment |
|---|---|---|
| | Safety deficiency rectified? Yes No; reason: | na |
| | >>>>> Equipment not released for use! | |
| | Rectified deficiencies: | |
| ☒ | Tasks fully completed | |
| ☐ | Follow-up assignment necessary for: | |
| ☐ | Follow-up order issued for: | |
| ☐ | Supply spares: | |
| Additional comments: | | |
| Replaced af, of, oil sep. cartridge, fluid, filter mats, run and tested ok | | |

| Consumed material | Materia No. | Pc | Serial No. | Part ID/batch | Store |
|---|---|---|---|---|---|

| Material delivered in advance | Material No. | Pc | Serial No. | Return | Returned by |
|---|---|---|---|---|---|
| Filter mat 112x112 | 6.3572.0 | 2 | | 0 | ○ Tech. ○ Customer |
| Oil filter | 6.3465.0 | 1 | | 0 | ○ Tech. ○ Customer |
| Air filter cartridge Ø420x130 | 6.4148.0 | 1 | | 0 | ○ Tech. ○ Customer |
| Oil Separator cartridge cpl. | 6.3623.0 | 1 | | 0 | ○ Tech. ○ Customer |
| M-460 Semi-Synthetic Oil $/(5 | ANM460-5 | 3 | | 0 | ○ Tech. ○ Customer |
| | | | | | ○ Tech. ○ Customer |

**Oper. 4920** **Maintain rotary blower**

| | | | |
|---|---|---|---|
| **Type** | EB 420 C VAC 40,0 hp 2.460 rpm | | |
| **Material No.** | EBC | **Year** | **2009** |
| **Serial No.** | 2138 | **EMR** | **3605958** |

**Previous service hours** 0 h **Current service hours** 0 h

| | Work to be done | Comment |
|---|---|---|
| | >Tasks to be completed and current condition recorded: OK | |
| ☒ | -Ensure safe working conditions as described in the manual | |
| ☒ | -Clean surface of airend and motor | |
| ☒ | -Check that the block mechanism turns freely | |
| ☒ | -Check the shaft sealing ring | |
| ☒ | -Check the drive shaft protection sleeve | |
| ☒ | -Check V-belts and change or re-tension as necessary | |
| ☒ | -Check belt pulleys | |
| ☒ | -Check guard | |
| ☐ | -Check extractor blade (enclosure) | |
| ☒ | -Change air filter | |
| ☒ | -Check oil and change if necessary | |
| ☒ | -Check the oil drain lines and connections | |
| ☐ | -Check pipe connections | |
| ☐ | -Check compensator(s) and change if necessary | |
| ☒ | -Clean and maintain unloaded start valve | |
| ☒ | -Clean and maintain check valve | |
| ☐ | -Check electrical cables and cable inlets | |
| ☐ | -Tighten mains terminals and check for oxidation | |
| ☐ | -Check overcurrent relays and motor protection switches | |
| ☐ | -Check motor bearings, re-grease (Unirex N3 only) as needed/change | |
| ☐ | -Check control voltage: L1 V | |
| ☐ | -Check power consumption: Line U1 A V1 A W1 A | |
| ☐ | -Check overheating shutdown function (option) | |
| ☐ | -Check pressure relief valve(s) | |
| ☐ | -Test run, check conditions: start, load and shut-down | |
| ☐ | -Check display functions | |
| ☐ | -Check oil level and check for leaks | |
| ☐ | -Register service: stick label/service manual/controller | |
| | Operating hours: h Oil type: sb220 | |
| | Existing safety deficiencies? No Yes: | |
| | Cause(s): | |

| | Work to be done | Comment |
|---|---|---|
| | Arising danger: | |
| | Safety deficiency rectified? Yes No; reason: | |
| | >>>>> Equipment not released for use! | |
| | Rectified deficiencies: | |
| ☒ | Tasks fully completed | |
| ☐ | Follow-up assignment necessary for: | |
| ☐ | Follow-up order issued for: | |
| ☐ | Supply spares: | |
| Additional comments: | | |
| Replaced filter,v-belts ,run and tested ok | | |

| Consumed material | Materia No. | Pc | Serial No. | Part ID/batch | Store |
|---|---|---|---|---|---|

| Material delivered in advance | Material No. | Pc | Serial No. | Return | Returned by |
|---|---|---|---|---|---|
| Filter fleece DN150 (EB..C) | 893606.0 | 1 | | 0 | ○ Tech. ○ Customer |
| Omega Blower 220 Synthetic O | ANSB-220 | 2 | | 0 | ○ Tech. ○ Customer |
| Narrow V-belt set (5pcs)XPZ 2( | 893437.0 | 1 | | 0 | ○ Tech. ○ Customer |
| | | | | | ○ Tech. ○ Customer |

**Oper. 4940** **Maintain rotary blower**

**Type** EB 420 C VAC 40,0 hp 2.460 rpm

**Material No.** EBC **Year** **2009**

**Serial No.** 2140 **EMR** **3605982**

**Previous service hours** 0 h **Current service hours** 0 h

| | Work to be done | Comment |
|---|---|---|
| | >Tasks to be completed and current condition recorded: OK | |
| ☒ | -Ensure safe working conditions as described in the manual | |
| ☒ | -Clean surface of airend and motor | |
| ☒ | -Check that the block mechanism turns freely | |
| ☒ | -Check the shaft sealing ring | |
| ☒ | -Check the drive shaft protection sleeve | |
| ☒ | -Check V-belts and change or re-tension as necessary | |
| ☒ | -Check belt pulleys | |
| ☒ | -Check guard | |
| ☐ | -Check extractor blade (enclosure) | |
| ☒ | -Change air filter | |
| ☒ | -Check oil and change if necessary | |
| ☒ | -Check the oil drain lines and connections | |
| ☐ | -Check pipe connections | |
| ☐ | -Check compensator(s) and change if necessary | |
| ☐ | -Clean and maintain unloaded start valve | |
| ☒ | -Clean and maintain check valve | |
| ☐ | -Check electrical cables and cable inlets | |
| ☐ | -Tighten mains terminals and check for oxidation | |
| ☐ | -Check overcurrent relays and motor protection switches | |
| ☐ | -Check motor bearings, re-grease (Unirex N3 only) as needed/change | |
| ☐ | -Check control voltage: L1 V | |
| ☐ | -Check power consumption: Line U1 A V1 A W1 A | |
| ☐ | -Check overheating shutdown function (option) | |
| ☐ | -Check pressure relief valve(s) | |
| ☐ | -Test run, check conditions: start, load and shut-down | |
| ☐ | -Check display functions | |
| ☐ | -Check oil level and check for leaks | |
| ☐ | -Register service: stick label/service manual/controller | |
| | Operating hours: h Oil type: | |
| | Existing safety deficiencies? No Yes: | |
| | Cause(s): | |

| | Work to be done | Comment |
|---|---|---|
| | Arising danger: | |
| | Safety deficiency rectified? Yes No; reason: | |
| | >>>>> Equipment not released for use! | |
| | Rectified deficiencies: | |
| ☐ | Tasks fully completed | |
| ☐ | Follow-up assignment necessary for: | |
| ☐ | Follow-up order issued for: | |
| ☐ | Supply spares: | |
| Additional comments: | | |
| Replaced filters,v-belts, run and tested ok | | |

| Consumed material | Materia No. | Pc | Serial No. | Part ID/batch | Store |
|---|---|---|---|---|---|

| Material delivered in advance | Material No. | Pc | Serial No. | Return | Returned by |
|---|---|---|---|---|---|
| Filter fleece DN150 (EB..C) | 893606.0 | 1 | | 0 | ○ Tech. ○ Customer |
| Omega Blower 220 Synthetic O | ANSB-220 | 2 | | 0 | ○ Tech. ○ Customer |
| Narrow V-belt set (6pcs)XPZ 2( | 893441.0 | 1 | | 0 | ○ Tech. ○ Customer |
| | | | | | ○ Tech. ○ Customer |

**Oper. 5020** **Maintain refrigeration dryer (Sec.)**

| | | | |
|---|---|---|---|
| **Type** | Refrig. dryer TE 141 460/3/60 | | |
| **Material No.** | 1.8039.00010 | **Year** | **2009** |
| **Serial No.** | 1343 | **EMR** | **3575706** |

| | Work to be done | Comment |
|---|---|---|
| ☐ | >Tasks to be completed and current condition recorded: OK | |
| ☒ | -Ensure safe working conditions as described in the manual | |
| ☒ | -Check for condensate in air network | |
| ☒ | -Clean refrigerant condenser and straighten laminations | |
| ☐ | -Change air treatment filter element(s) | |
| ☒ | -Maintain condensate drain | |
| ☒ | -Repair any damage to the refrigerant circuit thermal insulation | |
| ☒ | -Check fan motor, blades and guarding | |
| ☒ | -Check electrical cables and cable inlets | |
| ☐ | -Check fan/extractor pressure switch | |
| ☐ | -Check cut-out pressures: High psi / Low psi | |
| ☐ | -Check compressed air temperature: Inlet °F \| Outlet °F | |
| ☒ | -Check dew point: blue ☒ green red \| °F | |
| ☒ | -Check refrigerant circuit for leaks | |
| ☒ | -Check setting and function of the compressed air bypass/diversion | |
| ☒ | -Test run | |
| ☒ | -Register service: stick label/service manual/controller | |
| ☐ | Refrigerant type R134a Ambient temperature 28 °F | |
| ☐ | Existing safety deficiencies? ☒ No Yes: | |
| ☐ | Cause(s): | na |
| ☐ | Arising danger: | none |
| ☐ | Safety deficiency rectified? Yes No; reason: | na |
| ☐ | >>>>> Equipment not released for use! | |
| ☐ | Rectified deficiencies: | |
| ☒ | Tasks fully completed | |
| ☐ | Follow-up assignment necessary for: | |
| ☐ | Follow-up order issued for: | |
| ☐ | Supply spares: | |

Additional comments:

Inspect unit, replaced eco - drain 31,run and tested ok *** unit does not have a eco - drain 21 on it ***returned eco - drain 21 parts.

| Consumed material | Materia No. | Pc | Serial No. | Part ID/batch | Store |
|---|---|---|---|---|---|
| Double nipple removeable | 6.1030.1 | 1 | | | 1002 |

| Material delivered in advance | Material No. | Pc | Serial No. | Return | Returned by |
|---|---|---|---|---|---|
| ~~Kaeser Eco-Drain 21 115V Mai~~ | ~~AN825200~~ | ~~1~~ | | 1 | (•) Tech. ( ) Customer |
| Kaeser Eco-Drain 31 Service U | AN8247400370 | 1 | | 0 | ( ) Tech. ( ) Customer |
| | | | | | ( ) Tech. ( ) Customer |

**Oper. 5500** **Maintain condens. treatment act. carb.**
**Type** KCF-100 Condensate Treatment System
**Material No.** ANKCF100 **Year** **2009**
**Serial No.** 10900584 **EMR** **3486488**

| | Work to be done | Comment |
|---|---|---|
| | >Tasks to be completed and current condition recorded: OK | |
| ☒ | -Ensure safe working conditions as described in the manual | |
| ☒ | -Empty oil catcher | |
| ☒ | -Check activated carbon filter and prefilter, change if necessary | |
| ☐ | -Change expansion chamber filter (except Aquamat 1) | |
| ☐ | -Clean dirt trap (except Aquamat 1) | |
| ☒ | -Check settling tank for contamination and clean if necessary | |
| ☒ | -Check oil drain and clean if necessary | |
| ☒ | -Check water drain, clean if necessary | |
| ☐ | -Clean valves and check function (Aquamat 20) | |
| ☒ | -Check for leaks in hoses, connections and air receiver | |
| ☐ | -Check heating (option) | |
| ☒ | -Check level sensor | |
| ☒ | -Register service: stick label/service manual/controller | |
| | Existing safety deficiencies? ☒ No Yes: | |
| | Cause(s): | na |
| | Arising danger: | none |
| | Safety deficiency rectified? Yes No; reason: | na |
| | >>>>> Equipment not released for use! | |
| | Rectified deficiencies: | |
| ☒ | Tasks fully completed | |
| ☐ | Follow-up assignment necessary for: | |
| ☐ | Follow-up order issued for: | |
| ☐ | Supply spares: | |

Additional comments:

Replaced cartridge, run and tested ok

| Consumed material | Materia No. | Pc | Serial No. | Part ID/batch | Store |
|---|---|---|---|---|---|

| Material delivered in advance | Material No. | Pc | Serial No. | Return | Returned by |
|---|---|---|---|---|---|
| Replacement Cartridge - KCF1( | ANKCF100CAR | 1 | | 0 | ○ Tech. ○ Customer |
| | | | | | ○ Tech. ○ Customer |

**Oper. 5700** **Maintain compressed air filter**

| | | | |
|---|---|---|---|
| **Type** | Particulate KPF-485.2 | | |
| **Material No.** | USKPF485.2 | **Year** | **2009** |
| **Serial No.** | * | **EMR** | **3742805** |

| | Work to be done | Comment |
|---|---|---|
| ☐ | >Tasks to be completed and current condition recorded: OK | |
| ☒ | -Ensure safe working conditions as described in the manual | |
| ☒ | -Change filter element(s) | |
| ☒ | -Clean filter housing and control bores in the filter head | |
| ☒ | -Maintain condensate drain | |
| ☐ | -Check pressure differential indicator (option) | |
| ☐ | -Check optional shutdown function, only with user's permission | |
| ☒ | -Check for leaks | |
| ☒ | -Register service: stick label/service manual/controller | |
| | Existing safety deficiencies? ☒ No Yes: | |
| | Cause(s): | na |
| | Arising danger: | none |
| | Safety deficiency rectified? Yes No; reason: | na |
| | >>>>> Equipment not released for use! | |
| | Rectified deficiencies: | |
| ☒ | Tasks fully completed | |
| ☐ | Follow-up assignment necessary for: | |
| ☐ | Follow-up order issued for: | |
| ☐ | Supply spares: | |

Additional comments:

Replaced filter, run and tested ok

| Consumed material | Materia No. | Pc | Serial No. | Part ID/batch | Store |
|---|---|---|---|---|---|

| Material delivered in advance | Material No. | Pc | Serial No. | Return | Returned by |
|---|---|---|---|---|---|
| Std 485 KPF Element | USPF-485 | 1 | | 0 | ○ Tech. ○ Customer |
| Internal Automatic Drain | US4170-08 | 1 | | 0 | ○ Tech. ○ Customer |
| | | | | | ○ Tech. ○ Customer |

**Oper. 5720** **Maintain compressed air filter**
**Type** Oil Removal KOR-485.2
**Material No.** USKOR485.2 **Year** **2009**
**Serial No.** * **EMR** **3742806**

| | Work to be done | Comment |
|---|---|---|
| ☐ | >Tasks to be completed and current condition recorded: OK | |
| ☒ | -Ensure safe working conditions as described in the manual | |
| ☒ | -Change filter element(s) | |
| ☒ | -Clean filter housing and control bores in the filter head | |
| ☒ | -Maintain condensate drain | |
| ☐ | -Check pressure differential indicator (option) | |
| ☐ | -Check optional shutdown function, only with user's permission | |
| ☒ | -Check for leaks | |
| ☒ | -Register service: stick label/service manual/controller | |
| ☐ | Existing safety deficiencies? ☒ No Yes: | |
| ☐ | Cause(s): | na |
| ☐ | Arising danger: | none |
| ☐ | Safety deficiency rectified? Yes No; reason: | na |
| ☐ | >>>>> Equipment not released for use! | |
| ☐ | Rectified deficiencies: | |
| ☒ | Tasks fully completed | |
| ☐ | Follow-up assignment necessary for: | |
| ☐ | Follow-up order issued for: | |
| ☐ | Supply spares: | |

Additional comments:

replaced filter , run and tested ok

| Consumed material | Materia No. | Pc | Serial No. | Part ID/batch | Store |
|---|---|---|---|---|---|

| Material delivered in advance | Material No. | Pc | Serial No. | Return | Returned by |
|---|---|---|---|---|---|
| Std 485 KOR Element (RED) | USOR-485 | 1 | | 0 | ○ Tech. ○ Customer |
| Internal Automatic Drain | US4170-08 | 1 | | 0 | ○ Tech. ○ Customer |
| | | | | | ○ Tech. ○ Customer |

# SERVICE ORDER

# KAESER COMPRESSORS

**Equipment at customer location** 538086 HDR Engineering/e2m, Memphis

## Registered machines

- Please enter or correct missing or incorrect years of manufacture, material numbers or serial numbers
- As far as air receivers, ZK, filters and dryers are concerned, please complete information applicable to the condensate drain (if not yet registered)-**ED**= ECO-Drain,**FV**= Float valve,**SV**= Solenoid valve
- If the customer has more than one compressed air station in different locations at the same address, please enter the exact location of each station (e.g. paint shop, number 1 works) etc.

| Type | S. Hr. | Year | Material No. | Serial No. | | Station | | |
|---|---|---|---|---|---|---|---|---|
| Refrig. dryer TE 141 460/3/60 | | 2009 | 1.8039.00010 | 1343 | reg. | | | - |
| CSD 100 125 psi 460/60 US | | 2009 | 100818.1 | 1234 | reg. | | | - |
| 200 Gal Tank | | 2009 | 9.9999.9 | 1251 | reg. | | | - |
| KCF-100 Condensate Treatment System | | 2009 | ANKCF100 | 10900584 | ------ | | | - |
| EB 420 C VAC 40,0 hp 2.460 rpm | | 2009 | EBC | 2138 | reg. | | | - |
| EB 420 C VAC 40,0 hp 2.460 rpm | | 2009 | EBC | 2140 | reg. | | | - |
| Oil Removal KOR-485.2 | | 2009 | USKOR485.2 | * | ------ | | | - |
| Particulate KPF-485.2 | | 2009 | USKPF485.2 | * | ------ | | | - |

## Non-registered machines

| Type | S. Hr. | Year | Material No. | Serial No. | | Station | | |
|---|---|---|---|---|---|---|---|---|
| | | | | | | | + | - |

# APPENDIX C

# RESULTS OF LABORATORY ANALYSES

TABLE C-1
ANALYTICAL RESULTS - SVE EFFLUENT
OFF DEPOT AS/SVE SYSTEM
ANNUAL OPERATIONS REPORT, YEAR FOUR
Dunn Field - Defense Depot Memphis, Tennessee

| Analyte | Location | ODSVE-EFF | ODSVE-EFF | ODSVE-EFF | ODSVE-EFF | ODSVE-EFF |
|---|---|---|---|---|---|---|
| | Lab ID | P1301045-001 | P1302661-001 | P1304297-001 | P1304722-001 | P1305542-001 |
| | Event | ODSVE_1Q13 | ODSVE_2Q13 | ODSVE_3Q13-1 | ODSVE_3Q13-2 | ODSVE-4Q13 |
| | Date | 13-Mar-13 | 20-Jun-13 | 25-Sep-13 | 22-Oct-13 | 12-Dec-13 |
| | Units | | | | | |
| 1,1,1-Trichloroethane (TCA) | ppbv | 0.71 | 0.65 | <0.12 | 0.88 | 0.73 |
| 1,1,2,2-Tetrachloroethane | ppbv | 1.3 | 1 | <0.093 | 0.77 | <0.1 |
| 1,1,2-Trichloroethane | ppbv | 0.036 J | 0.041 J | <0.12 | <0.11 | <0.13 |
| 1,1,2-Trichlorotrifluoroethane | ppbv | 6 | 7.1 | <0.083 | 4.6 | 3 |
| 1,1-Dichloroethane (1,1-DCA) | ppbv | 0.8 | 0.76 | <0.16 | 0.64 | 0.46 |
| 1,1-Dichloroethene (1,1-DCE) | ppbv | 2.3 | 2.2 | <0.16 | 1.7 | 1.1 |
| 1,2,4-Trichlorobenzene | ppbv | <0.08 | <0.085 | <0.086 | <0.084 | <0.095 |
| 1,2,4-Trimethylbenzene | ppbv | <0.12 | <0.13 | <0.13 | <0.13 | <0.14 |
| 1,2-Dibromo 3-Chloropropane | ppbv | <0.062 | <0.065 | <0.066 | <0.065 | <0.073 |
| 1,2-Dibromoethane | ppbv | <0.077 | <0.082 | <0.083 | <0.081 | <0.092 |
| 1,2-Dichloro-1,1,2,2-tetrafluoroethane (CFC 114) | ppbv | <0.085 | <0.09 | <0.091 | 0.075 J | <0.1 |
| 1,2-Dichlorobenzene | ppbv | <0.099 | <0.1 | <0.11 | <0.1 | <0.12 |
| 1,2-Dichloroethane | ppbv | <0.15 | <0.16 | <0.16 | <0.15 | <0.17 |
| 1,2-Dichloropropane | ppbv | <0.13 | <0.14 | <0.14 | <0.14 | <0.15 |
| 1,3,5-Trimethylbenzene | ppbv | <0.12 | <0.13 | <0.13 | <0.13 | <0.14 |
| 1,3-Butadiene | ppbv | <0.27 | <0.28 | <0.29 | <0.28 | <0.32 |
| 1,3-Dichlorobenzene | ppbv | <0.099 | <0.1 | <0.11 | <0.1 | <0.12 |
| 1,4-Dichlorobenzene | ppbv | <0.099 | <0.1 | <0.11 | <0.1 | <0.12 |
| 1,4-Dioxane | ppbv | <0.17 | <0.17 | <0.18 | <0.17 | <0.2 |
| 2-Butanone (MEK) | ppbv | 0.2 J | 0.94 J | 0.32 J | 0.51 J | <2.4 |
| 2-Hexanone | ppbv | 0.077 J | 0.24 | <0.16 | 0.12 J | <0.17 |
| 2-Propanol (Isopropyl Alcohol) | ppbv | <2.4 | <2.6 | <2.6 | <2.5 | <2.9 |
| 3-Chloro-1-propene (Allyl Chloride) | ppbv | <0.19 | <0.2 | <0.2 | <0.2 | <0.23 UJ |
| 4-Ethyltoluene | ppbv | <0.12 | <0.13 | <0.13 | <0.13 | <0.14 |
| 4-Methyl-2-pentanone | ppbv | <0.15 | 0.062 J | <0.16 | <0.15 | <0.17 |
| Acetone | ppbv | <2.5 | 4.2 | 1.6 J | 3.6 | <3 |
| Acetonitrile | ppbv | <0.35 | <0.38 | <0.38 | <0.37 | <0.42 |
| Acrolein | ppbv | <1 | 0.32 J | 0.17 J | 0.4 J | <1.2 |
| Acrylonitrile | ppbv | <0.27 | <0.29 | <0.29 | <0.29 | <0.32 |
| alpha-Pinene | ppbv | <0.11 | <0.11 | <0.11 | <0.11 | <0.13 |
| Benzene | ppbv | 0.064 J | 0.072 J | <0.2 | <0.2 | <0.22 |
| Benzyl Chloride | ppbv | <0.11 | <0.12 | <0.12 | <0.12 | <0.14 |
| Bromodichloromethane | ppbv | <0.089 | 0.032 J | <0.095 | <0.093 | <0.11 |
| Bromoform | ppbv | <0.058 | <0.061 | <0.061 | <0.06 | <0.068 |
| Bromomethane | ppbv | <0.15 | <0.16 | <0.16 | <0.16 | <0.18 |
| Carbon Disulfide | ppbv | 0.16 J | 0.35 J | 0.061 JB | <2 | <2.3 |
| Carbon Tetrachloride | ppbv | 0.42 | 0.7 | <0.1 | 0.52 | 0.45 |
| Chlorobenzene | ppbv | <0.13 | <0.14 | <0.14 | <0.14 | <0.15 |
| Chloroethane | ppbv | <0.23 | <0.24 | <0.24 | <0.24 | <0.27 |
| Chloroform | ppbv | 3.5 | 4.5 | <0.13 | 4.3 | 3.5 |
| Chloromethane | ppbv | <0.29 | <0.31 | <0.31 | <0.3 | <0.34 |
| cis-1,2-Dichloroethene | ppbv | 1.9 | 2.9 | <0.16 | 3.9 | 3.6 |
| cis-1,3-Dichloropropene | ppbv | <0.13 | <0.14 | <0.14 | <0.14 | <0.16 |
| Cyclohexane | ppbv | 0.28 J | 0.29 J | <0.37 | <0.36 | <0.41 |
| Dibromochloromethane | ppbv | <0.07 | <0.074 | <0.075 | <0.073 | <0.083 |
| Dichlorodifluoromethane (CFC 12) | ppbv | 0.91 | 0.84 | <0.13 | 1.2 | 16 |
| Dichloromethane (Methylene Chloride) | ppbv | 0.099 JB | <0.18 | <0.18 | 0.071 J | <0.2 |
| d-Limonene | ppbv | <0.11 | <0.11 | <0.11 | <0.11 | <0.13 |
| Ethanol | ppbv | <3.2 | 0.69 J | <3.4 | <3.3 | <3.7 |
| Ethyl Acetate | ppbv | <0.33 | <0.35 | <0.35 | <0.35 | <0.39 |
| Ethylbenzene | ppbv | <0.14 | 0.086 J | <0.15 | <0.14 | <0.16 |
| Hexachlorobutadiene | ppbv | <0.056 | <0.059 | <0.06 | <0.059 | <0.066 |
| Isopropylbenzene (Cumene) | ppbv | <0.12 | <0.13 | <0.13 | <0.13 | <0.14 |
| m,p-Xylenes | ppbv | <0.27 | 0.38 | <0.29 | <0.29 | <0.32 |
| Methyl Methacrylate | ppbv | <0.29 | <0.31 | <0.31 | <0.31 | <0.34 |
| Methyl tert-Butyl Ether | ppbv | <0.17 | <0.17 | <0.18 | <0.17 | <0.2 |
| Naphthalene | ppbv | <0.11 | 0.065 J | <0.12 | <0.12 | <0.13 |
| n-Butyl Acetate | ppbv | <0.13 | <0.13 | <0.13 | <0.13 | <0.15 |
| n-Heptane | ppbv | <0.15 | <0.15 | <0.16 | <0.15 | <0.17 |
| n-Hexane | ppbv | 0.1 J | 0.14 J | <0.18 | <0.18 | 0.1 J |
| n-Nonane | ppbv | <0.11 | 0.062 J | <0.12 | <0.12 | <0.13 |
| n-Octane | ppbv | <0.13 | 0.058 J | <0.14 | <0.13 | <0.15 |
| n-Propylbenzene | ppbv | <0.12 | <0.13 | <0.13 | <0.13 | <0.14 |
| o-Xylene | ppbv | <0.14 | 0.13 J | <0.15 | <0.14 | <0.16 |
| Propene | ppbv | 1.6 | 0.44 | 0.12 J | 0.46 J | <0.41 |
| Styrene | ppbv | <0.14 | <0.15 | <0.15 | <0.15 | <0.17 |
| Tetrachloroethene | ppbv | 3.3 | 3.5 | <0.094 | 3 | 2.2 |
| Tetrahydrofuran (THF) | ppbv | <0.2 | <0.21 | <0.22 | <0.21 | <0.24 |
| Toluene | ppbv | 0.072 J | 0.25 | <0.17 | <0.17 | <0.19 |
| trans-1,2-Dichloroethene | ppbv | 0.48 | 0.45 | <0.16 | 0.56 | 0.46 |
| trans-1,3-Dichloropropene | ppbv | <0.13 | <0.14 | <0.14 | <0.14 | <0.16 |
| Trichloroethene (TCE) | ppbv | 23 | 24 | <0.12 | 23 | 21 |
| Trichlorofluoromethane (CFC 11) | ppbv | 0.3 | 0.33 | <0.11 | 0.36 | 0.55 |
| Vinyl Acetate | ppbv | <1.7 | <1.8 | 0.24 J | 0.76 J | <2 |
| Vinyl Chloride | ppbv | <0.23 | <0.25 | <0.25 | 0.13 J | 0.1 J |

Notes:
ppbv: part per billion volume
RL: laboratory reporting limit
<: Result is less than RL
J: Estimated
B: Blank contamination

# APPENDIX D

# DATA QUALITY EVALUATION

## DATA QUALITY EVALUATION

System monitoring for the Off Depot Air Sparging and Soil Vapor Extraction (AS/SVE) System during Year Four included sampling and analysis of soil vapor effluent. Samples were collected quarterly in March, June, September and December 2013 to evaluate performance and ensure compliance with discharge limits. An additional sample was collected in October 2013 to investigate low results of chlorinated analytes in the September 2013 sample. System monitoring was performed in accordance with the *Dunn Field Off Depot Groundwater Remedial Action Work Plan, Revision 2* (HDR, 2009). The vapor samples were submitted to Columbia Analytical Services in Simi Valley, California for analysis under subcontract to Microbac Laboratories in Marietta, Ohio.

Field activities and laboratory analyses were performed in accordance with the *Remedial Action Sampling and Analysis Plan, Rev. 1* (RA SAP) (MACTEC 2005) and *Remedial Action Operations and Long Term Monitoring Quality Assurance Project Plan, Rev. 0* (QAPP) (HDR 2011c). The QAPP is consistent with the RA SAP but has not received final approval.

The data quality evaluation (DQE) process involves assessment of field and laboratory procedures, including independent data validation completed by Diane Short and Associates, Inc. (DSA) in accordance with the RA SAP/QAPP. The assessment is designed to evaluate the quality assurance (QA)/quality control (QC) associated with the laboratory data and potential impact to data quality objectives (DQOs). Final qualification and data usability reports were prepared by HDR. The data validation reports and usability reports are included in this appendix. The DQE findings are summarized in the following sections.

### FIELD ACTIVITIES AND FIELD QUALITY CONTROL

The field effort included the collection of AS/SVE effluent vapor samples using 6-liter (L) Summa canisters during four quarterly events in March, June, September and December 2013 and one extra sample collected in October 2013. The AS/SVE effluent sample location is on the north side of the SVE compound shown on Figure 1 of the report. Documentation of the sampling was performed in the field to ensure that the samples collected, sample labels, chain-of-custody (COC) records and requests for analysis were consistent. COC forms were filled out manually.

## ANALYTICAL METHODS

The air samples were analyzed for volatile organic compounds (VOCs) by Toxic Organics (TO) Method TO-15.

## LABORATORY QUALITY CONTROL

The laboratory QC program, including sample handling, laboratory control, and reporting, is documented in the RA SAP/QAPP. Sample handling includes documentation of sample receipt, placement in storage, lab personnel using the sample and disposal. The laboratory control consists of instrument calibration and maintenance, laboratory control samples (LCS), surrogates and method blanks. Reporting of the laboratory control data was planned prior to the collection of the data, allowing the laboratory to place the appropriate information into the data package so that the DQE could be performed in a timely manner.

## DQE SUMMARY

The objective of the DQE was to provide a review of the chemical data reports submitted by the laboratory and to assess the data in relation to the DQOs stated in the RA SAP/QAPP. The DQE consisted of review of laboratory QC data and field QC parameters and flagging of the data as usable, usable with qualification, or unusable in accordance with the DQE standard operating procedures (SOPs) using the criteria stated in the RA SAP/QAPP for each analytical method performed. The following information was reviewed:

- Sample Integrity (Deliverables)
- Sample Completeness
- Sample Holding Times
- Laboratory Methods for Analysis (Calibration, Internal Standards)
- Method Accuracy (bias) and Precision (Surrogates, LCS Recoveries, Laboratory Duplicates)
- Laboratory Performance Criteria (Blanks, Instrument Performance Checks)

Field QC parameters were evaluated through field documentation and shipping criteria. Field duplicates, which are collected at a frequency of 10 percent, were not collected due to the small number of samples.

The DQE was summarized by use of flags that indicate to the reviewer that the data being considered has been qualified using the established criteria. Sample delivery group (SDG) narratives detailing the

evaluation of the laboratory data by DSA are included as attachments in this Appendix. The SDGs and associated air samples are listed on Table D-1.

The following sections provide summary discussions of the required data qualifications for each sampling event. A Level III DQE was performed and the data quality indicators (DQIs), expressed in terms of precision, accuracy, representativeness, comparability, completeness, and sensitivity, were assessed. This included the evaluation of sample integrity, holding times, method blanks, internal standards, surrogate recoveries, LCSs and laboratory duplicate precision. The results of the DQI assessment are provided below.

**Precision**

Laboratory duplicates are generally analyzed to assess laboratory precision and consist of a second sample analyzed from the same canister or of a LCS duplicate. Precision is best expressed in terms of relative percent difference (RPD). During Year Four of the AS/SVE system study, no lab sample duplicates or LCS duplicates were analyzed. However, internal standards can be used as a reference for calibrating and controlling the precision of the applied analytical method, and all internal standard results were within control limits, therefore laboratory precision met the project goals.

**Accuracy**

Accuracy or bias was measured through the analysis of LCSs. Sample specific accuracy is measured through surrogate recovery. Accuracy is expressed as percent recovery (%R).

Except for one result for allyl chloride (3-chloro-1-propene), accuracy goals based upon LCS and surrogates were met. Further discussion of the LCS and surrogate recoveries is provided in the attached DQE narratives.

**Representativeness**

Representativeness refers to the degree sample data accurately and precisely describes the population of samples at a sampling point or under certain environmental conditions. Samples that are not properly preserved or are analyzed beyond holding times may not be considered representative. Review of sampling procedures, laboratory preparation, analysis holding times and method blank analysis help in providing this assessment.

Sampling procedures followed the RA SAP/QAPP and were considered representative of the matrix collected. Laboratory preparation and analysis followed method guidelines.

**Comparability**

The selection of standardized methods and consistent laboratory practices facilitates the comparison of data between events. Consistent methodology has been maintained throughout the sampling events. Past data are comparable to recent events except for the initial (September) sampling in 3Q13, in which chlorinated analytes were detected at low concentrations or were not detected. Because this finding was inconsistent with previous events, another sample was collected in October 2013, and results from the analysis of this sample were generally consistent with previous events, discounting the sample collected in September 2013.

**Completeness**

Completeness is determined for both field and analytical objectives. Field completeness is calculated from the number of samples proposed versus the actual number of samples collected. Analytical completeness is expressed in terms of usable data. The project completeness goal for DDMT is 90 percent as stated in the RA SAP/QAPP.

Field completeness for the AS/SVE effluent sample events was 100 percent. Analytical completeness was 100 percent for all events as all samples collected were analyzed by the appropriate method and with usable results.

**Sensitivity**

Analytical sensitivity is the concentration at which the measurement system can quantitate target analytes in the environmental matrices of concern. Analytical sensitivity is expressed in terms of the reporting limit (RL), which is provided by the respective laboratories as their reasonable and defensible quantitation limit for environmental samples above the method detection limit (MDL), which is established by each laboratory using clean matrix. The analytical method RLs and MDLs were compared to protective soil vapor concentrations as provided in Dunn Field Record of Decision and were determined to meet the overall project objectives. Nominal RLs were at or below the project quantitation limits (PQLs). All results are usable.

Dilutions were not necessary.

The following sections discuss only those deficiencies encountered during the evaluation that resulted in qualified and/or unusable data.

**AS/SVE Effluent Quarterly Sampling Event – March 2013**

A total of one air sample including one field sample and no QA/QC samples was collected from one effluent location. The sample was analyzed for VOCs. The data are usable with qualifications as described below:

- Any result reported below the RL but above the MDL was flagged "J" and considered an estimated result.
- Methylene chloride was additionally qualified "B" due to the presence of methylene chloride in the method blank.

**AS/SVE Effluent Quarterly Sampling Event – June 2013**

A total of one air sample including one field sample and no QA/QC samples was collected from one effluent location. The sample was analyzed for VOCs. The data are usable with qualifications as described below:

- Any result reported below the RL but above the MDL was flagged "J" and considered an estimated result.

**AS/SVE Effluent Quarterly Sampling Event – September 2013**

A total of one air sample including one field sample and no QA/QC samples was collected from one effluent location. The sample was analyzed for VOCs. The data are usable with qualifications as described below. However, the representativeness of the data are questionable, as there were no detected chlorinated analytes, as there had been in previous and subsequent samples.

- Any result reported below the RL but above the MDL was flagged "J" and considered an estimated result.
- Carbon disulfide was additionally qualified "B" due to the presence of carbon disulfide in the method blank.

**AS/SVE Effluent Extra Sampling Event – October 2013**

A total of one air sample including one field sample and no QA/QC samples was collected from one effluent location. The sample was analyzed for VOCs. The data are usable with qualifications as described below:

- Any result reported below the RL but above the MDL was flagged "J" and considered an estimated result.
- Propene was qualified as estimated "J" due to interference.

**AS/SVE Effluent Quarterly Sampling Event – December 2013**

A total of one air sample including one field sample and no QA/QC samples was collected from one effluent location. The sample was analyzed for VOCs. The data are usable with qualifications as described below:

- Any result reported below the RL but above the MDL was flagged "J" and considered an estimated result.
- Allyl chloride (3-chloro-1-propene) was non-detect and qualified as non-detect estimated "UJ" due to a low LCS recovery.

**SUMMARY**

The sample data from the AS/SVE effluent events met the data quality objectives and are of sufficient quality to support the evaluation of remedial actions.

TABLE D-1
SDG SUMMARY TABLE
OFF DEPOT AS/SVE SYSTEM
ANNUAL OPERATIONS REPORT, YEAR FOUR
Dunn Field - Defense Depot Memphis, Tennessee

| SDG | Field Samples |
|---|---|
| **AS/SVE Effluent Quarterly Event - March 2013** | |
| P1301045 | ODSVE-EFF-1Q13 |
| **AS/SVE Effluent Quarterly Event - June 2013** | |
| P1302661 | ODSVE-EFF-2Q13 |
| **AS/SVE Effluent Quarterly Event - September - October 2013** | |
| P1304297 | ODSVE-EFF-3Q13-1 |
| P1304722 | ODSVE-EFF-3Q13-2 |
| **AS/SVE Effluent Quarterly Event - December 2013** | |
| P1305542 | ODSVE-EFF-4Q13 |

DIANE SHORT & ASSOCIATES, INC.
1978 S. Garrison St. # 114
Lakewood CO 80227
303:271-9642 Fax 988-4027
dsa7cbc@eazy.net

**ORGANIC AIR QUALITY REPORT**
**METHOD TO-15**

SDG: P1301045 , project 192672-007

PROJECT: Memphis Defense Depot soil vapor extraction for HDR Inc.

LABORATORY: Microbac, subcontracted to Columbia Analytical Services Laboratories, CA

SAMPLE MATRIX: Air

SAMPLING DATE (Month/Year): March 2013

NUMBER OF SAMPLES: 1 sample

ANALYSES REQUESTED: Summa Canister VOA TO-15

SAMPLE NO.: ODSVE-EFF-1Q13

DATA REVIEWER: Diane Short

QA REVIEWER: Diane Short & Associates, Inc. INITIALS/DATE: __DLS_5/8/2013_____

Telephone Logs included Yes____ No __X__

Contractual Violations Yes____ No __X_

The EPA CLP National Functional Guidelines for Organic Data Review, 2001 (SOP); the current project QAPP, (9/2011), EPA Method TO-15 current updates have been referenced by the reviewer to perform this data validation review. The EPA qualifiers have been expanded to include a descriptor code and value to define QC violations and their values, per the approval of the HDR Project Manager. Per the Scope of Work, the review of these samples includes validation of all QC forms and submitted calibrations referencing the QC limits in the above documents.

DELIVERABLES
All deliverables were present as specified in the Statement of Work (SOW) or in the project contract.
Yes _X__ No ____
Note an extended list of volatile compounds was reported. Level IV data packages were submitted and Level III validation was performed for holding times, chain of custody, calibrations and QC. As raw data were included, an oversight check was performed.

II. ANALYTICAL REPORT FORMS
A. The Analytical Report or Data Sheets are present and complete for all requested analyses.
Yes __X__ No___

B. Holding Times
The contract holding times were met for all analyses (Time of sample receipt to time of analysis (VOA) or extraction and from extraction to analysis). Contract holding times for TO-15 canisters is 30 days from date of collection.
Yes ___X__ No____

C. Chains of Custody
Chains of Custody were present and were complete with signatures, sign-offs and complete entry of data. Canisters were properly sampled and received.
Yes __X___ No ____
The project manager is informed of the following and the project record is being updated.
There are gaps from relinquishment to sample receipt. The courier is identified as FedEx and there is no airbill number on the chain or log-in. The client notes that the coolers are often sealed before the airbill number is known. The required tracking is in the project record.

D. Canister Pressure
Canister pressures were measured and recorded for initial vacuum check, initial field vacuum, final field reading, lab initial pressure and final pressure.
Yes ___X___ No _____ NA _____
Pressures were reported for the field initial and final pressures and the laboratory final pressure and were acceptable.

All readings met the limits or exceptions were noted and pressure corrected
Yes ___X__ No ____ NA ____

III. INSTRUMENT CALIBRATION

A. Initial Calibration – GC/MS
1. The Relative Response Factors (RRF) and average RRF for all compounds for all analyses met the required criteria.
Yes __X__ No____ NA____
Minimum response factors are not defined by the method but meet routine Method 8260 limits. This method does not involve purging water samples. Consequently, all targets, including the typically poor-purging compounds, normally have response factors that are acceptable per validation criteria for volatiles.

The relative standard deviation (RSD) for the five-point calibration was within the 30% limit.
Yes ___X__ No ____

B. Continuing Calibration – GC/MS
1. The RRF standard was analyzed for each analysis at the required frequency and the QC criteria were met
Yes __X__ No____ NA____

Minimum response factors are not defined by the method, but met validation guidance. There were original calibrations and those for analysis of dilutions.

2. The percent difference (%D) limits of 30% were met.
Yes __X__ No ____
Differences of < 20% were reported for the ICV and CCV.

IV. GC/MS INSTRUMENT PERFORMANCE CHECK
A. The BFB performance check was injected once at the beginning of each 12-hour period and relative abundance criteria for the ions were met.
Yes ___X__ No____ NA ____
Tunes were provided and were acceptable.

V. INTERNAL STANDARDS
A. Area Limits
The Internal Standards met the 100% upper and -50% lower limits criteria and the Retention times were within the required windows.
Yes __X___ No____ NA ____

B. Retention Times
The relative retention times of the internal standards and sample compounds met the $\pm$ 0.06 RRT units limit.
Yes __ X ___ No____ NA ____

VI. SURROGATE
Surrogate spikes were analyzed with every sample.
Yes __X___ No ____
Note that three surrogates are used. Method 8260 requires 3 surrogates, but one is acceptable for TO-15.

And met the recovery limits defined in the current contract
Yes __ X _ No ____

VII. MATRIX SPIKE/MATRIX SPIKE DUPLICATE
A. Matrix spike (MS) and matrix spike duplicates (MSD) were analyzed for every analysis performed and for every 20 samples or for every matrix whichever is more frequent.
Yes____ No ____NA ___X__
Spikes are not amenable to canister analysis and are not required. Laboratory duplicates are required and are provided by the laboratory. See below.

B. The laboratory duplicate relative percent differences (RPD) were within the defined contract limits. Method requirements are 25% maximum RPD.
Yes ___ No ____ NA__X_
For validation purposes, only results > 5x PQL are qualified for RPD outliers. For results < 5x PQL, results are qualified if the absolute difference is greater than 2x PQL. The qualifier added is JD#, where # is the RPD or the absolute difference observed, as appropriate.
No duplicate run was reported.

VIII. DUPLICATE CONTROL SAMPLES
A. Duplicate Control and Duplicate Control Sample Duplicates similar to Laboratory Control Samples (LCS) were performed for every set.
Yes _X_ No ___
Only the LCS was required or reported.

B. And percent recoveries were acceptable at 70 – 130%.
Yes _X___ No ____

There was an LCS reported for all days of analysis.

C. And Relative Percent Differences were within lab limits.
Yes ___ No____ NA__X__
LCSDs have not been performed, and are not required by the method.

IX. SHIFT CHECKS
Shift checks were performed and were within time limits.
Yes __X__ No____

X. BLANKS
A. Method Blanks were analyzed at the required frequency and for each matrix and analysis.
Yes __X___ No____
This is a nitrogen blank run with each set.

B. The method blank was free of contamination.
Yes _____ No ___X__
Methylene chloride was reported in the method blanks. Data are qualified BMB#, where # is the blank corrected value. Only data that are less than 10 x the blank (corrected for dilution) are qualified.

| LAB_ID | CLIENT_ID | ANALYTE | Result ppbv | flag | MDL | Qualifier |
|---|---|---|---|---|---|---|
| P1301045-001 | ODSVE-EFF-1Q13 | Dichloromethane (Methylene Chloride) | 0.099 | F, B | 0.053 | BMB.059 |

C. If Field Blanks were identified, they were free of contamination.
Yes _____ No ____ NA ___X___
There were no field blanks identified.

D. Contamination level was less than 0.03 mg/cubic meter before samples were analyzed per the method.
Yes __X__ No____ NA _____
Reporting units include both ppbv and ug/m3.

XI. FIELD QC
A. If Field duplicates or Performance Check Compounds were identified, they met the RPD or % recovery criteria for the project.
Yes ___ No ____ NA_X__
No field duplicate pair is reported in this set.

XII. TCL COMPOUNDS
A. The identification is accurate and all retention times, library spectra and reconstructed ion chromatograms (RIC) were evaluated for all detected compounds:
Yes __X_ No____ NA___
No high dilutions were reported for this set of samples.
Note that 1,2-dichloro1,1,2,2-tetrafluorethane is present, but is not reported as it appears to be below the detection limit.

B. Quantitation was checked to determine the accuracy of calculations for representative compounds in each internal standard set
Yes___ No ____ NA___X__

**OVERALL ASSESSMENT**

Data are considered to be usable for project purposes after consideration of qualifiers or comments. Points of significance are summarized below:
Note an extended list of volatile compounds was reported. Level IV data packages were submitted and Level III validation was performed for holding times, chain of custody, calibrations and QC. As raw data were included, an oversight check was performed.

Laboratory Duplicate
No laboratory duplicates was reported.

Method Blanks
Methylene chloride was reported in all method blanks. Data are qualified BMB#, where # is the blank corrected value. Only data that are less than 10 x the blank (corrected for dilution) are qualified.

| LAB_ID | CLIENT_ID | ANALYTE | Result ppbv | flag | MDL | Qualifier |
|---|---|---|---|---|---|---|
| P1301045-001 | ODSVE-EFF-1Q13 | Dichloromethane (Methylene Chloride) | 0.099 | F, B | 0.051 | BMB.059 |

Field Duplicates
No field duplicate pair is reported. These are regularly sampled locations and the precision is built in as the sites are sampled routinely.

Compound Identification
Note that 1,2-dichloro1,1,2,2-tetrafluorethane is present, but is not reported as it appears to be below the detection limit.

TABLE OF QUALIFIED DATA

| LAB_ID | CLIENT_ID | ANALYTE | Result ppbv | flag | MDL | Qualifier |
|---|---|---|---|---|---|---|
| P1301045-001 | ODSVE-EFF-1Q13 | Dichloromethane (Methylene Chloride) | 0.099 | F, B | 0.051 | BMB.059 |

# Final Data Qualification and Usability Report

| | |
|---|---|
| Project: | Defense Depot Memphis, TN (DDMT)<br>OD-SVE |
| Sampling Event: | OD-SVE March 2013 (1Q13) |
| Project / Task Number: | 228-192672-007 |
| Sample Data Package(s): | P1301045 |
| Data Validation Performed by: | Diane Short & Associates (DSA) |
| Final Data Qualification and Usability Report Prepared by: | Lynn K. Lutz, HDR Inc. |

**Data Validation Report Review and Comments**

The data validation report was acceptable.

**Final Data Qualifiers**

Final qualifiers were J where the lab had qualified as F.

Final qualifier was B where validator had qualified BMB.059.

**Data Usability**

There were no rejected sample results. All results are usable as qualified.

08 May 2013

Lynn K. Lutz, HDR Inc. Date

DIANE SHORT & ASSOCIATES, INC.
1978 S. Garrison St. # 114
Lakewood CO 80227
303:271-9642 Fax 988-4027
dsa7cbc@eazy.net

**ORGANIC AIR QUALITY REPORT**
**METHOD TO-15**

SDG: P130266 project 192672-007

PROJECT: Memphis Defense Depot off depot soil vapor extraction for HDR Inc.

LABORATORY: Microbac, subcontracted to ALS Laboratories, Simi Valley, CA

SAMPLE MATRIX: Air

SAMPLING DATE (Month/Year): June 2013

NUMBER OF SAMPLES: 1 sample

ANALYSES REQUESTED: Summa Canister VOA TO-15

SAMPLE NO.: ODSVE-EFF -3Q13

DATA REVIEWER: Diane Short

QA REVIEWER: Diane Short & Associates, Inc. INITIALS/DATE: __DLS_7/18/2013_____

Telephone Logs included Yes____ No __X__

Contractual Violations Yes____ No __X_

The EPA CLP National Functional Guidelines for Organic Data Review, 2001 (SOP); the current project QAPP, (9/2011), EPA Method TO-15 current updates have been referenced by the reviewer to perform this data validation review. The EPA qualifiers have been expanded to include a descriptor code and value to define QC violations and their values, per the approval of the HDR Project Manager. Per the Scope of Work, the review of these samples includes validation of all QC forms and submitted calibrations referencing the QC limits in the above documents.

DELIVERABLES
All deliverables were present as specified in the Statement of Work (SOW) or in the project contract.
Yes _X__ No ____
Note an extended list of volatile compounds was reported. Level III data packages were submitted and Level III validation was performed for holding times, chain of custody, calibrations and QC. A full raw data review has been performed on previous SDGs to fulfill the 10% raw data review.

II. ANALYTICAL REPORT FORMS
A. The Analytical Report or Data Sheets are present and complete for all requested analyses.
Yes __X__ No___

B. Holding Times
The contract holding times were met for all analyses (Time of sample receipt to time of analysis (VOA) or extraction and from extraction to analysis). Contract holding times for TO-15 canisters is 30 days from date of collection.
Yes ___X__ No____

C. Chains of Custody
Chains of Custody were present and were complete with signatures, sign-offs and complete entry of data. Canisters were properly sampled and received.
Yes __X___ No ____
The project manager is informed of the following and the project record is being updated.
There are gaps from relinquishment to sample receipt. The courier is identified as FedEx and there is no airbill number on the chain or log-in. The client notes that the coolers are usually sealed before the airbill number is known and the project record is complete.
There are numerous scratch outs but no sample integrity data are impacted.

D. Canister Pressure
Canister pressures were measured and recorded for initial vacuum check, initial field vacuum, final field reading, lab initial pressure and final pressure.
Yes ___X___ No _____ NA _____
Pressures were reported for the field initial and final pressures and the laboratory final pressure and were acceptable.

All readings met the limits or exceptions were noted and pressure corrected
Yes ___X__ No ____ NA ____

III. INSTRUMENT CALIBRATION

A. Initial Calibration – GC/MS
1. The Relative Response Factors (RRF) and average RRF for all compounds for all analyses met the required criteria.
Yes __X__ No____ NA____
Minimum response factors are not defined by the method but meet routine Method 8260 limits. This method does not involve purging water samples. Consequently, all targets, including the typically poor-purging compounds, normally have response factors that are acceptable per validation criteria for volatiles.

The relative standard deviation (RSD) for the five-point calibration was within the 30% limit.
Yes ___X__ No ____

B. Continuing Calibration – GC/MS
1. The RRF standard was analyzed for each analysis at the required frequency and the QC criteria were met
Yes __X__ No____ NA____

Minimum response factors are not defined by the method, but met validation guidance. There were original calibrations and those for analysis of dilutions.

2. The percent difference (%D) limits of 25% were met.
Yes __X__ No ____

IV. GC/MS INSTRUMENT PERFORMANCE CHECK
A. The BFB performance check was injected once at the beginning of each 12-hour period and relative abundance criteria for the ions were met.
Yes ___X__ No____ NA ____
No tunes were provided and are not required for Level III.

V. INTERNAL STANDARDS
A. Area Limits
The Internal Standards met the 100% upper and -50% lower limits criteria and the Retention times were within the required windows.
Yes __X___ No____ NA ____

B. Retention Times
The relative retention times of the internal standards and sample compounds met the $\pm$ 0.06 RRT units limit.
Yes __ X ___ No____ NA ____

VI. SURROGATE
Surrogate spikes were analyzed with every sample.
Yes __X___ No ____
Note that three surrogates are used. Method 8260 requires 3 surrogates, but one is acceptable for TO-15.

And met the recovery limits defined in the current contract
Yes __ X _ No ____

VII. MATRIX SPIKE/MATRIX SPIKE DUPLICATE
A. Matrix spike (MS) and matrix spike duplicates (MSD) were analyzed for every analysis performed and for every 20 samples or for every matrix whichever is more frequent.
Yes____ No ____NA ___X__
Spikes are not amenable to canister analysis and are not required. Laboratory duplicates are required and are provided by the laboratory. See below.

B. The laboratory duplicate relative percent differences (RPD) were within the defined contract limits. Method requirements are 25% maximum RPD.
Yes ____ No __X__ NA___
No duplicate was run with this set.

VIII. DUPLICATE CONTROL SAMPLES
A. Duplicate Control and Duplicate Control Sample Duplicates similar to Laboratory Control Samples (LCS) were performed for every set.
Yes _X_ No ___
Only the LCS was required or reported.

B. And percent recoveries were acceptable at 70 – 130%.
Yes _X___ No ____
There was an LCS reported for all days of analysis.

C. And Relative Percent Differences were within lab limits.

Yes ___ No____ NA__X__
LCSDs have not been performed, and are not required by the method.

IX. SHIFT CHECKS
Shift checks were performed and were within time limits.
Yes ____ No____ NA __X_

X. BLANKS
A. Method Blanks were analyzed at the required frequency and for each matrix and analysis.
Yes __X___ No____
This is a nitrogen blank run with each set.

B. The method blank was free of contamination.
Yes __X___ No _____

C. If Field Blanks were identified, they were free of contamination.
Yes _____ No ____ NA ___X___
There were no field blanks identified.

D. Contamination level was less than 0.03 mg/cubic meter before samples were analyzed per the method.
Yes __X__ No____ NA _____
Reporting units include both ppbv and ug/m3.

XI. FIELD QC
A. If Field duplicates or Performance Check Compounds were identified, they met the RPD or % recovery criteria for the project.
Yes ___ No ____ NA_X__
No field duplicate pair is required as this is an ongoing monitoring and sampling event.

XII. TCL COMPOUNDS
A. The identification is accurate and all retention times, library spectra and reconstructed ion chromatograms (RIC) were evaluated for all detected compounds:
Yes __X_ No____ NA___
It is noted that there are high values for trichloroethene and trichlorotrifluoroethane and not high enough to require dilution.

B. Quantitation was checked to determine the accuracy of calculations for representative compounds in each internal standard set
Yes___ No ____ NA___X__

**OVERALL ASSESSMENT**
Data are considered to be usable for project purposes and no qualifiers have been required.
Note an extended list of volatile compounds was reported. Level III data packages were submitted and Level III validation was performed for holding times, chain of custody, calibrations and QC.

<u>Reported Results:</u>
It is noted that there are high values for trichloroethene and trichlorotrifluoroethane and not high enough to require dilution.

# Final Data Qualification and Usability Report

| | |
|---|---|
| Project: | Defense Depot Memphis, TN (DDMT)<br>OD-SVE |
| Sampling Event: | OD-SVE June 2013 (2Q13) |
| Project / Task Number: | 228-192672-007 |
| Sample Data Package(s): | P1302661 |
| Data Validation Performed by: | Diane Short & Associates (DSA) |
| Final Data Qualification and Usability Report Prepared by: | Lynn K. Lutz, HDR Inc. |

**Data Validation Report Review and Comments**

The data validation report was acceptable.

**Final Data Qualifiers**

Final qualifiers were J where the lab had qualified as F.

**Data Usability**

There were no rejected sample results. All results are usable as qualified.

14 August 2013

Lynn K. Lutz, HDR Inc. Date

DIANE SHORT & ASSOCIATES, INC.
1978 S. Garrison St. # 114
Lakewood CO 80227
303:271-9642 Fax 988-4027
dsa7cbc@eazy.net

**ORGANIC AIR QUALITY REPORT**
**METHOD TO-15**

SDG: P1304297 , project 228-192672-007

PROJECT: Memphis Defense Depot soil vapor extraction for HDR Inc.

LABORATORY: Microbac, subcontracted to Columbia Analytical Services Laboratories, CA

SAMPLE MATRIX: Air

SAMPLING DATE (Month/Year): September 2013

NUMBER OF SAMPLES: 1 sample

ANALYSES REQUESTED: Summa Canister VOA TO-15

SAMPLE NO.: ODSVE-EFF-4Q13

DATA REVIEWER: Diane Short

QA REVIEWER: Diane Short & Associates, Inc. INITIALS/DATE: DLS 12/10/2013

Telephone Logs included Yes____ No __X__

Contractual Violations Yes____ No __X_

The EPA CLP National Functional Guidelines for Organic Data Review, 2001 (SOP); the current project QAPP, (9/2011), EPA Method TO-15 current updates have been referenced by the reviewer to perform this data validation review. The EPA qualifiers have been expanded to include a descriptor code and value to define QC violations and their values, per the approval of the HDR Project Manager. Per the Scope of Work, the review of these samples includes validation of all QC forms and submitted calibrations referencing the QC limits in the above documents.

DELIVERABLES
All deliverables were present as specified in the Statement of Work (SOW) or in the project contract.
Yes _X__ No ____
Note an extended list of volatile compounds was reported. Level IV data packages were submitted and Level III validation was performed for holding times, chain of custody, calibrations and QC. As raw data were included, an oversight check was performed.

II. ANALYTICAL REPORT FORMS
A. The Analytical Report or Data Sheets are present and complete for all requested analyses.
Yes __X__ No___

B. Holding Times
The contract holding times were met for all analyses (Time of sample receipt to time of analysis (VOA) or extraction and from extraction to analysis). Contract holding times for TO-15 canisters is 30 days from date of collection.
Yes ___X__ No____

C. Chains of Custody
Chains of Custody were present and were complete with signatures, sign-offs and complete entry of data. Canisters were properly sampled and received.
Yes __X___ No ____
The project manager is informed of the following and the project record is being updated.
There are gaps from relinquishment to sample receipt. The courier is identified as FedEx and there is no airbill number on the chain or log-in. The client notes that the coolers are often sealed before the airbill number is known. The required tracking is in the project record.

D. Canister Pressure
Canister pressures were measured and recorded for initial vacuum check, initial field vacuum, final field reading, lab initial pressure and final pressure.
Yes ___X___ No _____ NA _____
Pressures were reported for the field initial and final pressures and the laboratory final pressure and were acceptable.

All readings met the limits or exceptions were noted and pressure corrected
Yes ___X__ No ____ NA ____

III. INSTRUMENT CALIBRATION

A. Initial Calibration – GC/MS
1. The Relative Response Factors (RRF) and average RRF for all compounds for all analyses met the required criteria.
Yes __X__ No____ NA____
Minimum response factors are not defined by the method but meet routine Method 8260 limits. This method does not involve purging water samples. Consequently, all targets, including the typically poor-purging compounds, normally have response factors that are acceptable per validation criteria for volatiles.

The relative standard deviation (RSD) for the five-point calibration was within the 30% limit.
Yes ___X__ No ____

B. Continuing Calibration – GC/MS
1. The RRF standard was analyzed for each analysis at the required frequency and the QC criteria were met
Yes __X__ No____ NA____

Minimum response factors are not defined by the method, but met validation guidance. There were original calibrations and those for analysis of dilutions.

2. The percent difference (%D) limits of 30% were met.
Yes __X__ No ____
Differences of < 25% were reported for the ICV and CCV except for cyclohexanone at 25.9.

IV. GC/MS INSTRUMENT PERFORMANCE CHECK
A. The BFB performance check was injected once at the beginning of each 12-hour period and relative abundance criteria for the ions were met.
Yes ___X__ No____ NA ____
Tunes were provided and were acceptable.

V. INTERNAL STANDARDS
A. Area Limits
The Internal Standards met the 100% upper and -50% lower limits criteria and the Retention times were within the required windows.
Yes __X___ No____ NA ____

B. Retention Times
The relative retention times of the internal standards and sample compounds met the $\pm$ 0.06 RRT units limit.
Yes __ X ___ No____ NA ____

VI. SURROGATE
Surrogate spikes were analyzed with every sample.
Yes __X___ No ____
Note that three surrogates are used. Method 8260 requires 3 surrogates, but one is acceptable for TO-15.

And met the recovery limits defined in the current contract
Yes __ X _ No ____

VII. MATRIX SPIKE/MATRIX SPIKE DUPLICATE
A. Matrix spike (MS) and matrix spike duplicates (MSD) were analyzed for every analysis performed and for every 20 samples or for every matrix whichever is more frequent.
Yes____ No ____NA ___X__
Spikes are not amenable to canister analysis and are not required. Laboratory duplicates are required and are provided by the laboratory. See below.

B. The laboratory duplicate relative percent differences (RPD) were within the defined contract limits. Method requirements are 25% maximum RPD.
Yes ___ No ____ NA__X_
For validation purposes, only results > 5x PQL are qualified for RPD outliers. For results < 5x PQL, results are qualified if the absolute difference is greater than 2x PQL. The qualifier added is JD#, where # is the RPD or the absolute difference observed, as appropriate.
No duplicate run was reported.

VIII. DUPLICATE CONTROL SAMPLES
A. Duplicate Control and Duplicate Control Sample Duplicates similar to Laboratory Control Samples (LCS) were performed for every set.
Yes _X_ No ___
Only the LCS was required or reported.

B. And percent recoveries were acceptable at 70 – 130%.
Yes _X___ No ____

There was an LCS reported for all days of analysis.

C. And Relative Percent Differences were within lab limits.
Yes ___ No____ NA__X__
LCSDs have not been performed, and are not required by the method.

IX. SHIFT CHECKS
Shift checks were performed and were within time limits.
Yes __X__ No____

X. BLANKS
A. Method Blanks were analyzed at the required frequency and for each matrix and analysis.
Yes __X___ No____
This is a nitrogen blank run with each set.

B. The method blank was free of contamination.
Yes _____ No __X___
There is one detection of carbon disulfide at 0.097 ppbv. The detection of carbon disulfide is qualified UMB.097 and data are fully usable as non-detects.

C. If Field Blanks were identified, they were free of contamination.
Yes _____ No ____ NA ___X___
There were no field blanks identified.

D. Contamination level was less than 0.03 mg/cubic meter before samples were analyzed per the method.
Yes __X__ No____ NA _____
Reporting units include both ppbv and ug/m3.

XI. FIELD QC
A. If Field duplicates or Performance Check Compounds were identified, they met the RPD or % recovery criteria for the project.
Yes ___ No ____ NA_X__
No field duplicate pair is reported in this set.

XII. TCL COMPOUNDS
A. The identification is accurate and all retention times, library spectra and reconstructed ion chromatograms (RIC) were evaluated for all detected compounds:
Yes __X_ No____ NA___
No high dilutions were reported for this set of samples. It is noted, however, that the reported results for this sample are very different than historic samples from this site. There are usually a number of detections of compounds and particularly of TCE. There is no evidence of leakage and the lack of compounds is not traceable from the data reported.

B. Quantitation was checked to determine the accuracy of calculations for representative compounds in each internal standard set
Yes___ No ____ NA___X__
This is not a requirement at this level. It is noted, however, that the reported results for this sample are very different than historic samples from this site. There are usually a number of detections of compounds and particularly of TCE. There is no evidence of leakage per the laboratory narratives and the lack of compounds is not traceable from the data reported.

**OVERALL ASSESSMENT**
Data are considered to be usable for project purposes after consideration of qualifiers or comments. Points of significance are summarized below:

Note an extended list of volatile compounds was reported. Level IV data packages were submitted and Level III validation was performed for holding times, chain of custody, calibrations and QC. As raw data were included, an oversight check was performed.

Laboratory Duplicate

No laboratory duplicates was reported.

Method Blank

There is one detection of carbon disulfide at 0.097 ppbv. The detection of carbon disulfide is qualified UMB.097 and data are fully usable as non-detects.

Field Duplicates

No field duplicate pair is reported. These are regularly sampled locations and the precision is built in as the sites are sampled routinely.

Compound Identification

It is noted that the reported results for this sample are very different than historic samples from this site. There are usually a number of detections of compounds and particularly of TCE. There is no evidence of leakage per the laboratory narratives and the lack of compounds is not traceable from the data reported.

DIANE SHORT & ASSOCIATES, INC.
1978 S. Garrison St. # 114
Lakewood CO 80227
303:271-9642 Fax 988-4027
dsa7cbc@eazy.net

**ORGANIC AIR QUALITY REPORT**
**METHOD TO-15**

SDG: P1304722 , project 228-192672-007

PROJECT: Memphis Defense Depot soil vapor extraction for HDR Inc.

LABORATORY: Microbac, subcontracted to Columbia Analytical Services Laboratories, CA

SAMPLE MATRIX: Air

SAMPLING DATE (Month/Year): October 2013

NUMBER OF SAMPLES: 1 sample

ANALYSES REQUESTED: Summa Canister VOA TO-15

SAMPLE NO.: ODSVE-EFF-4Q13

DATA REVIEWER: Diane Short

QA REVIEWER: Diane Short & Associates, Inc. INITIALS/DATE: DLS 11/25/2013

Telephone Logs included Yes____ No __X__

Contractual Violations Yes____ No __X_

The EPA CLP National Functional Guidelines for Organic Data Review, 2001 (SOP); the current project QAPP, (9/2011), EPA Method TO-15 current updates have been referenced by the reviewer to perform this data validation review. The EPA qualifiers have been expanded to include a descriptor code and value to define QC violations and their values, per the approval of the HDR Project Manager. Per the Scope of Work, the review of these samples includes validation of all QC forms and submitted calibrations referencing the QC limits in the above documents.

DELIVERABLES
All deliverables were present as specified in the Statement of Work (SOW) or in the project contract.
Yes _X__ No ____
Note an extended list of volatile compounds was reported. Level IV data packages were submitted and Level III validation was performed for holding times, chain of custody, calibrations and QC. As raw data were included, an oversight check was performed.

II. ANALYTICAL REPORT FORMS
A. The Analytical Report or Data Sheets are present and complete for all requested analyses.
Yes __X__ No___

B. Holding Times
The contract holding times were met for all analyses (Time of sample receipt to time of analysis (VOA) or extraction and from extraction to analysis). Contract holding times for TO-15 canisters is 30 days from date of collection.
Yes ___X__ No____

C. Chains of Custody
Chains of Custody were present and were complete with signatures, sign-offs and complete entry of data. Canisters were properly sampled and received.
Yes __X___ No ____
The project manager is informed of the following and the project record is being updated.
There are gaps from relinquishment to sample receipt. The courier is identified as FedEx and there is no airbill number on the chain or log-in. The client notes that the coolers are often sealed before the airbill number is known. The required tracking is in the project record.

D. Canister Pressure
Canister pressures were measured and recorded for initial vacuum check, initial field vacuum, final field reading, lab initial pressure and final pressure.
Yes ___X___ No _____ NA _____
Pressures were reported for the field initial and final pressures and the laboratory final pressure and were acceptable.

All readings met the limits or exceptions were noted and pressure corrected
Yes ___X__ No ____ NA ____

III. INSTRUMENT CALIBRATION

A. Initial Calibration – GC/MS
1. The Relative Response Factors (RRF) and average RRF for all compounds for all analyses met the required criteria.
Yes __X__ No____ NA____
Minimum response factors are not defined by the method but meet routine Method 8260 limits. This method does not involve purging water samples. Consequently, all targets, including the typically poor-purging compounds, normally have response factors that are acceptable per validation criteria for volatiles.

The relative standard deviation (RSD) for the five-point calibration was within the 30% limit.
Yes ___X__ No ____

B. Continuing Calibration – GC/MS
1. The RRF standard was analyzed for each analysis at the required frequency and the QC criteria were met
Yes __X__ No____ NA____

Minimum response factors are not defined by the method, but met validation guidance. There were original calibrations and those for analysis of dilutions.

2. The percent difference (%D) limits of 30% were met.
Yes __X__ No ____
Differences of < 20% were reported for the ICV and CCV.

IV. GC/MS INSTRUMENT PERFORMANCE CHECK
A. The BFB performance check was injected once at the beginning of each 12-hour period and relative abundance criteria for the ions were met.
Yes ___X__ No____ NA ____
Tunes were provided and were acceptable.

V. INTERNAL STANDARDS
A. Area Limits
The Internal Standards met the 100% upper and -50% lower limits criteria and the Retention times were within the required windows.
Yes __X___ No____ NA ____

B. Retention Times
The relative retention times of the internal standards and sample compounds met the $\pm$ 0.06 RRT units limit.
Yes __ X ___ No____ NA ____

VI. SURROGATE
Surrogate spikes were analyzed with every sample.
Yes __X___ No ____
Note that three surrogates are used. Method 8260 requires 3 surrogates, but one is acceptable for TO-15.

And met the recovery limits defined in the current contract
Yes __ X _ No ____

VII. MATRIX SPIKE/MATRIX SPIKE DUPLICATE
A. Matrix spike (MS) and matrix spike duplicates (MSD) were analyzed for every analysis performed and for every 20 samples or for every matrix whichever is more frequent.
Yes____ No ____NA ___X__
Spikes are not amenable to canister analysis and are not required. Laboratory duplicates are required and are provided by the laboratory. See below.

B. The laboratory duplicate relative percent differences (RPD) were within the defined contract limits. Method requirements are 25% maximum RPD.
Yes ___ No ____ NA__X_
For validation purposes, only results > 5x PQL are qualified for RPD outliers. For results < 5x PQL, results are qualified if the absolute difference is greater than 2x PQL. The qualifier added is JD#, where # is the RPD or the absolute difference observed, as appropriate.
No duplicate run was reported.

VIII. DUPLICATE CONTROL SAMPLES
A. Duplicate Control and Duplicate Control Sample Duplicates similar to Laboratory Control Samples (LCS) were performed for every set.
Yes _X_ No ___
Only the LCS was required or reported.

B. And percent recoveries were acceptable at 70 – 130%.
Yes _X___ No ____

There was an LCS reported for all days of analysis.

C. And Relative Percent Differences were within lab limits.
Yes ___ No____ NA__X__
LCSDs have not been performed, and are not required by the method.

IX. SHIFT CHECKS
Shift checks were performed and were within time limits.
Yes __X__ No____

X. BLANKS
A. Method Blanks were analyzed at the required frequency and for each matrix and analysis.
Yes __X___ No____
This is a nitrogen blank run with each set.

B. The method blank was free of contamination.
Yes __X___ No _____

C. If Field Blanks were identified, they were free of contamination.
Yes _____ No ____ NA ___X___
There were no field blanks identified.

D. Contamination level was less than 0.03 mg/cubic meter before samples were analyzed per the method.
Yes __X__ No____ NA _____
Reporting units include both ppbv and ug/m3.

XI. FIELD QC
A. If Field duplicates or Performance Check Compounds were identified, they met the RPD or % recovery criteria for the project.
Yes ___ No ____ NA_X__
No field duplicate pair is reported in this set.

XII. TCL COMPOUNDS
A. The identification is accurate and all retention times, library spectra and reconstructed ion chromatograms (RIC) were evaluated for all detected compounds:
Yes __X_ No____ NA___
No high dilutions were reported for this set of samples.
Note that propene is high impacted by interference and the mass ratios cannot be confirmed. It is recommended that the reported result could be estimated due to interferences. Data are qualified JQ to indicate this.

| Lab ID | Client ID | Compound | result ppbv | RL | Qualifier |
|---|---|---|---|---|---|
| P1304722-001 | ODSVE-EFF-4Q13 | Propene | 0.46 | ppbV | JQ |

B. Quantitation was checked to determine the accuracy of calculations for representative compounds in each internal standard set
Yes___ No ____ NA___X__

**OVERALL ASSESSMENT**

Data are considered to be usable for project purposes after consideration of qualifiers or comments. Points of significance are summarized below:
Note an extended list of volatile compounds was reported. Level IV data packages were submitted and Level III validation was performed for holding times, chain of custody, calibrations and QC. As raw data were included, an oversight check was performed.

Laboratory Duplicate
No laboratory duplicates was reported.

Field Duplicates
No field duplicate pair is reported. These are regularly sampled locations and the precision is built in as the sites are sampled routinely.

Compound Identification
Note that propene is high impacted by interference and the mass ratios cannot be confirmed. It is recommended that the reported result could be estimated due to interferences. Data are qualified JQ to indicate this.

| Lab ID | Client ID | Compound | result ppbv | RL | Qualifier |
|---|---|---|---|---|---|
| P1304722-001 | ODSVE-EFF-4Q13 | Propene | 0.46 | ppbV | JQ |

# Final Data Qualification and Usability Report

| | |
|---|---|
| Project: | Defense Depot Memphis, TN (DDMT)<br>OD-SVE |
| Sampling Event: | OD-SVE September – October 2013 (3Q13) |
| Project / Task Number: | 228-192672-007 |
| Sample Data Package(s): | P1304297 and P1304722 |
| Data Validation Performed by: | Diane Short & Associates (DSA) |
| Final Data Qualification and Usability Report Prepared by: | Lynn K. Lutz, HDR Inc. |

**Project Comments**

The sample was collected on 25 September 2013 and no chlorinated analytes were reported as detected. The sample was collected again on 22 October 2013 and there were detected results for chlorinated analytes.

**Data Validation Report Review and Comments**

The data validation reports were acceptable.

**Final Data Qualifiers**

The final data qualifier for propene was J where the validator had qualified as JQ.

The final data qualifier for carbon disulfide was B where the validator had qualified as UMB.097.

Final qualifiers were J where the lab had qualified as F.

**Data Usability**

There were no rejected sample results. All results are usable as qualified.

09 December 2013

Lynn K. Lutz, HDR Inc. Date

DIANE SHORT & ASSOCIATES, INC.
1978 S. Garrison St. # 114
Lakewood CO 80227
303:271-9642 Fax 988-4027
dsa7cbc@eazy.net

**ORGANIC AIR QUALITY REPORT**
**METHOD TO-15**

SDG: P1305542 , project 228-192672-007

PROJECT: Memphis Defense Depot soil vapor extraction for HDR Inc.

LABORATORY: Microbac, subcontracted to Columbia Analytical Services Laboratories, CA

SAMPLE MATRIX: Air

SAMPLING DATE (Month/Year): December 2013

NUMBER OF SAMPLES: 1 sample

ANALYSES REQUESTED: Summa Canister VOA TO-15

SAMPLE NO.: ODSVE-EFF-Y4Q4

DATA REVIEWER: Diane Short

QA REVIEWER: Diane Short & Associates, Inc. INITIALS/DATE: __DLS_01/16//2014_____

Telephone Logs included Yes____ No __X__

Contractual Violations Yes____ No __X_

The EPA CLP National Functional Guidelines for Organic Data Review, 2001 (SOP); the current project QAPP, (9/2011), EPA Method TO-15 current updates have been referenced by the reviewer to perform this data validation review. The EPA qualifiers have been expanded to include a descriptor code and value to define QC violations and their values, per the approval of the HDR Project Manager. Per the Scope of Work, the review of these samples includes validation of all QC forms and submitted calibrations referencing the QC limits in the above documents.

DELIVERABLES
All deliverables were present as specified in the Statement of Work (SOW) or in the project contract.
Yes _X__ No ____
Note an extended list of volatile compounds was reported. Level IV data packages were submitted and Level III validation was performed for holding times, chain of custody, calibrations and QC. A raw data oversight check was performed on the last data set.

II. ANALYTICAL REPORT FORMS
A. The Analytical Report or Data Sheets are present and complete for all requested analyses.
Yes __X__ No___

B. Holding Times
The contract holding times were met for all analyses (Time of sample receipt to time of analysis (VOA) or extraction and from extraction to analysis). Contract holding times for TO-15 canisters is 30 days from date of collection.
Yes ___X__ No____

C. Chains of Custody
Chains of Custody were present and were complete with signatures, sign-offs and complete entry of data. Canisters were properly sampled and received.
Yes __X___ No ____
The project manager is informed of the following and the project record is being updated.
There are gaps from relinquishment to sample receipt. The courier is identified as FedEx and there is no airbill number on the chain or log-in. The client notes that the coolers are often sealed before the airbill number is known. The required tracking is in the project record.

D. Canister Pressure
Canister pressures were measured and recorded for initial vacuum check, initial field vacuum, final field reading, lab initial pressure and final pressure.
Yes ___X___ No _____ NA _____
Pressures were reported for the field initial and final pressures and the laboratory final pressure and were acceptable.

All readings met the limits or exceptions were noted and pressure corrected
Yes ___X__ No ____ NA ____

III. INSTRUMENT CALIBRATION

A. Initial Calibration – GC/MS
1. The Relative Response Factors (RRF) and average RRF for all compounds for all analyses met the required criteria.
Yes __X__ No____ NA____
Minimum response factors are not defined by the method but meet routine Method 8260 limits. This method does not involve purging water samples. Consequently, all targets, including the typically poor-purging compounds, normally have response factors that are acceptable per validation criteria for volatiles.

The relative standard deviation (RSD) for the five-point calibration was within the 30% limit.
Yes ___X__ No ____

B. Continuing Calibration – GC/MS
1. The RRF standard was analyzed for each analysis at the required frequency and the QC criteria were met
Yes __X__ No____ NA____

Minimum response factors are not defined by the method, but met validation guidance. There were original calibrations and those for analysis of dilutions.

2. The percent difference (%D) limits of 30% were met.
Yes __X__ No ____
Differences of < 20% were reported for the ICV and CCV except for allyl chloride at -21.3%D which is within project limits.

IV. GC/MS INSTRUMENT PERFORMANCE CHECK
A. The BFB performance check was injected once at the beginning of each 12-hour period and relative abundance criteria for the ions were met.
Yes ___X__ No____ NA ____
Tunes were provided and were acceptable.

V. INTERNAL STANDARDS
A. Area Limits
The Internal Standards met the 100% upper and -50% lower limits criteria and the Retention times were within the required windows.
Yes __X___ No____ NA ____

B. Retention Times
The relative retention times of the internal standards and sample compounds met the $\pm$ 0.06 RRT units limit.
Yes __ X ___ No____ NA ____

VI. SURROGATE
Surrogate spikes were analyzed with every sample.
Yes __X___ No ____
Note that three surrogates are used. Method 8260 requires 3 surrogates, but one is acceptable for TO-15.

And met the recovery limits defined in the current contract
Yes __ X _ No ____

VII. MATRIX SPIKE/MATRIX SPIKE DUPLICATE
A. Matrix spike (MS) and matrix spike duplicates (MSD) were analyzed for every analysis performed and for every 20 samples or for every matrix whichever is more frequent.
Yes____ No ____NA ___X__
Spikes are not amenable to canister analysis and are not required. Laboratory duplicates are required and are provided by the laboratory. See below.

B. The laboratory duplicate relative percent differences (RPD) were within the defined contract limits. Method requirements are 25% maximum RPD.
Yes ___ No ____ NA__X_
For validation purposes, only results > 5x PQL are qualified for RPD outliers. For results < 5x PQL, results are qualified if the absolute difference is greater than 2x PQL. The qualifier added is JD#, where # is the RPD or the absolute difference observed, as appropriate.
No duplicate run was reported.

VIII. DUPLICATE CONTROL SAMPLES
A. Duplicate Control and Duplicate Control Sample Duplicates similar to Laboratory Control Samples (LCS) were performed for every set.
Yes _X_ No ___
Only the LCS was required or reported.

B. And percent recoveries were acceptable at 70 – 130%.

Yes ____ No __X__
There was an LCS reported for all days of analysis. The %R for ally chloride (3-chloro-1-propene) was below the project and laboratory limits at 68%. Data are qualified JL68 to indicate a possible slight low bias, or in this case a possible false non-detect. As the bias is low, the non-detect at the PQL would be considered usable and the non-detect at the MDL might be false.

C. And Relative Percent Differences were within lab limits.
Yes ___ No____ NA__X__
LCSDs have not been performed, and are not required by the method.

IX. SHIFT CHECKS
Shift checks were performed and were within time limits.
Yes __X__ No____

X. BLANKS
A. Method Blanks were analyzed at the required frequency and for each matrix and analysis.
Yes __X___ No____
This is a nitrogen blank run with each set.

B. The method blank was free of contamination.
Yes __X___ No _____

C. If Field Blanks were identified, they were free of contamination.
Yes _____ No ____ NA ___X___
There were no field blanks identified.

D. Contamination level was less than 0.03 mg/cubic meter before samples were analyzed per the method.
Yes __X__ No____ NA _____
Reporting units include both ppbv and ug/m3.

XI. FIELD QC
A. If Field duplicates or Performance Check Compounds were identified, they met the RPD or % recovery criteria for the project.
Yes ___ No ____ NA_X__
No field duplicate pair is reported in this set.

XII. TCL COMPOUNDS
A. The identification is accurate and all retention times, library spectra and reconstructed ion chromatograms (RIC) were evaluated for all detected compounds:
Yes __X_ No____ NA___
No high dilutions were reported for this set of samples. This level of review is not required for this project, but was performed for the last data set.

B. Quantitation was checked to determine the accuracy of calculations for representative compounds in each internal standard set
Yes___ No ____ NA___X__

**OVERALL ASSESSMENT**
Data are considered to be usable for project purposes after consideration of qualifiers or comments. Points of significance are summarized below:
Note an extended list of volatile compounds was reported. Level IV data packages were submitted and Level III validation was performed for holding times, chain of custody, calibrations and QC.

Laboratory Duplicate
No laboratory duplicates was reported.

Laboratory Control Sample
There was an LCS reported for all days of analysis. The %R for ally chloride (3-chloro-1-propene) was below the project and laboratory limits at 68%. Data are qualified JL68 to indicate a possible slight low bias, or in this case a possible false non-detect. As the bias is low, the non-detect at the PQL would be considered usable and the non-detect at the MDL might be false.

Field Duplicates
No field duplicate pair is reported. These are regularly sampled locations and the precision is built in as the sites are sampled routinely.

SUMMARY OF DATA QUALIFIERS

| Lab ID | Client ID | Compound | result ppbv | RL | Qualifier |
|---|---|---|---|---|---|
| P1305542-001 | ODSVE-EFF-Y4Q4 | 3-chloro-1-propene | 0.23 U | ppbV | JL68 |

# Final Data Qualification and Usability Report

| | |
|---|---|
| Project: | Defense Depot Memphis, TN (DDMT)<br>OD-SVE |
| Sampling Event: | OD-SVE December 2013 (4Q13) |
| Project / Task Number: | 228-192672-007 |
| Sample Data Package(s): | P1305542 |
| Data Validation Performed by: | Diane Short & Associates (DSA) |
| Final Data Qualification and Usability Report Prepared by: | Lynn K. Lutz, HDR Inc. |

**Data Validation Report Review and Comments**

The data validation reports were acceptable.

**Final Data Qualifiers**

The final data qualifier for allyl chloride was J where the validator had qualified as JL68 due to a low LCS recovery.

Final qualifiers were J where the lab had qualified as F.

**Data Usability**

There were no rejected sample results. All results are usable as qualified.

17 January 2014

Lynn K. Lutz, HDR Inc. Date