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

Dunn Field - Defense Depot Memphis, Tennessee

Prepared for:

Department of the Army

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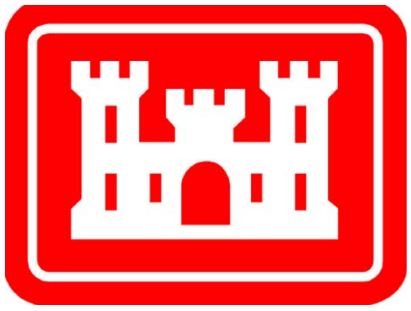

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Task Order No. 0019

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Prepared for:

U.S. Army Corps of Engineers, Fort Worth District
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Prepared by:

HDR
9563 S. Kingston Court
Suite 200
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
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
PMW	performance monitoring well
ppbv	parts per billion by volume
ppm	parts per million
psi	pounds per square inch
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
TA	treatment area

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 W9216G-09-D-0069, Task Order 0019 to the United States Army Corps of Engineers (USACE), Ft. Worth District. This report summarizes the operations and maintenance (O&M) activities and the results of system monitoring for Year Three 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 2012.

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 U.S. Environmental Protection Agency (USEPA) Region 4 and the Tennessee Department of Environment and Conservation (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^2M, 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 action; 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, Rev.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 a receiving tank, refrigerated dryer, pressure regulator and relief valve, solenoid panel and sparge manifold, and the 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 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 generally due to normal 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, Rev. 0* (HDR, 2012a). 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; the AS compressor and SVE blowers were operated approximately 43% of the time during Year Two. 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.

1.5.2 Groundwater Monitoring

Groundwater monitoring results from 36 performance monitoring wells (PMWs) were used to assess the overall effectiveness of the AS-SVE system during the first two years of operation. The PMWs were incorporated in long-term monitoring (LTM) in 2012. 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 PMWs immediately downgradient of the AS/SVE barrier in June

2010. The total CVOC concentration in MW-246, the PMW with the highest baseline concentration, decreased 99.7 percent from October 2009 (4607 µg/L) to January 2011 (13.5 µg/L).

In September 2011, CVOC concentrations in the Off Depot plume met the treatment goal of 50 µg/L for individual CVOCs in all but three PMWs (MW-159, MW-166 and MW-166A), including all wells downgradient of the AS/SVE system. MW-159 is near the center of the off depot plume and upgradient of the AS/SVE system. MW-166 and MW-166A are near the southern edge of the AS/SVE system and in the area of potential plume diversion. Additional information is provided in the *Off Depot Annual Groundwater Monitoring Report – 2011, Rev. 1* (HDR, 2012b).

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 AS/SVE operations includes the following activities:

- Weekly system inspections with repair or replacement of components, as required;
- Weekly readings at AS compressor, SVE wells and system effluent for flow rate, vacuum, temperature, and operating hours;
- Weekly PID measurements at SVE wells and system effluent;
- Monthly PID and vacuum measurements at VMPs;
- Quarterly laboratory samples from system effluent analyzed for VOCs;
- Quarterly 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

Operation of the AS compressor and the SVE blowers has been limited to 2 to 4 days per week since November 2010 to limit potential plume diversion around the AS/SVE system. During Year 3, normal operations with the AS compressor and the SVE blowers and with all 12 SVE wells and 1/3 of the 90 AS wells operating were maintained at 3 to 4 days per week to June 2012. 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.

Groundwater monitoring results in April 2012 showed only LTM well MW-159 exceeded the treatment goal of 50 µg/L for individual CVOCs, and systems modifications were recommended to target areas with higher CVOC concentrations. The modifications were made 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 (4 hour blocks) 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. Operation of the AS compressor and blower(s) was continued at 3 to 4 days per week.

An additional change was made on 10 July 2012. 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. One SVE blower operates 7 days per week with the two blowers alternating on a 12-hr cycle. The change was made to reduce time required for adjustments by the field technician while maintaining the weekly operating hours for AS wells.

The two closed SVE wells, SVE-8 and SVE-12, were opened on 24 October because of increased PID readings observed at SVE wells since June 2012. The current system plan is shown on Figure 1.

2.1 SYSTEM PERFORMANCE

AS/SVE system uptime during Year Three was approximately 97%. The primary causes of downtime were power outages during storms and utility maintenance, and system maintenance, including problems with Blower #1 and with automatic drains in the AWS.

2.2 SYSTEM FLOW RATES AND VACUUMS

Operating conditions were recorded weekly in Year Three, except during a few field events and holidays. 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.

AS injection rates, listed on Table 1, ranged from 234 to 298 scfm and averaged 268 scfm prior to closing 24 AS wells in June 2012. After the AS wells were closed, AS injection rates ranged from 134 to 209 scfm and averaged 192 scfm.

Air flow 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 for most of Year 3; average flow rates at individual SVE wells were 45 to 67 acfm with one blower, except for SVE-7 which averaged 21 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 with a single blower averaged 652 scfm at 8.2 in. Hg. Combined flow from 10 SVE wells with a single blower (July to October 2012) averaged 592 scfm at 8.4 in. Hg. Combined flow from all SVE wells with both blowers operating (April to June) averaged 989 scfm at 13.4 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 rates of 268 scfm prior to June and 192 scfm after June and the average combined SVE flow rate of 652 scfm with one blower in operation, the SVE system extracted approximately 2.4 to 3.4 times the injection rate during Year Three.

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 Three are listed below:

- The system shut down on 30 December 2011 due to a "Low Voltage/Phase" alarm, which was caused by a copper theft from the adjacent substation. The system was restarted on 3 January 2012.
- The system was shutdown several times due to system alarms or for evaluation and maintenance of Blower #1 until the problem was resolved in June 2012.
  - The system was shut down briefly on 24 February for initial testing of Blower #1 by an HDR electrical engineer. The problem appeared to be related to incoming power supply, but problems with the blower's electric motor were also noted. The testing ended when the blower could not be restarted.
  - The system was shut down briefly on 28 February for evaluation of Blower #1 by a Kaeser technician. All blower components tested within specified parameters.
  - The system was shut down on 8 March and new conduit was added to separate the electrical power for each blower; the control and sensor wiring were left in the old conduit.
  - The system was down part-time on 19-20 March while the SVE blowers were evaluated by a subcontractor, Process Logic. The specific cause of the Blower #1 shutdowns could not be determined. However, minor changes to system controls and the variable frequency drive (VFD) were made, and the blower operated properly.
  - Blower #1 went down with a "VFD Fault" on 7 May; the time was not recorded due to a programming error that has since been corrected. It was restarted at 8:02 on 9 May and went down at 18:04 with the same alarm. Blower #1 was restarted at 8:32 on 10 May and then turned off at 14:10 for repair of the cooling fan for the blower enclosure.
  - A Kaeser technician inspected the Blower #1 fan on 14 May. A loose wire was tightened and re-crimped, and the fan operated properly. Blower #1 shut down at 10:59 due to a VFD fault.
  - Following further evaluation, the subcontractor, Process Logic, replaced the VFD for Blower #1 with a motor starter and made programming modifications to incorporate the change. The system was shut down at 10:05 on 6 June while the changes were made. The system was restarted with a single blower and the compressor at 17:05.

  - The system shut-down due to a "Blower 1 Fault" on 6 June at 23:42. The power supply to the system was observed to be erratic on the morning on 7 June. MLGW was contacted and the power supply returned to normal in the afternoon; Blower #2 was restarted at 13:44.

- The automatic magnetic drain on the compressor knockout tank was replaced by Kaeser on 31 January.

- The system shut down on 12 February, 22 March, 18 June and 27 June due to "AWS High Level" alarms. The AWS tank was not draining automatically and had to be manually drained. The AWS tank was drained and the system restarted in each case.

- The system went down on 21 February due to a "Low Voltage/Phase" alarm attributed to storms in the area. The system was restarted on 22 February.

- The AS-6/7solenoid was replaced on 2 May and the AS-1/2 solenoid was replaced on 24 August; the AS compressor was shutdown for 30 minutes each time.

- The AS air dryer shutdown on 14 June due to a high temperature fault. A Kaeser technician replaced the temperature relay and thermostat that day. The relay switch shutdown again on 21 June; the AS system continued to operate. The technician checked the electrical connections and ran the dryer on 22 June and determined the shut down was normal cycling due to air temperature. While on-site, the technician performed regular maintenance on the AS compressor (motor bearings, valves, and electrical systems).

- An exhaust fan in the AS building burned out on 14 June. The fan motor was removed by Overton Electric and a new motor was installed on 15 June; the motor was not the correct model and was replaced on 19 June. No system downtime resulted from the AS dryer or exhaust fan problems.

- The system shutdown due to a "Low Voltage/Phase" alarm on 23 September at 6:41 and was restarted on 24 September at 8:23. There were no obvious equipment problems, and the shutdown was assumed to be due to problems with the MLGW power supply.

- The AS compressor was shutdown during water level measurements on 16 October from 9:15 to 13:25.

- The AS/SVE system shutdown due to a "Low Voltage/Phase" alarm at 10:18 on 25 October and was restarted on 26 October at 13:55. The system went down with the same alarm at 10:18 on 27 October and was restarted at 8:15 on 28 November. There were no obvious mechanical problems

observed after either shutdown. Because the alarm was at the same time of day, it was assumed to be related to operations at a nearby industrial user that affected the power supply.

- A "VFD Fault" for SVE Blower #2 was recorded at 11:59 on 29 November. The system did not shutdown because Blower #1 was operating. No obvious problem with Blower #2 was found.
- The AS/SVE system went down sometime after the morning of 26 December; no alarm was registered. The shutdown was assumed to be due to a weather-related power outage. The system was restarted on at 9:22 on 27 December. The power was shutdown later that day by MLGW for maintenance. The AS/SVE system was restarted at 18:00.
- A Kaeser technician performed annual maintenance on 3 January. The system was down from 7:23 to 14:27.
  - Blower 1 and 2 : replaced V-belts, oil, air filters
  - Compressor: replaced oil, air filter, oil filter, air/oil separator, controller filter mats
  - Inline filters: replaced filters, o-rings
  - Tightened a loose and leaking pipe on the knockout tank automatic magnetic drain between the dryer and compressor.
  - Checked all electrical connections and lubricated equipment where appropriate.
  - Replaced the KCF filter which filters condensate from various lines in compressor building prior to discharge.

The number of AS wells with 0 acfm air injection rates increased from 4 wells in each 30-well group in 2011 to as many as 10 wells in the 22-well groups operating after June 2012. Maintenance was performed 21 to 25 January 2013 to clear as many wells as practical. Air flow and pressure were measured in the 66 AS wells in full-time (48) or half-time (18) operation; the 24 closed AS wells were not tested. There were 22 AS wells with 0 acfm flow; these wells were closed and the remainder were set to standard operation. AS/SVE operations continued during work on the blocked AS wells.

There were five AS wells (AS-8, 9, 17, 33 and 42) with 0 flow and 0 pressure, which were determined to have faulty solenoids. The solenoids were replaced for these AS wells and for two additional AS wells (AS-2 and 5) that were running continuously. All these wells operated properly after the replacement.

The remaining 17 AS wells were uncapped and depths were measured to check for sediment in the wells. All measured depths were close to the total depth recorded during well construction indicating sediment

build-up was not the problem. Approximately 1/3-gallon of chlorine bleach was poured into the AS wells to address potential biofouling in the sparge points. Four of the treated wells were run continuously for 24 hours, but there was no increase in air flow.

The AS wells were then cleaned by pumping potable water through a tremie pipe with slots in the bottom two feet to side-discharge pressurized water into the sparge points. The jetting continued until clear water overflowed the well riser into the manhole; a few gallons were pumped from each well. The jetting was completed in the afternoon of 24 January and the wells were set to operate continuously. One well, AS-22, was observed to be leaking air around the casing; the source of the leak could not be found and the well was closed. An initial set of measurements on 25 January indicated air flow at 7 of the 16 remaining AS wells. A final set of readings on 29 January indicated air flow at 5 more AS wells after which the wells were returned to standard operation.

The AS well maintenance was successful in re-establishing air injection at 17 of the 22 AS wells. One well (AS-22) remains closed because of a leak and four wells still show 0 acfm (AS-23, 31, 32 and 35). Another five AS wells remain closed because the air line connections were ruptured because of excess pressure. In summary, 56 of the 66 AS wells selected for operation are functioning properly.

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 AS/SVE RAWP. Sampling and analysis are performed in accordance with the *Remedial Action Sampling and Analysis Plan* (RA SAP) (MACTEC, 2005).

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. Measurements were not recorded at two VMP pairs, 7A/B and 10A/B, in January due to moisture in the VMP tubing. Average vacuum at VMPs ranged from 5.0 to 14.4 in. H_2O with one blower operating; the vacuum measurements collected in June and July were not included because two blowers were operating in June and the effect of both blowers was still apparent in July. The measurements demonstrate air injected during sparging is captured throughout the treatment area (TA) 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.

Weekly measurements at SVE wells and system effluent were varied between standard operations with the AS compressor and one or both blowers operating, and with the AS compressor off and a single blower operating; the measurements are shown on Table 3. The PID measurements varied during Year Three based on changes in system operations.

Five sets of PID measurements were made with the AS compressor off-line: 20 January, 17 February, 16 March, 28 April and 25 May. The measurements in February, March and April were made several hours after the compressor was shutdown and are much lower than the measurements made with the compressor operating. The measurements in January and May were made shortly after the compressor was shut down.

The PID measurements made with the AS compressor operating were higher from 6 January to 13 April, decreased until 21 June after the modifications were made to AS operations and two SVE wells were closed, and then decreased again on 7 December after the two SVE wells were re-opened in October. During standard operations from January to 13 April, PID readings at the system effluent measured 10.4 to 12.8 ppm and 2.9 to 25.6 ppm at the SVE wells. From 21 April to 14 June, the system effluent measured 0.9 to 4.1 ppm and SVE wells measured 0.6 to 4.0 ppm.

The PID measurements at SVE wells fell in two ranges after AS well operations were changed in June. From 21 June to 12 October, PID readings measured 4.9 to 17 ppm at the system effluent, 0.9 to 2.6 ppm at SVE-1 to SVE-4, and 11.8 to 20.8 ppm at SVE-5 to SVE-11; SVE-8 and SVE-12 were closed. The PID measurements were similar after SVE-8 and SVE-12 were opened on 24 October until 7 December when measurements decreased. From 7 to 29 December, PID readings measured 2.8 to 4.7 at the system effluent; 0.8 to 2.1 ppm at SVE-1 to SVE-4, SVE-8 and SVE-12; and 7.2 to 10.5 ppm at SVE-5 toSVE-7 and SVE-9 to SVE-11. The higher concentration SVE wells are on the northern line of SVE wells near the operating AS wells; the lower concentration SVE wells are on and near the eastern line of SVE wells with operating AS wells and in areas where AS wells are not operating.

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 final PID readings from VMPs are shown on Table 4. PID measurements at VMPs were at low levels during Year Three, generally ranging from 0 to 1 ppm with only a few individual measurements at 1.4 to 3.2 ppm. PID measurements at VMPs did not vary with location as measurements at SVE wells did.

3.3 VAPOR SAMPLES

Vapor samples were collected from the system effluent during Year Three 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 2012 and an additional sample was collected in February 2012 to evaluate the higher PID readings in SVE wells and effluent since December 2011. 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 A, Table A-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.

Total primary CVOCs in the system effluent ranged from 21.3 to 33.1 ppbv in Year 3. The CVOC detected at the highest concentrations was TCE at 59% to 69% of the total primary CVOC concentration. Total VOCs in the system effluent ranged from 27.6 to 208 ppbv. The range in concentrations is due to an anomalously high concentration of toluene (170 ppbv) in the June 2012 sample; toluene concentrations in the other Year 3 samples were below 1 ppbv and the highest previous toluene concentration in the AS/SVE effluent was 5 ppbv in June 2010. 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 2012 were reviewed to qualify the data relative to the data quality objectives (DQOs) described in the RA SAP. 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 A.

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 3 samples is provided in Appendix B. The main findings from the DQE are summarized below:

- Any result reported below the RL but above the method detection limit was flagged “J” and considered an estimated result.
- Methylene chloride was additionally qualified “B” due to its presence in the method blank for the samples collected in February and March 2012.
- Isopropyl alcohol was additionally qualified “J” due to a high relative standard deviation in the initial calibration for the sample collected in June 2012.

3.5 MASS REMOVAL ESTIMATE

The VOC mass removed from the Off Depot TA 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 0.0004 to 0.0021 lb/hr during Year Three. The higher emission rates are due to the high reported toluene concentration in June. The emissions remained well below the de minimus standard of 0.1 lb/hr for the MSCHD permit. The AS/SVE system removed approximately 5 pounds of VOCs in Year Three and 80 pounds of VOCs since startup (Table 6).

4.0 CONCLUSIONS AND RECOMMENDATIONS

4.1 SYSTEM OPERATIONS

The AS/SVE system uptime was approximately 97% during Year Three (1 January to 31 December 2012). Normal system operations with the AS compressor and the SVE blowers and with all 12 SVE wells and 1/3 of the 90 AS wells operating were maintained at 3 to 4 days per week to June 2012. A single SVE blower was operated when the AS compressor was off-line.

LTM results from April 2012 showed the overall success of the RAs on Dunn Field and in the Off Depot TA. AS/SVE operations were modified in June 2012 to target the smaller area with higher CVOC concentrations. 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 (4 hour blocks) at the other 48 AS wells. Two SVE wells, SVE-8 and SVE-12, were closed to increase vapor extraction near the operating AS wells.

An additional change was made in July to reduce time required for weekly system changes, while maintaining the weekly operating hours for AS wells. 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 system was set to run a single SVE blower at all times, with the two blowers alternating on a 12-hr cycle. Finally, SVE-8 and SVE-12 were re-opened in October because of increased PID readings observed at SVE wells since June.

The number of AS wells out of operation increased significantly in 2012 from approximately 10 percent to almost 50 percent of the designated AS wells. AS well maintenance performed in January returned 17 wells to operations, leaving 15 percent of the AS wells closed.

PID measurements at SVE wells were variable during Year 3 although they remained at relatively low levels. Prior to the changes in system operations made in June, the PID measurements generally ranged from 0.9 to 12.8 ppm for SVE system effluent and 0.6 to 25.6 ppm at SVE wells. After June, the PID measurements in SVE wells fell in two ranges; the northern line of SVE wells near operating AS wells had PID measurements of 7.2 to 20.8 ppm, while the eastern line of SVE wells and SVE wells in areas with closed AS wells had PID measurements of 0.9 to 4.7 ppm. PID readings at the system effluent measured 2.8 to 17 ppm in the second half of Year 3. PID measurements at VMPs were at low levels during Year Three, generally ranging from 0 to 1 ppm, and did not vary by location as at the SVE wells.

The variation in PID measurements was not confirmed by analytical results for quarterly system effluent samples, which remained at low levels. Total VOC concentrations were 28 to 43 ppbv, with the omission of an anomalous concentration of toluene in the June sample. Estimated VOC emission rates in the effluent were 0.0004 to 0.002 lb/hr during Year Three, below the de minimus standard of 0.1 lb/hr for the MSCHD permit. The higher estimated emission rate was due to the reported toluene concentration in June. Approximately 80 pounds of VOCs have been removed since startup.

4.2 RECOMMENDATIONS

No changes to AS/SVE system operation are currently recommended. However, system monitoring of AS and SVE operations and PID readings at SVE wells will be reduced from weekly to monthly in Year 4 (2013); vacuum and PID readings at VMPs will continue monthly. The decreased operational monitoring is based on the overall success of the RA and the suggested monitoring frequency in the Off Depot Remedial Design (RD). Laboratory analysis of system effluent will remain quarterly.

Additional maintenance is recommended to return AS wells to operation. To repair the five wells with ruptured connections, it will be necessary to remove the manhole and excavate around the well head to determine where the break has occurred. Once the break is found, the well will be evaluated to determine if it can be returned to operation. The wells were capped after the rupture was identified but soil may have fallen in to the well prior to it being capped. Other AS wells without air flow should be jetted again as well.

The AS/SVE system will continue to operate until the upgradient concentrations from the Dunn Field plume do not exceed 50 µg/L for individual CVOCs. Only one LTM well, MW-159, currently exceeds that standard.

5.0 REFERENCES

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e^{2}M, 2009. *Dunn Field Off Depot Groundwater Remedial Action Work Plan, Revision 2.* Prepared for the Air Force Center for Engineering and the Environment. April, 2009.

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HDR, 2011c. *Remedial Action Operations and Long Term Monitoring Quality Assurance Project Plan, Revision 0.* Prepared for the Air Force Center for Engineering and the Environment. September, 2011.

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MACTEC, 2005. *Remedial Action Sampling and Analysis Plan. Volume I: Field Sampling Plan and Volume II: Quality Assurance Plan*. Prepare for the Air Force Center for Environmental Excellence. November, 2005.

TABLES

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

Date/Time of Recording	Number of Blowers in Operation	AS Compressor Flow rate (scfm)	SVE Effluent		SVE-1		SVE-2		SVE-3		SVE-4		SVE-5		SVE-6	
			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)	Flow rate (acfm)	Vacuum (in. H_2O)	Flow rate (acfm)	Vacuum (in. H_2O)
1/6/2012	1	298	788	8.2	50	56	60	47	50	50	70	50	50	60	80	47
1/13/2012	1	260	624	8.4	50	59	60	51	50	54	50	52	50	63	90	50
1/20/2012	1	0	590	9	50	70	60	60	50	64	70	63	50	73	80	60
1/28/2012	1	287	660	8.4	50	61	60	52	50	56	70	55	40	65	90	54
2/3/2012	1	258	767	8.3	50	59	60	50	50	51	70	50	50	60	90	47
2/10/2012	1	280	677	8.2	50	55	60	46	50	51	70	49	50	59	80	48
2/17/2012	1	0	607	9	50	65	60	60	50	61	70	61	40	70	80	59
2/25/2012	1	239	686	9	50	65	60	60	50	60	70	60	50	70	90	58
3/2/2012	1	242	633	9.2	50	70	60	61	50	65	70	65	50	74	80	65
3/9/2012	1	294	663	7.6	50	54	60	45	50	50	70	48	40	58	80	48
3/16/2012	1	0	646	7.3	50	36	60	41	50	49	70	47	40	56	90	49
3/23/2012	1	281	660	6.9	50	35	50	42	40	46	60	41	20	53	90	41
3/31/2012	1	276	656	7.2	50	35	50	42	50	50	60	46	20	56	80	46
4/6/2012	2	251	961	13.8	100	90	100	74	90	86	100	71	80	103	110	79
4/13/2012	2	253	956	13.9	100	93	100	82	100	93	100	51	100	119	100	72
4/21/2012	2	252	945	13.7	100	91	100	74	100	90	100	64	100	116	100	71
4/28/2012	1	0	677	7.8	50	60	50	50	50	59	60	51	50	69	80	47
5/4/2012	2	290	936	12.4	100	76	100	55	100	76	100	62	100	105	100	53
5/11/2012	1	248	622	7.4	50	53	50	43	50	52	60	42	50	62	70	41
5/18/2012	1	277	641	7.6	50	54	50	43	50	52	60	45	50	62	70	41
5/25/2012	1	0	589	10.0	50	64	50	54	50	63	60	55	40	72	70	52
6/1/2012	1	234	614	7.6	40	57	50	40	60	55	60	-	50	65	80	43
6/8/2012	1	286	710	7.4	40	51	50	40	60	50	70	43	40	60	80	38
6/14/2012	2	281	1145	13.2	100	86	100	65	110	87	100	75	110	114	100	66
6/29/2012	2	195	920	14.1	100	86	90	66	110	92	100	74	110	120	100	64
7/5/2012	2	195	900	14.0	100	88	90	67	110	93	100	75	110	122	100	64
7/13/2012	1	201	597	8.7	60	70	60	52	70	66	70	57	60	80	80	51
7/21/2012	1	163	594	8.4	60	61	60	48	70	60	70	52	60	74	80	46
7/27/2012	1	205	580	8.2	50	56	60	43	60	49	70	48	60	69	80	41
8/3/2012	1	207	583	8.3	60	58	60	44	70	57	70	49	60	70	80	43
8/10/2012	1	185	593	8.4	60	57	60	44	70	44	70	49	60	70	70	43
8/17/2012	1	205	621	8.3	60	57	70	45	70	59	70	49	60	70	80	43
8/24/2012	1	203	587	8.5	60	56	60	43	70	58	70	49	60	69	80	42
9/1/2012	1	198	596	8.4	60	57	60	45	70	56	70	48	60	68	80	43
9/10/2012	1	176	571	8.2	60	56	60	44	70	56	70	49	60	68	80	43
9/15/2012	1	198	580	8.2	60	57	60	44	70	58	70	48	60	68	80	43
9/22/2012	1	179	589	8.5	60	60	70	48	70	50	70	51	60	76	80	47
9/28/2012	1	203	610	8.8	60	61	70	47	70	47	70	52	60	75	80	46
10/5/2012	1	200	590	8.6	60	59	60	48	70	48	70	50	60	72	80	45
10/12/2012	1	205	593	8.7	60	59	60	46	70	47	70	50	60	71	80	44
10/25/2012	1	202	625	8.5	60	60	60	47	70	47	70	50	60	72	70	48
11/2/2012	1	193	602	8.9	50	60	50	49	50	58	50	53	40	67	70	52
11/16/2012	1	192	602	8.2	50	58	50	47	50	56	56	50	48	66	70	48
12/1/2012	1	209	658	8.3	50	57	50	40	50	54	60	45	50	65	80	46
12/7/2012	1	134	620	7.6	50	55	50	40	50	54	60	47	50	63	80	45
12/14/2012	1	193	633	8.1	50	54	50	42	50	51	60	47	50	60	80	43
12/29/2012	1	170	709	8.7	50	54	60	42	50	52	60	48	50	61	80	44

Notes:
acfm: actual cubic feet per minute
in. Hg: inches of mercury
in. H_2O: inches of water
scfm: standard cubic feet per minute

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

Date/Time of Recording	Number of Blowers in Operation	SVE-7		SVE-8		SVE-9		SVE-10		SVE-11		SVE-12	
		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)	Flow rate (acfm)	Vacuum (in. H_2O)
1/6/2012	1	30	75	50	48	50	74	50	42	70	38	70	38
1/13/2012	1	20	77	50	50	50	78	50	42	70	39	70	39
1/20/2012	1	20	88	50	68	50	86	50	53	70	49	70	47
1/28/2012	1	20	80	60	55	60	78	50	45	70	43	70	43
2/3/2012	1	20	74	50	51	40	74	50	41	80	37	70	36
2/10/2012	1	20	76	50	49	50	70	60	40	70	35	70	36
2/17/2012	1	20	85	60	58	50	85	50	52	70	50	70	46
2/25/2012	1	20	85	50	58	50	81	50	50	80	46	70	44
3/2/2012	1	20	87	50	62	50	87	50	54	70	50	70	48
3/9/2012	1	20	73	50	47	50	71	50	39	70	36	60	35
3/16/2012	1	20	70	50	46	50	70	50	38	70	34	70	35
3/23/2012	1	20	66	50	41	50	65	50	35	70	32	60	30
3/31/2012	1	20	70	50	46	50	69	50	39	60	33	60	34
4/6/2012	2	50	146	100	78	90	144	80	60	110	56	100	53
4/13/2012	2	20	145	100	82	60	145	100	70	100	55	100	55
4/21/2012	2	20	143	100	79	60	143	100	69	100	53	100	54
4/28/2012	1	20	77	50	53	50	77	60	50	70	37	70	37
5/4/2012	2	80	129	100	65	60	131	100	60	100	42	100	44
5/11/2012	1	20	71	50	46	50	70	60	42	60	32	70	32
5/18/2012	1	20	71	50	45	50	70	60	42	60	33	70	32
5/25/2012	1	20	81	50	56	50	81	50	52	60	41	70	40
6/1/2012	1	50	74	60	48	60	70	70	45	70	34	75	34
6/8/2012	1	20	66	50	44	50	68	60	41	70	29	70	30
6/14/2012	2	80	141	100	74	90	141	110	67	100	50	100	51
6/29/2012	2	90	149	-	-	80	151	110	66	105	48	-	-
7/5/2012	2	90	151	-	-	90	152	110	65	110	47	-	-
7/13/2012	1	40	93	-	-	60	92	80	52	80	90	-	-
7/21/2012	1	20	86	-	-	60	85	80	49	70	37	-	-
7/27/2012	1	20	81	-	-	50	80	70	45	70	33	-	-
8/3/2012	1	20	82	-	-	60	80	70	46	70	34	-	-
8/10/2012	1	20	82	-	-	50	81	70	46	70	34	-	-
8/17/2012	1	20	82	-	-	60	79	70	45	70	34	-	-
8/24/2012	1	20	82	-	-	60	82	70	45	70	33	-	-
9/1/2012	1	20	82	-	-	60	81	70	45	70	34	-	-
9/10/2012	1	20	81	-	-	60	82	70	44	70	34	-	-
9/15/2012	1	20	82	-	-	60	82	70	45	70	34	-	-
9/22/2012	1	20	86	-	-	60	86	70	50	70	40	-	-
9/28/2012	1	20	88	-	-	50	88	70	49	70	37	-	-
10/5/2012	1	20	84	-	-	60	82	80	45	80	33	-	-
10/12/2012	1	20	83	-	-	60	83	80	46	80	34	-	-
10/25/2012	1	20	80	50	49	50	81	50	45	50	38	60	36
11/2/2012	1	20	79	50	50	50	77	50	46	50	39	60	35
11/16/2012	1	20	79	55	50	60	78	60	46	60	35	50	36
12/1/2012	1	20	77	60	52	50	76	60	45	60	31	70	38
12/7/2012	1	20	74	60	52	50	74	50	43	60	32	70	36
12/14/2012	1	20	73	50	50	50	73	50	42	60	36	60	35
12/29/2012	1	20	73	60	50	50	72	50	42	60	36	70	36

Notes:
acfm: actual cubic feet per minute
in. Hg: inches of mercury
in. H_2O: inches of water
scfm: standard cubic feet per minute

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

Date	1/30/2012	2/27/2012	3/23/2012	5/23/2012	6/21/2012	7/31/2012	8/29/2012	9/26/2012	10/29/2012	11/28/2012	12/19/2012
Blowers	1	1	1	1	2	1	1	1	1	1	1
Sparge	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
VMP1A	7.6	7.8	7.7	7.7	11.1	10.8	8.0	7.7	6.4	6.1	6.4
VMP1B	4.1	4.2	6.8	4.9	10.7	10.4	6.1	5.3	4.2	4.3	4.9
VMP2A	6.8	7.0	8.8	7.0	18.2	15.8	7.8	7.0	6.5	6.3	6.7
VMP2B	6.7	6.8	7.0	6.9	15.3	13.4	7.1	6.8	5.9	5.3	5.4
VMP3A	9.4	9.3	8.6	8.9	19.7	18.4	9.8	9.2	8.9	8.3	8.7
VMP3B	9.1	9.1	9.6	8.8	20.0	18.4	10.2	8.8	8.1	7.4	8.0
VMP4A	9.0	8.9	13.3	9.2	26.8	24.9	10.3	8.9	8.4	7.9	8.6
VMP4B	9.2	9.0	7.4	9.1	23.0	24.6	9.5	9.1	8.6	8.4	8.9
VMP5A	8.4	8.5	10.8	8.8	23.4	20.9	8.9	8.3	7.7	7.3	7.5
VMP5B	9.1	9.4	11.7	9.1	23.5	23.8	10.3	10.1	8.9	8.1	8.5
VMP6A	9.8	10.2	11.0	10.3	26.1	24.8	11.2	10.1	8.8	8.4	8.6
VMP6B	10.4	10.7	10.9	10.5	26.1	25.1	11.5	10.6	10.1	9.6	9.5
VMP7A	-	11.5	11.4	10.9	28.1	26.9	11.6	11.1	10.4	9.7	10.1
VMP7B	-	9.9	3.8	7.6	25.1	26.1	8.9	9.2	8.3	8.1	8.5
VMP8A	12.7	12.8	10.2	9.9	27.1	24.8	11.9	11.9	10.8	10.2	10.9
VMP8B	11.1	10.4	12.0	11.3	26.9	24.3	11.4	10.4	9.7	9.4	10.1
VMP9A	14.9	15.1	12.6	13.1	30.3	29.1	15.6	14.8	14.2	13.9	15.1
VMP9B	15.7	15.3	13.6	13.2	30.4	29.2	14.9	14.9	14.1	13.8	14.5
VMP10A	-	11.8	3.4	10.9	24.5	25.3	10.8	11.6	10.7	10.6	11.2
VMP10B	-	13.4	11.9	11.6	28.6	27.6	12.4	11.8	11.2	10.7	11.2

Notes:

1) Vacuum measurements made with a digital manometer; units are in inches of water

VMP: vapor monitoring point

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

Date	Blowers	Sparge	Sparge Group	SVE1	SVE2	SVE3	SVE4	SVE5	SVE6	SVE7	SVE8	SVE9	SVE10	SVE11	SVE12	Effluent
1/6/2012	1	Y	A	11.1	8.7	8.9	13.9	25.6	11.4	11.7	16.4	4.8	4.6	10.8	5.7	12.8
1/13/2012	1	Y	C	10.8	8.7	8.6	13.1	25.2	10.8	11.2	15.9	4.8	4.6	10.7	5.5	12.4
1/20/2012	1	N	-	10.7	8.3	8.4	12.7	24.4	10.4	10.9	15.4	4.5	4.2	10.2	4.9	11.7
1/28/2012	1	Y	A	9.6	7.4	7.6	11.9	16.7	9.6	9.8	13.1	3.7	3.5	8.9	4.1	10.7
2/3/2012	1	Y	C	9.1	7.0	7.8	10.8	13.2	8.8	10.1	12.4	3.2	3.3	7.8	4.2	10.6
2/10/2012	1	Y	A	8.8	6.9	7.2	10.1	12.8	8.4	9.4	11.8	2.9	3.1	7.7	4.2	10.4
2/17/2012	1	N	-	0.2	0.4	0.2	0.1	0.2	0.2	1.0	0.2	0.2	0.2	0.3	0.2	0.3
2/25/2012	1	Y	B	8.9	7.0	7.1	10.3	13.0	8.6	9.7	12.1	3.0	3.1	8.0	5.0	10.9
3/2/2012	1	Y	B	9.0	7.2	8.0	10.5	15.4	10.1	10.2	14.6	5.0	3.8	9.5	5.1	11.2
3/9/2012	1	Y	A	8.8	7.1	7.9	10.2	14.8	9.5	9.8	13.5	4.8	3.6	9.1	5.2	11.1
3/16/2012	1	N	-	0.3	0.4	0.3	0.1	0.2	0.1	0.8	0.1	0.1	0.1	0.2	0.1	0.3
3/23/2012	1	Y	B	8.3	7.0	7.8	10.3	13.6	9.3	9.4	13.2	4.2	3.7	8.9	5.1	11.0
3/31/2012	1	Y	A	8.2	7.1	7.8	10.0	12.8	9.4	9.4	13.0	5.0	3.6	9.1	5.7	11.4
4/6/2012	2	Y	C	8.0	7.2	7.8	10.2	12.9	9.8	9.5	13.3	4.9	4.0	9.1	5.7	11.5
4/13/2012	2	Y	C	7.7	6.9	7.3	10.1	12.2	8.4	9.6	13.4	4.6	3.7	8.8	5.2	11.0
4/21/2012	2	Y	C	2.3	3.6	1.0	1.4	0.5	0.4	0.6	0.6	0.7	1.0	0.7	0.8	0.9
4/28/2012	1	N	-	0.2	0.2	0.3	0.1	0.2	0.1	0.2	0.1	0.1	0.2	0.2	0.2	0.2
5/4/2012	2	Y	A	4.0	3.7	1.4	2.1	1.1	0.9	0.7	0.6	0.7	0.9	0.8	0.8	1.0
5/11/2012	1	Y	C	2.9	3.6	1.2	1.5	0.8	0.6	0.7	0.6	0.7	0.8	0.8	0.7	1.0
5/18/2012	1	Y	B	2.8	3.6	1.1	1.4	0.9	0.7	0.6	0.8	0.6	0.7	0.6	0.8	0.9
5/25/2012	1	N	-	2.5	3.2	0.9	1.3	0.7	0.5	0.6	0.5	0.9	0.7	0.7	0.9	1.1
6/1/2012	1	Y	C	1.7	1.8	1.9	1.4	2.3	2.5	2.2	2.2	1.7	2.2	2.1	1.9	1.1
6/14/2012	2	Y	A	1.2	2.8	1.1	1.0	3.1	0.7	3.8	1.3	2.7	0.8	1.0	1.0	4.1
6/21/2012	2	Y	C	1.9	2.4	2.1	2.6	17.1	17.3	16.5	-	18.1	20.8	16.3	-	17.0
6/29/2012	2	Y	C	1.6	1.5	1.4	1.2	18.0	19.4	18.6	-	17.8	14.2	15.9	-	4.9
7/13/2012	1	Y	C	1.7	1.6	1.4	1.3	17.9	18.1	17.3	-	18.2	17.3	15.6	-	7.1
7/21/2012	1	Y	C	1.8	2.1	1.5	1.3	18.1	17.9	17.6	-	18.0	17.5	15.7	-	7.4
7/27/2012	1	Y	B	2.1	1.7	1.6	1.3	18.0	17.9	17.8	-	18.1	17.2	15.8	-	5.5
8/3/2012	1	Y	A	0.9	2.4	1.6	1.1	16.8	18.4	16.9	-	17.6	16.2	15.4	-	6.3
8/10/2012	1	Y	A	1.6	1.8	1.4	1.2	18.2	17.7	17.8	-	17.4	16.0	16.0	-	6.4
8/17/2012	1	Y	B	1.7	1.9	1.4	1.4	17.8	18.2	17.9	-	18.1	17.1	15.8	-	7.2
8/24/2012	1	Y	B	1.8	2.0	1.3	1.4	17.1	18.3	17.6	-	17.9	17.3	15.8	-	6.8
9/1/2012	1	Y	A	1.4	1.8	1.1	1.0	14.3	15.3	16.2	-	15.8	14.8	15.4	-	5.5
9/10/2012	1	Y	C	1.1	1.7	1.0	1.0	14.3	14.8	16.2	-	14.7	14.2	14.4	-	5.1
9/15/2012	1	Y	A	1.0	1.8	1.1	0.9	13.8	14.2	15.2	-	12.9	13.7	13.8	-	5.1
9/22/2012	1	Y	C	0.9	1.8	1.0	1.0	12.5	13.9	15.3	-	12.2	13.3	13.7	-	5.0
9/28/2012	1	Y	A	1.0	1.7	1.0	1.1	12.1	13.5	15.1	-	11.8	13.1	13.5	-	5.0
10/5/2012	1	Y	B	0.9	1.7	0.9	1.0	12.1	13.4	15.2	-	11.9	13.2	13.2	-	4.9
10/12/2012	1	Y	B	1.0	1.9	1.1	1.0	12.3	13.7	15.2	-	12.1	12.9	13.2	-	5.1
10/25/2012	1	Y	A	0.9	1.7	0.9	0.9	12.1	13.4	15.1	2.1	11.8	12.8	13.1	1.0	5.0
11/2/2012	1	Y	B	1.0	1.7	1.0	0.9	11.9	13.1	15.2	3.3	11.7	13.3	13.1	1.1	5.2
11/16/2012	1	Y	C	0.9	1.8	0.9	0.9	12.1	13.1	15.1	2.9	11.9	13.2	13.2	1.0	5.2
12/1/2012	1	Y	A	1.0	1.8	1.0	1.0	12.1	13.3	15.1	2.2	12.0	13.3	13.2	0.9	5.1
12/7/2012	1	Y	B	1.0	1.7	1.0	0.9	8.7	9.1	10.5	2.0	9.2	8.6	8.4	0.8	4.7
12/14/2012	1	Y	B	0.9	1.2	1.0	0.9	7.4	9.2	9.9	2.1	9.4	8.2	8.4	0.9	4.1
12/29/2012	1	Y	C	1.0	1.3	0.9	1.0	7.2	9.0	9.0	2.0	8.9	8.2	8.1	0.9	2.8

Notes:

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

PID: photoionization detector

SVE: soil vapor extraction

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

Date	1/30/2012	2/27/2012	3/23/2012	5/23/2012	6/21/2012	7/31/2012	8/29/2012	9/26/2012	10/29/2012	11/28/2012	12/19/2012
Blowers	1	1	1	1	2	1	1	1	1	1	1
Sparge	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
VMP1A	0.4	0.3	0.4	0.3	0.0	0.2	0.1	0.1	0.1	0.1	0.1
VMP1B	0.3	0.3	0.3	0.3	0.2	0.1	0.1	0.2	0.1	0.1	0.0
VMP2A	0.3	0.2	0.2	0.2	0.0	0.0	0.0	0.1	0.1	0.1	0.1
VMP2B	0.2	0.2	0.3	0.2	0.5	0.4	0.3	0.3	0.2	0.1	0.0
VMP3A	0.2	0.1	1.0	0.4	0.4	0.4	0.2	0.1	0.1	0.1	0.1
VMP3B	0.2	0.2	0.9	0.8	0.2	0.1	0.1	0.1	0.2	0.1	0.1
VMP4A	0.4	0.4	1.4	0.6	0.0	0.0	0.1	0.1	0.1	0.2	0.2
VMP4B	0.4	0.3	1.4	1.0	0.4	0.3	0.2	0.1	0.1	0.1	0.1
VMP5A	0.3	0.3	0.7	0.8	0.0	0.3	0.0	0.1	0.1	0.1	0.1
VMP5B	0.5	0.4	0.8	0.5	0.0	0.0	0.0	0.0	0.0	0.1	0.1
VMP6A	0.2	0.1	0.3	0.4	0.1	0.1	0.0	0.1	0.1	0.1	0.1
VMP6B	0.3	0.1	0.2	0.3	0.0	0.0	0.0	0.1	0.1	0.1	0.1
VMP7A	0.1	0.1	0.4	0.2	3.2	0.1	0.1	0.0	0.1	0.1	0.1
VMP7B	0.1	0.1	0.6	0.4	0.0	0.1	0.2	0.1	0.1	0.0	0.1
VMP8A	0.3	0.2	0.3	0.3	0.0	0.2	0.2	0.0	0.1	0.1	0.0
VMP8B	0.3	0.3	0.3	0.3	0.0	0.2	0.2	0.0	0.0	0.1	0.0
VMP9A	0.4	0.2	0.3	0.3	0.0	0.3	0.3	0.2	0.1	0.0	0.0
VMP9B	0.5	0.4	0.4	0.4	0.0	0.2	0.2	0.1	0.0	0.1	0.1
VMP10A	0.1	0.1	0.7	0.6	0.1	0.5	0.1	0.1	0.1	0.0	0.1
VMP10B	0.1	0.2	0.2	0.3	0.0	0.1	0.1	0.2	0.1	0.0	0.0

Notes:

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

PID: photoionization detector

VMP: vapor monitoring point

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

Analyte	Location Lab ID Date Units	ODSVE-EFF P1200622-001 16-Feb-12	ODSVE-EFF P1201356-001 31-Mar-12	ODSVE-EFF P1202436-001 14-Jun-12	ODSVE-EFF P1204031-001 28-Sep-12	ODSVE-EFF P1300099-001 29-Dec-12
1,1,2,2-Tetrachloroethane	ppbv	2.4	1	1.2	0.91	1.4
1,1,2-Trichloroethane	ppbv	0.075 J	0.046 J	<0.69	0.038 J	0.037 J
1,1-Dichloroethene	ppbv	1.6	1.6	1.6	2.5	2.5
1,2-Dichloroethane	ppbv	<0.3	<0.17	<0.93	<0.16	<0.14
Carbon Tetrachloride	ppbv	0.19 J	0.25	0.3 J	0.29	0.37
Chloroform	ppbv	2	2.2	3.3	2.3	2.5
cis-1,2-Dichloroethene	ppbv	1.3	1.7	1.5	1.6	1.3
Dichloromethane (Methylene Chloride)	ppbv	0.11 JB	0.1 JB	1.2	0.12 J	0.068 J
Tetrachloroethene	ppbv	0.5	1.9	0.78	1.8	3.1
trans-1,2-Dichloroethene	ppbv	0.17 J	0.19	<0.95	0.26	0.36
Trichloroethene	ppbv	13	19	18	23	17
Vinyl Chloride	ppbv	<0.48	0.15 J	<1.5	0.27	<0.23
Total CVOCs		21.3	28.1	27.9	33.1	28.6
1,1,1-Trichloroethane	ppbv	0.76	0.8	1	1.3	1.3
1,1,2-Trichlorotrifluoroethane	ppbv	4	4.8	5.6	5.1	5.6
1,1-Dichloroethane	ppbv	0.63	0.63	0.72 J	0.84	0.73
Dichlorodifluoromethane (CFC 12)	ppbv	0.56	0.54	0.6 J	1	1.3
Ethyl Acetate	ppbv	<0.34	0.28 J	1.2 J	1.1	<0.32
n-Hexane	ppbv	<0.35	0.24	1.1 J	0.17 J	<0.16
Tetrahydrofuran (THF)	ppbv	<0.41	<0.24	3.6	<0.21	<0.2
Toluene	ppbv	<0.32	0.58	170	0.11 J	0.57
Trichlorofluoromethane (CFC 11)	ppbv	0.27	0.27	0.32 J	0.33	0.34
Total VOCs		27.6	36.0	208	42.8	38.5

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 THREE
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	0.0015	2.5	70.5
12/7/2010	3/24/2011	872	965	60.4	64.7	0.0013	1.1	71.6
3/24/2011	6/17/2011	783	974	66.0	63.2	0.0013	1.0	72.6
6/17/2011	9/16/2011	1042	958	50.8	58.4	0.0012	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	0.0021	2.1	77.2
6/30/2012	9/30/2012	1124	612	42.8	125	0.0016	1.8	79.0
9/30/2012	12/31/2012	1061	628	38.5	40.7	0.0005	0.6	79.6

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

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

FIGURES

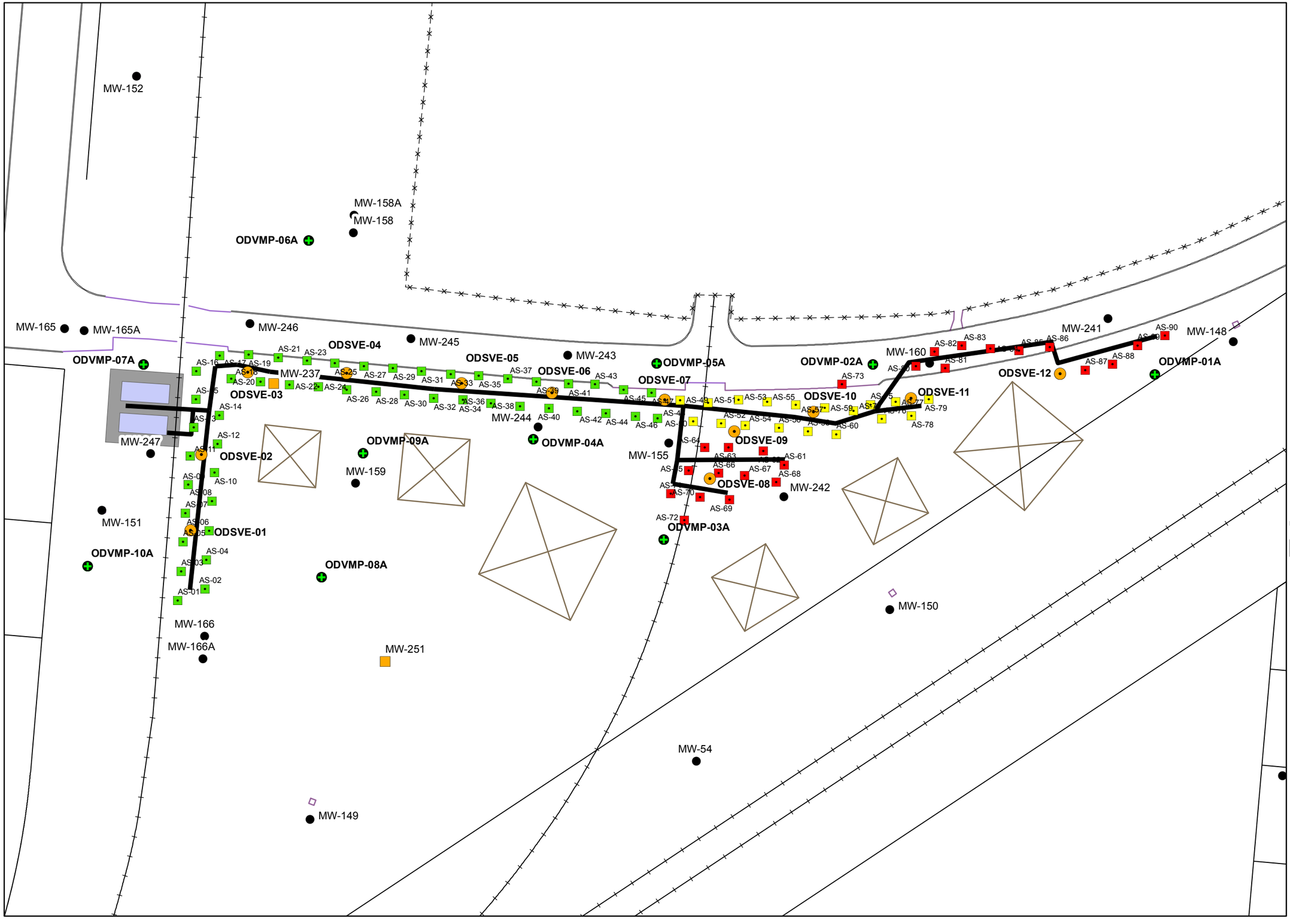

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Figure 1

AS-SVE SYSTEM PLAN MAP

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

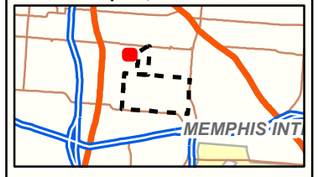
DUNN FIELD
DEFENSE DEPOT
MEMPHIS, TENNESSEE

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: January 2013
Edition: Rev 0

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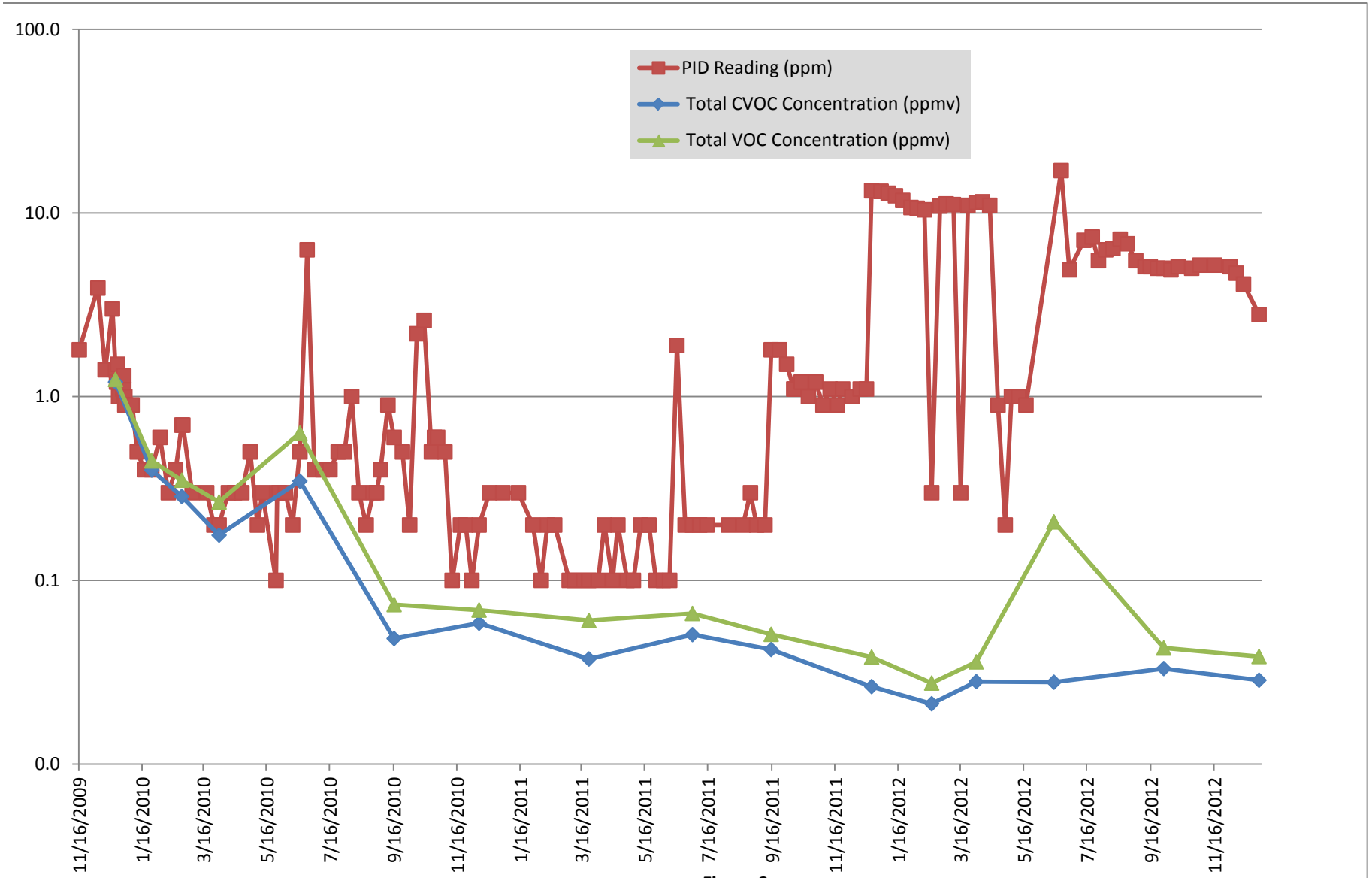

Figure 2
EFFLUENT CONCENTRATION TREND - ANALYTICAL RESULTS AND FIELD PID MEASUREMENTS
OFF DEPOT AS-SVE SYSTEM
ANNUAL OPERATIONS REPORT, YEAR THREE
Dunn Field – Defense Depot Memphis, Tennessee

APPENDIX A

RESULTS OF LABORATORY ANALYSES

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

Analyte	Location Lab ID Event Date Units	ODSVE-EFF P1200622-001 ODSVE_021612 16-Feb-12	ODSVE-EFF P1201356-001 ODSVE_1Q12 31-Mar-12	ODSVE-EFF P1202436-001 ODSVE_2Q12 14-Jun-12	ODSVE-EFF P1204031-001 ODSVE_3Q12 28-Sep-12	ODSVE-EFF P1300099-001 ODSVE_4Q12 29-Dec-12
1,1,1-Trichloroethane (TCA)	ppbv	0.76	0.8	1	1.3	1.3
1,1,2,2-Tetrachloroethane	ppbv	2.4	1	1.2	0.91	1.4
1,1,2-Trichloroethane	ppbv	0.075 J	0.046 J	<0.69	0.038 J	0.037 J
1,1,2-Trichlorotrifluoroethane	ppbv	4	4.8	5.6	5.1	5.6
1,1-Dichloroethane (1,1-DCA)	ppbv	0.63	0.63	0.72 J	0.84	0.73
1,1-Dichloroethene (1,1-DCE)	ppbv	1.6	1.6	1.6	2.5	2.5
1,2,4-Trichlorobenzene	ppbv	<0.16	<0.094	<0.51	<0.085	<0.077
1,2,4-Trimethylbenzene	ppbv	<0.25	<0.14	<0.77	<0.13	<0.12
1,2-Dibromo-3-chloropropane (DBCP)	ppbv	<0.13	<0.072	<0.39	<0.065	<0.06
1,2-Dibromoethane	ppbv	<0.16	<0.09	<0.49	<0.082	<0.075
1,2-Dichloro-1,1,2,2-tetrafluoroethane (CFC 114)	ppbv	<0.17	<0.099	<0.54	<0.09	<0.082
1,2-Dichlorobenzene	ppbv	<0.2	<0.12	<0.63	<0.1	<0.096
1,2-Dichloroethane	ppbv	<0.3	<0.17	<0.93	<0.16	<0.14
1,2-Dichloropropane	ppbv	<0.26	<0.15	<0.82	<0.14	<0.12
1,3,5-Trimethylbenzene	ppbv	<0.25	<0.14	<0.77	<0.13	<0.12
1,3-Butadiene	ppbv	<0.55	<0.31	<1.7	<0.28	<0.26
1,3-Dichlorobenzene	ppbv	<0.2	<0.12	<0.63	<0.1	<0.096
1,4-Dichlorobenzene	ppbv	<0.2	<0.12	<0.63	<0.1	<0.096
1,4-Dioxane	ppbv	<0.34	<0.19	<1	<0.17	<0.16
2-Butanone (MEK)	ppbv	0.22 J	0.39 J	5.1 J	0.28 J	0.12 J
2-Hexanone	ppbv	0.067 J	<0.17	<0.92	0.12 J	<0.14
2-Propanol (Isopropyl Alcohol)	ppbv	<0.5	<0.57	1.3 J	<2.6	<2.3
3-Chloro-1-propene (Allyl Chloride)	ppbv	<0.39	<0.22	<1.2	<0.2	<0.18
4-Ethyltoluene	ppbv	<0.25	<0.14	<0.77	<0.13	<0.12
4-Methyl-2-pentanone	ppbv	<0.3	<0.17	0.46 J	<0.15	<0.14
Acetone	ppbv	1.3 J	2.6 J	5.5 J	<2.7	<2.4
Acetonitrile	ppbv	<0.73	0.2 J	<2.3	<0.38	<0.34
Acrolein	ppbv	0.14 J	<1.2	<6.6	<1.1	<1
Acrylonitrile	ppbv	<0.56	<0.32	<1.7	<0.29	<0.27
alpha-Pinene	ppbv	<0.22	<0.12	<0.68	<0.11	<0.1
Benzene	ppbv	0.064 J	0.068 J	0.49 J	<0.2	<0.18
Benzyl Chloride	ppbv	<0.24	<0.13	<0.73	<0.12	<0.11
Bromodichloromethane	ppbv	<0.18	<0.1	<0.56	<0.094	<0.086
Bromoform	ppbv	<0.12	<0.067	<0.37	<0.061	<0.056
Bromomethane	ppbv	<0.31	<0.18	<0.97	<0.16	<0.15
Carbon Disulfide	ppbv	0.14 J	0.15 J	0.33 J	0.15 J	0.071 J
Carbon Tetrachloride	ppbv	0.19 J	0.25	0.3 J	0.29	0.37
Chlorobenzene	ppbv	<0.27	<0.15	<0.82	<0.14	<0.12
Chloroethane	ppbv	<0.46	<0.26	<1.4	<0.24	<0.22
Chloroform	ppbv	2	2.2	3.3	2.3	2.5
Chloromethane	ppbv	<0.59	<0.34	<1.8	<0.31	<0.28
cis-1,2-Dichloroethene	ppbv	1.3	1.7	1.5	1.6	1.3
cis-1,3-Dichloropropene	ppbv	<0.27	<0.15	<0.83	<0.14	<0.13
Cyclohexane	ppbv	<0.35	<0.4	<2.2	<0.37	<0.33
Dibromochloromethane	ppbv	<0.14	<0.082	<0.44	<0.074	<0.068
Dichlorodifluoromethane (CFC 12)	ppbv	0.56	0.54	0.6 J	1	1.3
Dichloromethane (Methylene Chloride)	ppbv	0.11 JB	0.1 JB	1.2	0.12 J	0.068 J
d-Limonene	ppbv	<0.22	<0.12	<0.68	<0.11	<0.1
Ethanol	ppbv	<3.2	<3.7	6.4 J	<3.3	<3.1
Ethyl Acetate	ppbv	<0.34	0.28 J	1.2 J	1.1	<0.32
Ethylbenzene	ppbv	<0.28	<0.16	<0.87	<0.15	<0.13
Hexachlorobutadiene	ppbv	<0.11	<0.065	<0.35	<0.059	<0.054
Isopropylbenzene (Cumene)	ppbv	<0.25	<0.14	<0.77	<0.13	<0.12
m,p-Xylenes	ppbv	<0.28	<0.32	<1.7	<0.29	<0.26
Methyl Methacrylate	ppbv	<0.3	<0.34	<1.8	<0.31	<0.28
Methyl tert-Butyl Ether	ppbv	<0.34	<0.19	<1	<0.17	<0.16
Naphthalene	ppbv	<0.23	<0.13	<0.72	<0.12	<0.11
n-Butyl Acetate	ppbv	<0.26	<0.15	0.38 J	<0.13	<0.12
n-Heptane	ppbv	<0.3	<0.17	<0.92	0.052 J	<0.14
n-Hexane	ppbv	<0.35	0.24	1.1 J	0.17 J	<0.16
n-Nonane	ppbv	<0.23	<0.13	<0.72	<0.12	<0.11
n-Octane	ppbv	<0.26	<0.15	<0.81	<0.13	<0.12
n-Propylbenzene	ppbv	<0.25	<0.14	<0.77	<0.13	<0.12
o-Xylene	ppbv	<0.28	<0.16	<0.87	<0.15	<0.13
Propene	ppbv	0.31 J	0.4 J	<2.2	0.18 J	0.1 J
Styrene	ppbv	<0.29	<0.16	<0.89	<0.15	<0.14
Tetrachloroethene	ppbv	0.5	1.9	0.78	1.8	3.1
Tetrahydrofuran (THF)	ppbv	<0.41	<0.24	3.6	<0.21	<0.2
Toluene	ppbv	<0.32	0.58	170	0.11 J	0.57
trans-1,2-Dichloroethene	ppbv	0.17 J	0.19	<0.95	0.26	0.36
trans-1,3-Dichloropropene	ppbv	<0.27	<0.15	<0.83	<0.14	<0.13
Trichloroethene (TCE)	ppbv	13	19	18	23	17
Trichlorofluoromethane (CFC 11)	ppbv	0.27	0.27	0.32 J	0.33	0.34
Vinyl Acetate	ppbv	<1.7	<2	<11	<1.8	<1.6
Vinyl Chloride	ppbv	<0.48	0.15 J	<1.5	0.27	<0.23

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

APPENDIX B

DATA QUALITY EVALUATION

DATA QUALITY EVALUATION

System monitoring for the Off Depot Air Sparging and Soil Vapor Extraction (AS/SVE) System during Year Three included sampling and analysis of soil vapor effluent. Samples were collected quarterly in March, June, September and December 2012 to evaluate performance and ensure compliance with discharge limits. An additional sample was collected in February 2012 to evaluate higher PID readings in SVE wells and effluent observed since December 2011. 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. The field and laboratory procedures were performed in accordance with past practice and the *Remedial Action Sampling and Analysis Plan* (RA SAP) (MACTEC, 2005).

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. 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 2012 and one extra sample collected in February 2012. 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. 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, laboratory duplicates 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. 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 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 B-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 were analyzed to assess laboratory precision and consisted of a second sample analyzed from the same canister. Precision is best expressed in terms of relative percent difference (RPD). Laboratory precision goals were met for the duplicate sample pairs. Laboratory precision is discussed in more detail in the attached narratives.

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).

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 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. Past data are comparable to recent events. Consistent methodology has been maintained throughout the sampling events.

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.

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. Results with RLs above the project quantitation limits (PQLs) are shown below. All results are usable.

Analyte	Project Action Limit (ppbv)	Project Quantitation Limit (ppbv)	Sample RL (ppbv)	Result
1,1-Dichloroethene (1,1-DCE)	29.03	0.5	0.95	Usable – result of 1.6 ppbv is above PQL and well below PAL
Methylene Chloride	2.85	0.5	1.1	Usable – result of 1.2 ppbv is above PQL and well below PAL
trans-1,2-Dichloroethene	133.5	0.5	0.95	Usable – result is non-detect above MDL of 0.29, which is below PQL and well below PAL
cis-1,2-Dichloroethene	39.52	0.5	0.95	Usable – result of 1.5 ppbv is above PQL and well below PAL
Chloroform	32.63	0.5	0.77	Usable – result of 3.3 ppbv is above PQL and well below PAL
1,2-Dichloroethane	0.64	0.4	0.93	Usable – result is non-detect at MDL of 0.26, which is below PQL and well below PAL ND
Carbon Tetrachloride	14.22	0.5	0.6	Usable – result of 0.3 ppbv is below PQL and well below PAL

Analyte	Project Action Limit (ppbv)	Project Quantitation Limit (ppbv)	Sample RL (ppbv)	Result
Trichloroethene (TCE)	2.06	0.5	0.7	Usable – result of 18 ppbv is above PQL and well above PAL
1,1,2-Trichloroethane	2.03	0.5	0.69	Usable – result is non-detect at MDL of 0.18, which is below PQL and well below PAL
Tetrachloroethene	0.99	0.5	0.56	Usable – result of 0.78 ppbv is above PQL and below PAL
1,1,2,2-Tetrachloroethane	0.55	0.4	0.55	Usable – result of 1.2 ppbv is above PQL and above PAL
Vinyl chloride	14.77	0.5	1.5	Usable – result is non-detect at MDL of 0.44, which is below PQL and well below PAL

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 Extra Sampling Event – February 2012

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 – March 2012

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 2012

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. A laboratory duplicate was also analyzed. 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.
- Isopropyl alcohol was additionally qualified "J" due to a high relative standard deviation (RSD) in the initial calibration.

AS/SVE Effluent Quarterly Sampling Event – September 2012

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 – December 2012

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.

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

SDG	Field Samples
AS/SVE Effluent Quarterly Event - February - March 2012	
P1200622	ODSVE-EFF-021612
P1201356	ODSVE-EFF-1Q12
AS/SVE Effluent Quarterly Event - June 2012	
P1202436	ODSVE-EFF-2Q12
AS/SVE Effluent Quarterly Event - September 2012	
P1204031	ODSVE-EFF-3Q12
AS/SVE Effluent Quarterly Event - December 2012	
P1300099	ODSVE-EFF-4Q12

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: P1200622 , project 121842-002

PROJECT: Memphis Defense Depot soil vapor extraction for HDR Inc. (formerly e2m)

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

SAMPLE MATRIX: Air

SAMPLING DATE (Month/Year): February 2012

NUMBER OF SAMPLES: 1 sample

ANALYSES REQUESTED: Summa Canister VOA TO-15

SAMPLE NO.: ODSVE-EFF-021612

DATA REVIEWER: Diane Short

QA REVIEWER: Diane Short & Associates, Inc. INITIALS/DATE: DLS 4/3/2012

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/e2m 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.

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 ____

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
P1200622-001	ODSVE-EFF-021612	Dichloromethane (Methylene Chloride)	0.11	F, B	0.053	BMB.055

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.

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 III 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.

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.

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.

TABLE OF QUALIFIED DATA

LAB_ID	CLIENT_ID	ANALYTE	Result ppbv	flag	MDL	Qualifier
P1200622-001	ODSVE-EFF-021612	Dichloromethane (Methylene Chloride)	0.11	F, B	0.053	BMB.055

Final Data Qualification and Usability Report

Project:	Defense Depot Memphis, TN (DDMT) OD-SVE
Sampling Event:	OD-SVE February 2012
Project / Task Number:	145803-002
Sample Data Package(s):	P1200622
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 for detected methylene chloride results associated with the method blank with methylene chloride were B where DSA had qualified as BMB.055.

Final qualifiers were J where detected results were between the MDL and RL.

Final qualifiers were JB where both the above instances occurred.

Data Usability

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

3 April 2012

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: P1201356 , project 145803-002

PROJECT: Memphis Defense Depot off depot soil vapor extraction for HDR Inc. (formerly e2m)

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

SAMPLE MATRIX: Air

SAMPLING DATE (Month/Year): March 2012

NUMBER OF SAMPLES: 1 sample

ANALYSES REQUESTED: Summa Canister VOA TO-15

SAMPLE NO.: ODSVE-EFF -1Q12

DATA REVIEWER: Diane Short

QA REVIEWER: Diane Short & Associates, Inc. INITIALS/DATE: __DLS_7/5/2012_____

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/e2m 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.

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 1st quarter 2012 samples were collected on 3/31/12 and relinquished 4/5/12. The project record contains storage information.

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 ____
Outliers were not client compounds.

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 __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 blank at 0.049 ppbv . The client sample data are qualified BMB#, where # is the blank value. Corrections for the canister volume dilution factor have not been incorporated as the qualifier would not change in application. Only data that are less than 10 x the blank (corrected for dilution) are qualified.

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 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 after consideration of qualifiers or comments. Points of significance are summarized below:
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>Method Blanks</u>
Methylene chloride was reported in the method blank at 0.049 ppbv. The client sample data are qualified BMB.049, where # is the blank value. Corrections for the canister volume dilution factor have not been incorporated as the qualifier would not change in application. Only data that are less than 10 x the blank are qualified.

Final Data Qualification and Usability Report

Project:	Defense Depot Memphis, TN (DDMT) OD-SVE
Sampling Event:	OD-SVE March 2012
Project / Task Number:	145803-002
Sample Data Package(s):	P1201356
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 validator noted that "[n]o [BFB] tunes were provided and are not required for Level III." BFB tunes were actually included in the pdf data package and were acceptable.

The data validation report was acceptable.

Final Data Qualifiers

Final qualifiers for detected methylene chloride results associated with the method blank with methylene chloride were B where DSA had qualified as BMB.049.

Final qualifiers were J where detected results were between the MDL and RL.

Final qualifiers were JB where both the above instances occurred.

Data Usability

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

6 July 2012

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: P1202436, project 145803-002

PROJECT: Memphis Defense Depot soil vapor event for HDR Inc. (formerly e2m)

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

SAMPLE MATRIX: Air

SAMPLING DATE (Month/Year): June 2012

NUMBER OF SAMPLES: 1 Air

ANALYSES REQUESTED: Summa Canister VOA TO-15

SAMPLE NO.: ODSVE-EFF-2Q12

DATA REVIEWER: Diane Short

QA REVIEWER: Diane Short & Associates, Inc. INITIALS/DATE: __DLS_9/24/2012_____

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/e2m 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.

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 _____ No __X__
Calibrations were out of limits for the following compounds. There could be variability to the reported data as there is variability to the response. Linear curves are not reported in the calibration data.

Lab ID	Client ID	Compound	Result ppbV	Flag	Dil'n	MDL	Qualifier
P1202436-01	ODSVE-EFF-2Q12	2-Propanol (Isopropyl Alcohol)	1.3	J	1.36	1.0	JC35.45

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 ____
For client compounds

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 _____ No____ NA __X__
No tunes were provided and are not necessarily part of the Level III deliverable.

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.
The duplicate run was reported for ODSVE-EFF-2Q12. All are within limits.

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 ___

There was one LCS for each QC batch that was reported.

B. And percent recoveries were acceptable at 70 – 130%.
Yes _X___ No ____
There was an LCS reported for all days of analysis. The QAPP limits noted above are used, not the laboratory limits. Both limits are met as the lab limits are sometimes tighter.

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 at 0.049 ppbv. Client results are > 10 x blank (corrected for dilution) and no qualifier is required.

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. The EDD contains only pbbV results

XI. FIELD QC
If Field duplicates or Performance Check Compounds were identified, they met the $\leq$ 25 %RPD or % recovery criteria for the project.
Yes ___ No _X___ NA___
No field duplicate pair is reported as this is an ongoing collection and monitoring of this sample and precision is over the life of the program.

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___

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 III data packages were submitted and Level III validation was performed for holding times, chain of custody, calibrations and QC.

Calibration:
Calibrations were out of limits for the following compounds. There could be variability to the reported data as there is variability to the response. Linear curves are not reported in the calibration data.

Lab ID	Client ID	Compound	Result ppbV	Flag	Dil'n	MDL	Qualifier
P1202436-01	ODSVE-EFF-2Q12	2-Propanol (Isopropyl Alcohol)	1.3	J	1.36	1.0	JC35.45

Laboratory Duplicates:
The duplicate run was reported for ODSVE-EFF-2Q12. All are within limits.

Method Blank
Methylene chloride was reported at 0.049 ppbv. Client results are > 10 x blank (corrected for dilution) and no qualifier is required.

Field Duplicates
None required for ongoing monitoring.

Final Data Qualification and Usability Report

Project:	Defense Depot Memphis, TN (DDMT) OD-SVE
Sampling Event:	OD-SVE June 2012
Project / Task Number:	145803-002
Sample Data Package(s):	P1202436
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 qualifier for isopropyl alcohol (2-propanol) was J where DSA had qualified as JC35.45 due to an initial calibration RRF.

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.

4 October 2012

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: P1204031 , project 145803-002

PROJECT: Memphis Defense Depot off depot soil vapor extraction for HDR Inc. (formerly e2m)

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

SAMPLE MATRIX: Air

SAMPLING DATE (Month/Year): September 2012

NUMBER OF SAMPLES: 1 sample

ANALYSES REQUESTED: Summa Canister VOA TO-15

SAMPLE NO.: ODSVE-EFF -3Q12

DATA REVIEWER: Diane Short

QA REVIEWER: Diane Short & Associates, Inc. INITIALS/DATE: __DLS_11/9/2012_____

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/e2m 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.

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.
Note that the log-in form has a project number of 145803.000. The chain and our records note 145803.002

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 ____

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 __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 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 not high enough to require dilution. Vinyl chloride is noted as requiring manual integration which is acceptable per the method.

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>Calibration:</u>
Outliers were not client compounds. Propene was recovered at 29.8% in the ICV. The same limits as the CCAL have been applied and no qualifier is added.

<u>Reported Results:</u>
It is noted that there are high values for trichloroethene and not high enough to require dilution. Vinyl chloride is noted as requiring manual integration which is acceptable per the method.

Final Data Qualification and Usability Report

Project:	Defense Depot Memphis, TN (DDMT) OD-SVE
Sampling Event:	OD-SVE September 2012
Project / Task Number:	145803-002
Sample Data Package(s):	P1204031
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.

31 January 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: P1300099 , project 145803-002

PROJECT: Memphis Defense Depot off depot soil vapor extraction for HDR Inc. (formerly e2m)

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

SAMPLE MATRIX: Air

SAMPLING DATE (Month/Year): December 2012

NUMBER OF SAMPLES: 1 sample

ANALYSES REQUESTED: Summa Canister VOA TO-15

SAMPLE NO.: ODSVE-EFF -4Q12

DATA REVIEWER: Diane Short

QA REVIEWER: Diane Short & Associates, Inc. INITIALS/DATE: DLS 1/31/2013

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/e2m 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.

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.

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 ____

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.

Reported Results:
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) OD-SVE
Sampling Event:	OD-SVE December 2012 (4Q12)
Project / Task Number:	327-145803-002
Sample Data Package(s):	P1300099
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.

31 January 2013

Lynn K. Lutz, HDR Inc. Date