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**Periodic Monitoring Report for  
Vapor-Sampling Activities at  
Material Disposal Area T,  
Consolidated Unit 21-016(a)-99,  
at Technical Area 21,  
Fourth Quarter Fiscal Year 2011**




Prepared by the Environmental Programs Directorate

Los Alamos National Laboratory, operated by Los Alamos National Security, LLC, for the U.S. Department of Energy under Contract No. DE-AC52-06NA25396, has prepared this document pursuant to the Compliance Order on Consent, signed March 1, 2005. The Compliance Order on Consent contains requirements for the investigation and cleanup, including corrective action, of contamination at Los Alamos National Laboratory. The U.S. government has rights to use, reproduce, and distribute this document. The public may copy and use this document without charge, provided that this notice and any statement of authorship are reproduced on all copies.


# Periodic Monitoring Report for Vapor-Sampling Activities at Material Disposal Area T, Consolidated Unit 21-016(a)-99, at Technical Area 21, Fourth Quarter Fiscal Year 2011

January 2012

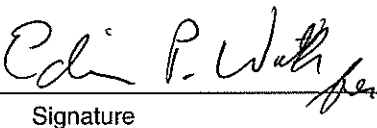
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## EXECUTIVE SUMMARY

This periodic monitoring report summarizes vapor-monitoring activities conducted during the fourth quarter of fiscal year (FY) 2011 at Material Disposal Area (MDA) T, Consolidated Unit 21-016(a)-99, in Technical Area 21, at Los Alamos National Laboratory. The objectives of vapor monitoring at MDA T are to (1) collect additional vapor samples from vapor-monitoring wells at MDA T and (2) compare sampling results with previously detected volatile organic compound (VOC) concentrations and tritium activities in pore gas beneath and surrounding MDA T.

Vapor monitoring included field screening and collecting vapor samples from five vapor-monitoring wells. Vapor samples were submitted for laboratory analysis of VOCs and tritium. The results of the detected VOCs in MDA T pore gas during the fourth quarter of FY2011 were similar to previous sampling results. The VOC screening evaluation identified two VOCs in MDA T pore gas at concentrations exceeding screening levels that are based on groundwater screening levels. All VOC concentrations in the deepest port sampled at MDA T were low or nondetect and did not exceed screening values.

The detected tritium activities in MDA T during the fourth quarter of FY2011 were similar to previous sampling results. The inconsistent peak activity reported in vapor-monitoring well 21-607955 during the October to December 2010 sampling event was not repeated during the fourth quarter of FY2011 sampling event.

In a letter submitted to the New Mexico Environment Department (NMED) on November 1, 2011, the U.S. Department of Energy and Los Alamos National Security, LLC, proposed to discontinue vapor sampling at MDA T beginning in the first quarter of FY2012 and instead monitor the current approved sampling ports on an annual basis. A letter was received by NMED on November 14, 2011, directing the Permittees to discontinue all vapor sampling of MDA T and to divert those limited resources earmarked for annual vapor sampling at MDA T to the sitewide groundwater monitoring program. NMED will address further vapor-monitoring activities at MDA T at the implementation phase of the selected remedy.



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## 1.0 INTRODUCTION

This periodic monitoring report (PMR) presents the results of vapor-monitoring activities conducted during the fourth quarter of fiscal year (FY) 2011 at Material Disposal Area (MDA) T, Consolidated Unit 21-016(a)-99, in Technical Area 21 (TA-21), at Los Alamos National Laboratory (LANL or the Laboratory). These activities are being conducted per the requirements outlined in the approved MDA T vapor-monitoring plan (LANL 2007, 098944; NMED 2007, 098946) and the approved MDA T Phase III investigation work plan (LANL 2009, 105645; NMED 2009, 105691; NMED 2009, 106455).

The objectives of the MDA T vapor-monitoring activities are to (1) collect additional vapor samples from vapor-monitoring wells at MDA T and (2) compare sampling results with previously detected volatile organic compound (VOC) concentrations and tritium activities in pore gas beneath and surrounding MDA T.

This report discusses the results obtained during the latest quarterly monitoring activities; however, for comparison, vapor data from the previous three quarterly PMRs, October to December 2010, second quarter of FY2011, and third quarter of FY2011 (LANL 2011, 202272; LANL 2011, 204633; LANL 2011, 207368), for MDA T are also included in the data evaluation section of this report. Vapor monitoring included field screening and collecting vapor samples from stainless-steel sampling ports in vapor-monitoring wells. All pore-gas samples were submitted for off-site analysis of VOCs and tritium.

No regulatory criteria exist for vapor-phase contaminants; therefore, this report presents the results of a screening evaluation of the pore-gas VOC data. This screening evaluation compares maximum concentrations of VOCs in pore gas with pore-gas screening levels (SLs) derived from groundwater SLs. This conservative screening process evaluates the potential for the detected VOC concentrations to result in contamination of groundwater above applicable regulatory criteria.

Information on radioactive materials and radionuclides, including the results of sampling and analysis of radioactive constituents, is voluntarily provided to the New Mexico Environment Department (NMED) in accordance with U.S. Department of Energy (DOE) policy.

### 1.1 Site Location and Description

MDA T is located within TA-21 on DP Mesa (Figure 1.1-1) and contains the following waste storage and disposal sites (Figure 1.1-2):

- four absorption beds (subsurface),
- multiple buried shafts (subsurface), and
- a former retrievable waste storage area (subsurface).

Current vegetation at MDA T includes grasses, chamisa bushes, and two young ponderosa pines. The top of the regional aquifer occurs approximately 1300 ft below MDA T, based on water-level information from regional monitoring well R-6 (Kleinfelder 2005, 091693). The MDA T investigation report (LANL 2006, 094151) presents further details regarding MDA T waste storage and disposal sites, operations, and historical investigation activities.

## 2.0 SCOPE OF ACTIVITIES

The following activities were completed at MDA T during the fourth quarter of FY2011. Vapor-monitoring activities were conducted from September 15, 2011, to September 23, 2011. Table 2.0-1 summarizes the history of periodic monitoring events completed at MDA T. Table 2.0-2 outlines the NMED-approved vapor-monitoring locations, port depths, and corresponding sampling intervals.

- Samples were field screened and collected in accordance with the current version of Standard Operating Procedure 5074, Sampling Subsurface Vapor.
- Field screening was conducted using a MultiRAE IR Multi-Gas Monitor to measure percent carbon dioxide (%CO<sub>2</sub>) and percent oxygen (%O<sub>2</sub>).
- Vapor samples were submitted to off-site analytical laboratories in SUMMA canisters for VOC analysis using U.S. Environmental Protection Agency (EPA) Method TO-15 and in silica gel columns for tritium analysis using EPA Method 906.
- A total of 42 pore-gas samples (34 characterization and 8 quality assurance [QA]/quality control [QC]) were collected for VOC analysis from 34 ports in 5 vapor-monitoring wells.
- A total of 42 samples (34 characterization and 8 QA/QC) were collected for tritium analysis from 34 ports in 5 vapor-monitoring wells.
- All analytical data were subject to QA/QC and data validation reviews in accordance with Laboratory guidance and procedures. Field duplicate samples were collected at a minimum frequency of 1 for every 10 samples. The QA/QC and data validation reviews for MDA T pore-gas data are presented in Appendix C.

No investigation-derived waste was generated at the time vapor-monitoring activities were conducted at MDA T.

Further discussion of the field methods used for pore-gas field screening and sample collection is presented in Appendix B. Field chain-of-custody forms and sample collection logs are provided in Attachment D-1 of Appendix D (on CD included with this document).

The pore-gas field-screening results are discussed in section 4, and the pore-gas analytical results are discussed in section 5. Any deviations from the scope of activities presented in the approved MDA T vapor-monitoring plan (LANL 2007, 098944; NMED 2007, 098946) and the approved MDA T Phase III investigation work plan (LANL 2009, 105645; NMED 2009, 105691; NMED 2009, 106455) are presented in the following section.

### 2.1 Deviations

Pore-gas samples were not collected from port 2 in either vapor-monitoring well 21-603058 or 21-603059 during the fourth quarter of FY2011 sampling activities at MDA T. As previously reported, sampling port 2 (160.5–165.5 ft below ground surface [bgs]) in vapor-monitoring well 21-603058 stopped producing pore gas after February 2008 either because of a mechanical failure or because it was installed within unit 2 of the Bandelier Tuff, a densely welded unit, which may inhibit vapor flow (LANL 2009, 105187). Sampling port 2 (112.5–117.5 ft bgs) in vapor-monitoring well 21-603059 has never produced pore gas since it was installed, possibly because of its location within the same densely welded unit (unit 2 of the Bandelier Tuff) (LANL 2009, 105187). During every sampling period, the inoperability of these ports is verified during field screening.

### 3.0 REGULATORY CRITERIA

The Compliance Order on Consent does not identify any cleanup standards, risk-based SLs, risk-based cleanup goals, or other regulatory criteria for pore gas. Because the primary pathway of concern for subsurface VOC vapors is migration to groundwater, an analysis was conducted to evaluate the potential for contamination of groundwater by VOCs in pore gas using SLs based on groundwater SLs. The analysis evaluated the groundwater concentration that would be in equilibrium with the maximum pore-gas concentrations of VOCs detected at MDA T.

The equilibrium relationship between air (pore-gas) and water concentrations is described by the following equation:

$$C_{water} = C_{air} / H' \quad \text{Equation 3.0-1}$$

where  $C_{water}$  = the volumetric concentration of contaminant in water,  
 $C_{air}$  = the volumetric concentration of contaminant in air, and  
 $H'$  = dimensionless form of Henry's law constant.

If the predicted concentration of a particular VOC in groundwater is less than the SL, then no potential exists for exceedances above applicable regulatory criteria at the vapor contaminant/groundwater interface.

The screening evaluation was based on groundwater standards or tap water SLs and Henry's law constants that describe the equilibrium relationship between vapor and water concentrations. The source of the Henry's law constants is the NMED technical background document (NMED 2009, 108070) or the EPA regional screening tables ([http://www.epa.gov/region6/6pd/rcra\\_c/pd-n/screen.htm](http://www.epa.gov/region6/6pd/rcra_c/pd-n/screen.htm)). The following dimensionless form of Henry's law constant was used:

$$H' = \frac{C_{air}}{C_{water}} \quad \text{Equation 3.0-2}$$

Equation 3.0-2 can be used to calculate the screening value (SV):

$$SV = \frac{C_{air}}{1000 \times H' \times SL} \quad \text{Equation 3.0-3}$$

where  $C_{air}$  is in units of  $\mu\text{g}/\text{m}^3$ ,  $SL$  is in units of  $\mu\text{g}/\text{L}$ , and 1000 is a conversion factor from L to  $\text{m}^3$ . The SLs are the groundwater standards or tap water SLs. The groundwater standards are the EPA maximum contaminant level (MCL) or New Mexico Water Quality Control Commission (NMWQCC) groundwater standard, whichever is lower. If no MCL or NMWQCC standard is available, the NMED tap water SL should be used (NMED 2009, 108070). If no NMED tap water SL is available, the EPA regional tap water SL ([http://www.epa.gov/region6/6pd/rcra\\_c/pd-n/screen.htm](http://www.epa.gov/region6/6pd/rcra_c/pd-n/screen.htm)) is used. If EPA SLs for carcinogens are used, they should be adjusted to  $10^{-5}$  risk. The numerator in Equation 3.0-3 is the actual concentration of the VOC in pore gas, and the denominator represents the pore-gas concentration needed to exceed the groundwater SL. Therefore, if the SV is less than 1, the concentration of the VOC in groundwater would not exceed the SL, even if the VOC plume were to come in contact with groundwater. Table 3.0-1 presents the calculated concentrations of contaminants in pore gas corresponding to groundwater SLs for the latest and previous three monitoring periods.

Results of the pore-gas screening evaluation are presented in section 5. No applicable standards for tritium in pore vapor are available, and the screening analysis described above does not apply to tritium.

#### 4.0 FIELD-SCREENING RESULTS

Field screening during the fourth quarter of FY2011 was conducted using a MultiRAE IR Multi-Gas Monitor to measure %CO<sub>2</sub> and %O<sub>2</sub>. Before each port was sampled, it was purged of stagnant air to ensure formation air was being collected. Each sampling port was then monitored until CO<sub>2</sub> and O<sub>2</sub> readings stabilized at levels representative of subsurface pore-gas conditions. Tables of all field-screening results obtained during the October to December 2010, second quarter of FY2011, third quarter of FY2011, and fourth quarter of FY2011 sampling events at MDA T are provided in Appendix D and sorted by vapor-monitoring well ID and depth. The CO<sub>2</sub> and O<sub>2</sub> field-screening methods and results are discussed further in Appendix B. The CO<sub>2</sub> and O<sub>2</sub> results for the fourth quarter of FY2011 were within calibration limits.

#### 5.0 ANALYTICAL DATA RESULTS

All vapor analytical sampling data presented in this report are available at the Risk Analysis, Communication, Evaluation, and Reduction (RACER) website (<http://www.racernm.com/>). Samples were submitted to off-site analytical laboratories in SUMMA canisters for VOC analysis using EPA Method TO-15 and in silica-gel columns for tritium analysis using EPA Method 906. The VOC pore-gas sampling results, VOC screening evaluation, and tritium sampling results are discussed below.

##### 5.1 VOC Results and Screening Evaluation

VOC results from the fourth quarter of FY2011 and the previous three vapor-monitoring periods are summarized in tables and provided in Appendix D. Figure 5.1-1 shows VOCs detected by vapor-monitoring well location during the fourth quarter of FY2011.

A total of 13 VOCs were detected in MDA T pore gas during the fourth quarter of FY2011 sampling activities, and the results are similar to previous sampling results. Five VOCs, carbon tetrachloride, chloroform, methylene chloride, tetrachloroethene, and, trichloroethene, were detected at the greatest concentrations relative to other detected VOCs during the latest monitoring period. Concentration-with-depth profiles for each of these five VOCs for all samples collected during the fourth quarter of FY2011 and the previous three quarters are presented for the two deep wells (21-607955 and 21-25262) in Figures 5.1-2 to 5.1-6. Data associated with the previous three vapor-monitoring periods (October to December 2010, second quarter of FY2011, and third quarter of FY2011) are included for comparison purposes only. Depth profiles provide a visual comparison of VOC concentrations at depth.

The screening evaluation included the thirteen detected VOCs in MDA T samples for which there are MCLs, NMWQCC standards, NMED tap water SLs, or EPA regional tap water SLs (Table 3.0-1). Ethanol was detected but does not have an MCL, NMWQCC standard, or tap water SL and was not evaluated.

The results of the VOC screening evaluation are presented in Table 5.1-1 and discussed below. Two detected VOCs had SVs greater than 1.

- Methylene chloride was detected in 25 of 34 samples. An SV greater than 1 was observed in 14 samples. The maximum calculated SV was 3.38 in vapor-monitoring well 21-607955 at 356.45 ft bgs.
- 1,1,2-Trichloroethane was detected in 5 of 34 samples. An SV greater than 1 was observed in one sample. The calculated SV was 1.18 in vapor-monitoring well 21-25262 at 475 ft bgs.

Methylene chloride and 1,1,2-trichloroethane decrease with depth from the maximum concentration to total depth in deep vapor-monitoring wells 21-607955 and 21-25262. SVs were not exceeded in the deepest port sampled (949 ft bgs in vapor-monitoring well 21-607955).

## 5.2 Tritium Results

Tritium results during the fourth quarter of FY2011 and the previous three vapor-monitoring quarters are summarized in tables and provided in Appendix D. Figure 5.2-1 shows tritium detected during the latest sampling quarter by vapor-monitoring well location. Tritium was detected in 21 of 34 vapor samples. The highest tritium activities detected were in vapor-monitoring well 21-25264. All tritium activities detected during the fourth quarter of FY2011 are similar to activities reported during previous sampling events. The inconsistent peak activity reported at 229 ft bgs in 21-607955 during the October to December 2010 sampling event was not repeated during this sampling event. Figure 5.2-2 shows vertical profiles for tritium collected during the fourth quarter of FY2011 and the previous three quarters for deep vapor-monitoring wells 21-607955 and 21-25262.

## 6.0 SUMMARY

The objectives of the MDA T vapor-monitoring activities are to (1) collect additional vapor samples from vapor-monitoring wells at MDA T and (2) compare sampling results with previously detected VOC concentrations and tritium activities beneath and surrounding MDA T. The results of the most recent vapor-monitoring activities are similar to results reported during previous vapor-monitoring activities.

- A total of thirteen VOCs were detected in the pore gas beneath MDA T. Concentrations for most VOCs detected in MDA T pore gas decreased with depth, were consistently detected at low concentrations, or were detected infrequently.
- Consistent with previous sampling results, methylene chloride and 1,1,2-trichloroethane were the only VOCs detected with SVs exceeding 1. The maximum SVs for methylene chloride and 1,1,2-trichloroethane were 3.38 and 1.18, respectively. SVs did not exceed 1 in the deepest port sampled at MDA T. No regulatory criteria exist for pore gas; therefore, the screening evaluation is a conservative comparison with groundwater SLs to help evaluate any potential for groundwater contamination by VOCs.
- Tritium was detected in the pore vapor beneath MDA T. Detected tritium activities generally decreased with depth. The inconsistent peak activity reported in vapor-monitoring well 21-607955 during the October to December 2010 sampling event was not repeated during this sampling event. The results are similar to previous sampling results.

In a letter submitted to NMED on November 1, 2011 (LANL 2011, 207418), DOE and Los Alamos National Security, LLC, proposed to discontinue vapor sampling at MDA T beginning in the first quarter of FY2012 and instead monitor the current approved sampling ports on an annual basis. A letter was received by NMED on November 14, 2011 (NMED 2011, 207573), directing the Permittees to discontinue all vapor sampling of MDA T and to divert those limited resources earmarked for annual vapor sampling at MDA T to the sitewide groundwater monitoring program. NMED will address further vapor-monitoring activities at MDA T at the implementation phase of the selected remedy.

## 7.0 REFERENCES AND MAP DATA SOURCES

### 7.1 References

*The following list includes all documents cited in this report. Parenthetical information following each reference provides the author(s), publication date, and ER ID. This information is also included in text citations. ER IDs are assigned by the Environmental Programs Directorate's Records Processing Facility (RPF) and are used to locate the document at the RPF and, where applicable, in the master reference set.*

*Copies of the master reference set are maintained at the NMED Hazardous Waste Bureau and the Directorate. The set was developed to ensure that the administrative authority has all material needed to review this document, and it is updated with every document submitted to the administrative authority. Documents previously submitted to the administrative authority are not included.*

Kleinfelder, April 2005. "Final Completion Report, Characterization Wells R-6/R-6i," report prepared for Los Alamos National Laboratory, Project No. 37151, Albuquerque, New Mexico. (Kleinfelder 2005, 091693)

LANL (Los Alamos National Laboratory), September 2006. "Investigation Report for Material Disposal Area T, Consolidated Unit 21-016(a)-99, at Technical Area 21," Los Alamos National Laboratory document LA-UR-06-6506, Los Alamos, New Mexico. (LANL 2006, 094151)

LANL (Los Alamos National Laboratory), October 2007. "Subsurface Vapor-Monitoring Plan for Material Disposal Area T at Technical Area 21," Los Alamos National Laboratory document LA-UR-07-7037, Los Alamos, New Mexico. (LANL 2007, 098944)

LANL (Los Alamos National Laboratory), February 2009. "Periodic Monitoring Report for Vapor-Sampling Activities at Material Disposal Area T, Consolidated Unit 21-016(a)-99, Technical Area 21, Fiscal Year 2008," Los Alamos National Laboratory document LA-UR-09-0791, Los Alamos, New Mexico. (LANL 2009, 105187)

LANL (Los Alamos National Laboratory), April 2009. "Phase III Investigation Work Plan for Material Disposal Area T, Consolidated Unit 21-016(a)-99," Los Alamos National Laboratory document LA-UR-09-2140, Los Alamos, New Mexico. (LANL 2009, 105645)

LANL (Los Alamos National Laboratory), July 2009. "Periodic Monitoring Report for Vapor-Sampling Activities at Material Disposal Area T, Consolidated Unit 21-016(a)-99, at Technical Area 21, February and April 2009," Los Alamos National Laboratory document LA-UR-09-4674, Los Alamos, New Mexico. (LANL 2009, 106665)

LANL (Los Alamos National Laboratory), October 2009. "Periodic Monitoring Report for Vapor-Sampling Activities at Material Disposal Area T, Consolidated Unit 21-016(a)-99, at Technical Area 21, June to August 2009," Los Alamos National Laboratory document LA-UR-09-6878, Los Alamos, New Mexico. (LANL 2009, 107448)

LANL (Los Alamos National Laboratory), January 2010. "Periodic Monitoring Report for Vapor-Sampling Activities at Material Disposal Area T, Consolidated Unit 21-016(a)-99, at Technical Area 21, September to November 2009," Los Alamos National Laboratory document LA-UR-10-0409, Los Alamos, New Mexico. (LANL 2010, 108529)

- LANL (Los Alamos National Laboratory), April 2010. "Periodic Monitoring Report for Vapor-Sampling Activities at Material Disposal Area T, Consolidated Unit 21-016(a)-99, at Technical Area 21, October to December 2009," Los Alamos National Laboratory document LA-UR-10-2421, Los Alamos, New Mexico. (LANL 2010, 109254)
- LANL (Los Alamos National Laboratory), July 2010. "Periodic Monitoring Report for Vapor-Sampling Activities at Material Disposal Area T, Consolidated Unit 21-016(a)-99, at Technical Area 21, January to March 2010," Los Alamos National Laboratory document LA-UR-10-3952, Los Alamos, New Mexico. (LANL 2010, 110059)
- LANL (Los Alamos National Laboratory), October 2010. "Periodic Monitoring Report for Vapor-Sampling Activities at Material Disposal Area T, Consolidated Unit 21-016(a)-99, at Technical Area 21, April to June 2010," Los Alamos National Laboratory document LA-UR-10-6803, Los Alamos, New Mexico. (LANL 2010, 111121)
- LANL (Los Alamos National Laboratory), January 2011. "Periodic Monitoring Report for Vapor-Sampling Activities at Material Disposal Area T, Consolidated Unit 21-016(a)-99, at Technical Area 21, July to September 2010," Los Alamos National Laboratory document LA-UR-11-0396, Los Alamos, New Mexico. (LANL 2011, 111733)
- LANL (Los Alamos National Laboratory), April 2011. "Periodic Monitoring Report for Vapor-Sampling Activities at Material Disposal Area T, Consolidated Unit 21-016(a)-99, at Technical Area 21, October to December 2010," Los Alamos National Laboratory document LA-UR-11-2083, Los Alamos, New Mexico. (LANL 2011, 202272)
- LANL (Los Alamos National Laboratory), July 2011. "Periodic Monitoring Report for Vapor-Sampling Activities at Material Disposal Area T, Consolidated Unit 21-016(a)-99, at Technical Area 21, Second Quarter Fiscal Year 2011," Los Alamos National Laboratory document LA-UR-11-3839, Los Alamos, New Mexico. (LANL 2011, 204633)
- LANL (Los Alamos National Laboratory), October 2011. "Periodic Monitoring Report for Vapor-Sampling Activities at Material Disposal Area T, Consolidated Unit 21-016(a)-99, at Technical Area 21, Third Quarter Fiscal Year 2011," Los Alamos National Laboratory document LA-UR-11-5878, Los Alamos, New Mexico. (LANL 2011, 207368)
- LANL (Los Alamos National Laboratory), November 1, 2011. "Request to Reduce the Frequency of Vapor Sampling at Material Disposal Area T," Los Alamos National Laboratory letter (EP2011-0356) to J. Kieling (NMED-HWB) from M.J. Graham (LANL) and G.J. Rael (DOE-LASO), Los Alamos, New Mexico. (LANL 2011, 207418)
- NMED (New Mexico Environment Department), October 31, 2007. "Approval with Modifications, Subsurface Vapor-Monitoring Plan for MDA T," New Mexico Environment Department letter to D. Gregory (DOE LASO) and D. McInroy (LANL) from J.P. Bearzi (NMED HWB), Santa Fe, New Mexico. (NMED 2007, 098946)
- NMED (New Mexico Environment Department), May 4, 2009. "Approval with Modifications, Phase III Work Plan for Material Disposal Area T, Consolidated Unit 21-016(a)-99," New Mexico Environment Department letter to D. Gregory (DOE-LASO) and D. McInroy (LANL) from J.P. Bearzi (NMED-HWB), Santa Fe, New Mexico. (NMED 2009, 105691)

NMED (New Mexico Environment Department), May 26, 2009. "Correction, Approval with Modifications, Phase III Work Plan for Material Disposal Area T, Consolidated Unit 21-016(a)-99," New Mexico Environment Department letter to D. Gregory (DOE-LASO) and D. McInroy (LANL) from J.P. Bearzi (NMED-HWB), Santa Fe, New Mexico. (NMED 2009, 106455)

NMED (New Mexico Environment Department), December 2009. "Technical Background Document for Development of Soil Screening Levels, Revision 5.0," with revised Table A-1, New Mexico Environment Department, Hazardous Waste Bureau and Ground Water Quality Bureau Voluntary Remediation Program, Santa Fe, New Mexico. (NMED 2009, 108070)

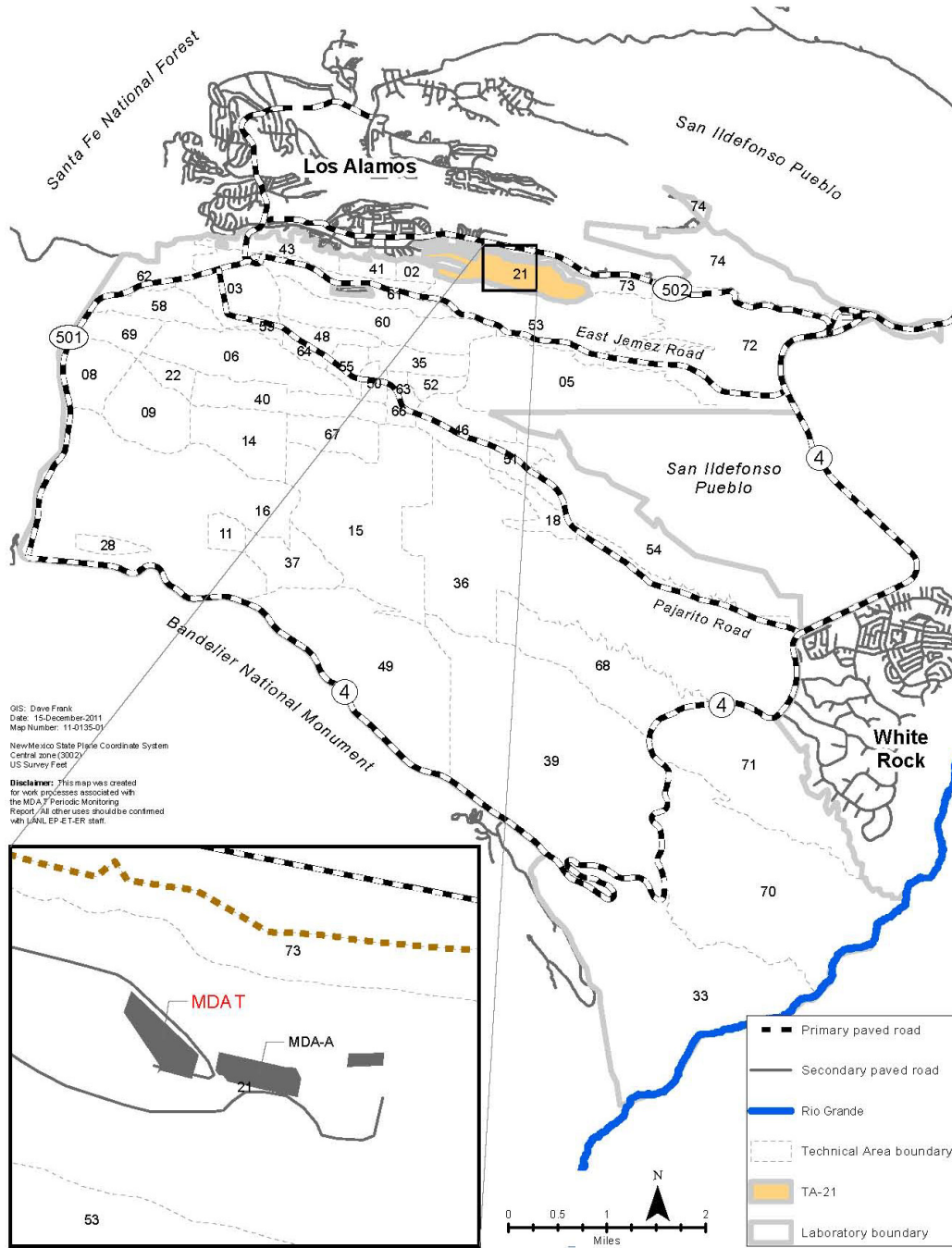
NMED (New Mexico Environment Department), November 14, 2011. "Approval, Request to Reduce Frequency of Vapor Sampling at Material Disposal Area T," New Mexico Environment Department letter to G.J. Rael (DOE-LASO) and M.J. Graham (LANL) from J.E. Kieling (NMED-HWB), Santa Fe, New Mexico. (NMED 2011, 207573)

## 7.2 Map Data Sources

Data sources used in original figures created for this report are described below and identified by legend title.

Legend Item/Type	Data Source
LANL boundary	LANL Areas Used and Occupied; Los Alamos National Laboratory, Site Planning & Project Initiation Group, Infrastructure Planning Office; 19 September 2007; as published 13 August 2010.
TA boundary	Technical Area Boundaries; Los Alamos National Laboratory, Site Planning & Project Initiation Group, Infrastructure Planning Office; September 2007; as published 13 August 2010.
ER projects	ER Project Locations; Los Alamos National Laboratory, ESH&Q Waste and Environmental Services Division, 2010-2E; 1:2,500 Scale Data; 04 October 2010.
MDAs	Materials Disposal Areas; Los Alamos National Laboratory, ENV Environmental Remediation and Surveillance Program; ER2004-0221; 1:2,500 Scale Data; 23 April 2004.
Paved parking	Paved Parking; Los Alamos National Laboratory, KSL Site Support Services, Planning, Locating and Mapping Section; 06 January 2004; as published 29 November 2010.
Paved road	Paved Road Arcs; Los Alamos National Laboratory, KSL Site Support Services, Planning, Locating and Mapping Section; 06 January 2004; as published 29 November 2010.
Dirt road	Dirt Road Arcs; Los Alamos National Laboratory, KSL Site Support Services, Planning, Locating and Mapping Section; 06 January 2004; as published 29 November 2010.
Road centerlines	Road Centerlines; Los Alamos National Laboratory, KSL Site Support Services, Planning, Locating and Mapping Section; 15 December 2005; as published 29 November 2010.
Structure	Structures; Los Alamos National Laboratory, KSL Site Support Services, Planning, Locating and Mapping Section; 06 January 2004; as published 29 November 2010.
Contours	Hypsography, 10 and 100 Foot Contour Interval; Los Alamos National Laboratory, ENV Environmental Remediation and Surveillance Program; 1991.
Fence	Security and Industrial Fences and Gates; Los Alamos National Laboratory, KSL Site Support Services, Planning, Locating and Mapping Section; 06 January 2004; as published 29 November 2010.
Drainage	Modeled Surface Drainage, 1991; Los Alamos National Laboratory, ENV Environmental Remediation and Surveillance Program, ER2002-0591; 1:24,000 Scale Data; Unknown publication date.





**Figure 1.1-1 Location of MDA T in TA-21 with respect to Laboratory TAs and surrounding landholdings**



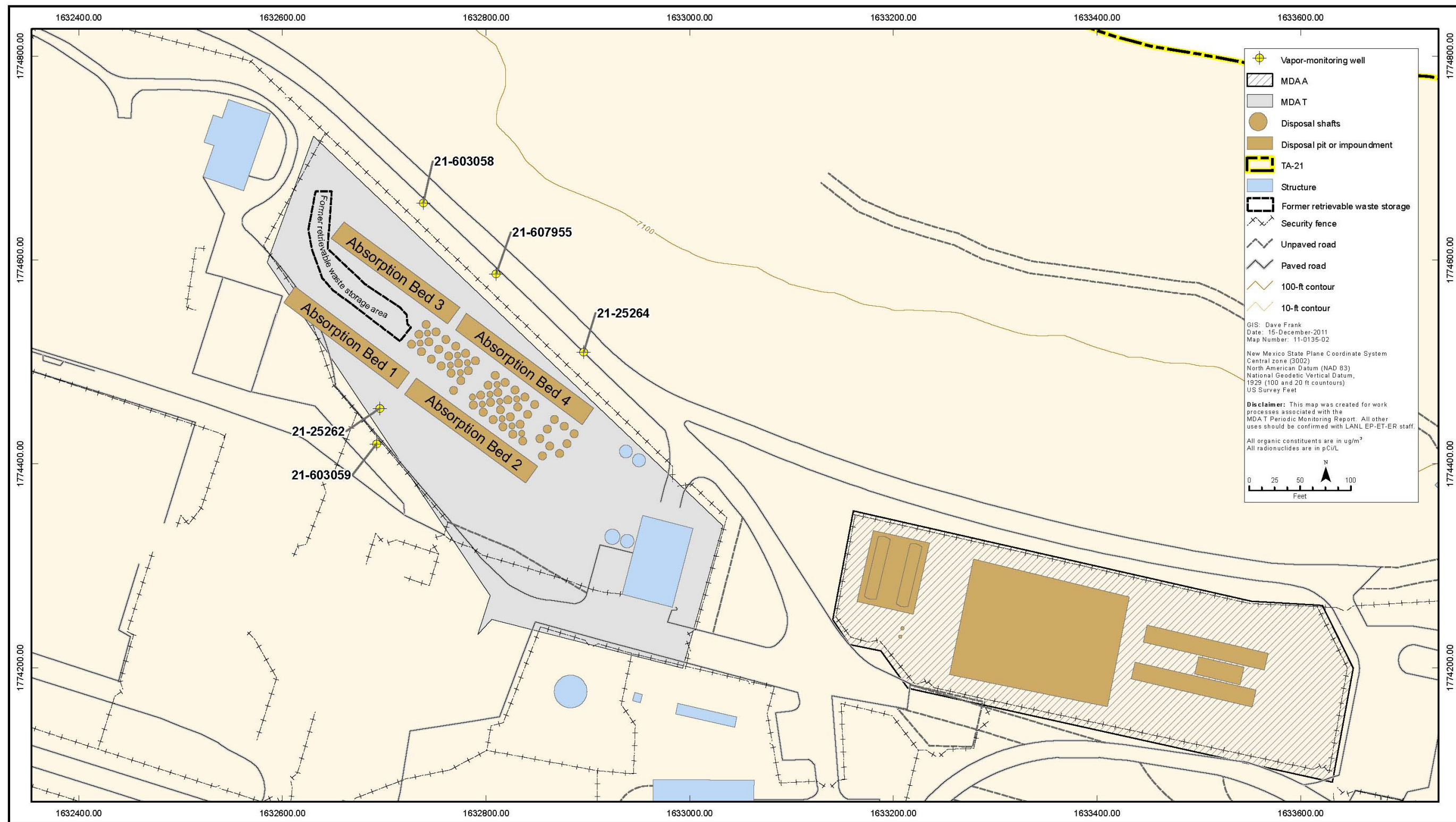


Figure 1.1-2 Locations of MDA T vapor-monitoring wells and associated structures and features

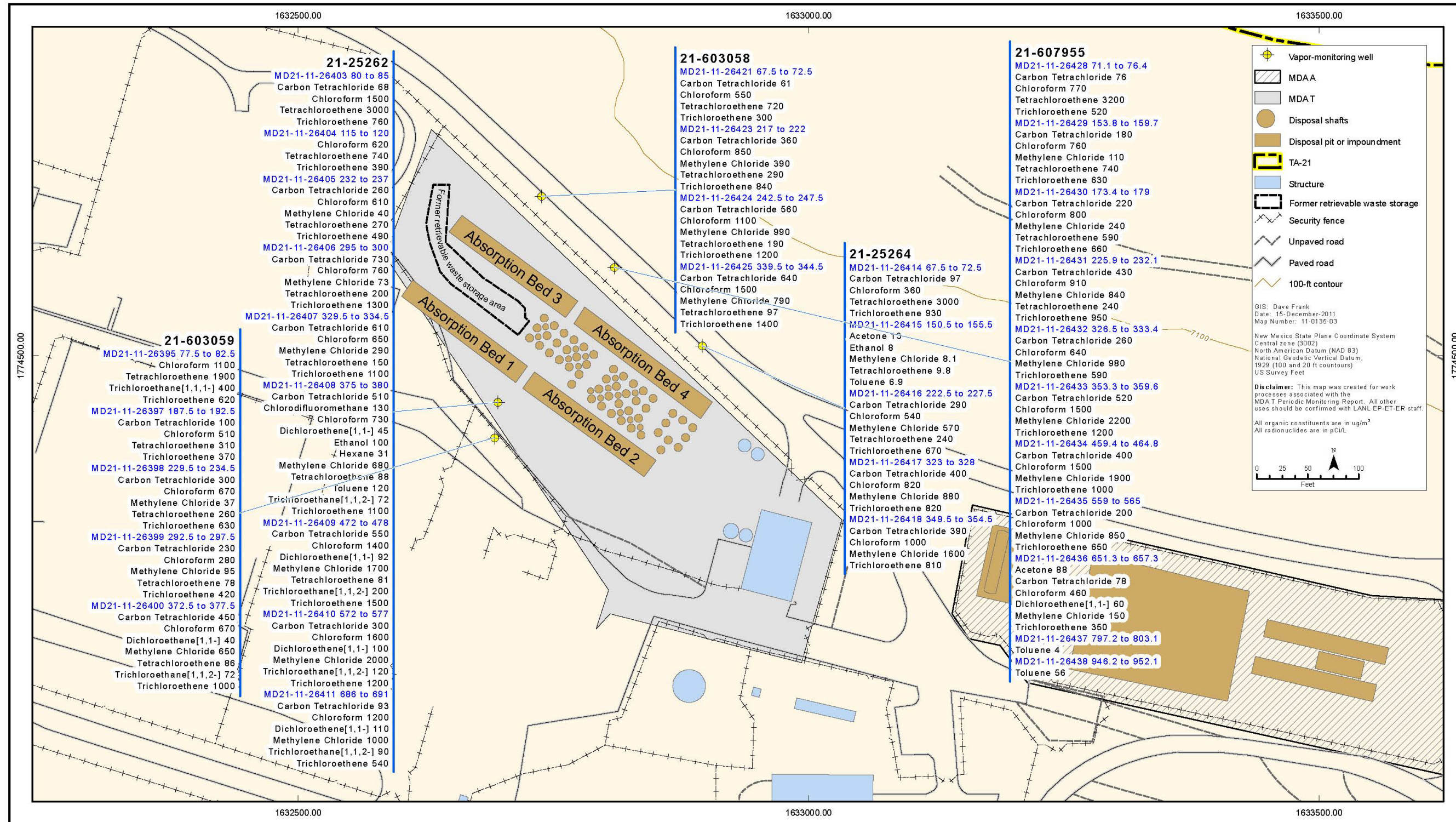


Figure 5.1-1 VOCs detected in vapor samples at MDA T

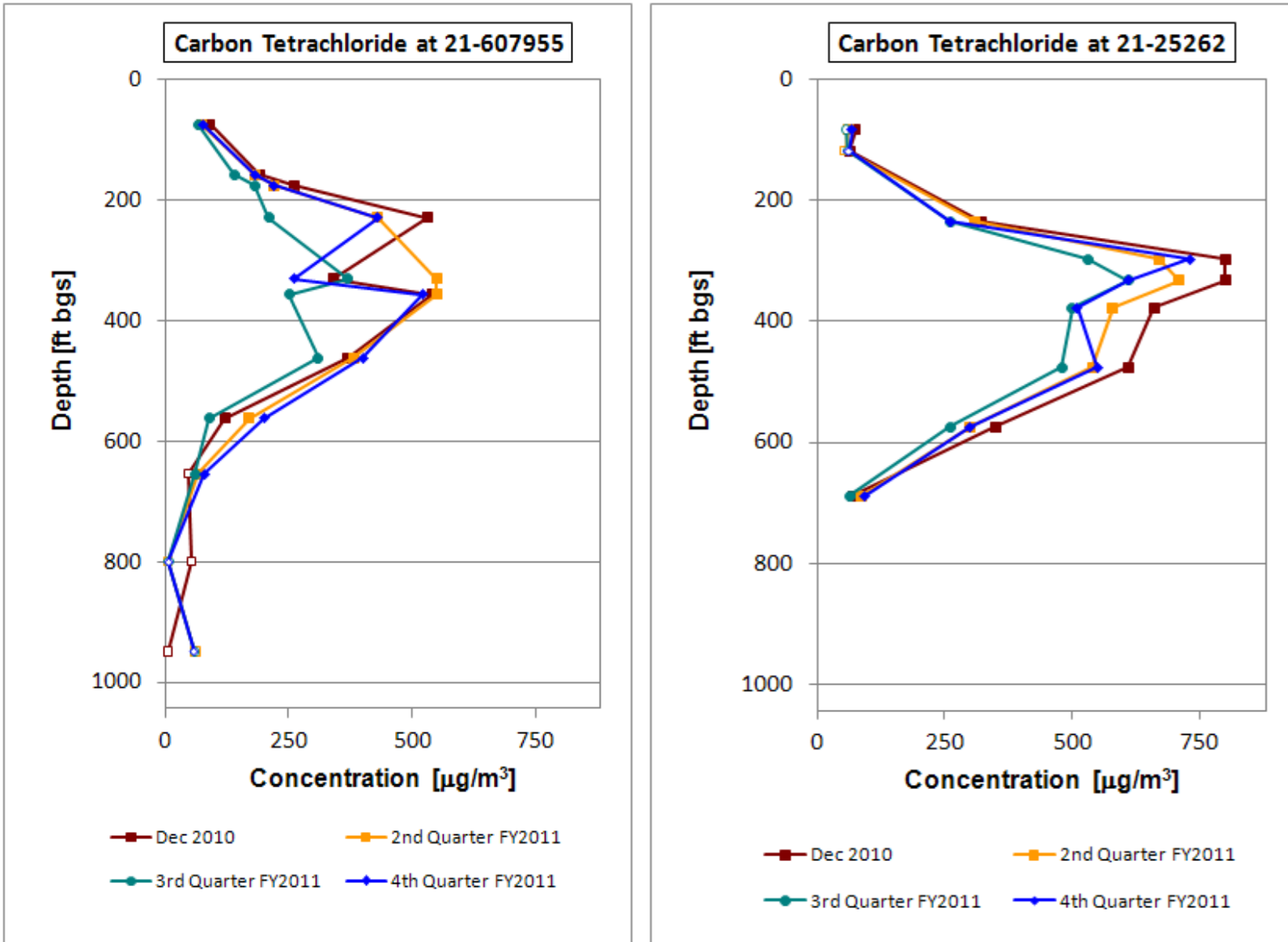


Figure 5.1-2 Vertical profiles of carbon tetrachloride in vapor-monitoring wells 21-607955 and 21-25262

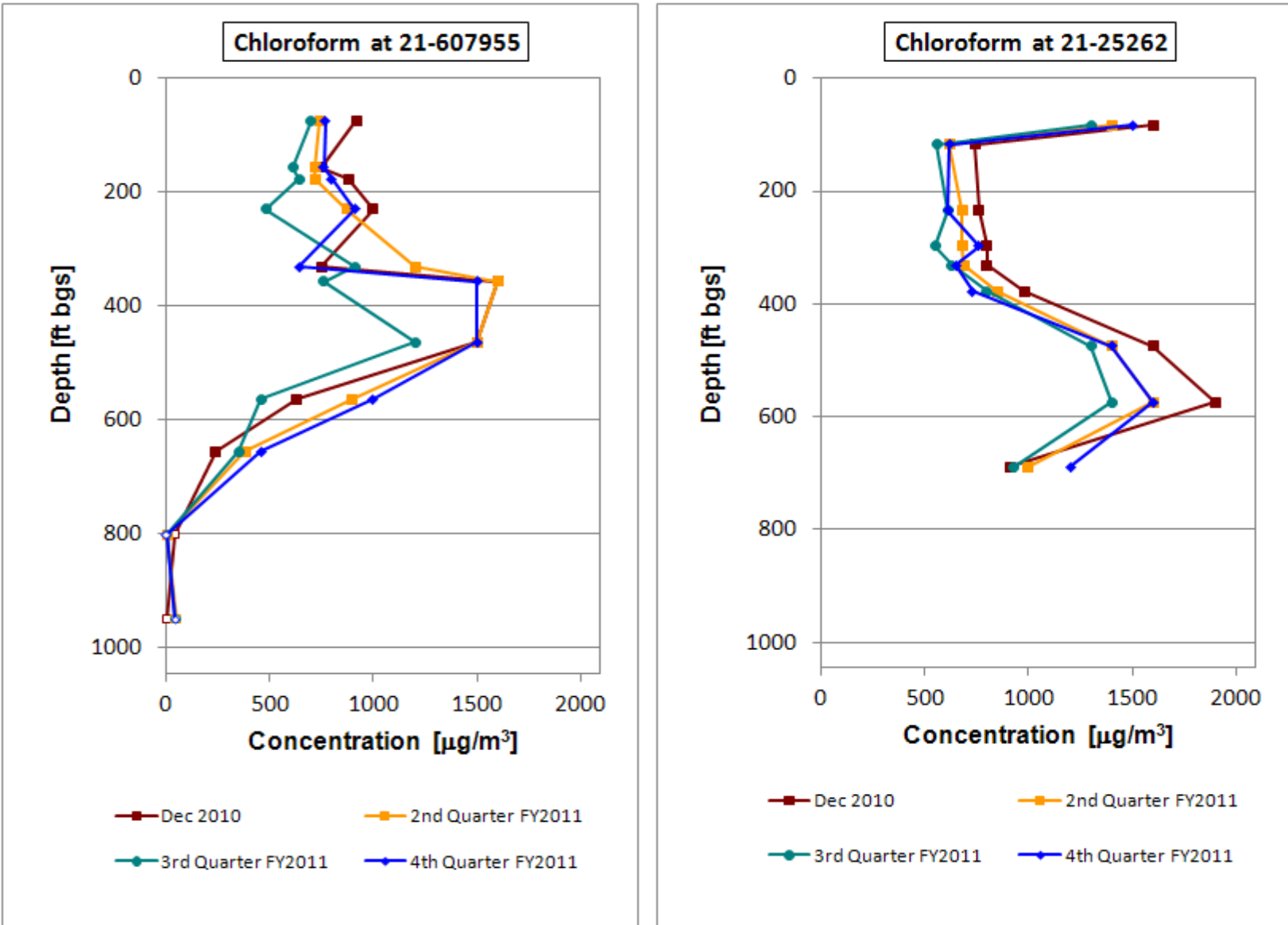


Figure 5.1-3 Vertical profiles of chloroform in vapor-monitoring wells 21-607955 and 21-25262

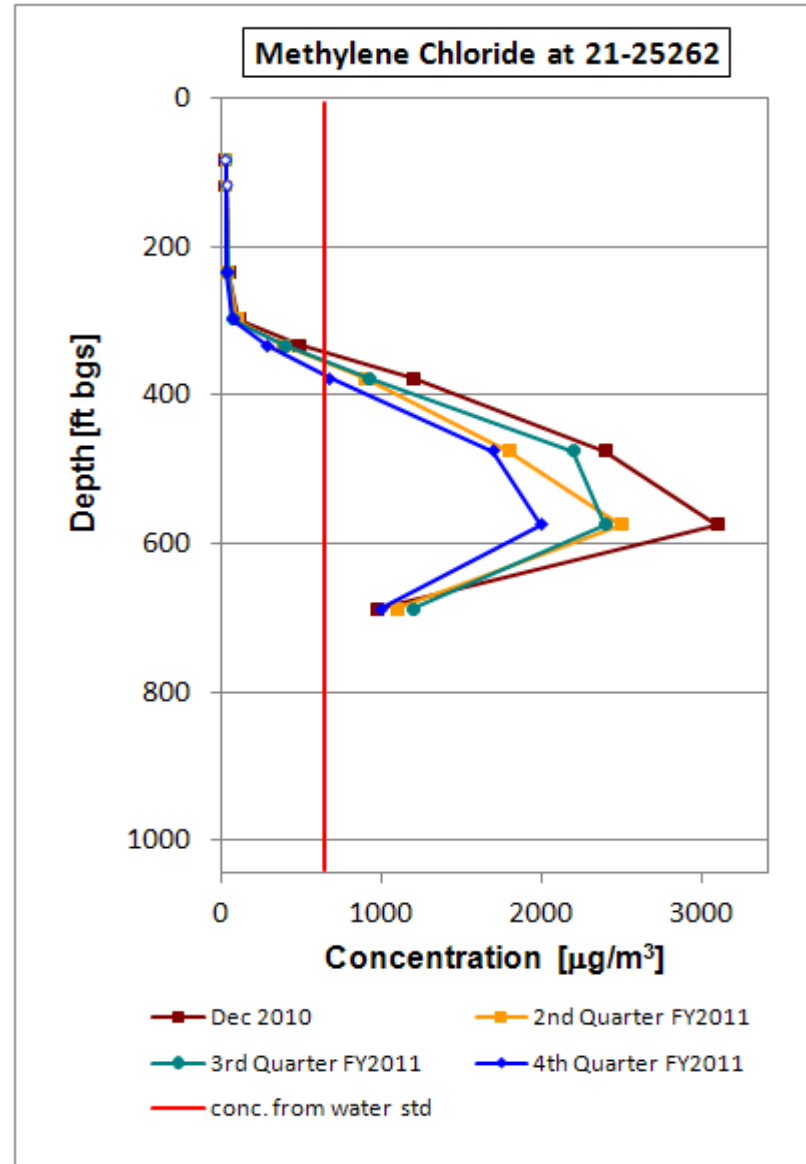
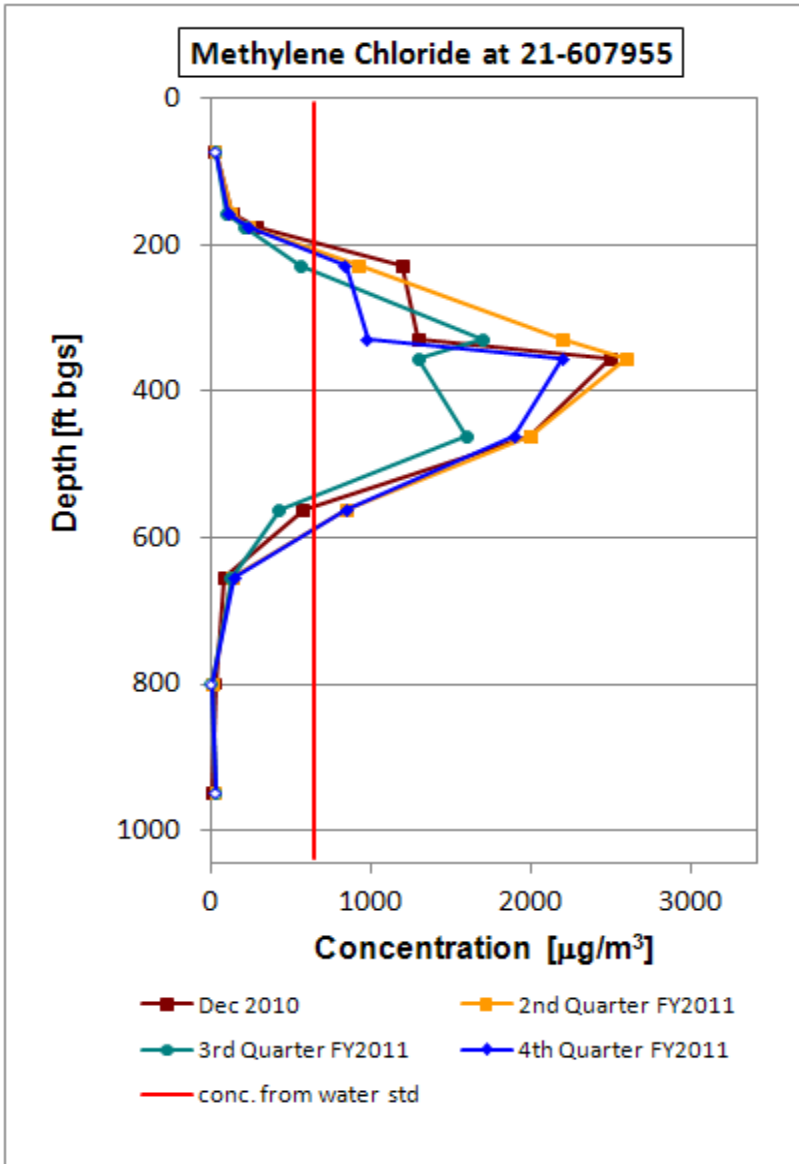


Figure 5.1-4 Vertical profiles of methylene chloride in vapor-monitoring wells 21-607955 and 21-25262

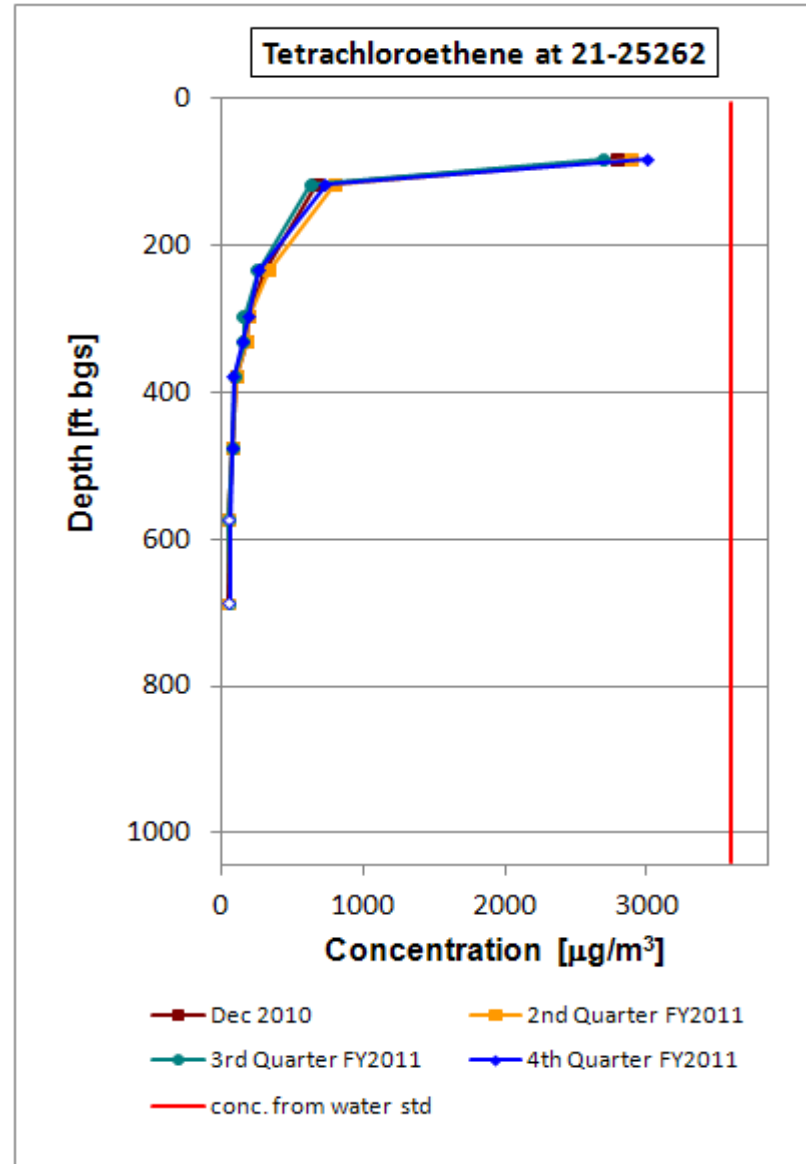
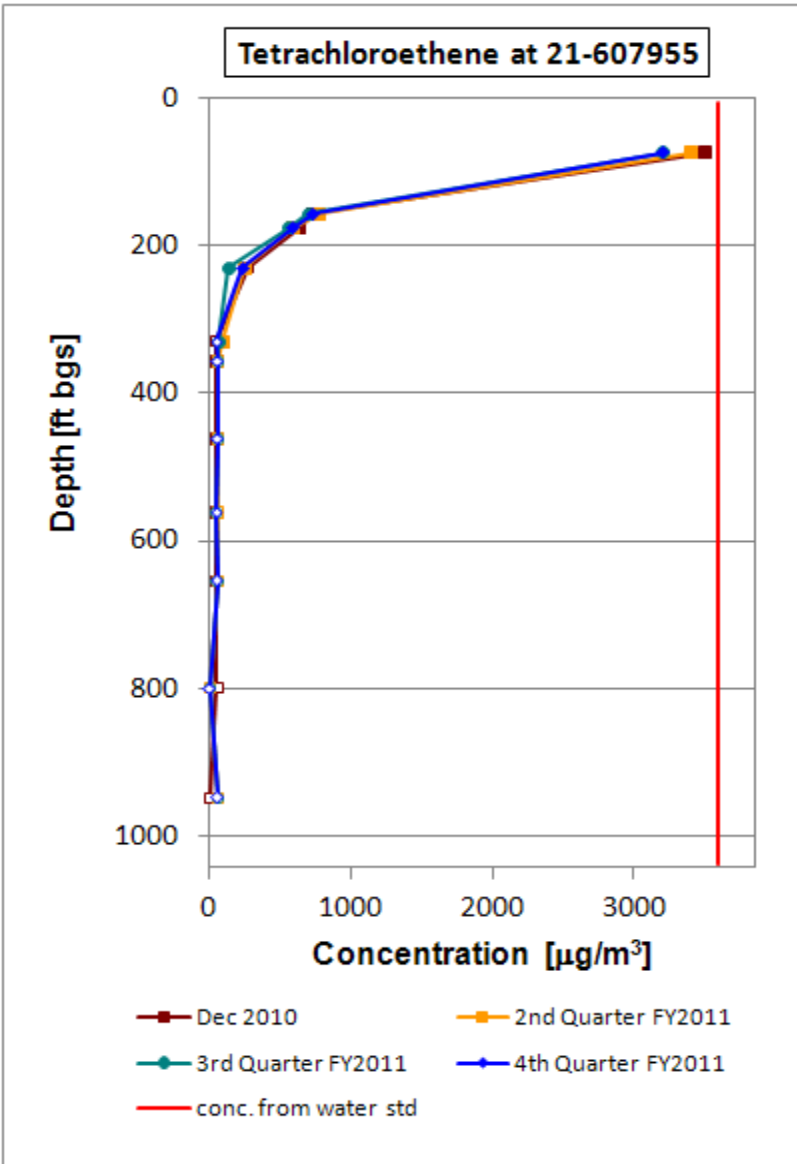


Figure 5.1-5 Vertical profiles of tetrachloroethene in vapor-monitoring wells 21-607955 and 21-25262



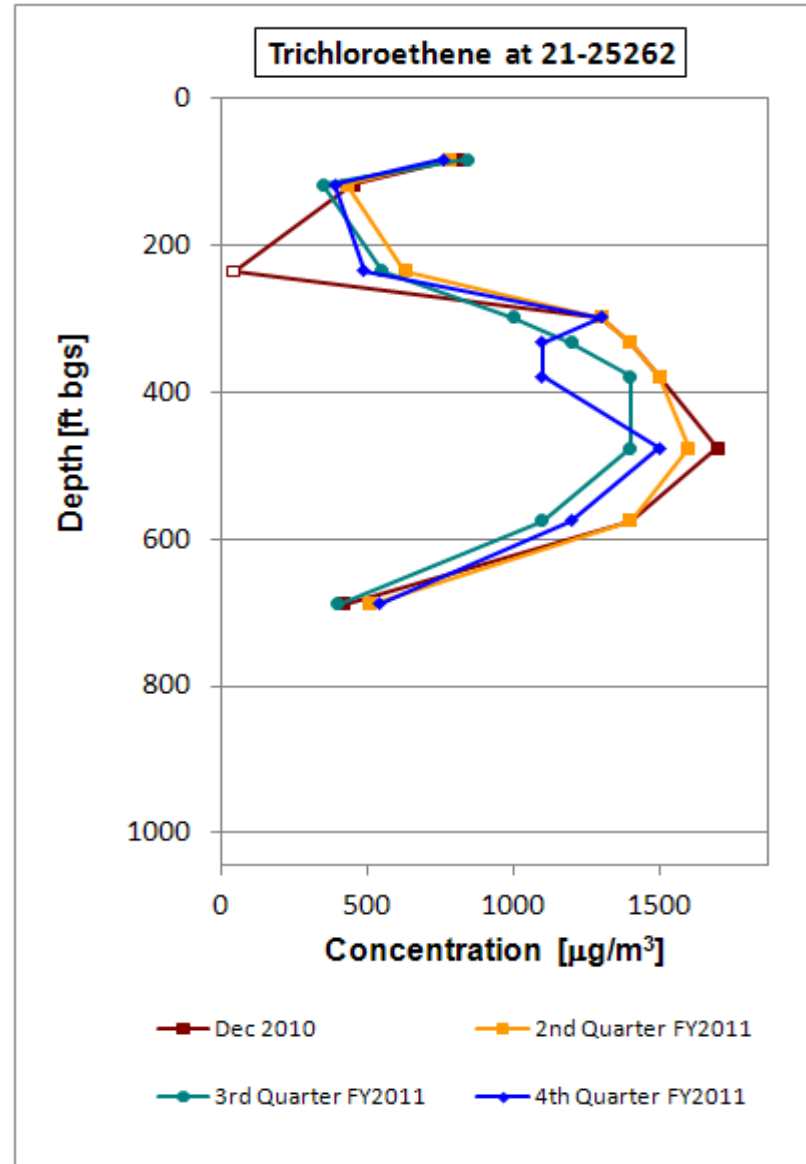
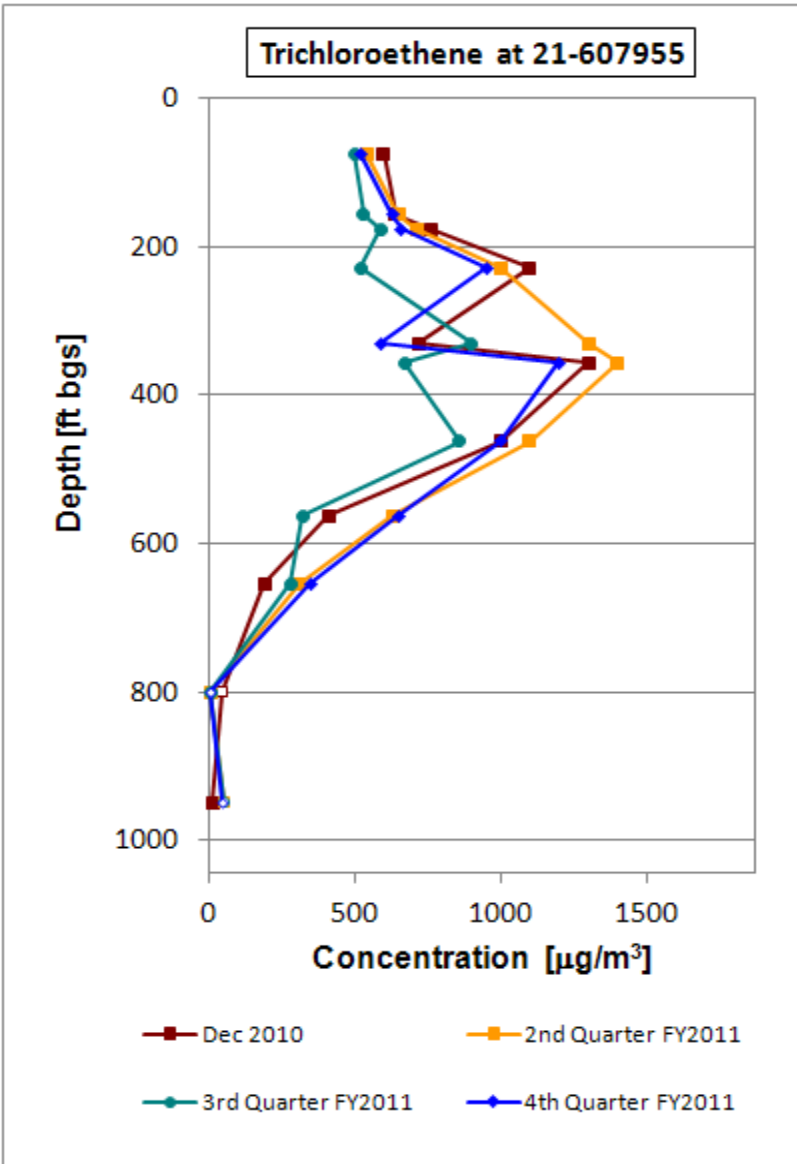


Figure 5.1-6 Vertical profiles of trichloroethene in vapor-monitoring wells 21-607955 and 21-25262



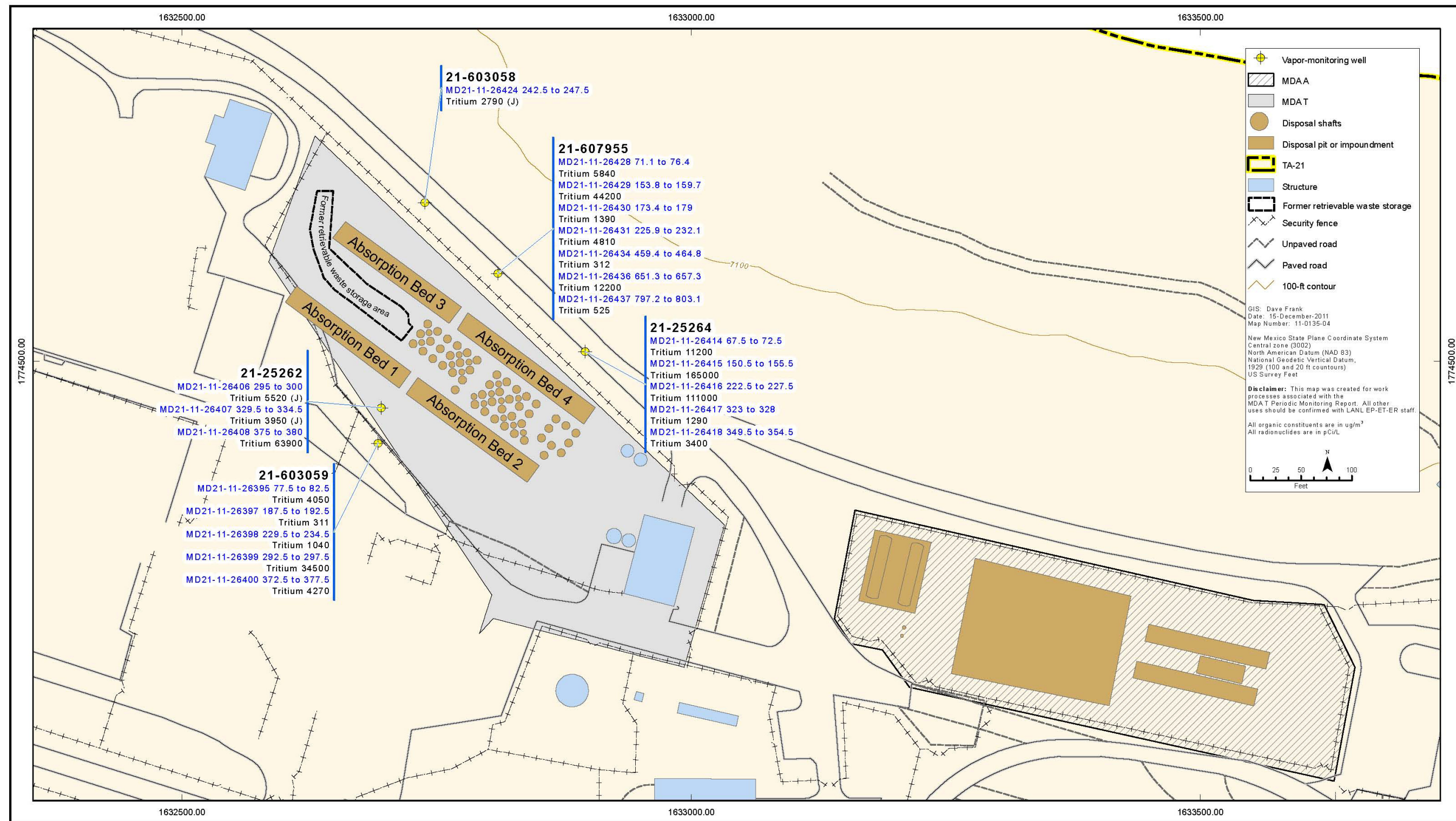


Figure 5.2-1 Tritium detected in vapor samples at MDA T

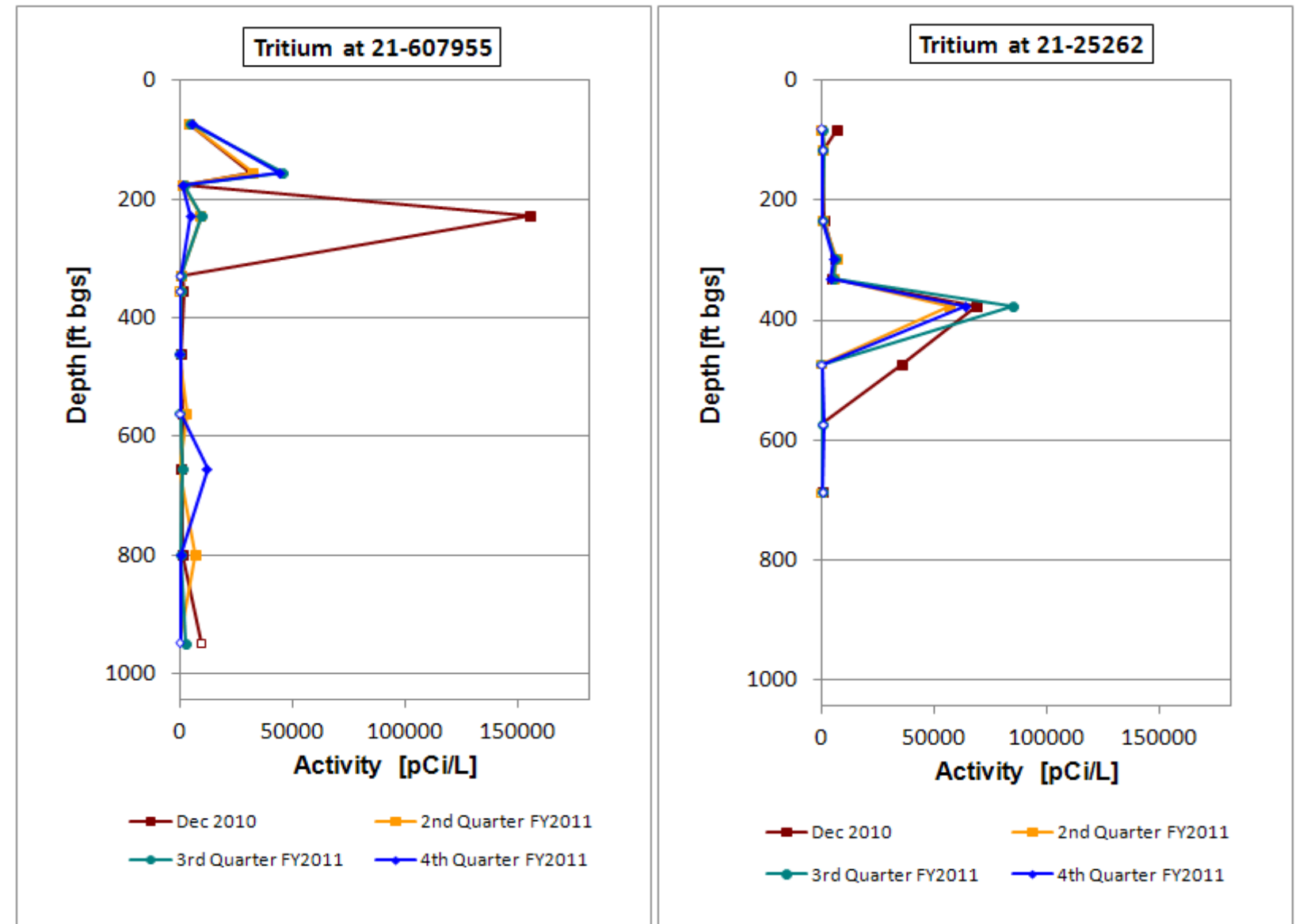


Figure 5.2-2 Vertical profiles of tritium in vapor-monitoring wells 21-607955 and 21-25262

**Table 2.0-1  
History of MDA T Periodic Monitoring Events**

Quarter	Sampling Event Date	Number of Vapor-Monitoring Wells <sup>a</sup>	Associated Report Title
15th Quarter	September 2011	5	Periodic Monitoring Report for Vapor-Sampling Activities at Material Disposal Area T Consolidated Unit 21-016(a)-99, at Technical Area 21, Fourth Quarter FY2011 (current report)
14th Quarter	June 2011	5	Periodic Monitoring Report for Vapor-Sampling Activities at Material Disposal Area T Consolidated Unit 21-016(a)-99, at Technical Area 21, Third Quarter FY2011 (LANL 2011, 207368)
13th Quarter	April 2011	5	Periodic Monitoring Report for Vapor-Sampling Activities at Material Disposal Area T Consolidated Unit 21-016(a)-99, at Technical Area 21, Second Quarter FY2011 (LANL 2011, 204633)
12th Quarter	December 2010	5	Periodic Monitoring Report for Vapor-Sampling Activities at Material Disposal Area T Consolidated Unit 21-016(a)-99, at Technical Area 21, October to December 2010 (LANL 2011, 202272)
11th Quarter	September 2010	5	Periodic Monitoring Report for Vapor-Sampling Activities at Material Disposal Area T Consolidated Unit 21-016(a)-99, at Technical Area 21, July to September 2010 (LANL 2011, 111733)
10th Quarter <sup>b</sup>	June 2010	5	Periodic Monitoring Report for Vapor-Sampling Activities at Material Disposal Area T Consolidated Unit 21-016(a)-99, at Technical Area 21, April to June 2010 (LANL 2010, 111121)
	April 2010		
9th Quarter	March 2010	5	Periodic Monitoring Report for Vapor-Sampling Activities at Material Disposal Area T Consolidated Unit 21-016(a)-99, at Technical Area 21, January to March 2010 (LANL 2010, 110059)
	February 2010		
	January 2010		
8th Quarter	December 2009	5	Periodic Monitoring Report for Vapor-Sampling Activities at Material Disposal Area T Consolidated Unit 21-016(a)-99, at Technical Area 21, October to December 2009 (LANL 2010, 109254)
	November 2009		
	October 2009	5	Periodic Monitoring Report for Vapor-Sampling Activities at Material Disposal Area T Consolidated Unit 21-016(a)-99, at Technical Area 21, September to November 2009 (LANL 2010, 108529)
	November 2009		
7th Quarter	September 2009	4	Periodic Monitoring Report for Vapor-Sampling Activities at Material Disposal Area T Consolidated Unit 21-016(a)-99, at Technical Area 21, June to August 2009 (LANL 2009, 107448)
	August 2009		
	July 2009		
6th Quarter <sup>c</sup>	June 2009	3	Periodic Monitoring Report for Vapor-Sampling Activities at Material Disposal Area T Consolidated Unit 21-016(a)-99, at Technical Area 21, February and April 2009 (LANL 2009, 106665)
	April 2009		
5th Quarter	February 2009		

Table 2.0-1 (continued)

Quarter	Sampling Event Date	Number of Vapor-Monitoring Wells <sup>a</sup>	Associated Report Title
4th Quarter	September 2008	3	Periodic Monitoring Report for Vapor-Sampling Activities at Material Disposal Area T Consolidated Unit 21-016(a)-99, at Technical Area 21, Fiscal Year 2008 (LANL 2009, 105187)
3rd Quarter	May 2008	3	
2nd Quarter	February 2008	3	
1st Quarter	October 2007	3	

Note: Results from the shaded dates are not presented in the current monitoring report.

<sup>a</sup> The number includes boreholes sampled and field screened.

<sup>b</sup> Monthly sampling ended in April 2010 with resumption of quarterly sampling.

<sup>c</sup> Sampling frequency increased from quarterly to monthly in June 2009.

**Table 2.0-2**  
**NMED-Approved MDA T Subsurface**  
**Vapor-Monitoring Locations, Port Depths, and Corresponding Sampling Intervals**

Vapor-Monitoring Well ID	VOC and Tritium Sampling-Port Depths and Intervals (ft bgs)
21-603058	<b>70 (67.5–72.5)</b> , 163 (160.5–165.5)*, <b>219.9 (217–222)</b> , <b>245 (242.5–247.5)</b> , <b>342 (339.5–344.5)</b>
21-603059	<b>80 (77.5–82.5)</b> , 115 (112.5–117.5)*, <b>190 (187.5–192.5)</b> , <b>232 (229.5–234.5)</b> , <b>295 (292.5–297.5)</b> , <b>375 (372.5–377.5)</b>
21-25264	<b>70 (67.5–72.5)</b> , <b>153 (150.5–155.5)</b> , <b>225 (222.5–227.5)</b> , <b>325.5 (323–328)</b> , <b>352 (349.5–354.5)</b>
21-25262	<b>82.5 (80–85)</b> , <b>117.5 (115–120)</b> , <b>234.5 (232–237)</b> , <b>297.5 (295–300)</b> , <b>332 (329.5–334.5)</b> , <b>377.5 (375–380)</b> , <b>475 (472–478)</b> , <b>574.5 (572–577)</b> , <b>688.5 (686–691)</b>
21-607955	<b>73.75 (71.1–76.4)</b> , <b>156.75 (153.8–159.7)</b> , <b>176.2 (173.4–179)</b> , <b>229 (225.9–232.1)</b> , <b>330 (326.6–333.4)</b> , <b>356.45 (353.3–359.6)</b> , <b>462.1 (459.4–464.8)</b> , <b>562 (559–565)</b> , <b>654.3 (651.3–657.3)</b> , <b>800.15 (797.2–803.1)</b> , <b>949.15 (946.2–952.1)</b>

Note: Depths in bold denote intervals that were field screened as well as ports where VOC and tritium samples were collected.

\* Blocked port.

**Table 3.0-1  
Henry's Law Constants, Groundwater SLs, and Calculated  
Concentrations Corresponding to Groundwater SLs for Historically Detected VOCs in Pore Gas**

VOC	Henry's Law Constant <sup>a</sup> (dimensionless)	Groundwater SL <sup>a</sup> (µg/L)	Calculated Concentrations in Pore Gas Corresponding to Groundwater Standard <sup>b</sup> (µg/m <sup>3</sup> )
Acetone	0.0016	21,800	34,900
Benzene	0.228	5 <sup>c</sup>	1140
Carbon Tetrachloride	1.1	5 <sup>c</sup>	5500
Chlorodifluoromethane	1.7	104,000	177,000,000
Chloroform	0.15	80 <sup>c</sup>	15,000
Cyclohexane	6.1 <sup>d</sup>	13,000 <sup>d</sup>	79,300,000
Dichlorobenzene[1,4-]	0.0996	75 <sup>c</sup>	7470
Dichlorodifluoromethane	14	395	5,520,000
Dichloroethane[1,2-]	0.048	5 <sup>c</sup>	240
Dichloroethene[1,1-]	1.1	5 <sup>e</sup>	5500
Dichloroethene[cis-1,2-]	0.17	70 <sup>c</sup>	11,900
Ethanol	na <sup>f</sup>	na	na
Hexane	74	876	64,800,000
Methylene Chloride	0.13	5 <sup>c</sup>	650
n-Heptane	na	na	na
Tetrachloroethene	0.72	5 <sup>c</sup>	3600
Toluene	0.272	750 <sup>e</sup>	204,000
Trichloro-1,2,2-trifluoroethane[1,1,2-]	22	59,200	1,300,000,000
Trichloroethane[1,1,1-]	0.705	60 <sup>e</sup>	42,300
Trichloroethane[1,1,2-]	0.034	5 <sup>c</sup>	170
Trichloroethene	0.4	5 <sup>c</sup>	2000
Xylene[1,3-]+Xylene[1,4-]	0.28	620 <sup>e</sup>	174,000

<sup>a</sup> Henry's law constants and SLs from NMED (2009, 108070) unless otherwise noted.

<sup>b</sup> Derived from denominator of Equation 3.0-3.

<sup>c</sup> EPA MCL (40 Code of Federal Regulations 141.61).

<sup>d</sup> Henry's law constants and SLs from EPA regional screening tables ([http://www.epa.gov/region6/6pd/rcra\\_c/pd-n/screen.htm](http://www.epa.gov/region6/6pd/rcra_c/pd-n/screen.htm)). Adjusted to 10<sup>-5</sup> risk for carcinogens.

<sup>e</sup> NMWQCC groundwater standard (20.6.2.3103 New Mexico Administrative Code).

<sup>f</sup> na = Not available.

**Table 5.1-1  
Screening of VOCs in Pore Gas at MDA T, Fourth Quarter FY2011**

VOCs	Maximum Pore-Gas Concentration ( $\mu\text{g}/\text{m}^3$ )	Calculated Concentrations in Pore Gas Corresponding to Groundwater Standard <sup>a</sup> ( $\mu\text{g}/\text{m}^3$ )	SV <sup>b</sup> (unitless)
Acetone	88	34,853	0.00252
Carbon Tetrachloride	730	5500	0.133
Chlorodifluoromethane	130	177,285,714	0.000000733
Chloroform	1600	15,000	0.107
Dichloroethene[1,1-]	110	5500	0.02
Ethanol	100	na <sup>c</sup>	na
Hexane	31	64,824,000	0.000000478
Methylene Chloride	2200	650	<b>3.38</b>
Tetrachloroethene	3200	3600	0.889
Toluene	120	204,000	0.000588
Trichloroethane[1,1,1-]	400	42,300	0.00946
Trichloroethane[1,1,2-]	200	170	<b>1.18</b>
Trichloroethene	1500	2000	0.75

<sup>a</sup> Derived from denominator of Equation 3.0-3.

<sup>b</sup> Calculated using Equation 3.0-3. If the SV is less than 1, the concentration of the VOC in pore gas does not have the potential to exceed the groundwater SL. Screening values greater than 1 are in bold.

<sup>c</sup> na = Not available.



# **Appendix A**

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*Acronyms and Abbreviations,  
Metric Conversion Table, and Data Qualifier Definitions*



**A-1.0 ACRONYMS AND ABBREVIATIONS**

ADEP	Environmental Programs Directorate
bgs	below ground surface
COC	chain of custody
DER	duplicate error ratio
DOE	Department of Energy (U.S.)
EPA	Environmental Protection Agency (U.S.)
FY	fiscal year
LANL	Los Alamos National Laboratory
LCS	laboratory control sample
MCL	maximum contaminant level
MDA	material disposal area
NMED	New Mexico Environment Department
NMWQCC	New Mexico Water Quality Control Commission
PMR	periodic monitoring report
QA	quality assurance
QC	quality control
RACER	Risk Analysis, Communication, Evaluation, and Reduction
RPD	relative percent difference
RPF	Records Processing Facility
SCL	sample collection log
SL	screening level
SMO	Sample Management Office
SOP	standard operating procedure
SV	screening value
TA	technical area
TPU	total propagated uncertainty
VOC	volatile organic compound

**A-2.0 METRIC CONVERSION TABLE**

Multiply SI (Metric) Unit	by	To Obtain U.S. Customary Unit
kilometers (km)	0.622	miles (mi)
kilometers (km)	3281	feet (ft)
meters (m)	3.281	feet (ft)
meters (m)	39.37	inches (in.)
centimeters (cm)	0.03281	feet (ft)
centimeters (cm)	0.394	inches (in.)
millimeters (mm)	0.0394	inches (in.)
micrometers or microns ( $\mu\text{m}$ )	0.0000394	inches (in.)
square kilometers ( $\text{km}^2$ )	0.3861	square miles ( $\text{mi}^2$ )
hectares (ha)	2.5	acres
square meters ( $\text{m}^2$ )	10.764	square feet ( $\text{ft}^2$ )
cubic meters ( $\text{m}^3$ )	35.31	cubic feet ( $\text{ft}^3$ )
kilograms (kg)	2.2046	pounds (lb)
grams (g)	0.0353	ounces (oz)
grams per cubic centimeter ( $\text{g}/\text{cm}^3$ )	62.422	pounds per cubic foot ( $\text{lb}/\text{ft}^3$ )
milligrams per kilogram ( $\text{mg}/\text{kg}$ )	1	parts per million (ppm)
micrograms per gram ( $\mu\text{g}/\text{g}$ )	1	parts per million (ppm)
liters (L)	0.26	gallons (gal.)
milligrams per liter ( $\text{mg}/\text{L}$ )	1	parts per million (ppm)
degrees Celsius ( $^{\circ}\text{C}$ )	$9/5 + 32$	degrees Fahrenheit ( $^{\circ}\text{F}$ )

**A-3.0 DATA QUALIFIER DEFINITIONS**

Data Qualifier	Definition
U	The analyte was analyzed for but not detected.
J	The analyte was positively identified, and the associated numerical value is estimated to be more uncertain than would normally be expected for that analysis.
J+	The analyte was positively identified, and the result is likely to be biased high.
J-	The analyte was positively identified, and the result is likely to be biased low.
UJ	The analyte was not positively identified in the sample, and the associated value is an estimate of the sample-specific detection or quantitation limit.
R	The data are rejected as a result of major problems with quality assurance/quality control parameters.

# **Appendix B**

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*Field Methods*



## **B-1.0 INTRODUCTION**

This appendix summarizes the field methods used during the fourth quarter of fiscal year (FY) 2011 sampling activities at Material Disposal Area (MDA) T, Consolidated Unit 21-016(a)-099, in Technical Area 21, at Los Alamos National Laboratory (LANL or the Laboratory). All activities were conducted in accordance with the applicable standard operating procedures (SOPs), quality procedures, and Laboratory implementation and procedural requirements. Table B-1.0-1 summarizes the field methods used, and Table B-1.0-2 lists the applicable procedures

## **B-2.0 FIELD METHODS**

All work was conducted according to site-specific health and safety documents and an integrated work document. The field activities conducted according to SOPs are discussed below.

### **B-2.1 Pore-Gas Field Screening**

All samples were field screened in accordance with the current version of SOP-5074, Sampling Subsurface Vapor. This procedure covers the use of the MultiRAE IR Multi-Gas Monitor. All field-screening results were recorded on the appropriate sample collection logs (SCLs) and/or in the field logbook and are provided in Attachment D-1 of Appendix D (on CD).

#### **B-2.1.1 MultiRAE IR Multi-Gas Monitor**

Before each sampling event, each sampling port was purged of stagnant air and then monitored with a MultiRAE IR Multi-Gas Monitor until the percent carbon dioxide (%CO<sub>2</sub>) and percent oxygen (%O<sub>2</sub>) levels stabilized at values representative of subsurface pore-gas conditions. Each rented instrument was shipped factory-calibrated to the subcontractor, and the calibration was checked daily.

The MultiRAE IR Multi-Gas Monitor can also be calibrated using a two-point process using "fresh air" and a standard gas. The first point calibration is the fresh air calibration that determines the zero point of the calibration curve for lower explosive limit, volatile organic compound (VOC), and toxic gas sensors. The fresh air calibration uses air containing a 20.9% oxygen concentration and is void of toxic gases and other impurities. The standard gas calibration sets the second point of the sensor calibration curve. The CO, CO<sub>2</sub>, and O<sub>2</sub> sensors are zeroed during this two-point calibration process.

Calibration information is reported below for the MultiRAE IR Multi-Gas Monitor used to generate results presented in this periodic monitoring report.

- Unit 2375 was calibrated on September 2, 2011, at Geotech Environmental Equipment, Inc., in Denver, Colorado. The zero points were set for CO<sub>2</sub> and O<sub>2</sub>. Percent oxygen was set to read ambient air at 20.9%.

Oxygen values should be near the zero point for O<sub>2</sub>. The CO<sub>2</sub> reading should be near zero. Readings deviating from the zero points for O<sub>2</sub> and CO<sub>2</sub> may be because of subsurface conditions or a need for calibration.

The vapor-sample tubing was purged of stagnant air by drawing sufficient air from the sampling interval through the line. To ensure that the sample collected was representative of the subsurface air at depth, every sampling activity included a purge cycle.

The %CO<sub>2</sub> and %O<sub>2</sub> screening levels are presented in Appendix D. The fourth quarter of FY2011 %CO<sub>2</sub> and %O<sub>2</sub> levels ranged from 0.17% to 0.75% and from 19.7% to 20.5%, respectively. These values are within acceptable limits and are representative of subsurface pore-gas conditions.

### **B-2.2 VOC Pore-Gas Sample Collection**

All VOC samples were collected in accordance with the current version of SOP-5074 and were submitted to the Sample Management Office (SMO) for processing and transport to off-site contract analytical laboratories.

Upon completion of purging and field screening, VOC samples were taken using a sample train setup along with a SUMMA canister. Information was recorded on the appropriate SCLs. Field chain-of-custody (COC) forms and SCLs are provided in Attachment D-1 of Appendix D (on CD).

### **B-2.3 Tritium Pore-Gas Sample Collection**

All tritium samples were collected in accordance with the current version of SOP-5074 and were submitted to the SMO for processing and transport to off-site contract analytical laboratories. Water vapor intended for tritium analysis was collected from pore gas by pulling a pore-gas sample through a canister of silica gel (silica-gel column), and the sample information was recorded on the appropriate SCL in Attachment D-1 of Appendix D (on CD). Silica gel was the medium used at the Laboratory to collect moisture from pore-gas samples. The moisture was analyzed for tritium using liquid scintillation counting. Silica-gel column field duplicate samples were also collected at a frequency greater than or equal to 10% per sampling event in accordance with the current version of SOP-5059, Field Quality Control Samples.

Silica gel was prepared for sampling by drying it at a temperature above 100°C. Drying removes moisture from the silica gel but does not remove bound water that is accounted for by measuring the bound water percentage in each batch of silica gel. Before sample collection, the amount of silica gel used in each sample was weighed (typically about 135 g). The sample canister with silica gel was also weighed before sampling. SOP-5074 requires that at least 5 g of moisture be collected. After sampling, the sample canister with silica gel was weighed again to verify that 5 g of water vapor had been collected.

The sample (canister plus silica gel) was shipped to the analytical laboratory where it was weighed again. The silica gel was emptied into a distillation apparatus and heated to 110°C, driving moisture off the silica gel. This moisture was collected and analyzed for tritium by liquid scintillation. The laboratory also weighed the empty canister and calculated the percent moisture of the sample as the amount of moisture collected divided by the calculated weight of the wet silica gel. The value of the tritium activity and the calculated percent moisture were reported to the Laboratory in the analytical data package and the electronic data deliverable.



**Table B-1.0-1  
Summary of Field Methods**

Method	Summary
General Instructions for Field Investigations	This procedure provides an overview of instructions regarding activities performed before, during, and after field investigations. It is assumed field investigations involve standard sampling equipment, personal protective equipment, waste management, and site-control equipment/materials. The procedure covers pre-mobilization activities, mobilization to the site, documentation and sample collection activities, sample media evaluation, surveillance, and completion of lessons learned.
Sample Containers and Preservation	Specific requirements/processes for sample containers, preservation techniques, and holding times are based on the U.S. Environmental Protection Agency guidance for environmental sampling, preservation, and quality assurance. Specific requirements were met for each sample and were printed in the SCLs provided by the Laboratory's SMO (size and type of container, preservatives, etc.).
Handling, Packaging, and Transporting Field Samples	Field team members sealed and labeled samples before packing to ensure sample and transport containers were free of external contamination. All environmental samples were collected, preserved, packaged, and transported to the SMO under COC. The SMO arranged for shipping of the samples to analytical laboratories. Any levels of radioactivity (i.e., action-level or limited-quantity ranges) were documented in SCLs submitted to the SMO.
Sample Control and Field Documentation	The collection, screening, and transport of samples were documented in standard forms generated by the SMO. These forms include SCLs, COC forms, sample container labels, and custody seals. Collection logs were completed at the time of sample collection and were signed by the sampler and a reviewer who verified the logs for completeness and accuracy. Corresponding labels were initialed and applied to each sample container, and custody seals were placed around container lids or openings. COC forms were completed and signed to verify that the samples were not left unattended.
Field Quality Control Samples	Field quality control samples were collected as follows:  Field duplicates were collected at a frequency of 10% and at the same time as a regular sample and submitted for the same analyses.  Field blanks required for all field events that include collecting samples for VOC analyses were collected. Field blanks were kept with the other sample containers during the sampling process and were submitted for laboratory analyses.
Sampling Subsurface Vapor	Vapor sampling was performed at five monitoring wells in accordance with the current version of SOP-5074, and samples were analyzed for VOCs and tritium. This SOP describes the process of sampling subsurface air from vapor ports in monitoring wells and boreholes. The procedure covers presampling activities, sampling to detect and quantify gaseous organic concentration in air, SUMMA sampling (a passive collection and containment system of laboratory-quality air samples), adsorbent column sampling, sampling through the packer system (a sampling system that uses inflatable bladders to seal off a desired interval in an open borehole or at the end of a drill casing to obtain a sample from a discrete section), and postsampling activities.

**Table B-1.0-2**  
**List of Applicable General Procedures for MDA T Pore-Gas Monitoring Activities**

<b>Document Number</b>	<b>LANL Procedure Title</b>
SOP-5055	General Instructions for Field Investigations
SOP-5056	Sample Containers and Preservation
SOP-5057	Handling, Packaging, and Transporting Field Samples
WES-EDA-QP-219	Sample Control and Field Documentation
SOP-5059	Field Quality Control Samples
SOP-5061	Field Decontamination of Equipment
SOP-5074	Sampling Subsurface Vapor
P 101-6	Personal Protective Equipment
SOP-01.12	Field Site Closeout Checklist
SOP-01.13	Initiating and Managing Data Set Requests
SOP-5181	Notebook and Logbook Documentation for Environmental Directorate Technical and Field Activities
SOP-5228	ADEP* Reporting Requirements for Abnormal Events
SOP-5269	Chain-of-Custody for Analytical Data Record Packages

\*ADEP = Environmental Programs Directorate.

# **Appendix C**

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*Quality Assurance/Quality Control Program*



## **C-1.0 INTRODUCTION**

This appendix presents the analytical methods and summarizes the data quality review for the fourth quarter of fiscal year (FY) 2011 pore-gas samples collected at Material Disposal Area (MDA) T, Consolidated Unit 21-016(a)-99, in Technical Area 21, at Los Alamos National Laboratory (LANL or the Laboratory).

Quality assurance (QA), quality control (QC), and data validation procedures were implemented in accordance with the Laboratory's "Quality Assurance Project Plan Requirements for Sampling and Analysis" (LANL 1996, 054609) and the Laboratory's scope of work for analytical services (LANL 2008, 109962). The results of the QA/QC activities were used to estimate the accuracy, bias, and precision of the analytical measurements. QC samples, including method blanks, blank spikes, matrix spikes, laboratory control samples (LCSs), internal standards, initial and continuing calibrations, and surrogates, were used to assess laboratory accuracy and bias.

The type and frequency of QC analyses are described in the analytical services scope of work (LANL 2008, 109962). Other QC factors, such as sample preservation and holding times, were also assessed. The requirements for sample preservation and holding times are presented in Standard Operating Procedure (SOP) 5056, Sample Containers and Preservation. Evaluating these QC indicators allows estimates to be made of the accuracy, bias, and precision of the analytical suites. A focused data validation was also performed for all the data packages (identified by request number) that included a more detailed review of the raw data. The SOPs used for data validation are presented in Table C-1.0-1. Copies of the analytical data, laboratory logbooks, and instrument printouts are provided in Attachment D-1 of Appendix D (on CD).

Analytical data were reviewed and evaluated based on U.S. Environmental Protection Agency (EPA) National Functional Guidelines for organic and inorganic chemical data review where applicable (EPA 1994, 048639; EPA 1999, 066649). Data have also been assessed using guidelines established in Method SW-846 (EPA 1997, 057589). As a result of the data validation and assessment efforts, qualifiers have been assigned to the appropriate analytical records. Definitions of the data qualifiers are presented in Appendix A.

### **C-1.1 Maintenance of Chain of Custody**

To maintain chain of custody is to document or demonstrate the possession of an item by only authorized individuals. The chain-of-custody process, described in SOP-5269, Chain of Custody for Analytical Data Record Packages, provides confidence in, and documentation of, analytical data integrity by establishing the traceability of the sample from the time of collection through processing to final maintenance as a record. The chain-of-custody forms are provided in Attachment D-1 of Appendix D (on CD).

### **C-1.2 Sample Documentation**

Establishing sample documentation acceptability, as described in WES-EDA-QP-219, Sample Control and Field Documentation, is the first step toward verifying that an analytical system has produced data of known quality. Documentation depends on the accessibility of review items that accurately and completely describe the work performed. In the absence of adequate sample documentation, data quality cannot be independently verified.

### **C-1.3 Sample Preservation**

Sample preservation is the use of specific types of sample containers and preservation techniques, as described in SOP-5056. Sample preservation is mandatory for hazardous site investigations because the integrity of any sample decreases over time. Physical factors (e.g., light, pressure, or temperature), chemical factors (e.g., changes in pH or volatilization), and biological factors may alter the original quality of a sample. Because the various target parameters are uniquely altered at varying rates, distinct sample containers, preservation techniques, and holding times have been established to maintain sample integrity for a reasonable and acceptable period of time.

### **C-1.4 Holding Times**

Holding time, the maximum amount of time a sample can be stored without potential unacceptable changes in analyte concentrations, is described in SOP-5056. Extraction holding time refers to the time that elapses between sample collection and sample preparation; analytical holding time refers to the time that elapses between sample preparation and analysis.

### **C-1.5 Initial and Continuing Calibration Verification (Including Interference-Check Standards)**

Calibration verification establishes a quantitative relationship between the response of the analytical procedure and the concentration of the target analyte. There are two aspects of calibration verification: initial and continuing. The initial calibration verifies the accuracy of the calibration curve and the individual calibration standards being used to perform the calibration. The continuing calibration ensures that the initial calibration is still holding and correct as the instrument is used to process samples. Interference-check samples are used to determine if a high concentration of a single analyte in a sample interferes with the accurate quantitation of other analytes.

### **C-1.6 Analyte Identification (Including Spectra Review and Thermal Ionization Cavity Review)**

Analyte identification is the process of associating an instrument signal with a compound or analyte of interest. Evaluation of signal retention times, spectral overlap, multiplex pattern matching, and mass spectral library searches are tools for making analyte identification determinations.

### **C-1.7 Analyte Quantitation**

Analyte quantitation is the association of an instrument signal with a concentration and the determination that a recorded signal is detected or not detected. Detection limits, instrument calibration linear ranges, internal standards, and carrier recoveries are tools for making analyte quantitation evaluations.

Organic chemical results are not detected if reported results are less than or equal to the method detection limit adjusted by sample-specific dilution or concentration factors.

Tritium results reported at less than the minimum detectable concentration are not detected. Each tritium result is also compared with the corresponding 1-sigma total propagated uncertainty (TPU). If the result is not greater than 3 times the TPU, it is also qualified as not detected (U).

### **C-1.8 Method Blanks**

A method blank is an analyte-free matrix to which all reagents are added in the same volumes or proportions as those used in the environmental sample processing and is extracted and analyzed in the same manner as the corresponding environmental samples. Method blanks are used to assess the

potential for sample contamination during extraction and analysis. All target analytes should be below the contract-required detection limit in the method blank (LANL 2008, 109962).

### **C-1.9 Matrix Spike Recoveries**

A matrix spike is an aliquot of a sample spiked with a known concentration of the target analyte(s). Matrix spike samples are used to measure the ability to recover prescribed analytes from a native sample matrix. Spiking typically occurs before sample preparation and analysis. Acceptable percentage recoveries for matrix spikes vary by method but should generally be greater than 10% for an analytical result to be usable (LANL 2008, 109962).

### **C-1.10 Surrogates**

Surrogates (organic chemical compounds) are similar in composition and behavior to target analytes but are not typically found in environmental samples. Surrogates are added to every blank, sample, and spike to evaluate the efficiency with which target analytes are recovered during extraction and analysis. The recovery percentages of the surrogates vary by method but should generally be greater than 10% for an analytical result to be usable (LANL 2008, 109962).

### **C-1.11 Internal Standard Responses and Carrier Recoveries**

Internal standards are chemical compounds added to blank, sample, and standard extracts at known concentrations. They are used to compensate for (1) analyte concentration changes that might occur during storage of the extract and (2) quantitation variations that can occur during analysis. Internal standard responses are used to adjust the reported concentrations for the quantitation of target analytes. The response factors for internal standards vary by method but should generally be within the range of  $\geq 50\%$  to  $\leq 200\%$  (LANL 2008, 109962).

### **C-1.12 LCS Recoveries**

An LCS is a known matrix that has been spiked with compound(s) representative of the target analytes. The LCS is used to document laboratory performance. The acceptance criteria for LCSs are method-specific but should generally be greater than 10% for an analytical result to be usable (LANL 2008, 109962).

### **C-1.13 Laboratory and Field Duplicates (Including Serial Dilutions)**

Laboratory duplicates are two portions of a sample taken from the same sample container (prepared for analysis and analyzed independently but under identical conditions) that are used to assess or demonstrate acceptable laboratory-method precision at the time of analysis. For radionuclide laboratory duplicates, the duplicate error ratio (DER) is also used to quantify precision. The DER is defined by the equation  $DER = |S - D|/\sqrt{[(2\sigma_S)^2 + (2\sigma_D)^2]}$ , where S represents the original sample value, D represents the duplicate value, and  $2\sigma_S$  and  $2\sigma_D$  represent the 2-sigma uncertainties surrounding the original and duplicate samples, respectively. A DER below 3 indicates sample-to-field-duplicate precision that is in control.

Field duplicates are samples taken as close as possible to the same time and from the same location. They are analyzed as two separate samples at the laboratory. Each duplicate sample is equally representative of the original material. All relative percent differences (RPDs) between samples and field duplicates should be  $\pm 35\%$  (LANL 2008, 109962). The RPD is defined by the equation  $RPD = [|D1 - D2|/(D1 + D2)/2] \times 100\%$ , where D1 and D2 represent analytical measurements on

duplicate samples. Field duplicates are collected for both volatile organic compound (VOC) and radionuclide analytes.

The field duplicate samples were collected at a frequency greater than or equal to 10% per sampling event in accordance with the current version of SOP-5059, Field Quality Control Samples.

#### **C-1.14 Field Blanks, Equipment Blanks, and Performance Evaluations**

A field blank is a sample of analyte-free medium taken to the sampling site and exposed to the atmosphere during sample-collection activities. Field blanks are used to measure contamination introduced during sample collection. The field blank samples were collected at a frequency greater than or equal to 10% per sampling event in accordance with the current version of SOP-5059.

An equipment blank is a sample used to verify cleanliness of the sampling equipment. It is collected after completion of decontamination and before sampling.

A performance evaluation is a sample of the field-screening instrument (Brüel and Kjær) operational check gas. The operational check gas consists of known quantities of mixed organic analytes in nitrogen.

#### **C-2.0 LABORATORY ANALYSIS SUMMARY**

During the fourth quarter of FY2011, 34 VOC pore-gas samples, 4 field blank samples, and 4 field duplicate samples were collected at MDA T. Additionally, 34 tritium samples, 4 field blank samples, and 4 field duplicate samples were collected. Analysis of pore gas was conducted for VOCs using EPA Method TO-15, and analysis for tritium was conducted using EPA Method 906.0. Table C-2.0-1 lists the analytical methods used for VOC and tritium analyses. All QC procedures were followed, as required by the analytical services scope of work (LANL 2008, 109962).

Sampling locations, sampling ports, and validated analytical results for VOCs and tritium are presented in Appendix D of this periodic monitoring report. The entire data set meets the standards for use in this report.

The tritium and VOC analyses are summarized in the following sections. The required minimum detectable concentration or estimated quantitation limit is prescribed in the analytical services scope of work (LANL 2008, 109962).

#### **C-3.0 ORGANIC CHEMICAL ANALYSES**

No VOC data were rejected during the fourth quarter of FY2011. Chain of custody, field documentation, and holding times were properly maintained for all samples. No sample preservation is required for VOCs. Analyte identification criteria were met for all VOC results. Method blanks, surrogate recoveries, and internal standards responses were all within acceptable limits. The data qualifiers are defined in Appendix A.

A total of 102 VOCs were qualified as UJ because the initial calibration curve and/or continuing calibration curve were recovered outside the method-specific limits.

A total of 64 VOCs were qualified as UJ because the affected analytes were analyzed with an initial calibration curve that exceeded the percent relative standard deviation criteria, and/or the associated multipoint calibration correlation coefficient is less than 0.995.



Two field duplicates and their associated samples had an RPD >35%. Table C-3.0-1 summarizes samples containing RPDs >35%.

One field blank had a detectable level of toluene. The concentration was 81 µg/m<sup>3</sup> in vapor-monitoring well 21-603059.

#### **C-4.0 RADIONUCLIDE ANALYSES**

No tritium results were rejected during the fourth quarter of FY2011. Chain of custody, field documentation, and holding times were properly maintained for all samples. No sample preservation is required for tritium. The LCS recoveries were within acceptable limits for all tritium analyses.

Three tritium samples were qualified as J because the affected analytes are considered estimated and biased high; these analytes were identified in the method blank but were greater than five times the method blank.

Eight tritium samples were qualified as U because the sample result was less than or equal to five times the concentration of the related analyte in the method blank.

Five tritium samples were qualified as U because the associated sample concentration was less than or equal to the minimum detectable concentration.

No field duplicates and their associated samples had RPDs >35%.

One field blank had a detectable level of tritium. The activity detected was 347 pCi/L in vapor-monitoring well 21-603059.

#### **C-5.0 REFERENCES**

*The following list includes all documents cited in this appendix. Parenthetical information following each reference provides the author(s), publication date, and ER ID. This information is also included in text citations. ER IDs are assigned by the Environmental Programs Directorate's Records Processing Facility (RPF) and are used to locate the document at the RPF and, where applicable, in the master reference set.*

*Copies of the master reference set are maintained at the NMED Hazardous Waste Bureau and the Directorate. The set was developed to ensure that the administrative authority has all material needed to review this document, and it is updated with every document submitted to the administrative authority. Documents previously submitted to the administrative authority are not included.*

EPA (U.S. Environmental Protection Agency), February 1994. "USEPA Contract Laboratory Program National Functional Guidelines for Inorganic Data Review," EPA-540/R-94/013, Office of Emergency and Remedial Response, Washington, D.C. (EPA 1994, 048639)

EPA (U.S. Environmental Protection Agency), 1997. "Test Methods for Evaluating Solid Waste, Laboratory Manual, Physical/Chemical Methods," SW-846, 3rd ed., Update III, Office of Solid Waste and Emergency Response, Washington, D.C. (EPA 1997, 057589)

EPA (U.S. Environmental Protection Agency), October 1999. "USEPA Contract Laboratory Program National Functional Guidelines for Organic Data Review," EPA540/R-99/008, Office of Emergency and Remedial Response, Washington, D.C. (EPA 1999, 066649)

LANL (Los Alamos National Laboratory), March 1996. "Quality Assurance Project Plan Requirements for Sampling and Analysis," Los Alamos National Laboratory document LA-UR-96-441, Los Alamos, New Mexico. (LANL 1996, 054609)

LANL (Los Alamos National Laboratory), June 30, 2008. "Exhibit 'D' Scope of Work and Technical Specifications, Analytical Laboratory Services for General Inorganic, Organic, Radiochemical, Asbestos, Low-Level Tritium, Particle Analysis, Bioassay, Dissolved Organic Carbon Fractionation, and PCB Congeners," Los Alamos National Laboratory document RFP No. 63639-RFP-08, Los Alamos, New Mexico. (LANL 2008, 109962)

**Table C-1.0-1  
Data Validation Procedures**

Procedure	Title	Effective Date
SOP-5161, R0	Routine Validation of Volatile Organic Compound (VOC) Analytical Data	6/10/2008
SOP-5166, R0	Routine Validation of Gamma Spectroscopy, Chemical Separation Alpha Spectrometry, Gas Proportional Counting, and Liquid Scintillation Analytical Data	6/30/2008

**Table C-2.0-1  
Analytical Methods Used for Sample Analyses**

Analytical Method	Analytical Description	Target Compound List
EPA Method TO-15	VOCs in pore gas	See analytical services scope of work (LANL 2008, 109962)
EPA Method 906.0	Tritium in pore gas	Tritium

**Table C-3.0-1  
VOC Sample Record with Field Duplicate Relative Percent Difference above 35%**

Vapor-Monitoring Well ID	Depth (ft)	Analyte	Sample Standard Result ( $\mu\text{g}/\text{m}^3$ )	Field Duplicate Result ( $\mu\text{g}/\text{m}^3$ )	RPD (%)
21-25264	153	Methylene Chloride	8.1	110	172.6
21-25264	153	Tetrachloroethene	9.8	450	191.5



## **Appendix D**

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*Field-Screening Results and  
Detected Volatile Organic Compounds and Tritium*



## **D-1.0 INTRODUCTION**

This appendix summarizes the field-screening results as well as detected volatile organic compound (VOC) concentrations and tritium activities for the fourth quarter of fiscal year (FY) 2011 at Material Disposal Area (MDA) T. The tables listed below are included in this appendix and are organized by vapor-monitoring well ID and depth.

- Table D-1.0-1, Summary of Pore-Gas Field-Screening Results Using a MultiRAE IR Multi-Gas Monitor at MDA T
- Table D-1.0-2, Summary of VOCs Detected in Pore-Gas Samples at MDA T
- Table D-1.0-3, Summary of Detected Tritium Results at MDA T

Data qualifiers used in these tables are defined in Appendix A of this periodic monitoring report.

Attachment D-1 (on CD included with this document) presents the analytical suites and results and analytical reports for the current and previous three monitoring periods.





**Table D-1.0-1  
Summary of Pore-Gas Field-Screening Results Using a MultiRAE IR Multi-Gas Monitor at MDA T**

Vapor-Monitoring Well ID	Begin Depth (ft bgs <sup>a</sup> )	End Depth (ft bgs)	December 2010			2nd Quarter FY2011			3rd Quarter FY2011			4th Quarter FY2011		
			Collection Date	%O <sub>2</sub> <sup>b</sup>	%CO <sub>2</sub> <sup>c</sup>	Collection Date	%O <sub>2</sub>	%CO <sub>2</sub>	Collection Date	%O <sub>2</sub>	%CO <sub>2</sub>	Collection Date	%O <sub>2</sub>	%CO <sub>2</sub>
21-25262	80	85	12/16/10	20.5	0.3	04/18/11	20.0	0.8	06/16/11	20.1	0.79	09/23/11	19.9	0.65
	115	120	12/16/10	20.6	0.2	04/18/11	19.9	0.6	06/16/11	20.5	0.45	09/23/11	20.1	0.52
	232	237	12/16/10	20.2	0.7	04/18/11	19.8	1.0	06/16/11	20.2	0.91	09/23/11	19.8	0.73
	295	300	12/16/10	20.1	0.7	04/18/11	19.8	1.0	06/16/11	20.2	0.87	09/23/11	19.7	0.75
	329.5	334.5	12/16/10	20.2	0.5	04/18/11	20.6	0.2	06/16/11	20.4	0.69	09/23/11	20.2	0.34
	375	380	12/16/10	20.4	0.3	04/18/11	20.1	0.5	06/16/11	20.4	0.41	09/23/11	19.9	0.47
	472	478	12/16/10	20.4	0.2	04/18/11	20.1	0.3	06/16/11	20.5	0.28	09/23/11	19.9	0.35
	572	577	12/16/10	20.5	0.2	04/18/11	20.1	0.3	06/16/11	20.6	0.23	09/23/11	20.0	0.28
	686	691	12/16/10	20.5	0.1	04/18/11	20.2	0.2	06/16/11	20.9	0.17	09/23/11	20.2	0.25
21-25264	67.5	72.5	12/15/10	20.4	0.3	04/07/11	19.6	0.8	06/24/11	19.8	1.0	09/19/11	19.9	0.68
	150.5	155.5	12/15/10	20.5	0.3	04/07/11	19.7	0.9	06/24/11	19.8	1.0	09/19/11	20.0	0.65
	222.5	227.5	12/15/10	20.5	0.3	04/07/11	19.6	0.9	06/24/11	19.8	1.0	09/19/11	19.9	0.67
	323	328	12/15/10	20.6	0.2	04/07/11	19.6	0.7	06/24/11	20.0	0.71	09/19/11	20.1	0.55
	349.5	354.5	12/15/10	20.6	0.2	04/07/11	20.4	0.3	06/24/11	19.9	0.59	09/19/11	20.2	0.46
21-603058	67.5	72.5	12/21/10	20.1	0.7	04/14/11	20.4	0.6	06/20/11	20.2	1.1	09/22/11	20.0	0.69
	217	222	12/21/10	20.4	0.5	04/14/11	20.5	0.4	06/20/11	20.3	0.86	09/22/11	20.0	0.63
	242.5	247.5	12/21/10	20.4	0.4	04/14/11	20.5	0.5	06/20/11	20.2	0.79	09/22/11	19.9	0.62
	339.5	344.5	12/21/10	20.5	0.4	04/14/11	20.5	0.4	06/20/11	20.3	0.70	09/22/11	19.8	0.61
21-603059	77.5	82.5	12/10/10	20.2	0.5	04/15/11	19.9	0.7	06/17/11	20.1	0.87	09/16/11	20.1	0.61
	187.5	192.5	12/10/10	20.2	0.5	04/15/11	20.1	0.7	06/17/11	20.3	0.76	09/16/11	20.3	0.55
	229.5	234.5	12/10/10	19.9	0.7	04/15/11	20.1	0.9	06/17/11	20.3	0.96	09/16/11	20.5	0.46
	292.5	297.5	12/10/10	19.8	0.6	04/15/11	20.1	0.7	06/17/11	20.2	1.6	09/16/11	20.2	0.71
	372.5	377.5	12/10/10	20.1	0.3	04/15/11	20.1	0.4	06/17/11	20.4	0.52	09/16/11	20.5	0.50

Table D-1.0-1 (continued)

Vapor-Monitoring Well ID	Begin Depth (ft bgs <sup>a</sup> )	End Depth (ft bgs)	December 2010			2nd Quarter FY2011			3rd Quarter FY2011			4th Quarter FY2011		
			Collection Date	%O <sub>2</sub> <sup>b</sup>	%CO <sub>2</sub> <sup>c</sup>	Collection Date	%O <sub>2</sub>	%CO <sub>2</sub>	Collection Date	%O <sub>2</sub>	%CO <sub>2</sub>	Collection Date	%O <sub>2</sub>	%CO <sub>2</sub>
21-607955	71.1	76.4	12/13/10	20.3	0.4	04/12/11	19.9	0.8	06/21/11	20.1	0.92	09/21/11	19.8	0.67
	153.8	159.7	12/13/10	20.4	0.4	04/12/11	20.1	0.7	06/21/11	20.1	0.86	09/21/11	20.0	0.64
	173.4	179	12/13/10	20.4	0.4	04/12/11	20.0	0.5	06/21/11	20.1	0.82	09/21/11	20.1	0.65
	225.9	232.1	12/13/10	20.5	0.3	04/12/11	20.2	0.6	06/21/11	20.1	0.74	09/21/11	20.1	0.62
	326.6	333.4	12/13/10	20.5	0.3	04/12/11	20.4	0.5	06/21/11	20.5	0.32	09/21/11	20.3	0.54
	353.3	359.6	12/13/10	20.5	0.2	04/12/11	20.4	0.3	06/21/11	20.7	0.08	09/21/11	20.3	0.17
	459.4	464.8	12/13/10	20.5	0.2	04/12/11	20.4	0.3	06/21/11	20.3	0.43	09/21/11	20.3	0.35
	559	565	12/13/10	20.5	0.2	04/12/11	20.4	0.2	06/21/11	20.4	0.36	09/21/11	20.4	0.30
	651.3	657.3	12/13/10	20.6	0.1	04/12/11	20.4	0.2	06/21/11	20.4	0.30	09/21/11	20.5	0.27
	797.2	803.1	12/13/10	20.3	0.1	04/12/11	20.4	0.1	06/21/11	20.9	0.05	09/21/11	19.7	0.21
946.2	952.1	12/13/10	20.9	0.0	04/12/11	20.9	0.0	06/21/11	20.9	0.06	09/21/11	19.7	0.21	

<sup>a</sup> bgs = Below ground surface.

<sup>b</sup> %O<sub>2</sub> = Percent oxygen.

<sup>c</sup> %CO<sub>2</sub> = Percent carbon dioxide.

**Table D-1.0-2  
Summary of VOCs Detected in Pore-Gas Samples at MDA T**

Vapor Monitoring Well ID	Begin Depth (ft bgs <sup>a</sup> )	End Depth (ft bgs)	Analyte	December 2010		2nd Quarter FY2011		3rd Quarter FY2011		4th Quarter FY2011	
				Collection Date	Result (µg/m <sup>3</sup> )	Collection Date	Result (µg/m <sup>3</sup> )	Collection Date	Result (µg/m <sup>3</sup> )	Collection Date	Result (µg/m <sup>3</sup> )
21-25262	80	85	Carbon Tetrachloride	12/16/10	74	04/22/11	61	06/16/11	ND <sup>b</sup>	09/23/11	68
			Chloroform	12/16/10	1600	04/22/11	1400	06/16/11	1300	09/23/11	1500
			Tetrachloroethene	12/16/10	2800	04/22/11	2900	06/16/11	2700	09/23/11	3000
			Trichloroethene	12/16/10	810	04/22/11	780	06/16/11	840	09/23/11	760
	115	120	Carbon Tetrachloride	12/16/10	63	04/22/11	ND	06/16/11	ND	09/23/11	ND
			Chloroform	12/16/10	740	04/22/11	620	06/16/11	560	09/23/11	620
			Tetrachloroethene	12/16/10	680	04/22/11	800	06/16/11	630	09/23/11	740
			Trichloroethene	12/16/10	450	04/22/11	430	06/16/11	350	09/23/11	390
	232	237	Carbon Tetrachloride	12/16/10	320	04/22/11	310	06/16/11	260	09/23/11	260
			Chloroform	12/16/10	760	04/22/11	680	06/16/11	610	09/23/11	610
			Methylene Chloride	12/16/10	47	04/22/11	44	06/16/11	41	09/23/11	40
			Tetrachloroethene	12/16/10	310	04/22/11	340	06/16/11	260	09/23/11	270
			Trichloroethene	12/16/10	ND	04/22/11	630	06/16/11	550	09/23/11	490
	295	300	Carbon Tetrachloride	12/16/10	800	04/22/11	670	06/16/11	530	09/23/11	730
			Chloroform	12/16/10	800	04/22/11	680	06/16/11	550	09/23/11	760
			Methylene Chloride	12/16/10	110	04/22/11	100	06/16/11	74	09/23/11	73
			Tetrachloroethene	12/16/10	200	04/22/11	200	06/16/11	160	09/23/11	200
			Toluene	12/16/10	ND	04/22/11	ND	06/16/11	47	09/23/11	ND
			Trichloroethene	12/16/10	1300	04/22/11	1300	06/16/11	1000	09/23/11	1300
	329.5	334.5	Carbon Tetrachloride	12/16/10	800	04/22/11	710	06/16/11	610	09/23/11	610
Chloroform			12/16/10	800	04/22/11	690	06/16/11	630	09/23/11	650	
Dichloroethene[1,1-]			12/16/10	45	04/22/11	ND	06/16/11	34 (J)	09/23/11	ND	
Methylene Chloride			12/16/10	490	04/22/11	390	06/16/11	400	09/23/11	290	
Tetrachloroethene			12/16/10	180	04/22/11	180	06/16/11	160	09/23/11	150	

Table D-1.0-2 (continued)

Vapor Monitoring Well ID	Begin Depth (ft bgs <sup>a</sup> )	End Depth (ft bgs)	Analyte	December 2010		2nd Quarter FY2011		3rd Quarter FY2011		4th Quarter FY2011	
				Collection Date	Result (µg/m <sup>3</sup> )	Collection Date	Result (µg/m <sup>3</sup> )	Collection Date	Result (µg/m <sup>3</sup> )	Collection Date	Result (µg/m <sup>3</sup> )
21-25262	329.5	334.5	Trichloroethane[1,1,2-]	12/16/10	46	04/22/11	ND	06/16/11	ND	09/23/11	ND
			Trichloroethene	12/16/10	1400	04/22/11	1400	06/16/11	1200	09/23/11	1100
	375	380	Carbon Tetrachloride	12/16/10	660	04/22/11	580	06/16/11	500	09/23/11	510
			Chlorodifluoromethane	12/16/10	ND	04/22/11	ND	06/16/11	ND	09/23/11	130
			Chloroform	12/16/10	980	04/22/11	850	06/16/11	800	09/23/11	730
			Dichloroethene[1,1-]	12/16/10	73	04/22/11	50	06/16/11	58	09/23/11	45
			Ethanol	12/16/10	ND	04/22/11	ND	06/16/11	ND	09/23/11	100
			Hexane	12/16/10	ND	04/22/11	ND	06/16/11	ND	09/23/11	31
			Methylene Chloride	12/16/10	<b>1200</b>	04/22/11	<b>900</b>	06/16/11	<b>920</b>	09/23/11	<b>680</b>
			Tetrachloroethene	12/16/10	110	04/22/11	110	06/16/11	100	09/23/11	88
			Toluene	12/16/10	ND	04/22/11	ND	06/16/11	ND	09/23/11	120
			Trichloroethane[1,1,2-]	12/16/10	100	04/22/11	90	06/16/11	74	09/23/11	72
	Trichloroethene	12/16/10	1500	04/22/11	1500	06/16/11	1400	09/23/11	1100		
	472	478	Carbon Tetrachloride	12/16/10	610	04/22/11	540	06/16/11	480	09/23/11	550
			Chloroform	12/16/10	1600	04/22/11	1400	06/16/11	1300	09/23/11	1400
			Dichloroethene[1,1-]	12/16/10	120	04/22/11	88	06/16/11	120	09/23/11	92
			Methylene Chloride	12/16/10	<b>2400</b>	04/22/11	<b>1800</b>	06/16/11	<b>2200</b>	09/23/11	<b>1700</b>
			Tetrachloroethene	12/16/10	81	04/22/11	84	06/16/11	80	09/23/11	81
			Trichloroethane[1,1,2-]	12/16/10	<b>240</b>	04/22/11	<b>210</b>	06/16/11	<b>190</b>	09/23/11	<b>200</b>
	572	577	Trichloroethene	12/16/10	1700	04/22/11	1600	06/16/11	1400	09/23/11	1500
			Carbon Tetrachloride	12/16/10	350	04/22/11	300	06/16/11	260	09/23/11	300
			Chloroform	12/16/10	1900	04/22/11	1600	06/16/11	1400	09/23/11	1600
			Dichloroethene[1,1-]	12/16/10	150	04/22/11	100	06/16/11	130	09/23/11	100
Methylene Chloride			12/16/10	<b>3100</b>	04/22/11	<b>2500</b>	06/16/11	<b>2400</b>	09/23/11	<b>2000</b>	
Trichloroethane[1,1,2-]			12/16/10	150	04/22/11	140	06/16/11	120	09/23/11	120	
Trichloroethene	12/16/10	1400	04/22/11	1400	06/16/11	1100	09/23/11	1200			

Table D-1.0-2 (continued)

Vapor Monitoring Well ID	Begin Depth (ft bgs <sup>a</sup> )	End Depth (ft bgs)	Analyte	December 2010		2nd Quarter FY2011		3rd Quarter FY2011		4th Quarter FY2011	
				Collection Date	Result (µg/m <sup>3</sup> )	Collection Date	Result (µg/m <sup>3</sup> )	Collection Date	Result (µg/m <sup>3</sup> )	Collection Date	Result (µg/m <sup>3</sup> )
21-25262	686	691	Carbon Tetrachloride	12/16/10	69	04/22/11	87	06/16/11	64	09/23/11	93
			Chloroform	12/16/10	910	04/22/11	1000	06/16/11	930	09/23/11	1200
			Dichloroethene[1,1-]	12/16/10	100	04/22/11	97	06/16/11	120	09/23/11	110
			Methylene Chloride	12/16/10	<b>980</b>	04/22/11	<b>1100</b>	06/16/11	<b>1200</b>	09/23/11	<b>1000</b>
			Trichloroethane[1,1,2-]	12/16/10	92	04/22/11	90	06/16/11	72	09/23/11	90
			Trichloroethene	12/16/10	420	04/22/11	510	06/16/11	400	09/23/11	540
21-25264	67.5	72.5	Carbon Tetrachloride	12/15/10	97	04/08/11	100	06/24/11	93	09/19/11	97
			Chloroform	12/15/10	320	04/08/11	350	06/24/11	350	09/19/11	360
			Tetrachloroethene	12/15/10	2500	04/08/11	2900	06/24/11	2600	09/19/11	3000
			Toluene	12/15/10	32	04/08/11	ND	06/24/11	ND	09/19/11	ND
			Trichloroethene	12/15/10	840	04/08/11	960	06/24/11	840	09/19/11	930
	150.5	155.5	Acetone	12/15/10	ND	04/08/11	ND	06/24/11	ND	09/19/11	13
			Carbon Tetrachloride	12/15/10	130	04/08/11	120	06/24/11	94	09/19/11	ND
			Chloroform	12/15/10	360	04/08/11	310	06/24/11	310	09/19/11	ND
			Ethanol	12/15/10	ND	04/08/11	ND	06/24/11	ND	09/19/11	8
			Methylene Chloride	12/15/10	110	04/08/11	94	06/24/11	91	09/19/11	8.1
			Tetrachloroethene	12/15/10	430	04/08/11	430	06/24/11	400	09/19/11	9.8
			Toluene	12/15/10	ND	04/08/11	ND	06/24/11	ND	09/19/11	6.9
			Trichloroethene	12/15/10	480	04/08/11	450	06/24/11	420	09/19/11	ND
	222.5	227.5	Carbon Tetrachloride	12/15/10	260	04/08/11	300	06/24/11	220	09/19/11	290
			Chloroform	12/15/10	450	04/08/11	510	06/24/11	410	09/19/11	540
			Methylene Chloride	12/15/10	530	04/08/11	580	06/24/11	470	09/19/11	570
			Tetrachloroethene	12/15/10	280	04/08/11	210	06/24/11	160	09/19/11	240
			Trichloroethene	12/15/10	600	04/08/11	670	06/24/11	490	09/19/11	670
	323	328	Carbon Tetrachloride	12/15/10	250	04/08/11	420	06/24/11	280	09/19/11	400
			Chloroform	12/15/10	480	04/08/11	790	06/24/11	560	09/19/11	820

Table D-1.0-2 (continued)

Vapor Monitoring Well ID	Begin Depth (ft bgs <sup>a</sup> )	End Depth (ft bgs)	Analyte	December 2010		2nd Quarter FY2011		3rd Quarter FY2011		4th Quarter FY2011	
				Collection Date	Result (µg/m <sup>3</sup> )	Collection Date	Result (µg/m <sup>3</sup> )	Collection Date	Result (µg/m <sup>3</sup> )	Collection Date	Result (µg/m <sup>3</sup> )
21-25264	323	328	Methylene Chloride	12/15/10	670	04/08/11	1000	06/24/11	700	09/19/11	880
			Tetrachloroethene	12/15/10	ND	04/08/11	68	06/24/11	ND	09/19/11	ND
			Trichloroethene	12/15/10	500	04/08/11	840	06/24/11	550	09/19/11	820
	349.5	354.5	Carbon Tetrachloride	12/15/10	180	04/08/11	190	06/24/11	250	09/19/11	390
			Chloroform	12/15/10	460	04/08/11	440	06/24/11	700	09/19/11	1000
			Methylene Chloride	12/15/10	870	04/08/11	810	06/24/11	1200	09/19/11	1600
			Toluene	12/15/10	42	04/08/11	ND	06/24/11	ND	09/19/11	ND
			Trichloroethene	12/15/10	400	04/08/11	400	06/24/11	560	09/19/11	810
21-603058	67.5	72.5	Carbon Tetrachloride	12/20/10	62	04/15/11	ND	06/20/11	ND	09/22/11	61
			Chloroform	12/20/10	500	04/15/11	310	06/20/11	570	09/22/11	550
			Dichlorodifluoromethane	12/20/10	4.9	04/15/11	ND	06/20/11	ND	09/22/11	ND
			Methylene Chloride	12/20/10	4.4	04/15/11	ND	06/20/11	ND	09/22/11	ND
			Tetrachloroethene	12/20/10	760	04/15/11	540	06/20/11	800	09/22/11	720
			Trichloroethane[1,1,1-]	12/20/10	17	04/15/11	ND	06/20/11	ND	09/22/11	ND
			Trichloroethene	12/20/10	330	04/15/11	210	06/20/11	340	09/22/11	300
	217	222	Benzene	12/20/10	2.8 (J)	04/15/11	ND	06/20/11	ND	09/22/11	ND
			Carbon Tetrachloride	12/20/10	220	04/15/11	140	06/20/11	300	09/22/11	360
			Chloroform	12/20/10	480	04/15/11	340	06/20/11	880	09/22/11	850
			Dichlorodifluoromethane	12/20/10	5.2	04/15/11	ND	06/20/11	ND	09/22/11	ND
			Dichloroethane[1,2-]	12/20/10	4.2	04/15/11	ND	06/20/11	ND	09/22/11	ND
			Dichloroethane[1,1-]	12/20/10	5.2	04/15/11	ND	06/20/11	ND	09/22/11	ND
			Methylene Chloride	12/20/10	280	04/15/11	200	06/20/11	600	09/22/11	390
			Tetrachloroethene	12/20/10	160	04/15/11	120	06/20/11	270	09/22/11	290
			Toluene	12/20/10	7.3	04/15/11	ND	06/20/11	ND	09/22/11	ND
			Trichloro-1,2,2-trifluoroethane[1,1,2-]	12/20/10	14	04/15/11	ND	06/20/11	ND	09/22/11	ND

Table D-1.0-2 (continued)

Vapor Monitoring Well ID	Begin Depth (ft bgs <sup>a</sup> )	End Depth (ft bgs)	Analyte	December 2010		2nd Quarter FY2011		3rd Quarter FY2011		4th Quarter FY2011	
				Collection Date	Result (µg/m <sup>3</sup> )	Collection Date	Result (µg/m <sup>3</sup> )	Collection Date	Result (µg/m <sup>3</sup> )	Collection Date	Result (µg/m <sup>3</sup> )
21-603058	217	222	Trichloroethane[1,1,1-]	12/20/10	21	04/15/11	ND	06/20/11	ND	09/22/11	ND
			Trichloroethane[1,1,2-]	12/20/10	9	04/15/11	ND	06/20/11	ND	09/22/11	ND
			Trichloroethene	12/20/10	530	04/15/11	380	06/20/11	880	09/22/11	840
	242.5	247.5	Carbon Tetrachloride	12/20/10	340	04/15/11	500	06/20/11	430	09/22/11	560
			Chloroform	12/20/10	620	04/15/11	980	06/20/11	1100	09/22/11	1100
			Dichlorobenzene[1,4-]	12/20/10	7.8	04/15/11	ND	06/20/11	ND	09/22/11	ND
			Dichlorodifluoromethane	12/20/10	5.4	04/15/11	ND	06/20/11	ND	09/22/11	ND
			Dichloroethane[1,2-]	12/20/10	11	04/15/11	ND	06/20/11	ND	09/22/11	ND
			Dichloroethene[1,1-]	12/20/10	9	04/15/11	ND	06/20/11	ND	09/22/11	ND
			Methylene Chloride	12/20/10	<b>680</b>	04/15/11	<b>1000</b>	06/20/11	<b>1400</b>	09/22/11	<b>990</b>
			Tetrachloroethene	12/20/10	100	04/15/11	180	06/20/11	170	09/22/11	190
			Trichloro-1,2,2-trifluoroethane[1,1,2-]	12/20/10	19	04/15/11	ND	06/20/11	ND	09/22/11	ND
			Trichloroethane[1,1,1-]	12/20/10	18	04/15/11	ND	06/20/11	ND	09/22/11	ND
			Trichloroethane[1,1,2-]	12/20/10	24	04/15/11	ND	06/20/11	ND	09/22/11	ND
			Trichloroethene	12/20/10	750	04/15/11	1200	06/20/11	1200	09/22/11	1200
	339.5	344.5	Benzene	12/20/10	2.8	04/15/11	ND	06/20/11	ND	09/22/11	ND
			Carbon Tetrachloride	12/20/10	400	04/15/11	510	06/20/11	480	09/22/11	640
			Chloroform	12/20/10	840	04/15/11	1200	06/20/11	1400	09/22/11	1500
			Dichlorobenzene[1,4-]	12/20/10	14	04/15/11	ND	06/20/11	ND	09/22/11	ND
			Dichlorodifluoromethane	12/20/10	4.8	04/15/11	ND	06/20/11	ND	09/22/11	ND
			Dichloroethane[1,2-]	12/20/10	18	04/15/11	ND	06/20/11	ND	09/22/11	ND
Dichloroethene[1,1-]			12/20/10	12	04/15/11	ND	06/20/11	ND	09/22/11	ND	
Dichloroethene[cis-1,2-]			12/20/10	3.6	04/15/11	ND	06/20/11	ND	09/22/11	ND	
Methylene Chloride			12/20/10	<b>740</b>	04/15/11	<b>870</b>	06/20/11	<b>1200</b>	09/22/11	<b>790</b>	
Tetrachloroethene	12/20/10	50	04/15/11	84	06/20/11	88	09/22/11	97			

Table D-1.0-2 (continued)

Vapor Monitoring Well ID	Begin Depth (ft bgs <sup>a</sup> )	End Depth (ft bgs)	Analyte	December 2010		2nd Quarter FY2011		3rd Quarter FY2011		4th Quarter FY2011	
				Collection Date	Result (µg/m <sup>3</sup> )	Collection Date	Result (µg/m <sup>3</sup> )	Collection Date	Result (µg/m <sup>3</sup> )	Collection Date	Result (µg/m <sup>3</sup> )
21-603058	339.5	344.5	Trichloro-1,2,2-trifluoroethane[1,1,2-]	12/20/10	19	04/15/11	ND	06/20/11	ND	09/22/11	ND
			Trichloroethane[1,1,1-]	12/20/10	10	04/15/11	ND	06/20/11	ND	09/22/11	ND
			Trichloroethane[1,1,2-]	12/20/10	24	04/15/11	ND	06/20/11	ND	09/22/11	ND
			Trichloroethene	12/20/10	840	04/15/11	1200	06/20/11	1200	09/22/11	1400
21-603059	77.5	82.5	Carbon Tetrachloride	12/10/10	55	04/18/11	ND	06/17/11	ND	09/16/11	ND
			Chloroform	12/10/10	1300	04/18/11	830	06/17/11	1100	09/16/11	1100
			Cyclohexane	12/10/10	58	04/18/11	ND	06/17/11	ND	09/16/11	ND
			Hexane	12/10/10	82	04/18/11	ND	06/17/11	ND	09/16/11	ND
			n-Heptane	12/10/10	65	04/18/11	ND	06/17/11	ND	09/16/11	ND
			Tetrachloroethene	12/10/10	2000	04/18/11	1500	06/17/11	1800	09/16/11	1900
			Trichloroethane[1,1,1-]	12/10/10	ND	04/18/11	ND	06/17/11	ND	09/16/11	400
			Trichloroethene	12/10/10	720	04/18/11	500	06/17/11	620	09/16/11	620
	187.5	192.5	Carbon Tetrachloride	12/10/10	160	04/18/11	340	06/17/11	77	09/16/11	100
			Chloroform	12/10/10	670	04/18/11	680	06/17/11	400	09/16/11	510
			Cyclohexane	12/10/10	46	04/18/11	ND	06/17/11	ND	09/16/11	ND
			Hexane	12/10/10	73	04/18/11	ND	06/17/11	ND	09/16/11	ND
			Methylene Chloride	12/10/10	ND	04/18/11	51	06/17/11	ND	09/16/11	ND
			n-Heptane	12/10/10	44	04/18/11	ND	06/17/11	ND	09/16/11	ND
Tetrachloroethene			12/10/10	400	04/18/11	280	06/17/11	210	09/16/11	310	
Trichloroethene	12/10/10	500	04/18/11	730	06/17/11	270	09/16/11	370			
229.5	234.5	Carbon Tetrachloride	12/10/10	390	04/18/11	ND	06/17/11	160	09/16/11	300	
		Chloroform	12/10/10	740	04/18/11	ND	06/17/11	350	09/16/11	670	
		Cyclohexane	12/10/10	32	04/18/11	ND	06/17/11	ND	09/16/11	ND	
		Hexane	12/10/10	41	04/18/11	ND	06/17/11	ND	09/16/11	ND	
		Methylene Chloride	12/10/10	50	04/18/11	ND	06/17/11	ND	09/16/11	37	



Table D-1.0-2 (continued)

Vapor Monitoring Well ID	Begin Depth (ft bgs <sup>a</sup> )	End Depth (ft bgs)	Analyte	December 2010		2nd Quarter FY2011		3rd Quarter FY2011		4th Quarter FY2011	
				Collection Date	Result (µg/m <sup>3</sup> )	Collection Date	Result (µg/m <sup>3</sup> )	Collection Date	Result (µg/m <sup>3</sup> )	Collection Date	Result (µg/m <sup>3</sup> )
21-603059	229.5	234.5	n-Heptane	12/10/10	39	04/18/11	ND	06/17/11	ND	09/16/11	ND
			Tetrachloroethene	12/10/10	280	04/18/11	ND	06/17/11	130	09/16/11	260
			Trichloroethene	12/10/10	750	04/18/11	ND	06/17/11	320	09/16/11	630
	292.5	297.5	Carbon Tetrachloride	12/10/10	660	04/18/11	520	06/17/11	290	09/16/11	230
			Chloroform	12/10/10	750	04/18/11	740	06/17/11	350	09/16/11	280
			Dichloroethene[1,1-]	12/10/10	ND	04/18/11	48	06/17/11	ND	09/16/11	ND
			Hexane	12/10/10	43	04/18/11	ND	06/17/11	ND	09/16/11	ND
			Methylene Chloride	12/10/10	290	04/18/11	<b>790</b>	06/17/11	160	09/16/11	95
			Tetrachloroethene	12/10/10	200	04/18/11	100	06/17/11	100	09/16/11	78
			Trichloroethane[1,1,2-]	12/10/10	ND	04/18/11	89	06/17/11	ND	09/16/11	ND
			Trichloroethene	12/10/10	1200	04/18/11	1300	06/17/11	580	09/16/11	420
	372.5	377.5	Carbon Tetrachloride	12/10/10	570	04/18/11	76	06/17/11	330	09/16/11	450
			Chloroform	12/10/10	800	04/18/11	350	06/17/11	520	09/16/11	670
			Dichloroethene[1,1-]	12/10/10	52	04/18/11	ND	06/17/11	ND	09/16/11	40
			Hexane	12/10/10	34	04/18/11	ND	06/17/11	ND	09/16/11	ND
Methylene Chloride			12/10/10	<b>870</b>	04/18/11	ND	06/17/11	540	09/16/11	650	
Tetrachloroethene			12/10/10	100	04/18/11	240	06/17/11	66	09/16/11	86	
Trichloroethane[1,1,2-]			12/10/10	ND	04/18/11	ND	06/17/11	58	09/16/11	72	
Trichloroethene			12/10/10	1200	04/18/11	290	06/17/11	830	09/16/11	1000	
21-607955	71.1	76.4	Carbon Tetrachloride	12/13/10	90	04/13/11	73	06/21/11	66	09/20/11	76
			Chloroform	12/13/10	920	04/13/11	740	06/21/11	700	09/20/11	770
			Tetrachloroethene	12/13/10	3500	04/13/11	3400	06/21/11	3200	09/20/11	3200
			Trichloroethene	12/13/10	600	04/13/11	540	06/21/11	500	09/20/11	520
	153.8	159.7	Carbon Tetrachloride	12/13/10	190	04/13/11	180	06/21/11	140	09/20/11	180
			Chloroform	12/13/10	750	04/13/11	720	06/21/11	610	09/20/11	760
			Methylene Chloride	12/13/10	140	04/13/11	130	06/21/11	100	09/20/11	110

Table D-1.0-2 (continued)

Vapor Monitoring Well ID	Begin Depth (ft bgs <sup>a</sup> )	End Depth (ft bgs)	Analyte	December 2010		2nd Quarter FY2011		3rd Quarter FY2011		4th Quarter FY2011	
				Collection Date	Result (µg/m <sup>3</sup> )	Collection Date	Result (µg/m <sup>3</sup> )	Collection Date	Result (µg/m <sup>3</sup> )	Collection Date	Result (µg/m <sup>3</sup> )
21-607955	153.8	159.7	Tetrachloroethene	12/13/10	740	04/13/11	780	06/21/11	700	09/20/11	740
			Trichloroethene	12/13/10	640	04/13/11	650	06/21/11	530	09/20/11	630
	173.4	179	Carbon Tetrachloride	12/13/10	260	04/13/11	220	06/21/11	180	09/20/11	220
			Chloroform	12/13/10	880	04/13/11	720	06/21/11	640	09/20/11	800
			Methylene Chloride	12/13/10	290	04/13/11	240	06/21/11	210	09/20/11	240
			Tetrachloroethene	12/13/10	630	04/13/11	590	06/21/11	560	09/20/11	590
			Trichloroethene	12/13/10	760	04/13/11	710	06/21/11	590	09/20/11	660
			225.9	232.1	Carbon Tetrachloride	12/13/10	530	04/14/11	430	06/21/11	210
	Chloroform	12/13/10			1000	04/14/11	870	06/21/11	480	09/20/11	910
	Methylene Chloride	12/13/10			<b>1200</b>	04/14/11	<b>930</b>	06/21/11	560	09/20/11	<b>840</b>
	Tetrachloroethene	12/13/10			ND	04/14/11	250	06/21/11	140	09/20/11	240
	Trichloroethene	12/13/10			1100	04/14/11	1000	06/21/11	520	09/20/11	950
	326.6	333.4	Carbon Tetrachloride	12/13/10	340	04/13/11	550	06/21/11	370	09/20/11	260
			Chloroform	12/13/10	750	04/13/11	1200	06/21/11	910	09/20/11	640
			Methylene Chloride	12/13/10	<b>1300</b>	04/13/11	<b>2200</b>	06/21/11	<b>1700</b>	09/20/11	<b>980</b>
			Tetrachloroethene	12/13/10	ND	04/13/11	95	06/21/11	70	09/20/11	ND
			Trichloroethene	12/13/10	720	04/13/11	1300	06/21/11	900	09/20/11	590
	353.3	359.6	Carbon Tetrachloride	12/13/10	540	04/13/11	550	06/21/11	250	09/20/11	520
			Chloroform	12/13/10	1600	04/13/11	1600	06/21/11	760	09/20/11	1500
			Methylene Chloride	12/13/10	<b>2500</b>	04/13/11	<b>2600</b>	06/21/11	<b>1300</b>	09/20/11	<b>2200</b>
Trichloroethene			12/13/10	1300	04/13/11	1400	06/21/11	670	09/20/11	1200	
459.4	464.8	Carbon Tetrachloride	12/13/10	370	04/13/11	380	06/22/11	310	09/21/11	400	
		Chloroform	12/13/10	1500	04/13/11	1500	06/22/11	1200	09/21/11	1500	
		Methylene Chloride	12/13/10	<b>2000</b>	04/13/11	<b>2000</b>	06/22/11	<b>1600</b>	09/21/11	<b>1900</b>	
		Trichloroethene	12/13/10	1000	04/13/11	1100	06/22/11	860	09/21/11	1000	

Table D-1.0-2 (continued)

Vapor Monitoring Well ID	Begin Depth (ft bgs <sup>a</sup> )	End Depth (ft bgs)	Analyte	December 2010		2nd Quarter FY2011		3rd Quarter FY2011		4th Quarter FY2011	
				Collection Date	Result (µg/m <sup>3</sup> )	Collection Date	Result (µg/m <sup>3</sup> )	Collection Date	Result (µg/m <sup>3</sup> )	Collection Date	Result (µg/m <sup>3</sup> )
21-607955	559	565	Carbon Tetrachloride	12/13/10	120	04/13/11	170	06/22/11	89	09/21/11	200
			Chloroform	12/13/10	630	04/13/11	900	06/22/11	460	09/21/11	1000
			Methylene Chloride	12/13/10	580	04/13/11	<b>850</b>	06/22/11	430	09/21/11	<b>850</b>
			Toluene	12/13/10	60	04/13/11	ND	06/22/11	ND	09/21/11	ND
			Trichloroethene	12/13/10	410	04/13/11	630	06/22/11	320	09/21/11	650
	651.3	657.3	Acetone	12/13/10	ND	04/13/11	ND	06/22/11	ND	09/21/11	88
			Carbon Tetrachloride	12/13/10	ND	04/13/11	67	06/22/11	60	09/21/11	78
			Chloroform	12/13/10	240	04/13/11	380	06/22/11	350	09/21/11	460
			Dichloroethene[1,1-]	12/13/10	40	04/13/11	47	06/22/11	52	09/21/11	60
			Methylene Chloride	12/13/10	90	04/13/11	140	06/22/11	130	09/21/11	150
			Toluene	12/13/10	100	04/13/11	ND	06/22/11	ND	09/21/11	ND
	797.2	803.1	Trichloroethene	12/13/10	190	04/13/11	310	06/22/11	280	09/21/11	350
			Acetone	12/14/10	ND	04/14/11	27	06/22/11	10	09/21/11	ND
			Chloroform	12/14/10	ND	04/14/11	6.6	06/22/11	ND	09/21/11	ND
			Methylene Chloride	12/14/10	ND	04/14/11	8.8	06/22/11	ND	09/21/11	ND
			Toluene	12/14/10	190	04/14/11	ND	06/22/11	ND	09/21/11	4
	946.2	952.1	Trichloroethene	12/14/10	ND	04/14/11	7.3	06/22/11	5.9	09/21/11	ND
			Acetone	12/14/10	30	04/14/11	ND	06/22/11	ND	09/21/11	ND
			Benzene	12/14/10	9.7	04/14/11	ND	06/22/11	ND	09/21/11	ND
			Cyclohexane	12/14/10	4	04/14/11	ND	06/22/11	ND	09/21/11	ND
			Dichloroethane[1,2-]	12/14/10	3.6	04/14/11	ND	06/22/11	ND	09/21/11	ND
Ethanol			12/14/10	25	04/14/11	ND	06/22/11	ND	09/21/11	ND	
Hexane			12/14/10	10	04/14/11	ND	06/22/11	ND	09/21/11	ND	
Methylene Chloride			12/14/10	8	04/14/11	ND	06/22/11	ND	09/21/11	ND	
Toluene			12/14/10	30	04/14/11	80	06/22/11	64	09/21/11	56	
Trichloroethane[1,1,1-]	12/14/10	6	04/14/11	ND	06/22/11	ND	09/21/11	ND			

**Table D-1.0-2 (continued)**

Vapor Monitoring Well ID	Begin Depth (ft bgs <sup>a</sup> )	End Depth (ft bgs)	Analyte	December 2010		2nd Quarter FY2011		3rd Quarter FY2011		4th Quarter FY2011	
				Collection Date	Result (µg/m <sup>3</sup> )	Collection Date	Result (µg/m <sup>3</sup> )	Collection Date	Result (µg/m <sup>3</sup> )	Collection Date	Result (µg/m <sup>3</sup> )
21-607955	946.2	952.1	Trichloroethene	12/14/10	13	04/14/11	ND	06/22/11	ND	09/21/11	ND
			Xylene[1,3-]+Xylene[1,4-]	12/14/10	8.2	04/14/11	ND	06/22/11	ND	09/21/11	ND

Note: Bold indicates concentrations that exceed a screening value of 1.

<sup>a</sup> bgs = Below ground surface.

<sup>b</sup> ND = Not detected.

**Table D-1.0-3  
Summary of Detected Tritium Results at MDA T**

Vapor-Monitoring Well ID	Begin Depth (ft bgs <sup>a</sup> )	End Depth (ft bgs)	December 2010		2nd Quarter FY2011		3rd Quarter FY2011		4th Quarter FY2011	
			Collection Date	Result (pCi/L)	Collection Date	Result (pCi/L)	Collection Date	Result (pCi/L)	Collection Date	Result (pCi/L)
21-25262	80	85	12/16/10	7060	04/22/11	294	06/16/11	446	09/23/11	ND <sup>b</sup>
	115	120	12/16/10	ND	04/22/11	917	06/16/11	890	09/23/11	ND
	232	237	12/16/10	1300	04/22/11	666	06/16/11	820	09/23/11	ND
	295	300	12/16/10	6120	04/22/11	6760	06/16/11	6420	09/23/11	5520 (J)
	329.5	334.5	12/16/10	4750	04/22/11	5510	06/16/11	5330	09/23/11	3950 (J)
	375	380	12/16/10	68,900	04/22/11	57,100	06/16/11	85,200	09/23/11	63,900
	472	478	12/16/10	35,700	04/22/11	ND	06/16/11	ND	09/23/11	ND
	572	577	12/16/10	ND	04/22/11	ND	06/16/11	809	09/23/11	ND
21-25264	67.5	72.5	12/15/10	7540	04/08/11	7190	06/24/11	13,200	09/19/11	11,200
	150.5	155.5	12/15/10	114,000	04/08/11	130,000	06/24/11	161,000	09/19/11	165,000
	222.5	227.5	12/15/10	98,400	04/08/11	91,000	06/24/11	119,000	09/19/11	111,000
	323	328	12/15/10	6610	04/08/11	1560	06/24/11	2170	09/19/11	1290
	349.5	354.5	12/15/10	2500	04/08/11	3060	06/24/11	3150	09/19/11	3400
21-603058	67.5	72.5	12/20/10	326	04/15/11	ND	06/20/11	263	09/22/11	ND
	217	222	12/20/10	912	04/15/11	565	06/20/11	953	09/22/11	ND
	242.5	247.5	12/20/10	2170	04/15/11	2130	06/20/11	3170	09/22/11	2790 (J)
21-603059	77.5	82.5	12/10/10	345	04/18/11	ND	06/17/11	465	09/16/11	4050
	187.5	192.5	12/10/10	977	04/18/11	764	06/17/11	405	09/16/11	311
	229.5	234.5	12/10/10	10,700	04/18/11	7640	06/17/11	759	09/16/11	1040
	292.5	297.5	12/10/10	5370	04/18/11	5900	06/17/11	6250	09/16/11	34,500
	372.5	377.5	12/10/10	4310	04/18/11	ND	06/17/11	4080	09/16/11	4270
21-607955	71.1	76.4	12/13/10	4170	04/13/11	4340	06/21/11	4990	09/20/11	5840
	153.8	159.7	12/13/10	31,800	04/13/11	32,700	06/21/11	46,000	09/20/11	44,200

**Table D-1.0-3 (continued)**

Vapor-Monitoring Well ID	Begin Depth (ft bgs <sup>a</sup> )	End Depth (ft bgs)	December 2010		2nd Quarter FY2011		3rd Quarter FY2011		4th Quarter FY2011	
			Collection Date	Result (pCi/L)	Collection Date	Result (pCi/L)	Collection Date	Result (pCi/L)	Collection Date	Result (pCi/L)
21-607955	173.4	179	12/13/10	1590	04/13/11	1260	06/21/11	2170	09/20/11	1390
	225.9	232.1	12/13/10	155,000	04/14/11	9510	06/21/11	9940	09/20/11	4810
	326.6	333.4	12/13/10	935	04/13/11	664	06/21/11	719	09/20/11	ND
	353.3	359.6	12/13/10	1610	04/13/11	ND	06/21/11	784	09/20/11	ND
	459.4	464.8	12/13/10	459	04/13/11	ND	06/22/11	ND	09/21/11	312
	559	565	12/13/10	1170	04/13/11	3190	06/22/11	ND	09/21/11	ND
	651.3	657.3	12/13/10	983	04/13/11	ND	06/22/11	1370	09/21/11	12,200
	797.2	803.1	12/14/10	1080	04/14/11	6790	06/22/11	677	09/21/11	525
946.2	952.1	12/14/10	ND	04/14/11	ND	06/22/11	2900	09/21/11	ND	

<sup>a</sup> bgs = Below ground surface.

<sup>b</sup> ND = Not detected.

## **Attachment D-1**

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*Analytical Suites and Results and Analytical Reports  
(on CD included with this document)*

