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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, October to December 2009

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EXECUTIVE SUMMARY

This periodic monitoring report summarizes the latest results of the vapor-monitoring activities (October–December 2009) conducted at Material Disposal Area (MDA) T, Consolidated Unit 21-016(a)-99, within Technical Area 21 at Los Alamos National Laboratory. The objectives of vapor-monitoring at MDA T are (1) to collect additional samples from vapor-monitoring wells at MDA T and (2) to compare the results with previously detected volatile organic compound (VOC) concentrations and tritium activities in pore gas beneath MDA T.

Samples taken during the current quarter were collected in October, November, and December of 2009 from vapor-monitoring wells 21-25262, 21-25264, 21-603058, and 21-603059 and in early- and mid-December of 2009 from vapor-monitoring well 21-607955, all located outside the MDA T nuclear facility boundary. Vapor-monitoring wells 21-25262 and 21-603059 are located immediately south of MDA T. Vapor-monitoring wells 21-25264, 21-603058, and 21-607955 are located immediately north of MDA T along North Perimeter Road.

Pore-gas data collected from all locations sampled from October to December 2009 are presented and discussed in this report. Pore-gas data from the previous three quarters of vapor monitoring at MDA T (February 2009, April and June 2009, and July through September 2009) are also presented and compared to the current quarter data, as appropriate, to help establish trends over time.

A total of 29 VOCs were detected in MDA T pore gas during the October–December 2009 sampling activities, and the results are consistent with previous sampling results for permanent vapor-monitoring wells 21-25262, 21-25264, 21-603058, and 21-603059. Pore-gas analytical results obtained from samples collected during the initial rounds of sampling at vapor-monitoring well 21-607955 also reflect the VOC trends observed at the other MDA T vapor-monitoring wells, with the exception of acetone. Acetone was detected the first time in November 2009 at a concentration of 30,000 $\mu g/m^3$ and again in December 2009 at a lower concentration of 1400 $\mu g/m^3$, both at total depth.

A VOC screening evaluation identified two VOCs, methylene chloride and 1,1,2-trichloroethane, in MDA T pore gas at concentrations resulting in screening values greater than 1.0. However, the screening levels were not exceeded for any VOCs for samples collected from the deepest sampling port; therefore, the current VOC concentrations detected at MDA T do not appear to threaten groundwater in excess of cleanup levels.

Tritium activities in vapor-monitoring wells 21-25262, 21-25264, 21-603058 were consistently low at TD but showed multiple peaks at varying depths in the middle ports. Tritium results obtained from samples collected during the initial rounds of sampling at vapor-monitoring well 21-607955 also generally reflect this trend. In vapor-monitoring well 21-603059, tritium activities generally increase with depth to TD.

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1.0 INTRODUCTION

This report presents the results of vapor-monitoring activities conducted during October–December 2009 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 MDA T vapor-monitoring plan and the associated New Mexico Environment Department (NMED) approval with modifications (LANL 2007, 098944; NMED 2007, 098946) and the approved MDA T Phase III investigation work plan and associated NMED correspondence (LANL 2009, 105645; NMED 2009, 105691; NMED 2009, 106455). Information on radioactive materials and radionuclides, including the results of sampling and analysis of radioactive constituents, is voluntarily provided to NMED in accordance with U.S. Department of Energy (DOE) policy.

The objectives of the MDA T vapor-monitoring activities are (1) to collect additional vapor samples from vapor-monitoring wells at MDA T and (2) to compare the results with previously detected volatile organic compound (VOC) concentrations and tritium activities beneath MDA T. In addition, this report presents the results of a screening evaluation of the pore-gas VOC data, which compares maximum concentrations of VOCs in pore gas to pore-gas screening levels (SLs). This conservative screening process evaluates the potential for the observed VOC concentrations to result in contamination of groundwater above applicable regulatory criteria.

To date, intermediate vapor-monitoring wells 21-25264, 21-603058, and 21-603059 have been sampled for 13 rounds, from October 2007 to December 2009; vapor-monitoring well 21-25262 has been sampled for 7 rounds, from June to December 2009; and the newest vapor-monitoring well 21-607955 has been sampled for 2 rounds from early to mid-December 2009 (for discussion purposes in this report, these samples are considered to be part of the November 2009 sampling event). Table 1.0-1 summarizes and clarifies MDA T vapor-monitoring sampling quarters, events, rounds and dates. All pore-gas samples were submitted for off-site analysis of VOCs and tritium.

This report primarily presents and discusses results obtained during the most recent quarter of monitoring activities at MDA T; however, vapor data presented in the three consecutive quarterly periodic monitoring reports immediately prior to the current quarter for MDA T (February 2009, April and June 2009, and July–September 2009) are also included in the data evaluation section of this report for comparison and to establish trends over time.

Beginning in June 2009, the frequency of sample collection at all MDA T vapor-monitoring wells was changed from quarterly to monthly in order to collect additional data points more rapidly and to allow for improved trend comparisons of VOCs and tritium over time. As a result, the quarterly sampling became offset from the schedule presented in the letter from NMED dated May 26, 2009. To reestablish schedule and have periodic monitoring report submittals accurately reflect the correct sampling quarter, the October and November 2009 sampling rounds are presented again in this report along with the data collected during the December 2009 sampling round.

Data collected during the months of January, February, and March of 2010 will be presented and evaluated in the next periodic monitoring report. Table 1.0-1 summarizes all sampling events presented in this report as well as all other sampling events completed since the beginning of permanent vapor-monitoring well installation at TA-21.

1.1 Site Location and Description

MDA T is located within TA-21 on DP Mesa and contains the following waste storage and disposal sites:

- four absorption beds (subsurface),
- multiple buried shafts (subsurface), and
- a former retrievable waste storage area (subsurface) (Figures 1.1-1 and 1.1-2).

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 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

As directed by 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), 13 rounds of pore-gas field-screening and sampling activities have been completed at intermediate-depth vapor-monitoring wells 21-603058, 21-603059, and 21-25264; 7 rounds have been completed at deep vapor-monitoring well 21-25262; and 2 rounds have been completed at deep vapor-monitoring well 21-607955 (Figure 1.1-2 and Table 2.0-1). The as-built well constructions as applicable to the five MDA T vapor-monitoring wells are described below.

Per the approved MDA T vapor-monitoring plan (LANL 2007, 098944; NMED 2007, 098946), five vapor-sampling ports were installed at wells 21-603058 and 21-25264 and six vapor-sampling ports were installed at well 21-603059 at the following intervals:

- base elevation of the nearby disposal unit (69–81 ft below ground surface [bgs]);
- intermediate depths correlated to the 2005–2006 packer sampling depths at locations 21-25262 and 21-25263; and
- borehole total depth (TD) (342–375 ft bgs).

Per the approved MDA T Phase III investigation work plan (LANL 2009, 105645; NMED 2009, 105691; NMED 2009, 106455), nine vapor-sampling ports were installed at well 21-25262 at the following intervals:

- depths correlated to the sampling port depths at well 21-603059 (sampling ports 1–4); and
- depths correlated to different lithologic units encountered beneath MDA T (i.e., Cerro Toledo interval of the Bandelier Tuff [sampling port 5], Otowi Member of the Bandelier Tuff [sampling ports 6–8], and the Guaje Pumice Bed [TD, sampling port 9]).

Per the approved MDA T Phase III investigation work plan (LANL 2009, 105645; NMED 2009, 105691; NMED 2009, 106455), eleven vapor-sampling ports were installed at well 21-607955 at the following intervals:

- depths correlated to the intermediate vapor-monitoring wells (sampling ports 1–6); and
- depths within different lithologic units encountered beneath MDA T (e.g., Otowi Member) (sampling ports 7 and 8); Guaje Pumice Bed (sampling port 9); and the Puye Formation (sampling ports 10 and 11).

During the most recent quarter of sampling activities (October–December 2009), a total of 117 pore-gas samples (91 characterization and 26 quality assurance/quality control [QA/QC]) were collected for VOC analysis, and 105 samples (91 characterization and 14 QA/QC) were collected for tritium analysis from (1) five out of five ports in well 21-25264; (2) five out of six ports in well 21-603059; (3) four out of five ports in well 21-603058; (4) nine out of nine ports in well 21-25262; and (5) eleven out of eleven ports in well 21-607955. Field duplicate (FD) and field blank (FB) samples were collected at a minimum frequency of 1 for every 10 samples. Samples were not collected at port 2 in either well 21-603058 or 21-603059 for reasons discussed in section 2.1.

Table 2.0-1 summarizes the MDA T pore-gas sampling depths and sample collection dates for the current and previous three quarters (February–December 2009) by well location. Tables 2.0-2 through 2.0-6 summarize, by well location, the February–December 2009 samples collected at MDA T monitoring wells 21-25262, 21-25264, 21-603058, 21-603059, and 21-607955 and their respective analyses.

All samples were collected in accordance with the current version of Standard Operating Procedure (SOP) EP-ERSS-SOP-5074, Sampling for Sub-Atmospheric Air, and submitted to off-site analytical laboratories for VOC analysis using U.S. Environmental Protection Agency (EPA) Method TO-15 and for tritium analysis using EPA Method 906.0. Further discussion of the field methods used for pore-gas field-screening and sample collection are presented in Appendix B. Field chain-of-custody forms and sample collection logs are provided on CD (Appendix D). No investigation-derived waste was generated during execution of vapor-monitoring activities at MDA T.

Pore-gas field-screening results are presented in section 4, and pore-gas analytical results are presented in section 5. In addition, section 5.4 presents a data summary of the December 2009 sampling event. Any deviations from the scope of activities presented in the approved MDA T vapor-monitoring plan (LANL 2007, 098944; NMED 2007, 098946) and/or the approved MDA T Phase III investigation work plan (LANL 2009, 105645; NMED 2009, 105691; NMED 2009, 106455) that relate to periodic monitoring activities are described 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 October–December 2009 sampling activities at MDA T. As previously reported, sampling port 2 (160.5–165.5 ft bgs) in vapor-monitoring well 21-603058 stopped producing pore gas after February 2008 (round 2) 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, again possibly because of its positioning within a massive welded unit (unit 2) (LANL 2009, 105187). During every sampling round, the continued 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 at MDA T. Because the primary objective of the 2009 investigation is to characterize the nature and extent of VOCs and tritium in subsurface vapor, a screening evaluation is provided comparing maximum concentrations of VOCs in pore gas with SLs. These SLs are based on equilibrium partitioning using the appropriate Henry's law constant with groundwater cleanup levels. This screening process evaluates the potential for the reported VOC concentrations to result in contamination of groundwater in excess of cleanup levels. Details regarding pore-gas screening evaluation criteria are presented in the following section. Results of the pore-gas screening evaluation are presented in section 5. There are no applicable standards for tritium in pore vapor.

The analysis evaluated the groundwater concentration that would be in equilibrium with the maximum concentrations of VOCs detected at MDA T during the current vapor-monitoring quarter (October–December 2009). The equilibrium relationship between air and water concentrations is described by the following equation.

$$C_{water} = C_{air} / H' \qquad \textbf{Equation 3.0-1}$$

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 an exceedance of the groundwater cleanup level at the contaminant/groundwater interface.

Because no SLs for pore gas address the potential for groundwater contamination, 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, 106420) or the EPA regional screening tables (http://www.epa.gov/region09/superfund/prg/). The following dimensionless form of Henry's law constant was used:

$$H' = \frac{C_{air}}{C_{water}} \qquad \textbf{Equation 3.0-2}$$

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

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

Where C_{air} = the concentration of a particular VOC in the pore-gas sample (µg/m^3),

H' = the dimensionless Henry's law constant,

SL = the screening level (µg/L), and

1000 is a conversion factor from L to m^3.

The SLs are the standards or EPA regional 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 there is no MCL or NMWQCC standard, the EPA regional tap water SL (http://www.epa.gov/region09/superfund/prg/ is used and adjusted to 10^{-5} risk for carcinogens. 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 SL. Therefore, if the SV is less than 1, the concentration of the VOC in pore gas does 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.

4.0 FIELD-SCREENING RESULTS

Before each sampling event, field screening was performed in each vapor-monitoring well and targeted sampling interval to ensure percent carbon dioxide (%CO_2) and percent oxygen (%O_2) levels at each sampling port had stabilized at values representative of subsurface pore-gas conditions. Table 4.0-1 presents a summary of all field-screening results obtained during the current quarter.

Atmospheric information was obtained from http://www.srh.noaa.gov/data/obhistory/KLAM.html on each day of sampling using the closest automated weather station to MDA T (Los Alamos Airport, latitude 35.88°, longitude 106.28°). Table 4.0-2 summarizes the barometric pressure, temperature, and relative humidity for the sampling dates.

5.0 ANALYTICAL DATA RESULTS

All analytical data were subject to extensive QA/QC and data validation reviews in accordance with Laboratory guidance and procedures. The QA/QC and data validation review for October–December 2009 for MDA T pore-gas data is presented in Appendix C. All validated analytical results from October–December 2009 pore-gas sampling as well as from the three previous sampling quarters (February–September 2009) are presented on a CD in Appendix D. Similar detail regarding vapor data collected during February–September 2009 is presented in prior periodic monitoring reports (LANL 2009, 105187; LANL 2009, 107448; LANL 2009, 106665; LANL 2010, 108529).

The CO_2 and O_2 field-screening results are discussed in Appendix B.

Vapor analytical sampling data are also available at the Risk Analysis, Communication, Evaluation, and Reduction (RACER) website (http://www.racernm.com/).

5.1 VOC Pore-Gas Results

VOC results from the current and previous three vapor-monitoring quarters (February–December 2009) are summarized by well location in Tables 5.1-1 through 5.1-5. Concentration with depth profiles for each VOC detected in each well sample collected from October–December 2009 are presented by sampling round in Figures 5.1-1 through 5.1-14. The results show several general spatial trends. These trends are generally consistent with results obtained during earlier sampling rounds (LANL 2009, 105187; LANL 2009, 106665; LANL 2009, 108012; LANL 2009, 107448; LANL 2010, 108529). Data associated with February–September 2009 have been previously presented and are included for comparison purposes only.

A total of 29 VOCs were detected in MDA T pore gas during the current quarter sampling activities and the results are consistent with previous sampling results. Five VOCs, methylene chloride, carbon tetrachloride, chloroform, trichloroethene (TCE), and tetrachloroethene (PCE), were consistently detected at the greatest concentrations relative to other detected VOCs during the MDA T monitoring period.

Concentration with depth profiles for each of these five VOCs for all samples collected during the current quarter and the previous three quarters are presented by well for comparison in Figures 5.1-15 through 5.1-20.The five VOCs and other VOCs of interest (e.g., acetone, toluene, 1,1,2-trichloethane) are discussed below.

- Methylene chloride pore-gas concentrations consistently increased with depth to TD in vapor-monitoring wells 21-25264, 21-603058, and 21-603059. In vapor-monitoring well 21-25262, methylene chloride concentrations increased with depth to a maximum at ~475–575 ft bgs before decreasing with depth to TD (Figure 5.1-15). In vapor-monitoring well 21-607955, methylene chloride concentrations generally increased to a maximum at ~375–475 ft bgs and then decreased to nondetect values below ~800 ft bgs.
- Carbon tetrachloride pore-gas concentrations also increased with depth in vapor-monitoring wells 21-25264, 21-603058, 21-603059, and 21-25262 to ~250–300 ft bgs; after 300 ft bgs, carbon tetrachloride decreased with depth to TD (Figure 5.1-16). In vapor-monitoring well 21-607955, carbon tetrachloride concentrations showed no obvious trend other than a decrease to nondetect values below ~575 ft bgs.
- Chloroform pore-gas concentrations displayed an S-shaped profile in vapor-monitoring well 21-25262, in which the concentrations were higher near the surface, lower at the lower-middle ports, and lowest in the upper-middle ports and at TD (Figure 5.1-17). In vapor-monitoring well 21-603059, chloroform concentrations decreased from a maximum near the surface (port 1, 80 ft bgs) to fairly constant concentrations from ~190 ft to TD. Chloroform results obtained from vapor-monitoring wells 21-25264 and 21-603058 were less consistent between rounds but, on average, the concentrations increased slightly with depth to TD in both wells during the current quarter. In vapor-monitoring well 21-607955, chloroform concentrations showed no obvious trend other than a decrease to nondetect values below ~800 ft bgs.
- Similar to chloroform, TCE pore-gas concentrations also displayed an S-shaped profile in vapor-monitoring well 21-25262 but not in vapor-monitoring wells 21-25264 and 21-603058 (Figure 5.1-18). In vapor-monitoring wells 21-25264 and 21-603058, the concentration trends were less consistent between wells and sampling rounds. During rounds 10–12, TCE concentrations, on average, slightly increased with depth to TD in vapor-monitoring well 21-603058 but decreased with depth to TD in vapor-monitoring well 21-25264 (except during round 12). In vapor-monitoring well 21-603059, TCE concentrations decreased from a maximum near the surface port to ~190 ft bgs, followed by an increasing trend to ~300 ft bgs, below which concentrations remained fairly constant to TD. In vapor-monitoring well 21-607955, TCE concentrations showed no obvious trend other than a decrease to nondetect values below ~800 ft bgs.
- PCE concentrations consistently decreased with depth to TD in all five vapor-monitoring wells (Figure 5.1-19).
- Acetone and toluene were detected at their maximum concentrations at TD (~950 ft bgs) during the initial round (early December 2009) of pore-gas sampling in vapor-monitoring well 21-607955 (concentrations of 30,000 $\mu g/m^3$ and 690 $\mu g/m^3$, respectively), as shown in Figure 5.1-14. These samples were retrieved under expedited sampling conditions, and similar detections are not observed in any pore-gas data obtained from the other MDA T wells. In the second round of pore-gas sampling at vapor-monitoring well 21-607955 (mid-December 2009), acetone concentrations at TD were again elevated relative to shallower depths (1400 $\mu g/m^3$), but at concentrations considerably lower than the first round (Figure 5.1-14). Toluene was not detected at TD in the mid-December 2009 round.

- Benzene; bromodichloromethane; bromomethane; 2-butanone; carbon disulfide; cyclohexane; 1,4-dichlorobenzene; dichlorodifluoromethane; 1,2-dichloroethane; 1,2-cis-dichloroethene; ethanol; hexane; n-heptane; 2-propanol; propylene; 1,1,2-trichloro-1,2,2-trifluoroethane; 1,1,1-trichloroethane; and 1,3-xylene+1,4-xylene concentrations showed no trends. These VOCs were either infrequently detected or detected at very low concentrations (at or near the standard quantitation limits (SQLs).
- Dichloroethene[1,1-] and 1,1,2-trichloroethane were both detected at depths of ~250–300 ft bgs in vapor-monitoring wells 21-25262 and 21-603059. Concentrations increased with depth to sampling port 6 (475 ft bgs) in vapor-monitoring well 21-25262, and then decreased in sampling port 9 (TD at 690 ft bgs). These two VOCs were detected at lower concentrations in vapor-monitoring wells 21-25264, 21-603058, and 21-607955. The maximum concentration of 1,1,2-trichloroethane in July 2009 exceeded the groundwater standard at ~450 ft bgs in vapor-monitoring well 21-25262 (LANL 2009, 107448). A profile of 1,1,2-trichloroethane concentration with depth for all vapor-monitoring wells from February–December 2009 is presented in Figure 5.1-20.
- Thirteen VOCs previously detected during all previous quarters of vapor-monitoring (October 2007–September 2009) (bromoform; 1,3-butadiene; 1-butanol; chlorodibromomethane; 1,2-dichlorobenzene; ethylbenzene; 4-ethyltoluene; 2-hexanone; methanol; 4-methyl-2-pentanone; tetrahydrofuran; 1,3,5-trimethylbenzene; and 1,2-xylene) were not detected during the current quarter (October–December 2009). In previous rounds, these VOCs were infrequently detected and at very low concentrations (at or near the SQL).
- Three VOCs were detected for the first time during the October–December 2009 sampling event. Bromomethane was detected in October 2009 at a concentration of 6.7 $\mu g/m^3$ in a single sample collected at port 9 (~690 ft bgs) in vapor-monitoring well 21-25262. However, this result is low, near the SQL. Chloromethane and 1,2,4-trimethylbenzene were detected in December 2009. Chloromethane was detected at a concentration of 14 $\mu g/m^3$ in a single sample collected at port 5 (~332 ft bgs) in vapor-monitoring well 21-25262; 1,2,4-trimethylbenzene was detected at a concentration of 6.3 $\mu g/m^3$ in a single sample collected at port 4 (~232 ft bgs) in vapor-monitoring well 21-603059.

5.2 VOC Screening Evaluation

The VOC results from the October–December 2009 sampling rounds were screened to evaluate whether the concentrations of VOCs could be a potential source of groundwater contamination. The evaluation included the 26 detected VOCs in MDA T samples for which there are MCLs, NMWQCC standards, or EPA regional tap water SLs (Table 5.2-1). Ethanol, 2-propanol, and propylene were detected but do not have MCLs, NMWQCC standards, or tap water SLs, and were not evaluated.

The results of the October–December 2009 VOC screening evaluation are presented in Table 5.2-1. The SVs were less than 1.0 for all detected VOCs, except for methylene chloride and 1,1,2-trichloroethane. The concentrations of methylene chloride in 29 out of 91 samples collected resulted in SVs greater than 1.0, with a maximum SV of 3.69. The concentration of 1,1,2-trichloroethane in 2 out of 91 samples collected resulted in SVs greater than 1.0, with a maximum SV of 1.41 (Figure 5.2-1). Screening levels were not exceeded for any VOCs for samples collected from the deepest sampling port; therefore, the current VOC concentrations detected at MDA T do not appear to threaten groundwater in excess of cleanup levels.

5.3 Pore-Vapor Tritium Results

The results of the current and previous three quarters (February–December 2009) of sampling for tritium are summarized by vapor-monitoring well location in Tables 5.3-1 through 5.3-5. Figure 5.3-1 presents tritium activity profiles for all samples collected during October–December 2009. Results obtained for tritium during the previous three quarters (February 2009, April and June 2009, and July–September 2009) are also presented in Figure 5.3-1 for comparison with the current quarter data. Certain activity trends observed during the October–December 2009 sampling period in vapor-monitoring wells 21-25262, 21-25264, 21-603058, and 21-603059 are similar to those reported during previous sampling rounds.

- Pore-gas tritium activities were higher in samples collected from vapor-monitoring well 21-25264 than in samples collected from the other vapor-monitoring wells, with the maximum tritium activity (129,340 pCi/L) in a sample collected during November 2009 at port 2 (at a depth of 155.5 ft bgs).
- Tritium sample activities in vapor-monitoring wells 21-25264 and 21-603058 peak at intermediate-depth ports followed by a marked decrease to TD. Tritium activities in vapor-monitoring well 21-603058 showed an increase of 116,521 pCi/L at port 4 (~250 ft bgs) in November 2009. Historically, the next highest detected activity in this well was 25,118 pCi/L at the same port in October 2007; the third highest was 6,339 pCi/L at port 3 in February 2009.
- Tritium sample activities in vapor-monitoring well 21-603059 generally increased with depth, with maximum tritium activities in samples collected at TD, with the exception of results from December 2009. In December 2009, tritium activities reached a maximum (23,765 pCi/L) at ~250 ft bgs, followed by a decrease to TD.
- Tritium sample activity in vapor-monitoring well 21-25262 peaks near 375 ft bgs, followed by a decrease to TD and nondetects below ~475 ft bgs.
- Tritium sample activities in vapor-monitoring well 21-607955 are low (less than 5500 pCi/L), with two peaks at ~160 ft bgs and ~230 ft bgs, followed by a decrease to nondetect values at ports 9 and 10 (654 and 800 ft bgs, respectively). The exception is an increase at ~150 ft bgs, with an activity of 20,563 pCi/L. Tritium is detected at TD at a low activity of 844 pCi/L in the initial sampling round of pore-gas sampling at vapor-monitoring well 21-607955 (early December 2009), and is not detected at TD during the second round (mid-December 2009).

5.4 December Data Summary

As specified in section 2.0, this section summarizes the December 2009 (round 13) vapor- monitoring activities at MDA T. Samples were collected in December from the vapor-monitoring wells 21-25262, 21-25264, 21-603058, 21-603059 and 21-607955.

During the December 2009 sampling event, a total of 25 VOCs were detected in pore gas, and the results are consistent with previous sampling results. The five VOCs (methylene chloride, carbon tetrachloride, chloroform, TCE, and PCE), consistently detected at the greatest concentrations relative to other detected VOCs, continued to indicate trends observed during previous vapor-monitoring events. Concentration with depth profiles for each of these five VOCs are presented by well in Figures 5.1-15 through 5.1-20. In December, chloromethane and 1,2,4-trimethylbenzene were detected for the first time. Chloromethane was detected at a concentration of 14 $\mu g/m^3$ in a single sample collected at port 5 (~332 ft bgs) in vapor-monitoring well 21-25262; 1,2,4-trimethylbenzene was detected at a concentration of 6.3 $\mu g/m^3$ in a single sample collected at port 4 (~232 ft bgs) in vapor-monitoring well 21-603059.

The December 2009 sampling activities completed the second round of sampling at newly installed well 21-607955. Acetone concentrations decreased from 30,000 µg/m^3 in November 2009 to 1400 µg/m^3 at TD in December 2009. Toluene concentrations decreased from 690 µg/m^3 in November 2009 to nondetect at TD in December 2009. Additional sampling data from vapor-monitoring well 21-607955 will be used to assess whether the acetone detections are indicative of deep (900+ ft bgs) conditions beneath MDA T or whether they are anomalous.

The screening evaluation for December 2009 is presented in Table 5.4-1. The evaluation shows two VOCs with a SV greater than 1. Figure 5.2-1 presents VOCs with screening values greater than 1. These include methylene chloride with a SV of 3.54 at 572–577 ft bgs and 1,1,2-trichloroethane with a SV of 1.18 at 472–478 ft bgs, both at vapor-monitoring well 21-25262.

Tritium sample activities obtained during December 2009 reflected trends observed in previous rounds of sampling, except in vapor monitoring well 21-603059 where activity reached a peak (23,765 pCi/L) at ~250 ft bgs, followed by a decrease to TD. Tritium activities in wells 21-25262, 21-25264, 21-603058, and 21-607955 indicate multiple peaks in the intermediate-depth ports with consistently low activities at TD.

6.0 SUMMARY

The objectives of the MDA T vapor-monitoring activities are (1) to collect additional vapor samples from vapor-monitoring wells at MDA T and (2) to compare the results with previously detected VOC concentrations and tritium activities beneath MDA T. The results of the current quarter of monitoring activities (October–December 2009) indicate similar trends to those reported during previous monitoring activities (October 2007–September 2009) (LANL 2009, 105187; LANL 2009, 106665; LANL 2009, 108012; LANL 2009, 107448).

A total of 29 VOCs and tritium 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 or near the SQL, or were infrequently detected. Methylene chloride, carbon tetrachloride, chloroform, TCE, and PCE, were consistently detected throughout the MDA T monitoring period at the greatest concentrations relative to the other detected VOCs. Methylene chloride and 1,1,2-trichloroethane both resulted in SVs greater than 1.0, however, all TD samples that resulted in an SV greater than 1.0 were from intermediate-depth wells (21-25264, 21-603058, and 21-603059) and not from the two deeper wells (21-25262 and 21-607955). Additionally, they were not detected in the deepest MDA T pore-gas sample (950 ft bgs in vapor-monitoring well 21-607955); therefore, the current VOC concentrations detected at MDA T do not appear to threaten groundwater in excess of cleanup levels. The five VOCs and other VOCs of interest (e.g., acetone, toluene, 1,1,2-trichloethane) are summarized below.

- Methylene chloride pore-gas concentrations consistently increased with depth to TD in vapor-monitoring wells 21-25264, 21-603058, and 21-603059. In vapor-monitoring wells 21-25262 and 21-607955, methylene chloride concentrations increased with depth to a maximum at ~350–575 ft bgs before decreasing with depth to TD.
- Carbon tetrachloride pore-gas concentrations also increased with depth in vapor-monitoring wells 21-25262, 21-25264, 21-603058, and 21-603059 to ~250–300 ft bgs; below 300 ft bgs, carbon tetrachloride decreased with depth to TD.
- Chloroform and TCE pore-gas concentrations generally show an S-shaped profile in vapor-monitoring wells 21-25262 and 21-603059, in which the concentrations were highest near the surface, lower at the lower-middle ports, and lowest in the upper-middle ports and at TD. Chloroform and TCE pore-gas concentrations in vapor-monitoring wells 21-25264 and 21-603058

were less consistent between rounds, but overall (1) chloroform concentrations increased slightly with depth to TD in both vapor-monitoring wells, and (2) TCE concentrations increased slightly with depth to TD in vapor-monitoring well 21-603058 and decreased with depth to TD in vapor-monitoring well 21-25264.

- In vapor-monitoring well 21-607955, carbon tetrachloride, chloroform, and TCE concentrations showed no obvious trends other than a decrease to nondetect values by ~800 ft bgs.
- PCE concentrations consistently decreased with depth to TD in all five vapor-monitoring wells.
- Acetone and toluene were detected at their maximum concentrations at TD (~950 ft bgs) during the initial round of pore-gas sampling in vapor-monitoring well 21-607955 in early December 2009 (concentrations of 30,000 $\mu g/m^3$ and 690 $\mu g/m^3$, respectively). In the second round of pore-gas sampling at vapor-monitoring well 21-607955 (mid-December 2009), acetone concentrations at TD were again elevated relative (1400 $\mu g/m^3$) to shallower depths, but at a considerably lower concentration than the first round. Toluene was not detected at TD in the mid-December 2009 round. Additional sampling data from vapor-monitoring well 21-607955 will be used to assess whether the acetone detections are indicative of deep (900+ ft bgs) conditions beneath MDA T or whether they are anomalous.
- In vapor-monitoring wells 21-25262 and 21-603059, 1,1,2-trichloroethane concentrations increased with depth from ~225 ft bgs to TD (375 ft bgs) in vapor-monitoring well 21-603059 and to sampling port 6 (475 ft bgs) in vapor-monitoring well 21-25262, then decreased to TD (690 ft bgs); 1,1,2-trichloroethane was detected at lower concentrations in vapor-monitoring wells 21-25264, 21-603058, and 21-607955.

Consistent with previous results, tritium activities were substantially higher in samples collected from vapor-monitoring well 21-25264 than in samples collected from vapor-monitoring wells 21-25262, 21-603058, 21-603059, and 21-607955 (except during the November 2009 sampling period, when vapor-monitoring well 21-603058 experienced an anomalous spike of 116,521 pCi/L at ~250 ft bgs). Tritium activities in vapor-monitoring wells 21-25264, 21-603058, and 21-25262 have one or two peaks at intermediate depths, followed by a marked decrease to TD. Vapor-monitoring well 21-603059 showed an increase in tritium activities to TD. In vapor-monitoring well 21-607955, tritium activities peaked at intermediate depths with a low detection at TD in early December 2009 and a non-detect at TD in mid-December 2009.

Vapor-monitoring activities are scheduled to continue at MDA T per the requirements outlined in the approved MDA T Phase III investigation work plan (LANL 2009, 105645; NMED 2009, 106455; NMED 2009, 105691) and the NMED approval with modifications (NMED 2010, 109021).

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)

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), August 2009. “Technical Background Document for Development of Soil Screening Levels, Revision 5.0,” New Mexico Environment Department, Hazardous Waste Bureau and Ground Water Quality Bureau Voluntary Remediation Program, Santa Fe, New Mexico. (NMED 2009, 106420)

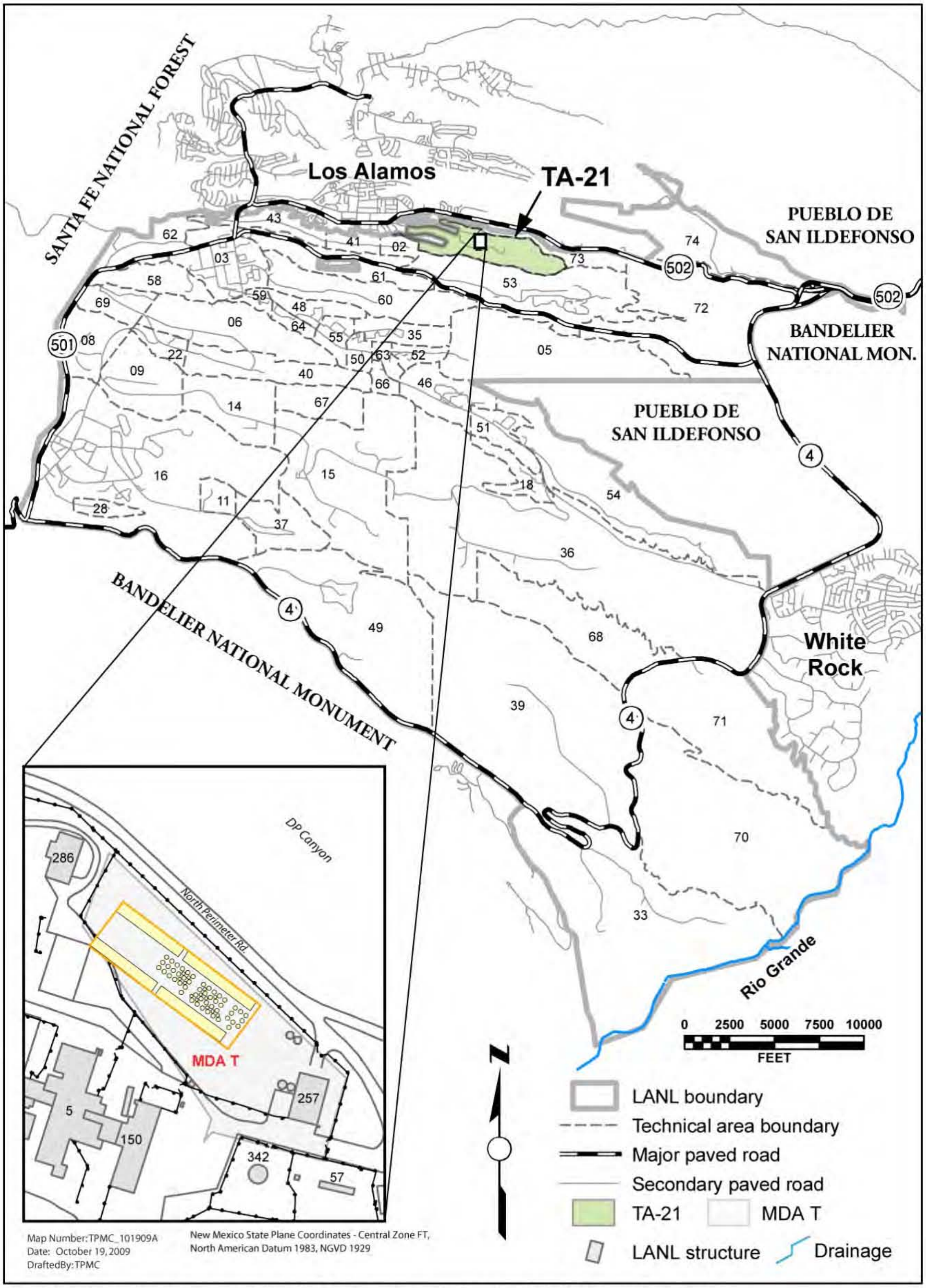
NMED (New Mexico Environment Department), February 17, 2010. “Approval with Modifications, Periodic Monitoring Report for Vapor-Sampling Activities at Material Disposal Area T, Consolidated Unit 21-016(a)-99, at Technical Area 21, June to August 2009,” New Mexico Environment Department letter to M.J. Graham (LANL) and G.J. Rael (DOE-LASO) from J.P. Bearzi (NMED-HWB), Santa Fe, New Mexico. (NMED 2010, 109021)

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
Rio Grande	Drainage Arcs; Los Alamos National Laboratory; Water Quality and Hydrology Group; 03 June 2003
LANL boundary	LANL Areas Used and Occupied; Los Alamos National Laboratory, Site Planning & Project Initiation Group, Infrastructure Planning Division; 19 September 2007.
TA boundary	Technical Area Boundaries; Los Alamos National Laboratory, Site Planning & Project Initiation Group, Infrastructure Planning Division; 19 September 2007.
NES boundary	Nuclear Environmental Sites; Los Alamos National Laboratory, EP Environment and Remediation Support Services Division, EP2006-1092; 1:2,500 Scale Data; 11 January 2007.
Major paved road	New Mexico Roads; Earth Data Analysis Center, Albuquerque, NM; 01 December1995.
Paved road	Paved Road Arcs; Los Alamos National Laboratory, KSL Site Support Services, Planning, Locating and Mapping Section; 06 January 2004; as published 04 January 2008.
Dirt road	Dirt Road Arcs; Los Alamos National Laboratory, KSL Site Support Services, Planning, Locating and Mapping Section; 06 January 2004; as published 04 January 2008.
Structure	Structures; Los Alamos National Laboratory, KSL Site Support Services, Planning, Locating and Mapping Section; 06 January 2004; as published 04 January 2008.
Former structure	Former Structures; Los Alamos National Laboratory, Waste and Environmental Services Division, EP2008-0441; 1:2,500 Scale Data; 08 August 2008.
Waste storage features	Waste Storage Features; Los Alamos National Laboratory, Environment and Remediation Support Services Division, GIS/Geotechnical Services Group, EP2007-0032; 1:2,500 Scale Data; 13 April 2007.
Contours	Hypsography, 100-, 20-, and 10-Ft Contour Intervals; 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 28 May 2009.
Revised MDA T fence	Revised MDA T Fencing; Los Alamos National Laboratory, Waste and Environmental Services Division, unpublished data, personal communication with N. Plannerer.

Legend Item/Type	Data Source
Gas line	Primary Gas Distribution Lines; Los Alamos National Laboratory, KSL Site Support Services, Planning, Locating and Mapping Section; 06 January 2004; as published 28 May 2009.
Water line	Water Lines; Los Alamos National Laboratory, KSL Site Support Services, Planning, Locating and Mapping Section; 06 January 2004; as published 28 May 2009.
Electric line	Primary Electric Grid; Los Alamos National Laboratory, KSL Site Support Services, Planning, Locating and Mapping Section; 06 January 2004; as published 28 May 2009.
Sewer line	Sewer Line System; Los Alamos National Laboratory, KSL Site Support Services, Planning, Locating and Mapping Section; 06 January 2004; as published 28 May 2009.
Steam line	Steam Line Distribution System; Los Alamos National Laboratory, KSL Site Support Services, Planning, Locating and Mapping Section; 06 January 2004; as published 28 May 2009.
Communication line	Communication Lines; Los Alamos National Laboratory, KSL Site Support Services, Planning, Locating and Mapping Section; 08 August 2002; as published 28 May 2009.
Building-associated features /structures	Primary Landscape Features; Los Alamos National Laboratory, KSL Site Support Services, Planning, Locating and Mapping Section; 06 January 2004; as published 28 May 2009.
Sampling locations	Point Feature Locations of the Environmental Restoration Project Database; Los Alamos National Laboratory, Waste and Environmental Services Division, EP2008-0109; 4 June 2009.



Disclaimer: This map was created for work processes assoctiated with the MDA T IR. All other uses for this map should be confirmed with the LANL Enviromental Programs Directorate.

Figure 1.0-1 Location of MDA T at TA-21

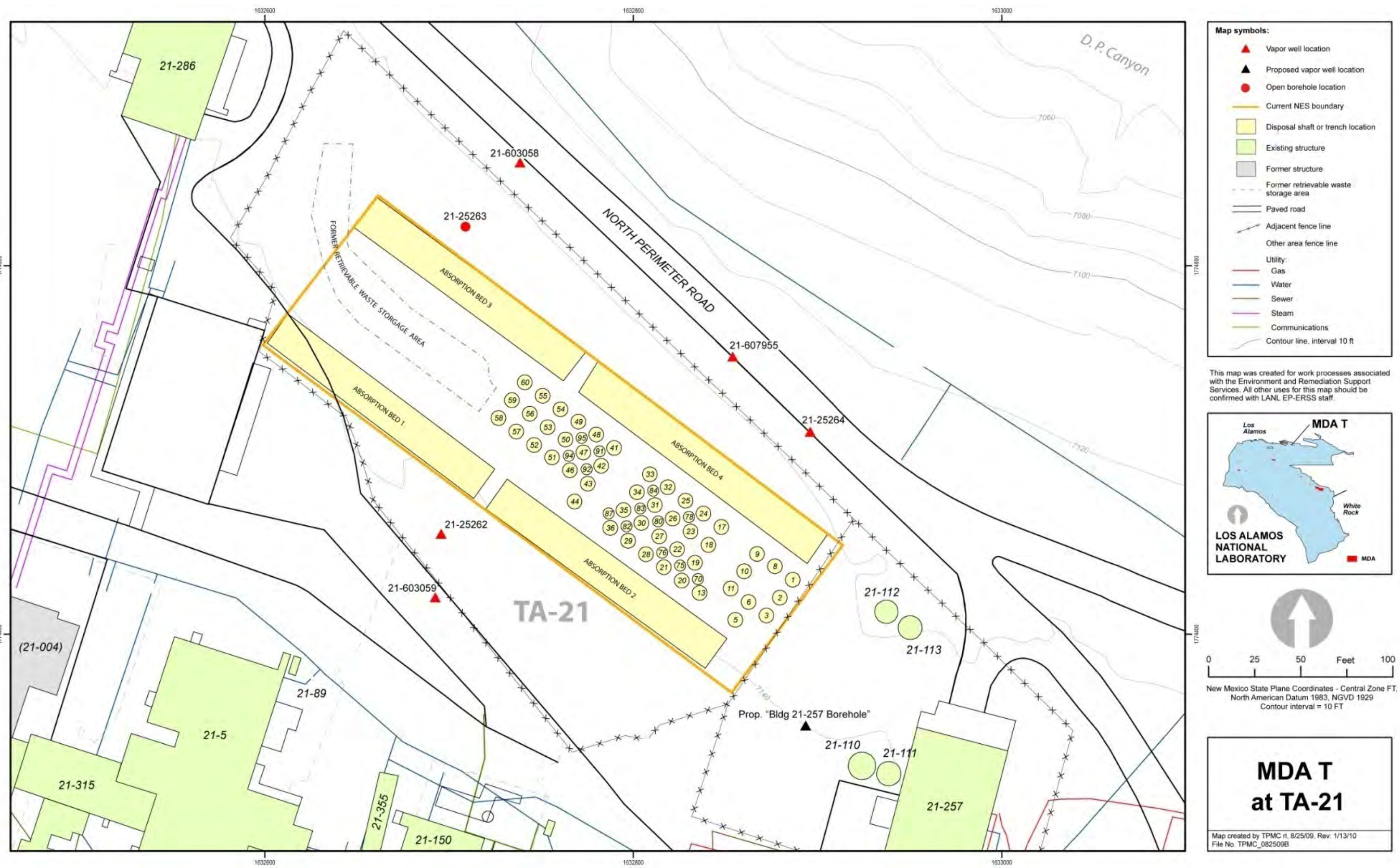


Figure 1.0-2 Locations of MDA T vapor-monitoring wells and associated structures and features

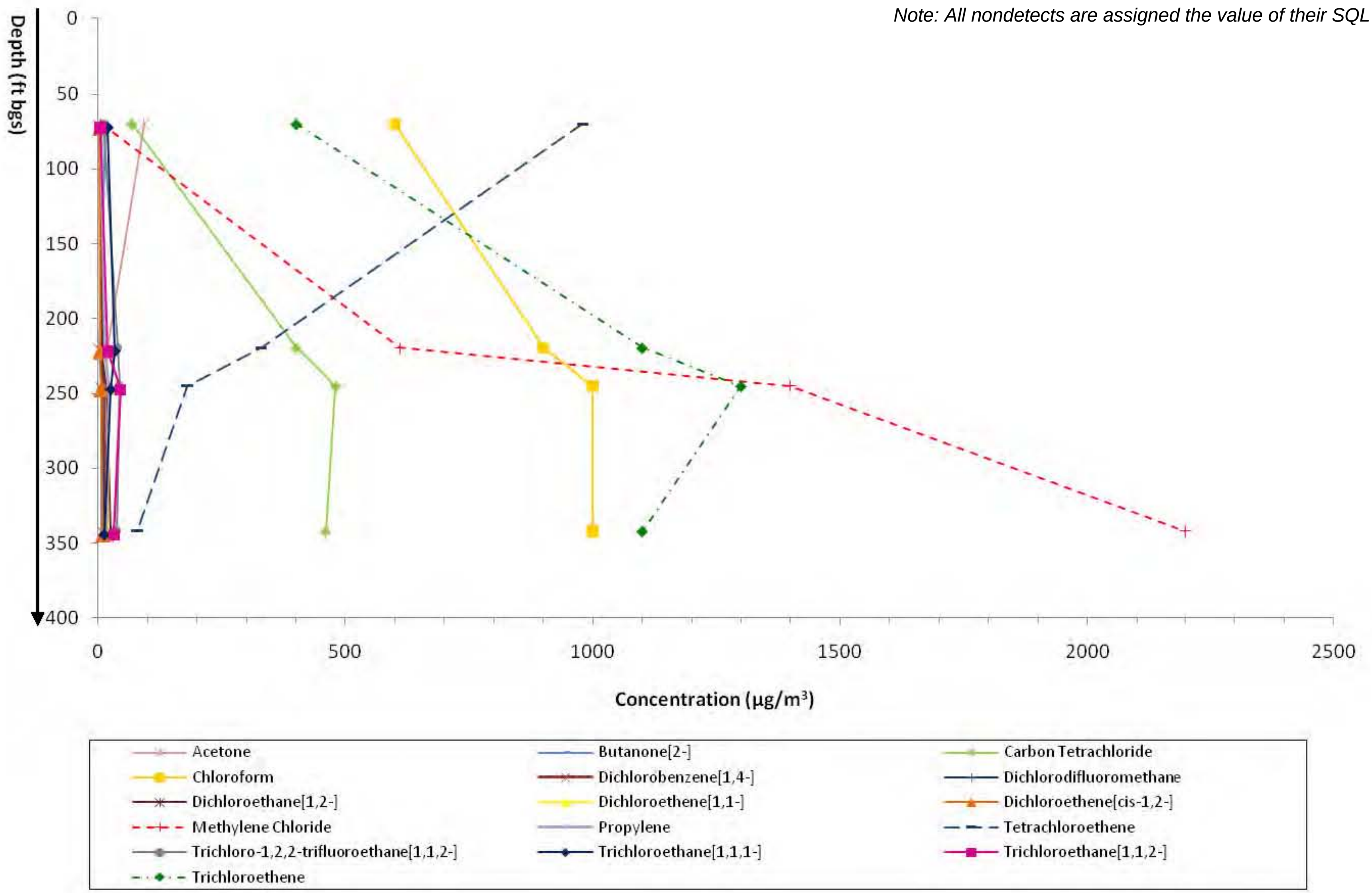


Figure 5.1-1 Vertical profile of detected VOCs in vapor-monitoring well 21-603058, October 2009

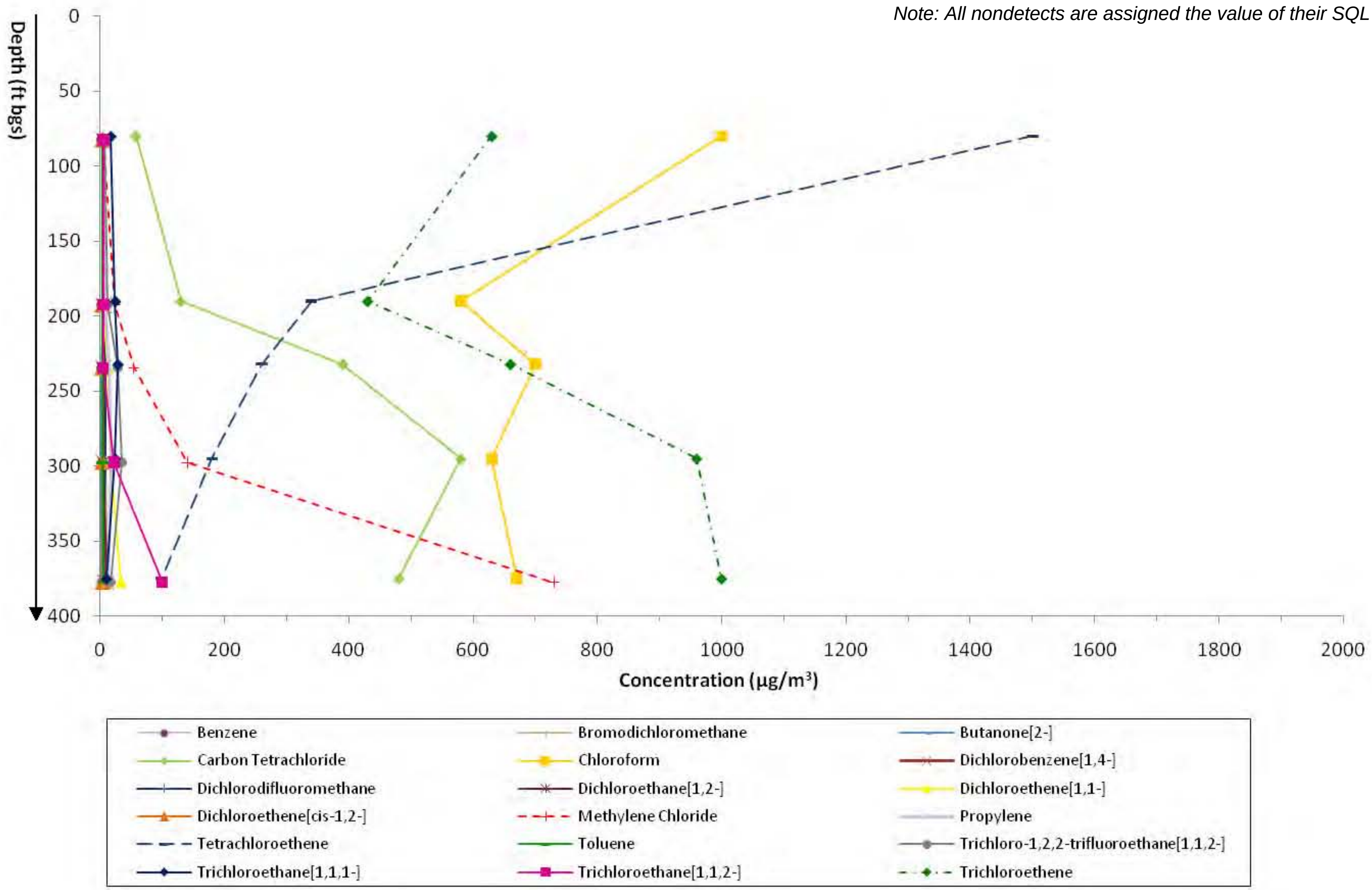


Figure 5.1-2 Vertical profile of detected VOCs in vapor-monitoring well 21-603059, October 2009

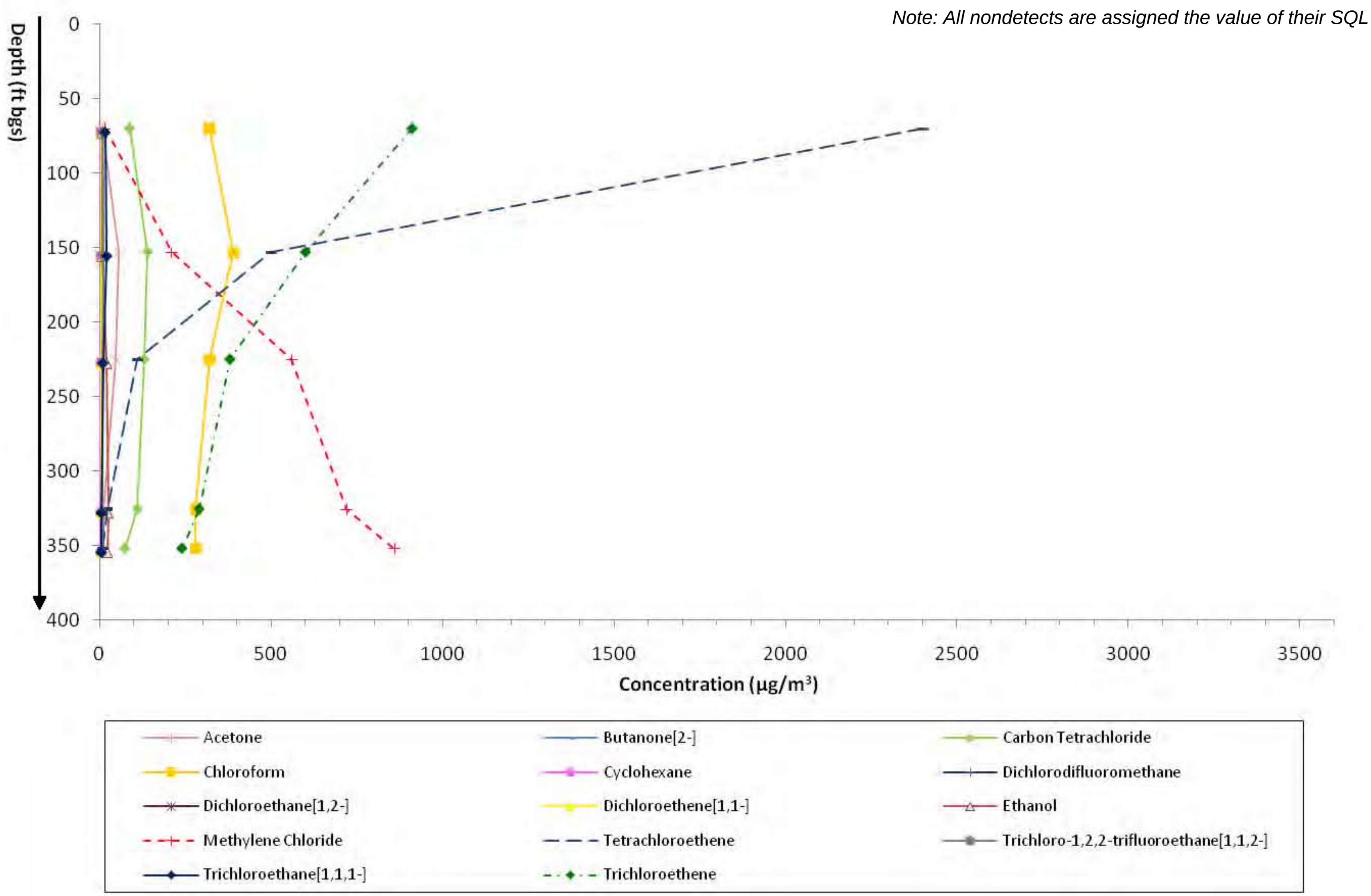


Figure 5.1-3 Vertical profile of detected VOCs in vapor-monitoring well 21-25264, October 2009

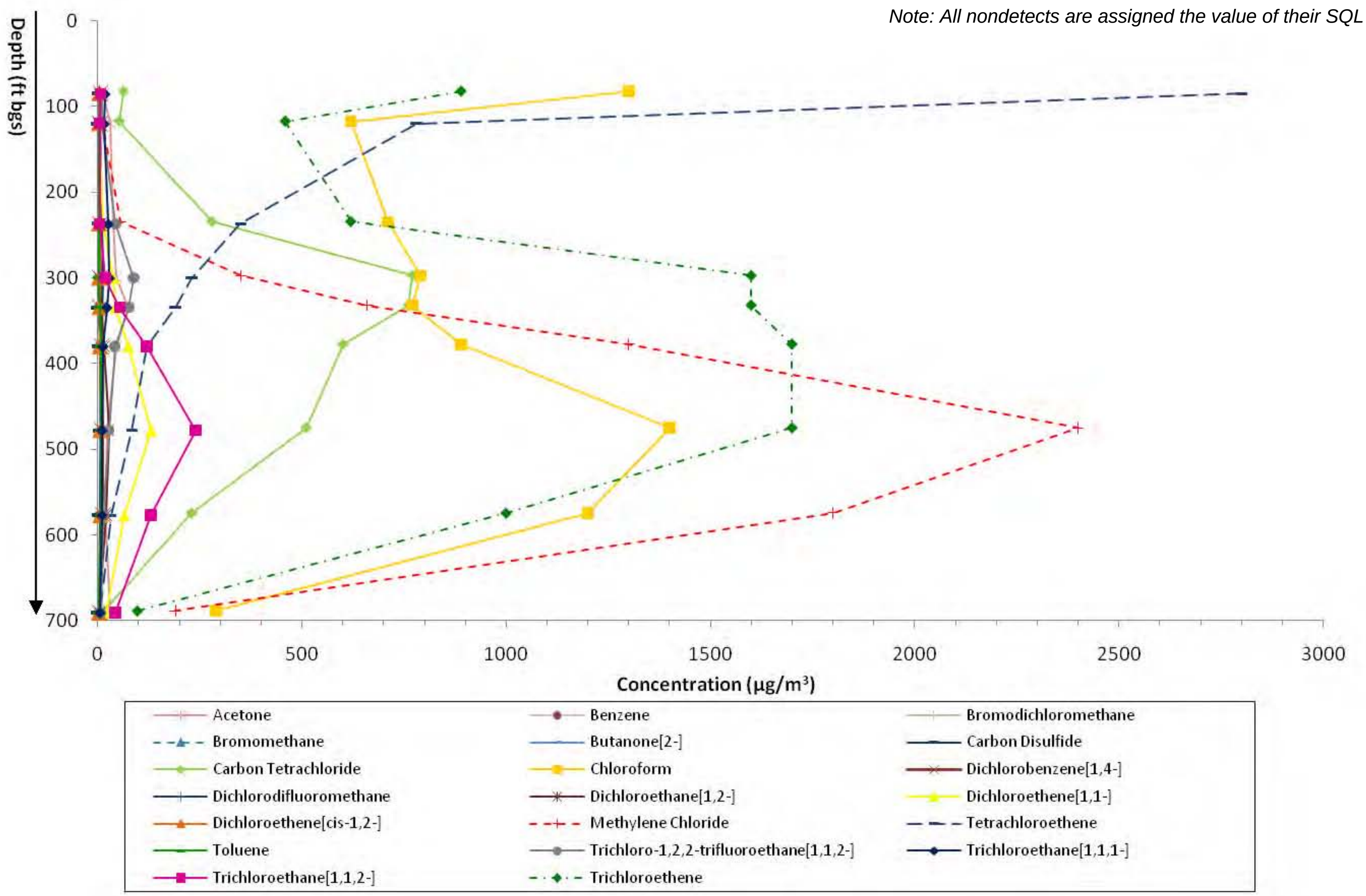


Figure 5.1-4 Vertical profile of detected VOCs in vapor-monitoring well 21-25262, October 2009

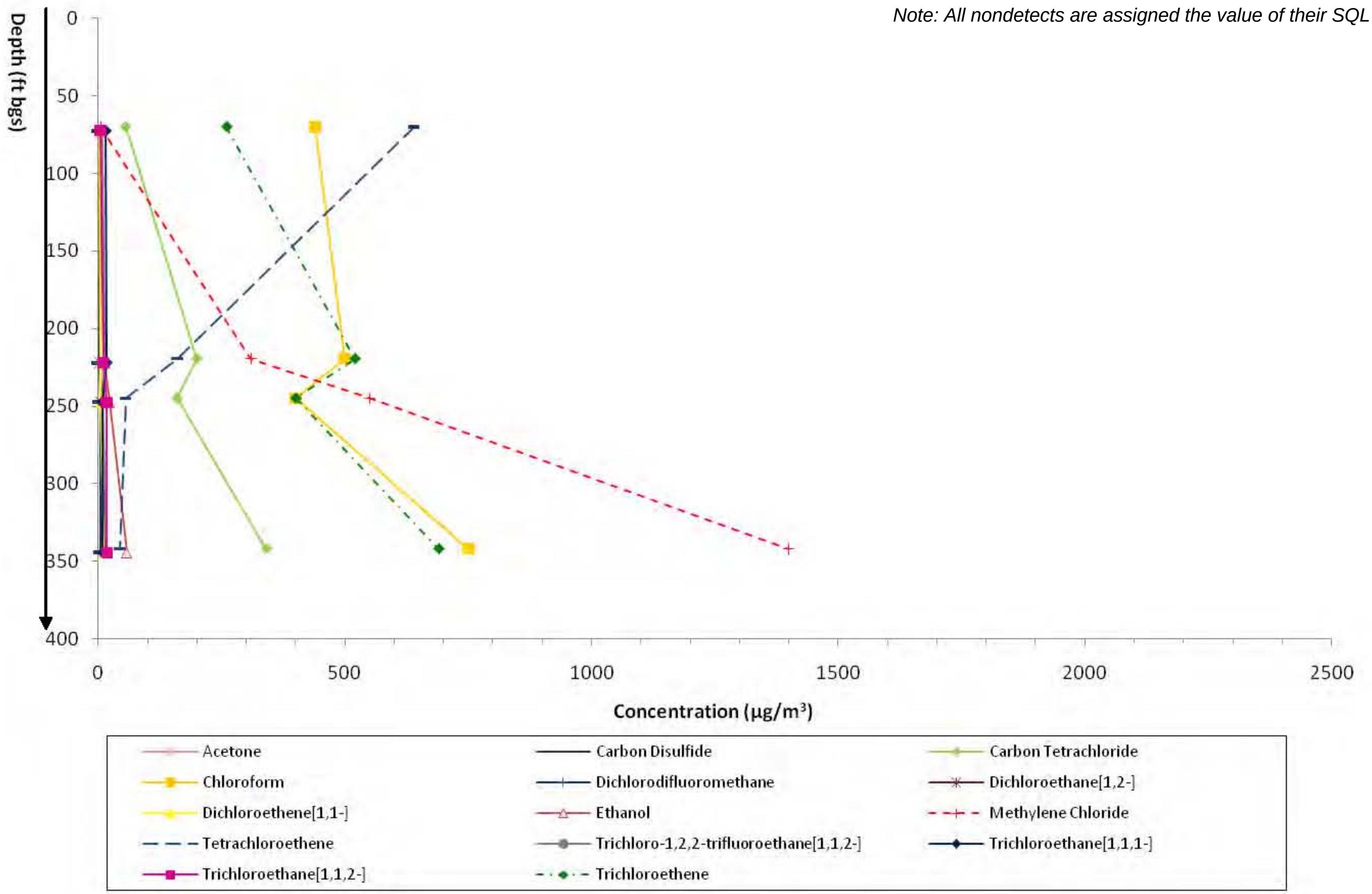


Figure 5.1-5 Vertical profile of detected VOCs in vapor-monitoring well 21-603058, November 2009

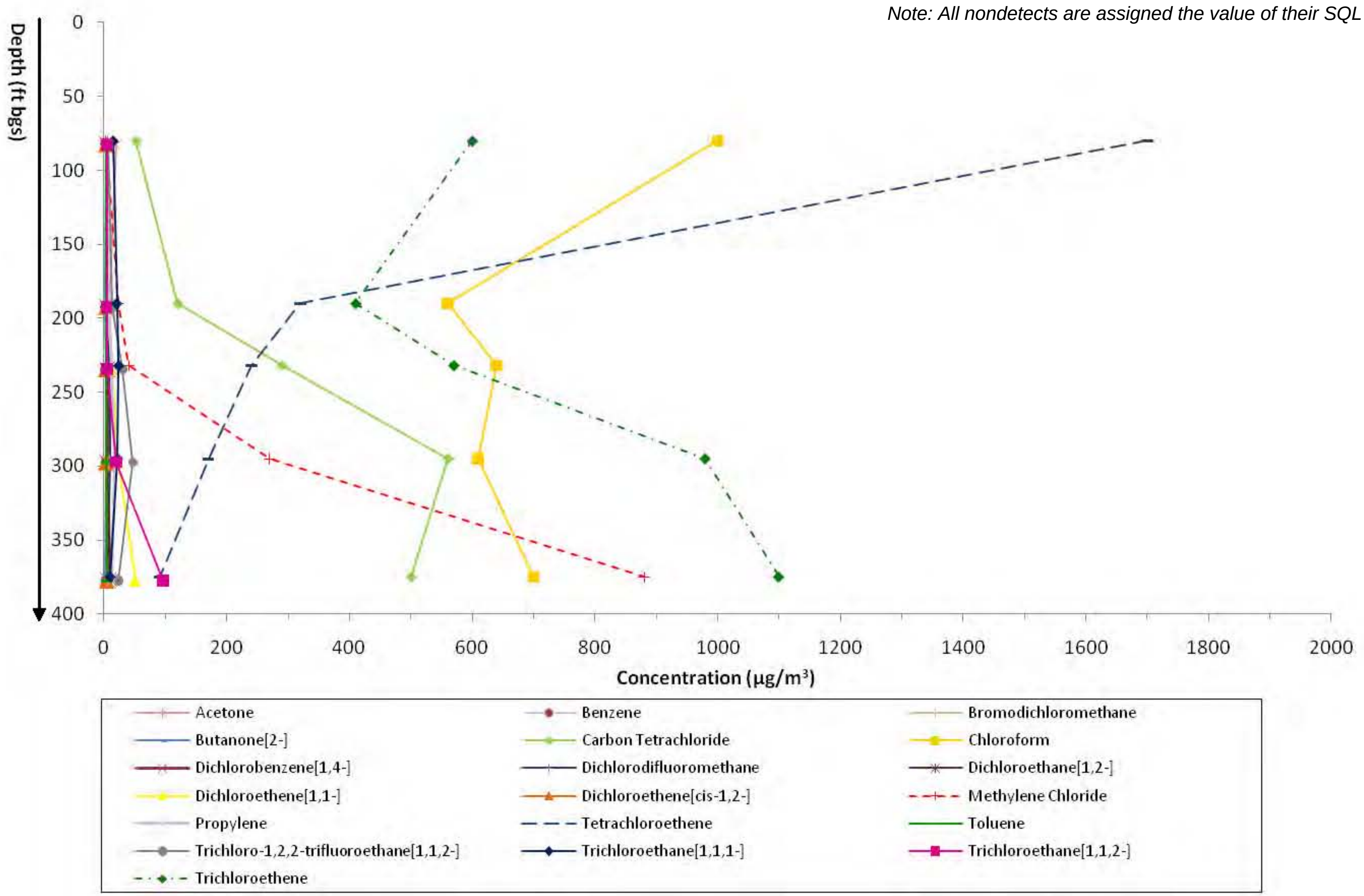


Figure 5.1-6 Vertical profile of detected VOCs in vapor-monitoring well 21-603059, November 2009

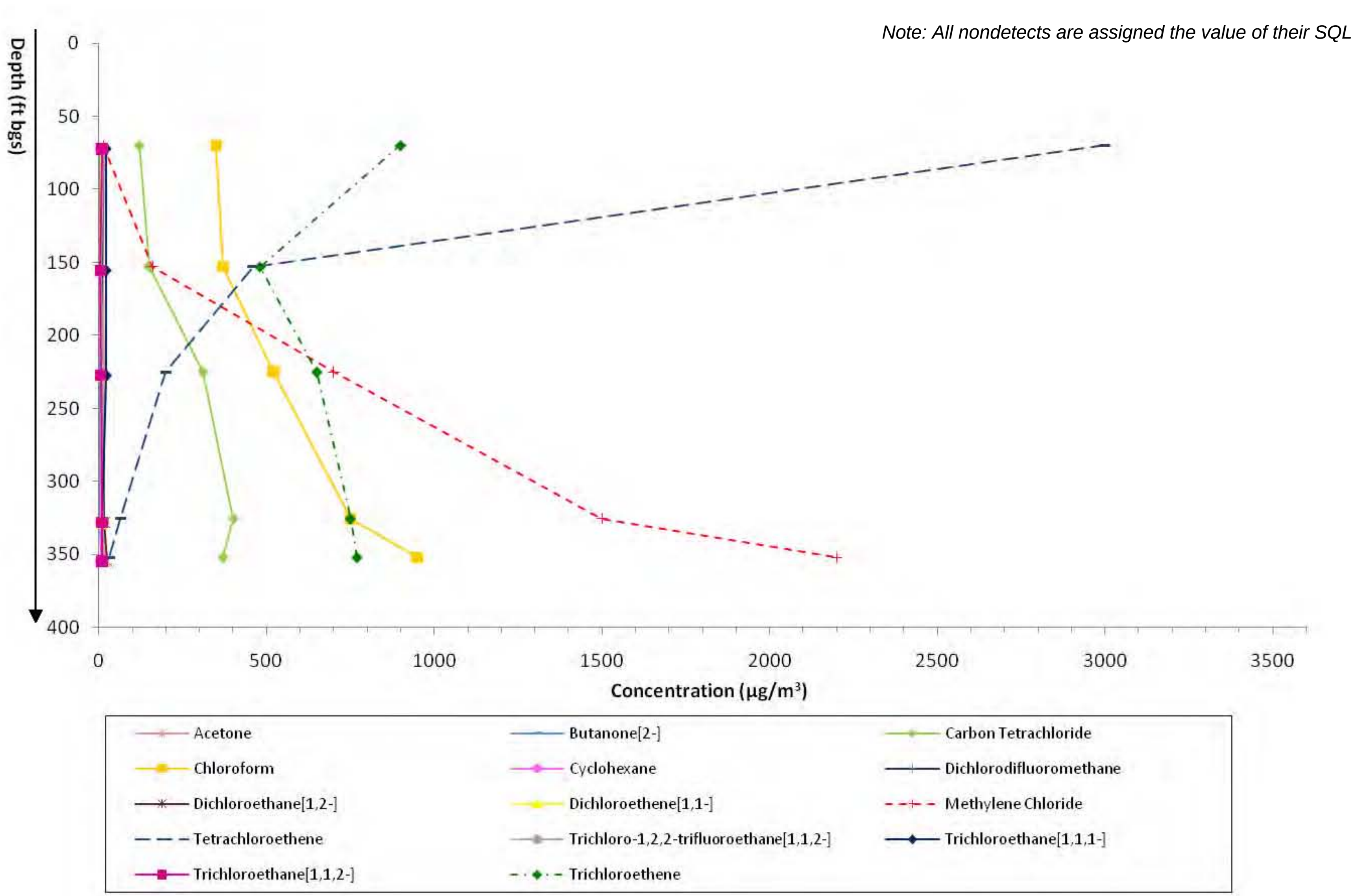


Figure 5.1-7 Vertical profile of detected VOCs in vapor-monitoring well 21-25264, November 2009

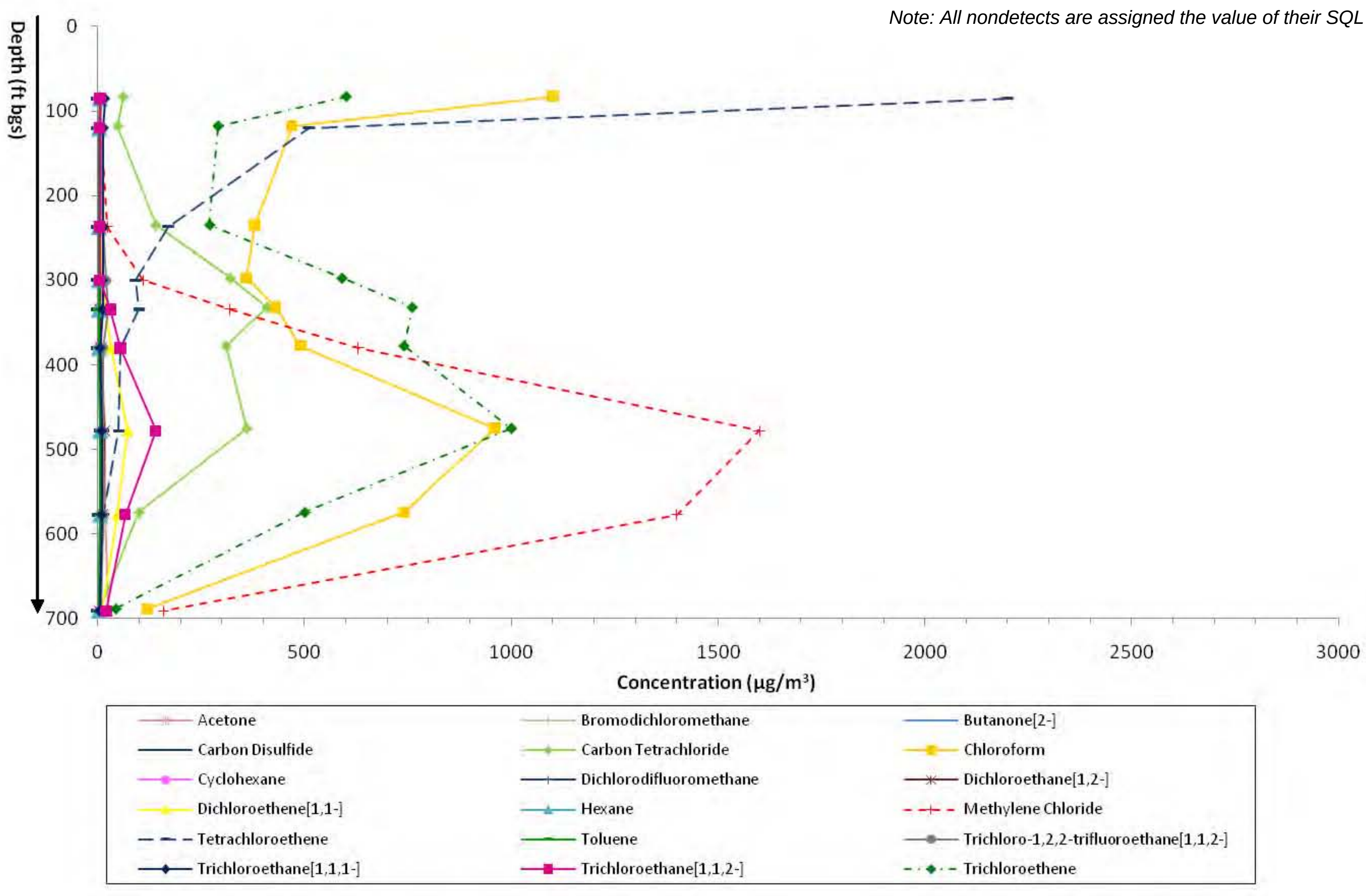


Figure 5.1-8 Vertical profile of detected VOCs in vapor-monitoring well 21-25262, November 2009

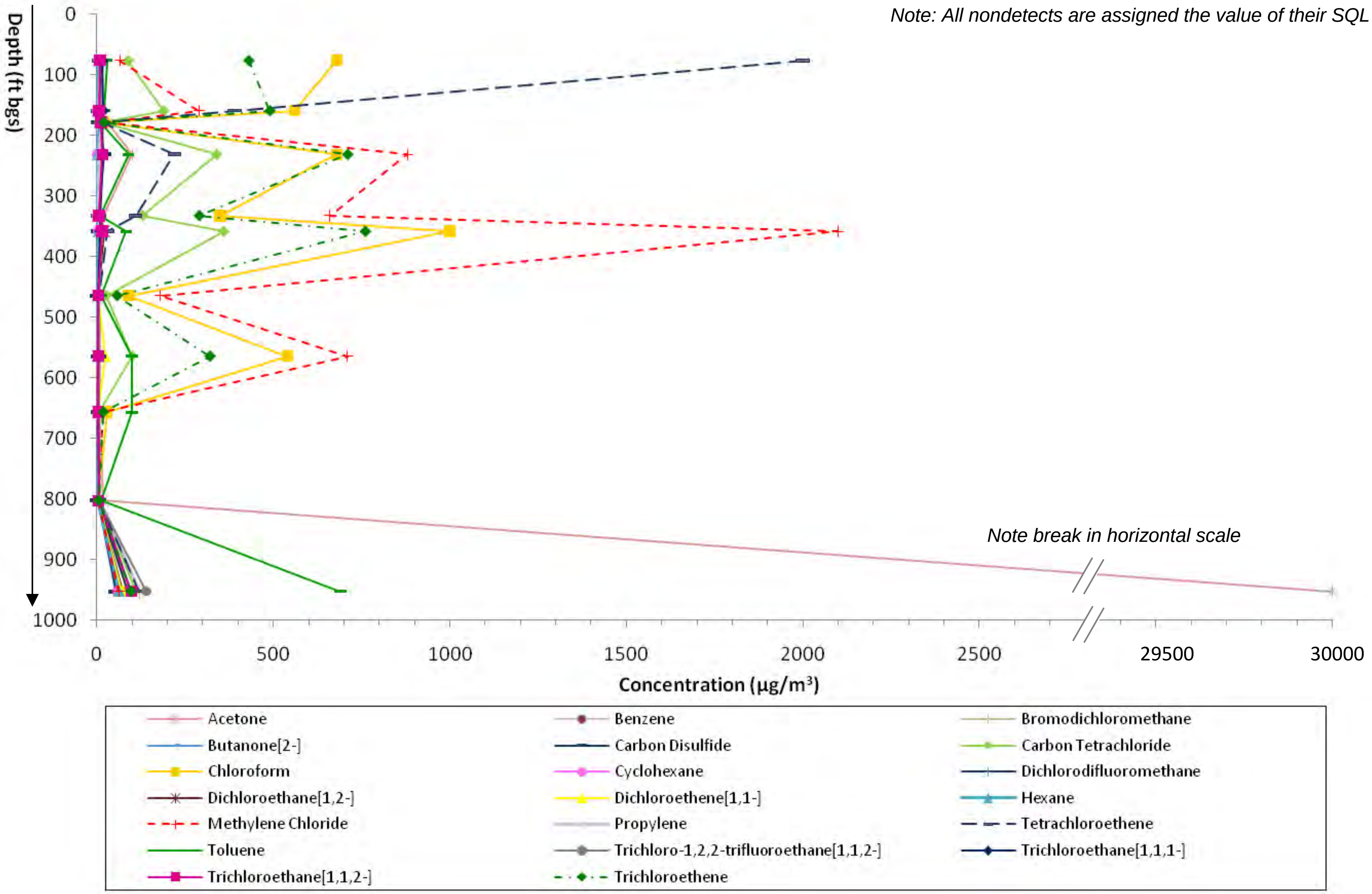


Figure 5.1-9 Vertical profile of detected VOCs in vapor-monitoring well 21-607955, November 2009

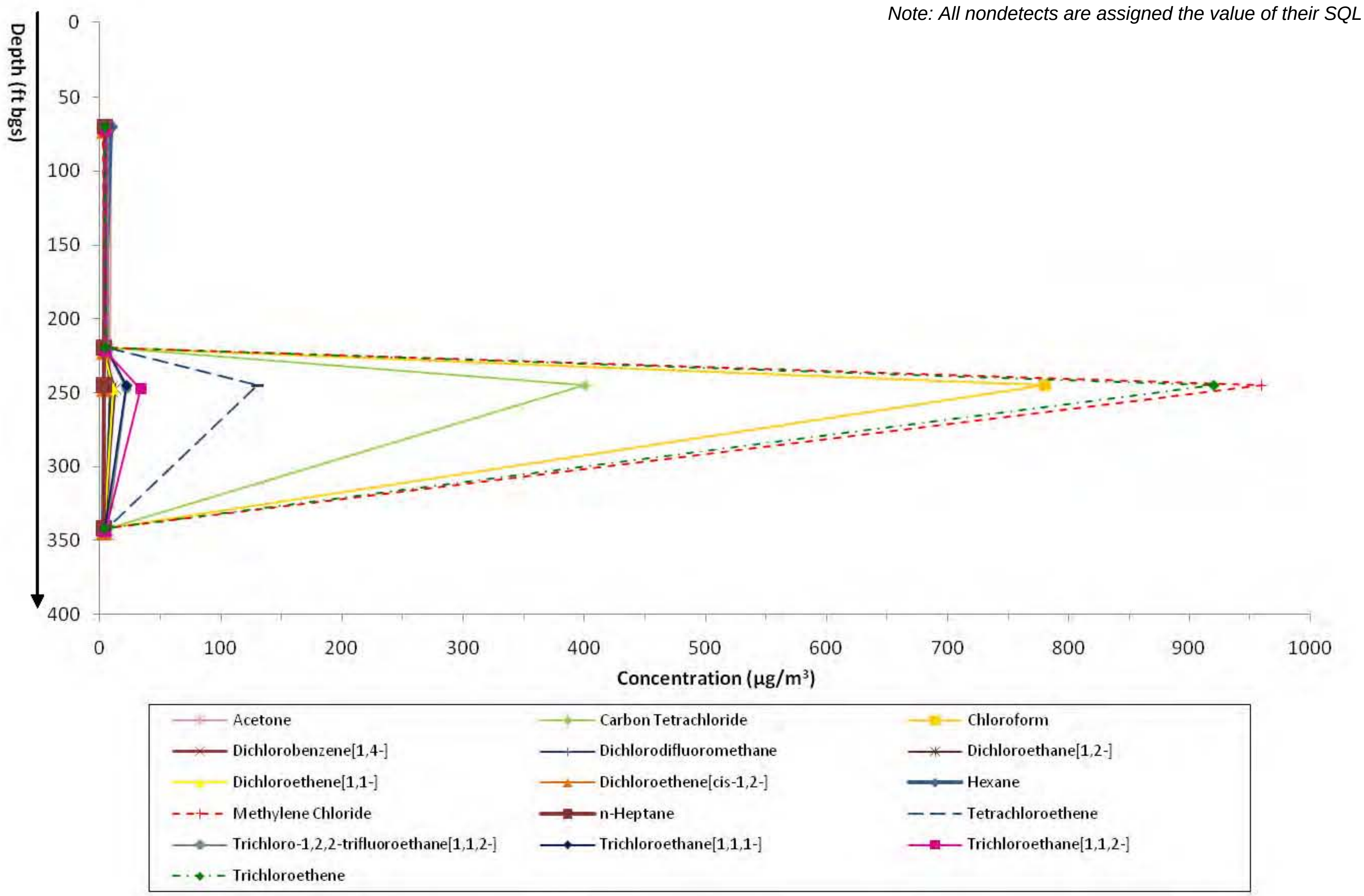


Figure 5.1-10 Vertical profile of detected VOCs in vapor-monitoring well 21-603058, December 2009

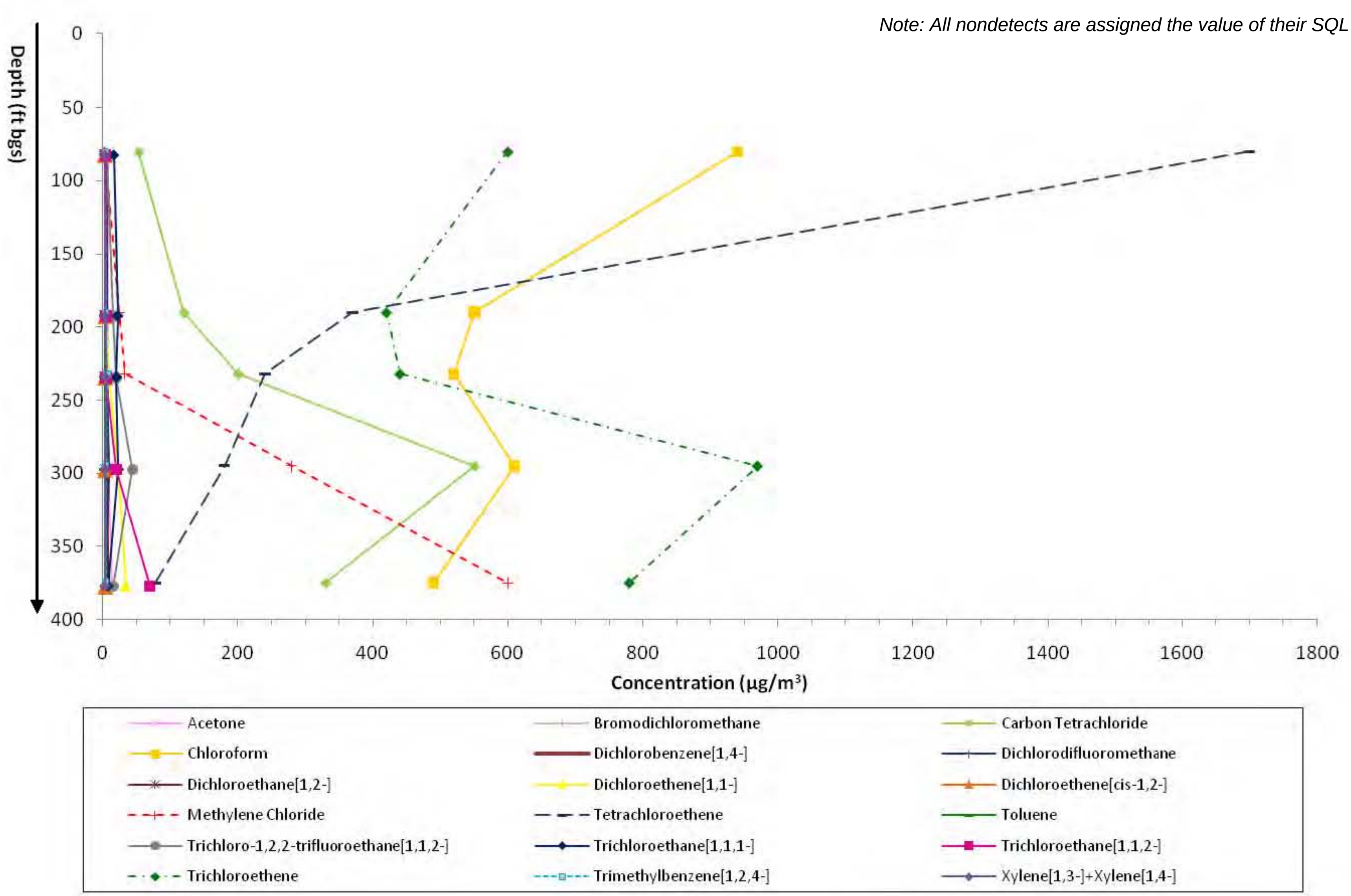


Figure 5.1-11 Vertical profile of detected VOCs in vapor-monitoring well 21-603059, December 2009

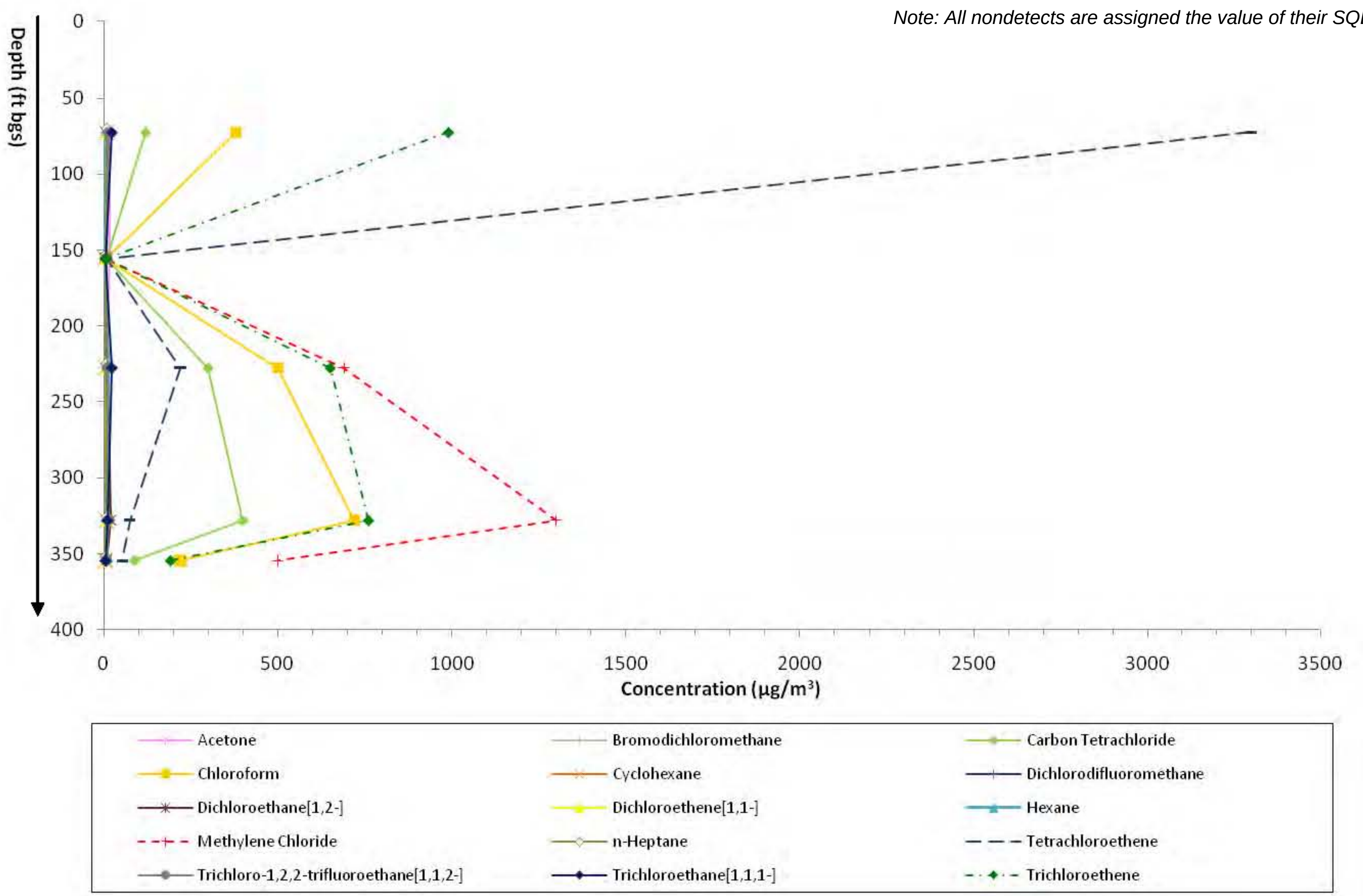


Figure 5.1-12 Vertical profile of detected VOCs in vapor-monitoring well 21-25264, December 2009

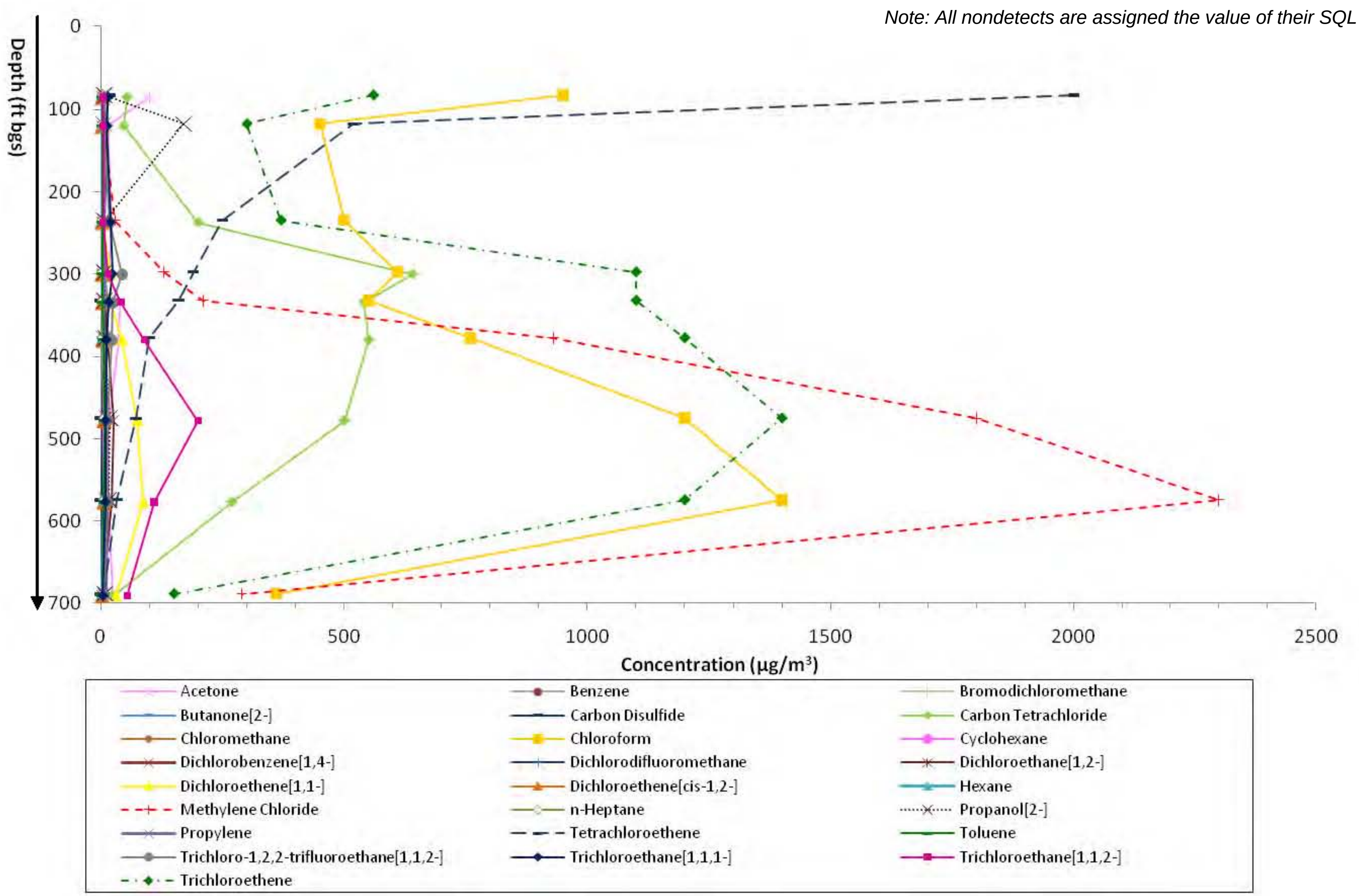


Figure 5.1-13 Vertical profile of detected VOCs in vapor-monitoring well 21-25262, December 2009

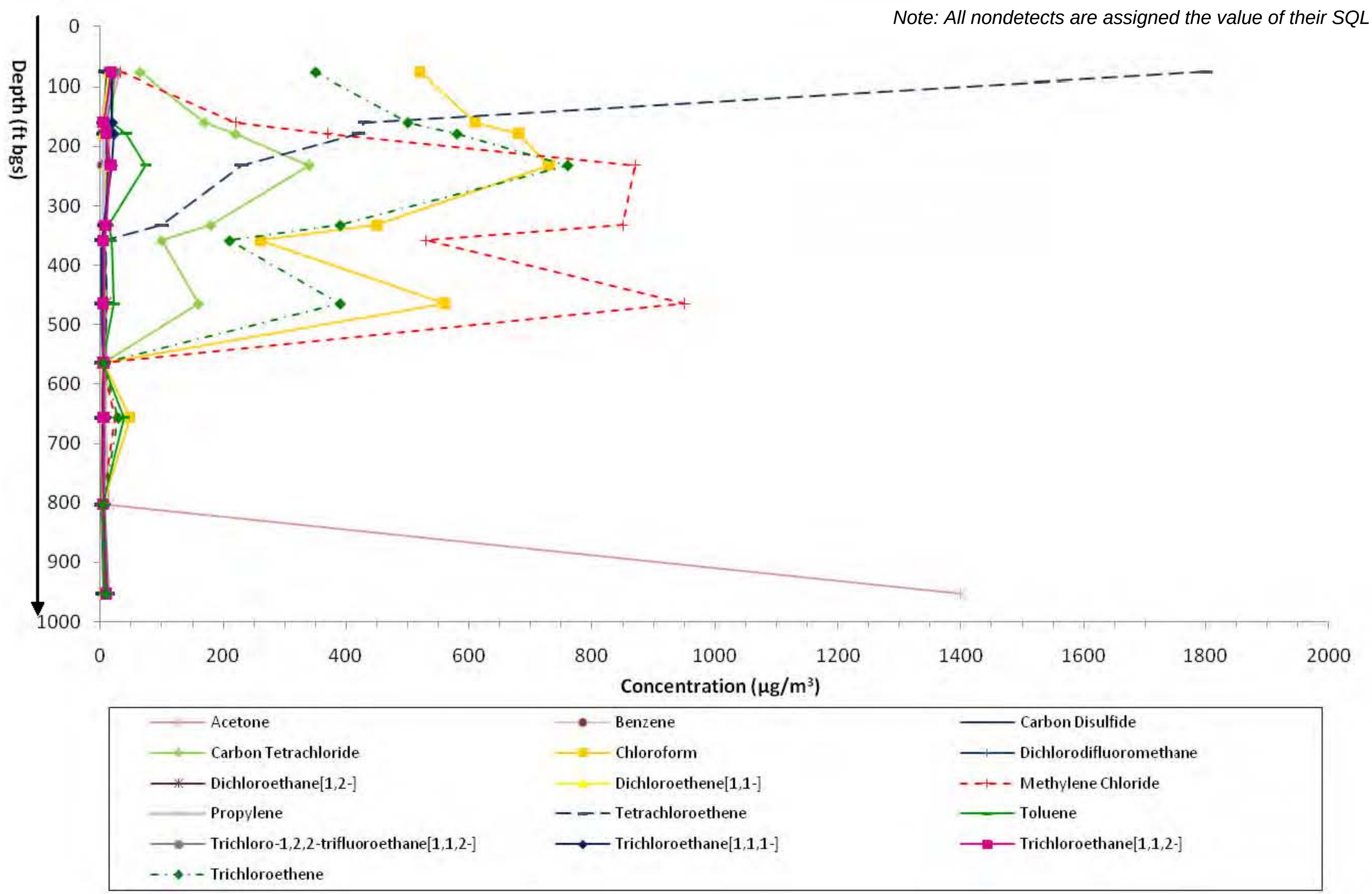


Figure 5.1-14 Vertical profile of detected VOCs in vapor-monitoring well 21-607955, December 2009

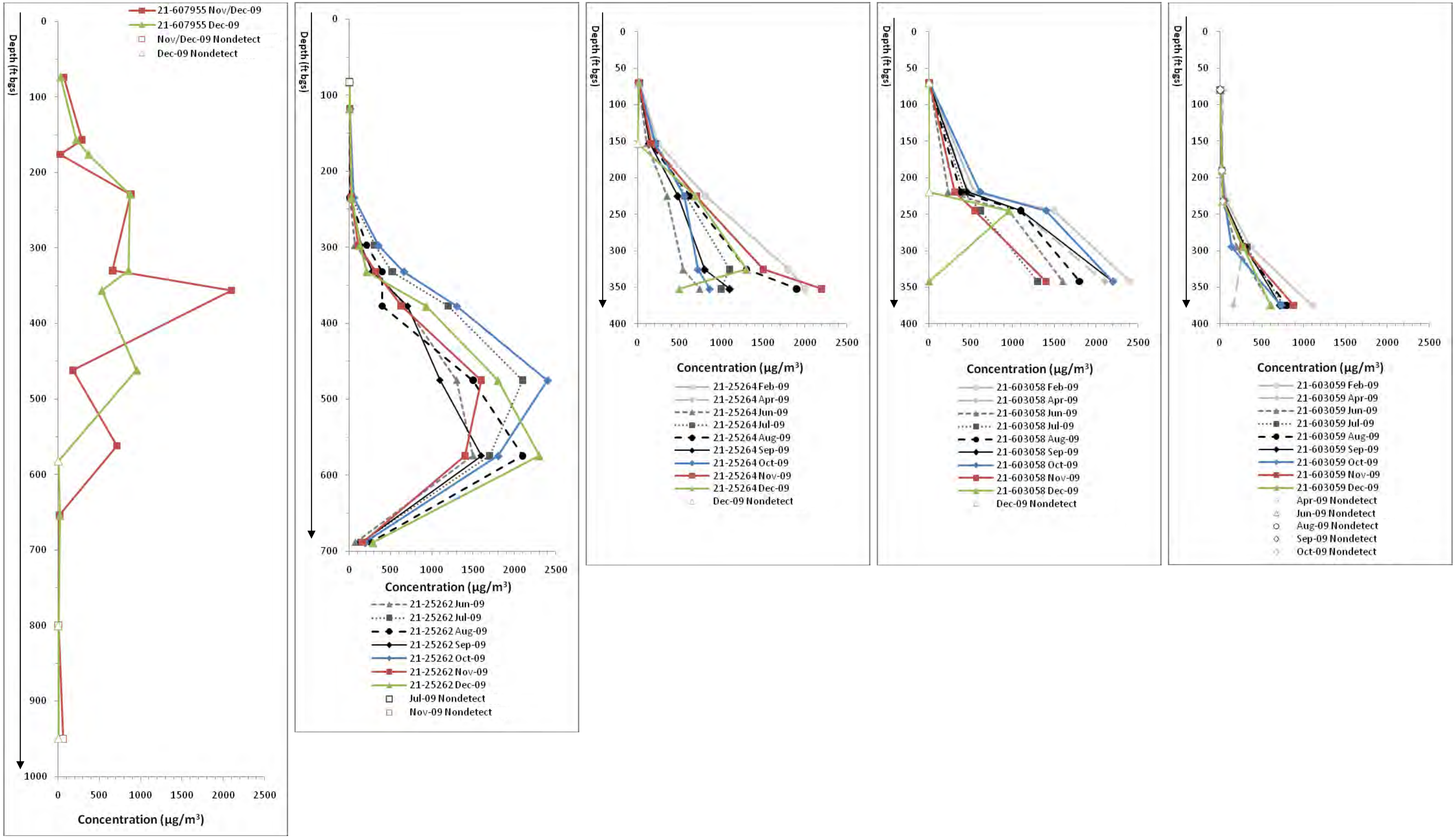


Figure 5.1-15 Vertical profile of methylene chloride in vapor-monitoring wells 21-607955, 21-25262, 21-25264, 21-603058, and 21-603059, February–December 2009

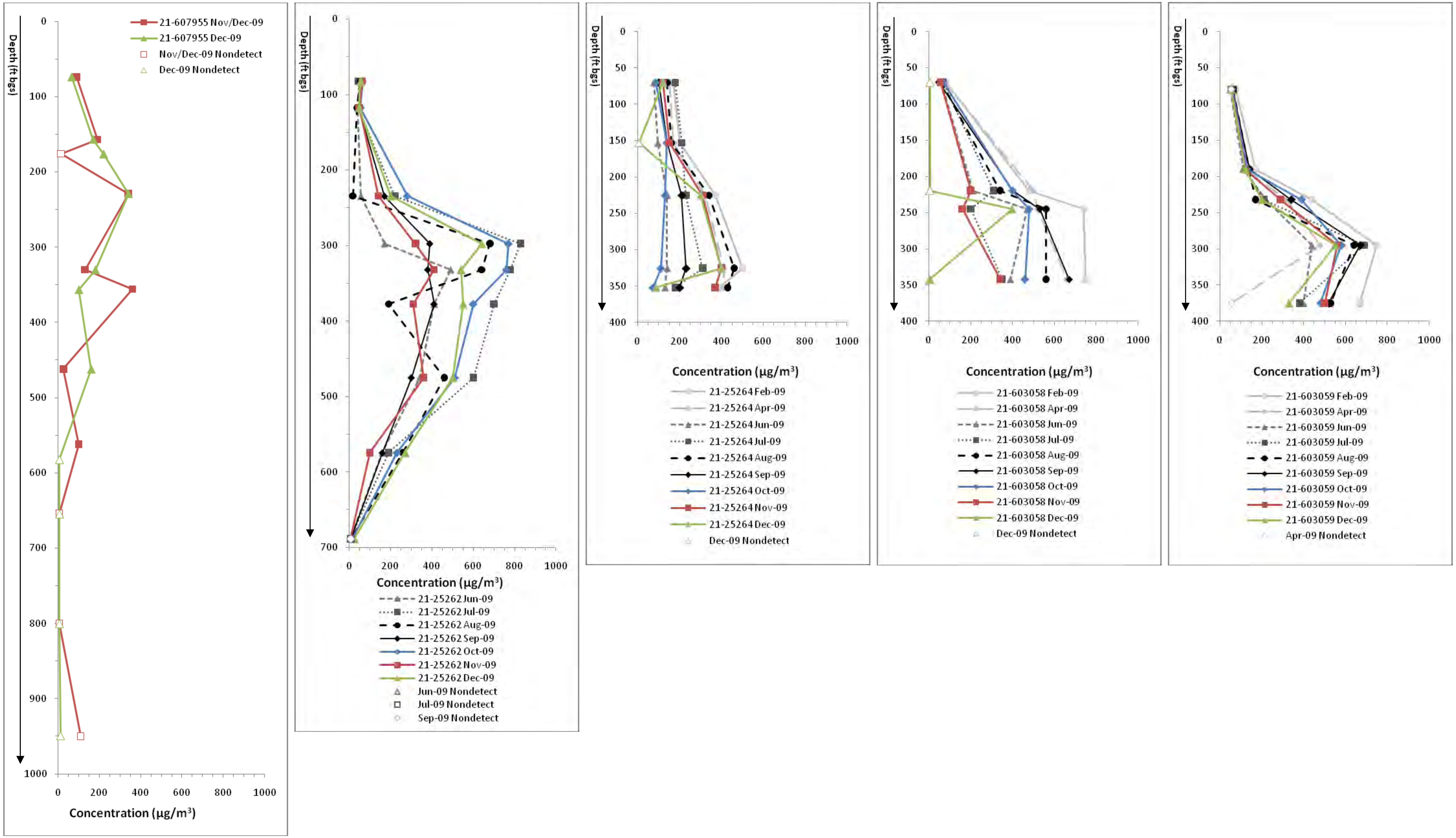


Figure 5.1-16 Vertical profile of carbon tetrachloride in vapor-monitoring wells 21-607955, 21-25262, 21-25264, 21-603058, and 21-603059, February–December 2009

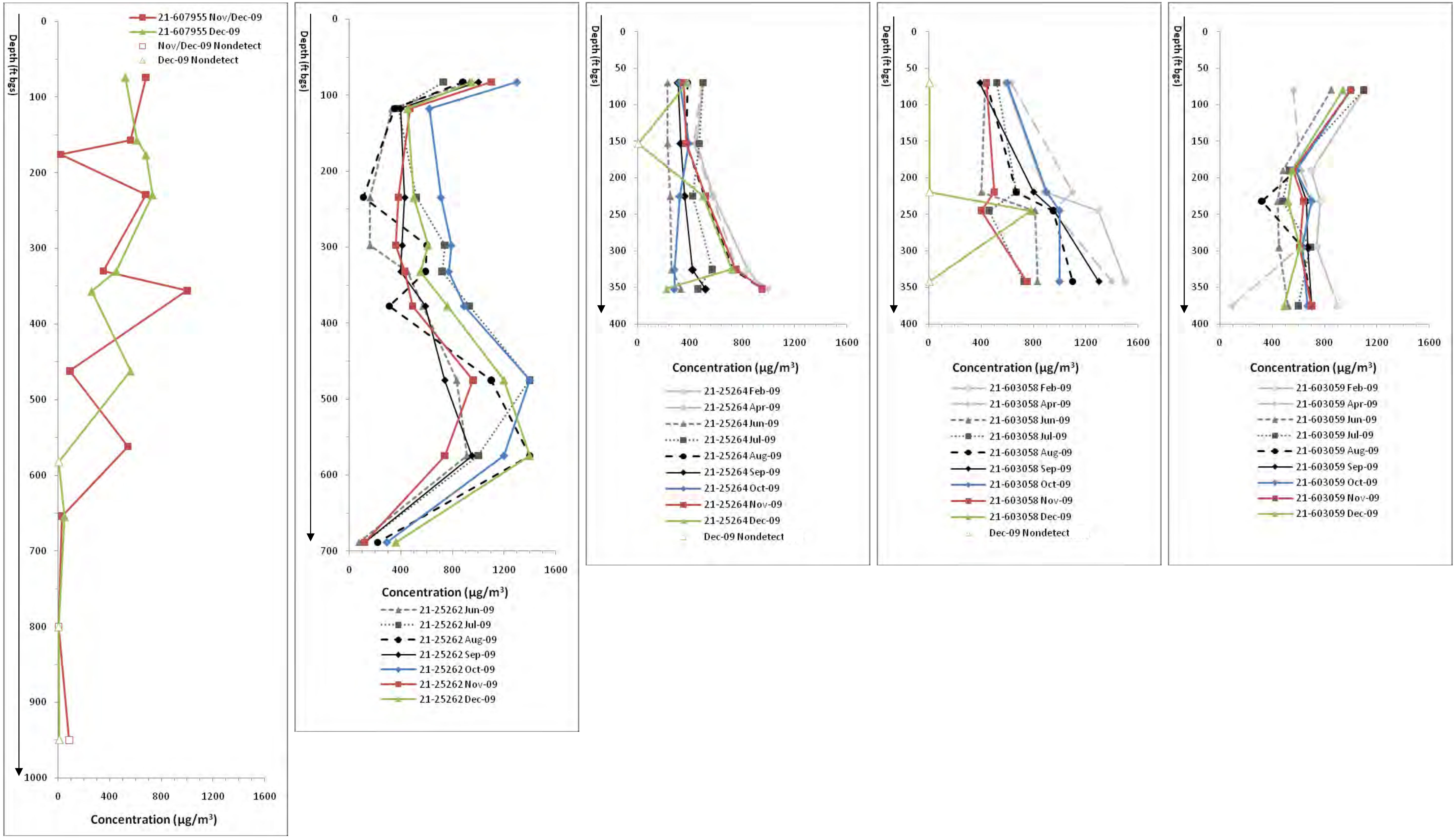


Figure 5.1-17 Vertical profile of chloroform in vapor-monitoring wells 21-607955, 21-25262, 21-25264, 21-603058, and 21-603059, February–December 2009

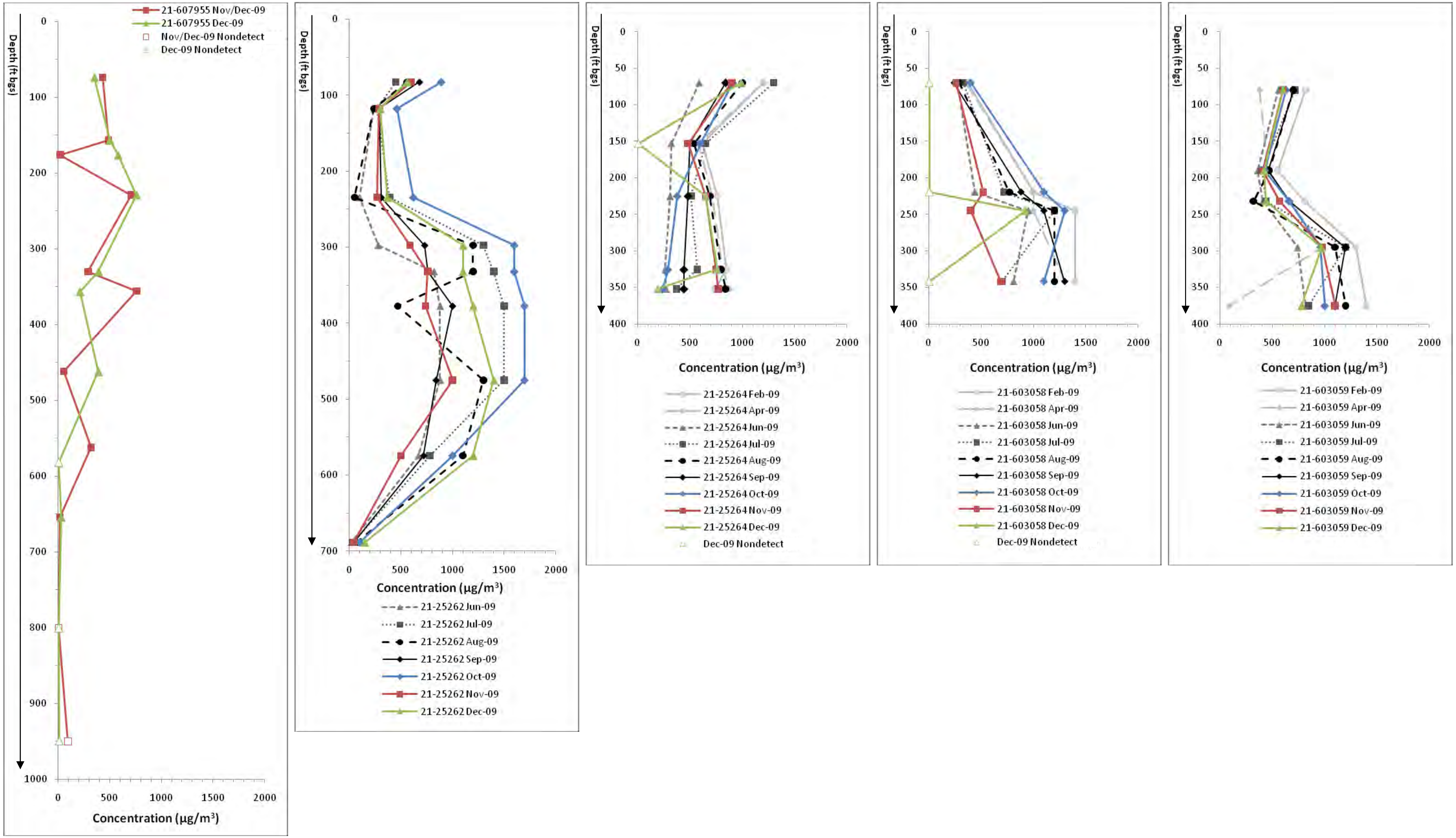


Figure 5.1-18 Vertical profile of TCE in vapor-monitoring wells 21-607955, 21-25262, 21-25264, 21-603058, and 21-603059, February–December 2009

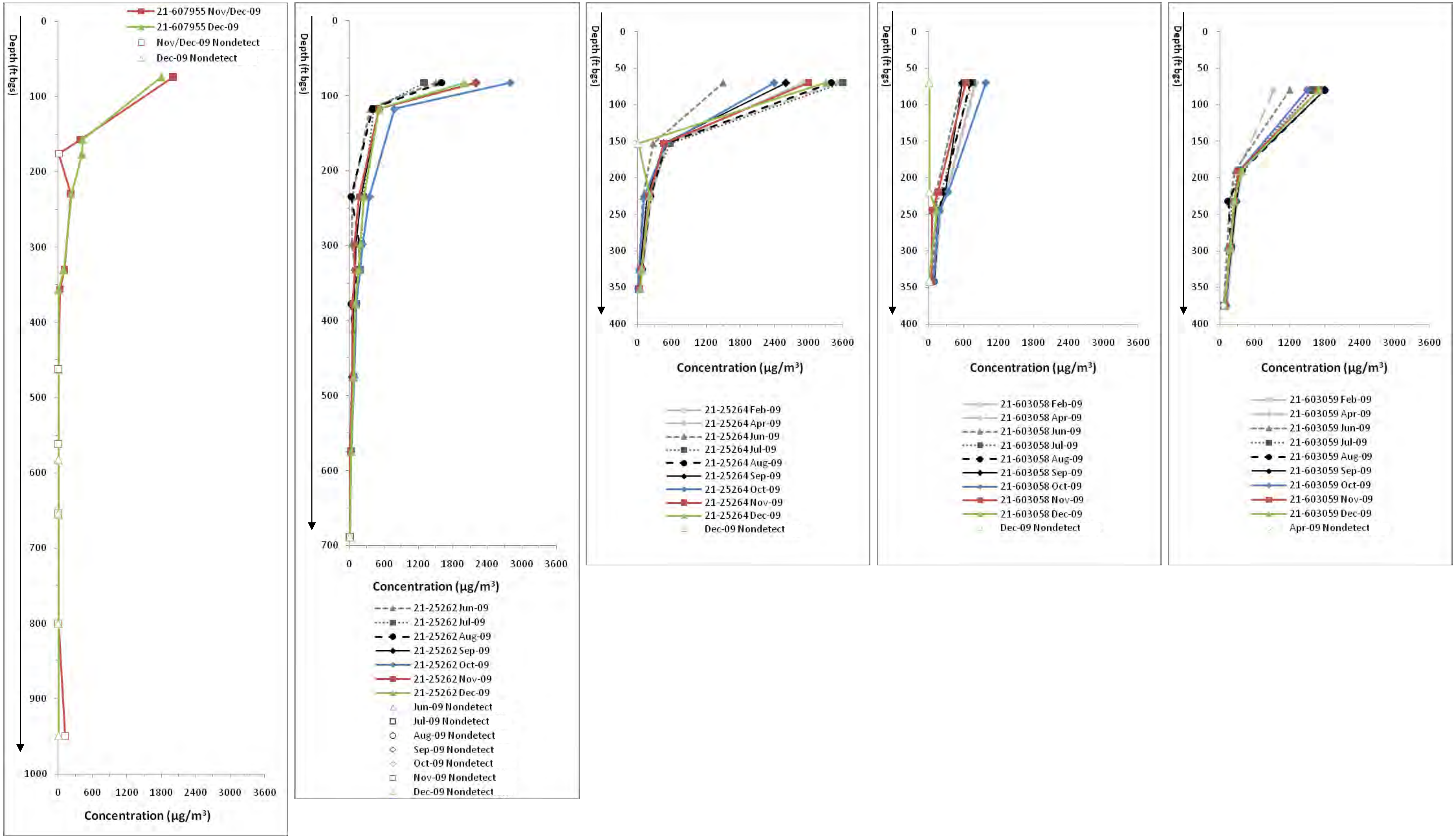


Figure 5.1-19 Vertical profile of PCE in vapor-monitoring wells 21-607955, 21-25262, 21-25264, 21-603058, and 21-603059, February–December 2009

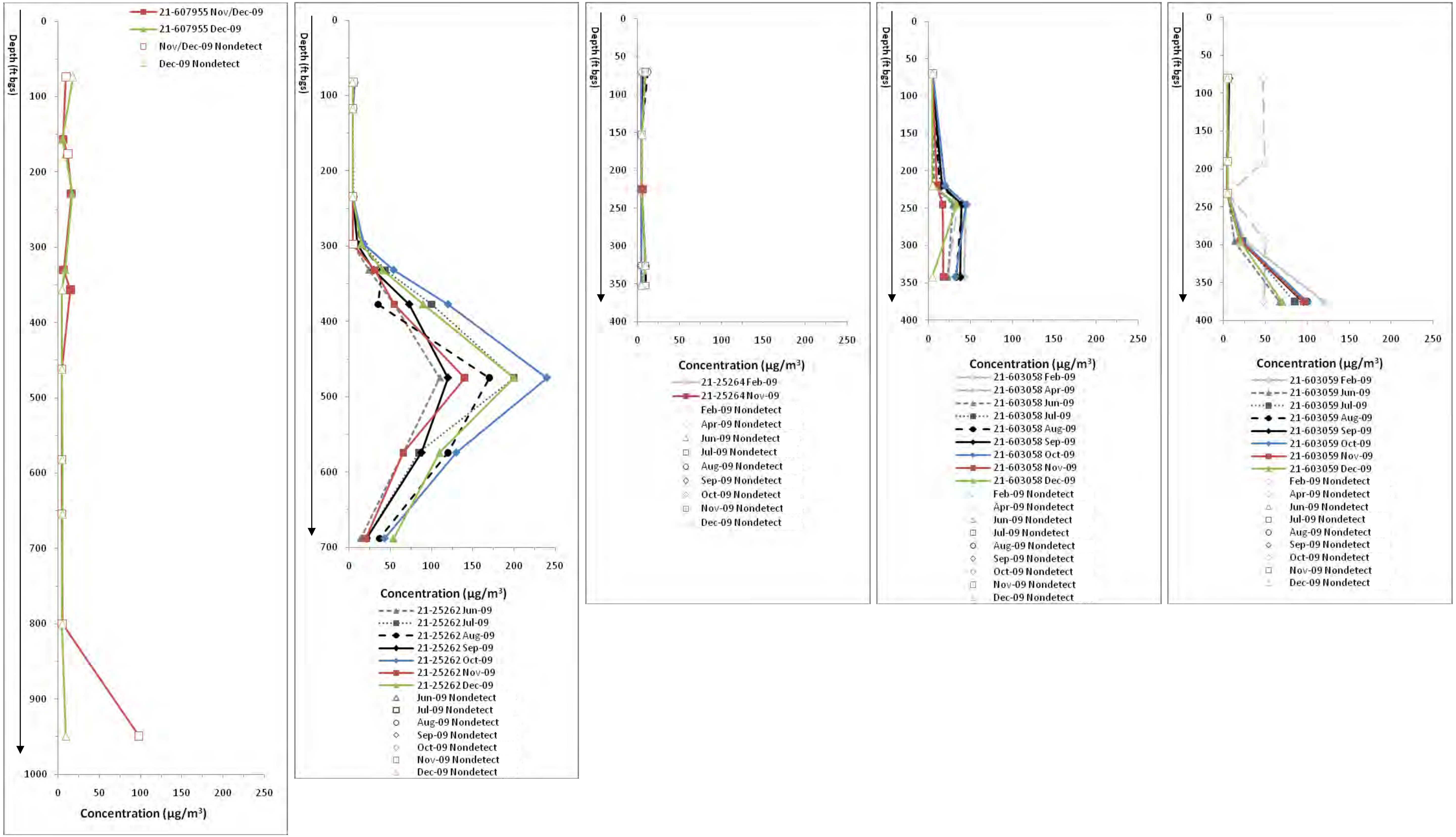
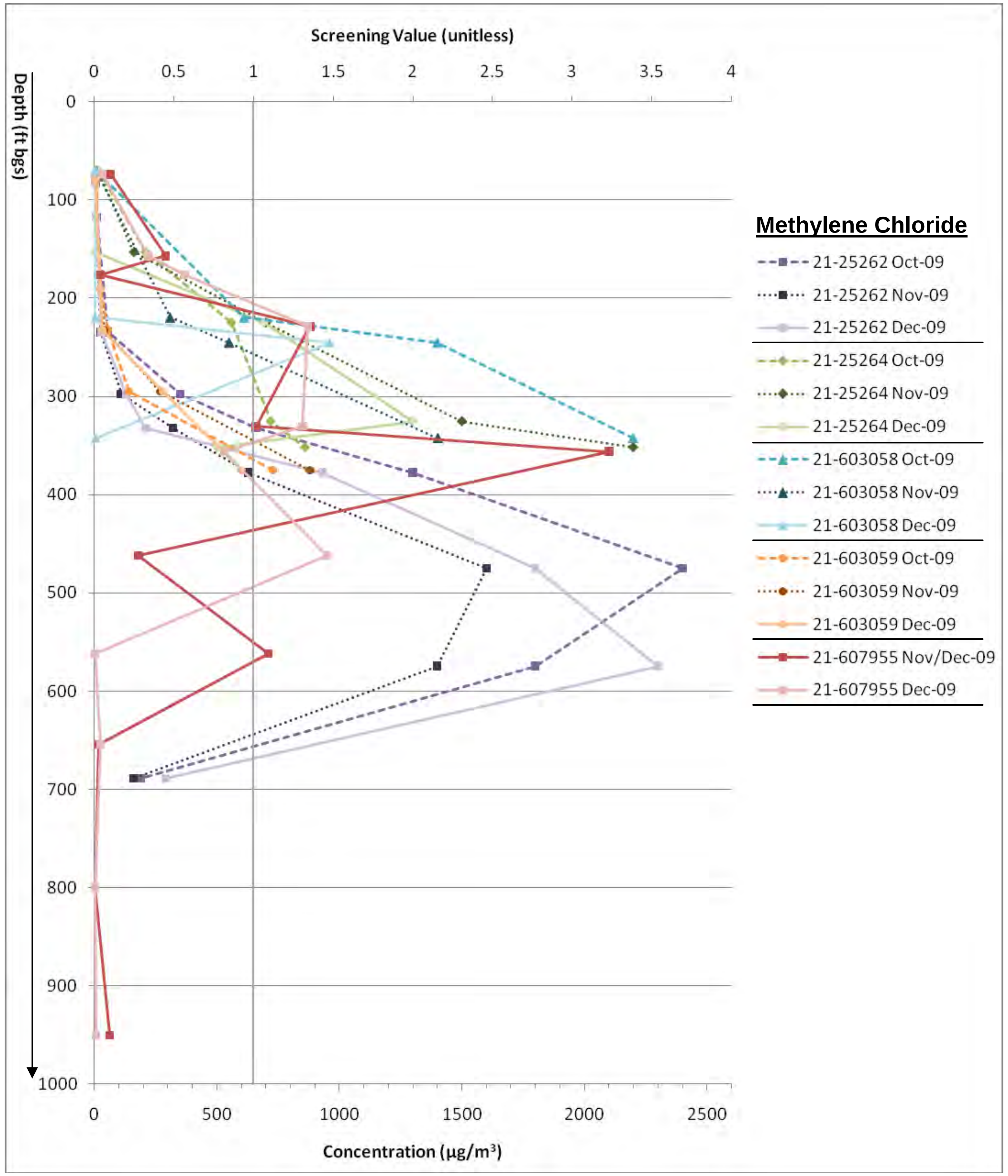


Figure 5.1-20 Vertical profile of 1,1,2-trichloroethane in vapor-monitoring wells 21-607955, 21-25262, 21-25264, 21-603058, and 21-603059, February–December 2009



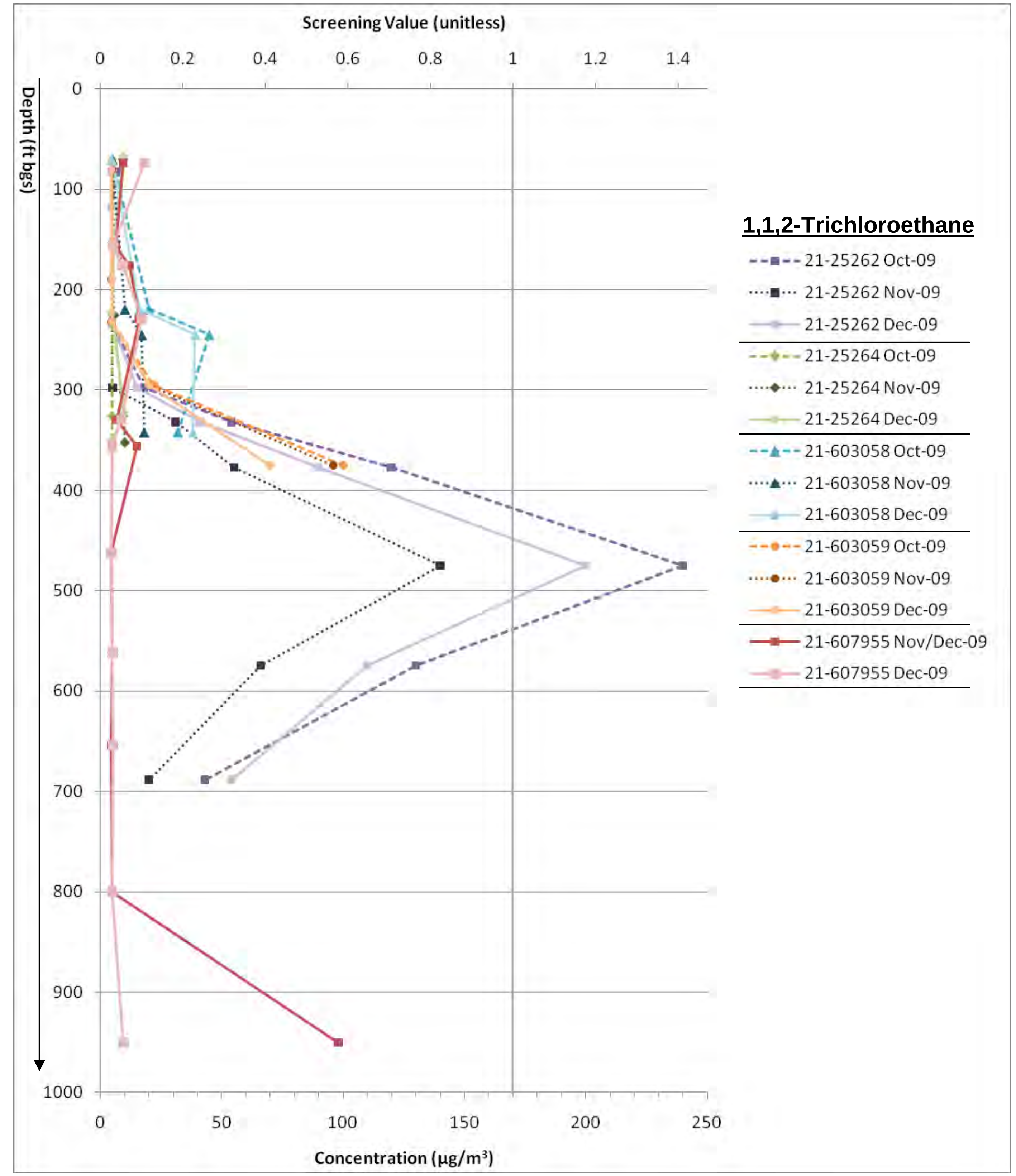


Figure 5.2-1 Groundwater screening of methylene chloride and 1,1,2-trichloroethane, October–December 2009

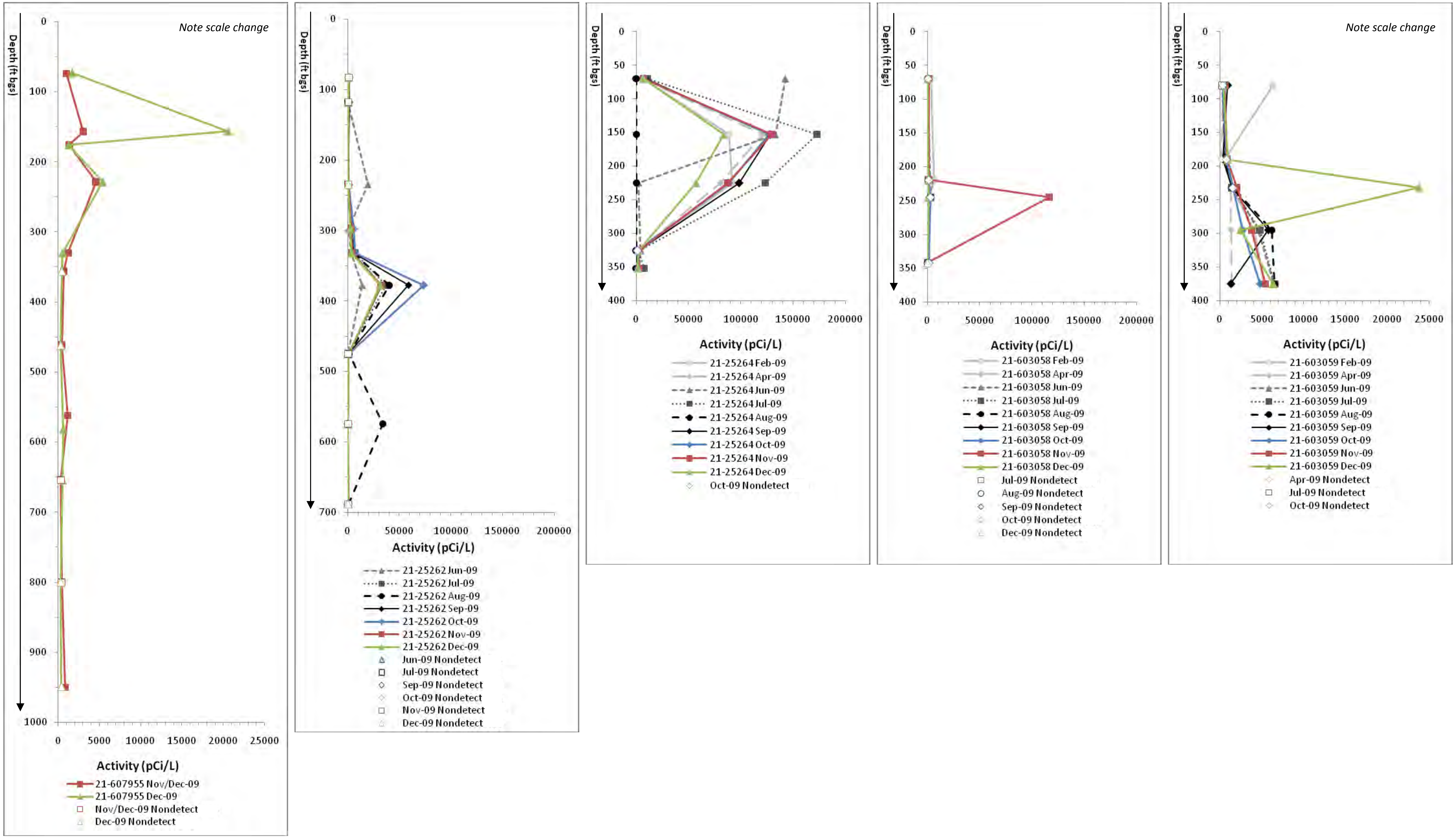


Figure 5.3-1 Vertical profile of tritium in vapor-monitoring wells 21-607955, 21-25262, 21-25264, 21-603058, and 21-603059, February–December 2009

Table 1.0-1
History of MDA T Periodic Monitoring Events

Quarter	Sampling Event Date	Round	Event ID	Vapor-Monitoring Wells Sampled	Associated Report Title
8th Quarter[a]	December 2009	13	2502/2512	21-25262, 21-25264, 21-603058, 21-603059, 21-607955[b]	October to December 2009 MDA T Periodic Monitoring Report
	November 2009	12	2434/2487		
	October 2009	11	2280		
	November 2009	12	2434/2487	21-25262, 21-25264, 21-603058, 21-603059, 21-607955[b]	September to November 2009 MDA T Periodic Monitoring Report
	October 2009	11	2280		
7th Quarter	September 2009	10	2235		
	August 2009	9	2192	21-25264, 21-603058, 21-603059, 21-25262[c]	June to August 2009 MDA T Periodic Monitoring Report (LANL 2009, 107448)
	July 2009	8	912		
6th Quarter[d]	June 2009	7	877		
	April 2009	6	751	21-25264, 21-603058, 21-603059	February and April 2009 MDA T Periodic Monitoring Report (LANL 2009, 106665)
5th Quarter	February 2009	5	649		
4th Quarter	September 2008[e]	4	487	21-25264, 21-603058, 21-603059	Fiscal year 2008 MDA T Periodic Monitoring Report (LANL 2009, 105187)[c]
3rd Quarter	May 2008[e]	3	407	21-25264, 21-603058, 21-603059	
2nd Quarter	February 2008[e]	2	340	21-25264, 21-603058, 21-603059	
1st Quarter	October 2007[e]	1	236	21-25264, 21-603058, 21-603059	

[a] Previous quarters were adjusted to match the current monitoring period.
[b] Vapor-monitoring well 21-607955 was first sampled during round 12.
[c] Vapor-monitoring well 21-25262 was completed and sampled beginning in June 2009.
[d] Sampling frequency increased from quarterly to monthly in June 2009.
[e] FY2008 vapor-monitoring data are not included in this report.

Table 2.0-1
MDA T Pore-Gas Sampling Depths and Collection Dates, February–December 2009

Vapor-Monitoring Well ID	Sample Port	Beginning Depth (ft bgs)	Ending Depth (ft bgs)	Round 5 Collection Date (Event ID 649)	Round 6 Collection Date (Event IDs 677 and 751)	Round 7 Collection Date (Event ID 877)	Round 8 Collection Date (Event ID 912)	Round 9 Collection Date (Event ID 2192)	Round 10 Collection Date (Event ID 2235)	Round 11 Collection Date (Event ID 2280)	Round 12 Collection Date (Event IDs 2434 and 2487)	Round 13 Collection Date (Event IDs 2502 and 2512)
21-25262	1	80	85	n/a[a]	n/a	6/12/2009	7/14/2009	8/11/2009	9/17/2009	10/19/2009	11/17/2009	12/15/2009
21-25262	2	115	120	n/a	n/a	6/12/2009	7/14/2009	8/11/2009	9/17/2009	10/19/2009	11/17/2009	12/15/2009
21-25262	3	232	237	n/a	n/a	6/12/2009	7/14/2009	8/11/2009	9/17/2009	10/19/2009	11/17/2009	12/15/2009
21-25262	4	295	300	n/a	n/a	6/12/2009	7/14/2009	8/13/2009	9/17/2009	10/19/2009	11/17/2009	12/15/2009
21-25262	5	329.5	334.5	n/a	n/a	6/12/2009	7/14/2009	8/13/2009	9/17/2009	10/19/2009	11/17/2009	12/15/2009
21-25262	6	375	380	n/a	n/a	6/12/2009	7/14/2009	8/11/2009	9/17/2009	10/19/2009	11/17/2009	12/15/2009
21-25262	7	472	478	n/a	n/a	6/12/2009	7/14/2009	8/13/2009	9/17/2009	10/19/2009	11/17/2009	12/15/2009
21-25262	8	572	577	n/a	n/a	6/12/2009	7/14/2009	8/14/2009	9/17/2009	10/19/2009	11/17/2009	12/15/2009
21-25262	Single packer[b]	679.25	680.75	n/a	4/23/2009	n/a	n/a	n/a	n/a	n/a	n/a	n/a
21-25262	9	686	691	n/a	n/a	6/15/2009	7/14/2009	8/14/2009	9/17/2009	10/19/2009	11/17/2009	12/15/2009
21-25264	1	67.5	72.5	2/4/2009	4/16/2009	6/17/2009	7/17/2009	8/19/2009	9/16/2009	10/16/2009	11/19/2009	12/22/2009
21-25264	2	150.5	155.5	2/4/2009	4/17/2009	6/17/2009	7/17/2009	8/19/2009	9/16/2009	10/16/2009	11/19/2009	12/22/2009

Table 2.0-1 (continued)

Vapor-Monitoring Well ID	Sample Port	Beginning Depth (ft bgs)	Ending Depth (ft bgs)	Round 5 Collection Date (Event ID 649)	Round 6 Collection Date (Event IDs 677 and 751)	Round 7 Collection Date (Event ID 877)	Round 8 Collection Date (Event ID 912)	Round 9 Collection Date (Event ID 2192)	Round 10 Collection Date (Event ID 2235)	Round 11 Collection Date (Event ID 2280)	Round 12 Collection Date (Event IDs 2434 and 2487)	Round 13 Collection Date (Event IDs 2502 and 2512)
21-25264	3	222.5	227.5	2/3/2009	4/17/2009	6/17/2009	7/17/2009	8/19/2009	9/16/2009	10/16/2009	11/19/2009	12/22/2009
21-25264	4	323	328	2/3/2009	4/17/2009	6/17/2009	7/17/2009	8/19/2009	9/16/2009	10/16/2009	11/19/2009	12/22/2009
21-25264	5	349.5	354.5	2/3/2009	4/16/2009	6/17/2009	7/17/2009	8/19/2009	9/16/2009	10/16/2009	11/19/2009	12/22/2009
21-603058	1	67.5	72.5	2/5/2009	4/14/2009	6/18/2009	7/16/2009	8/18/2009	9/15/2009	10/14/2009	11/20/2009	12/21/2009
21-603058	2	160.5	165.5	—[c]	—	—	—	—	—	—	—	—
21-603058	3	217	222	2/5/2009	4/14/2009	6/18/2009	7/16/2009	8/18/2009	9/15/2009	10/14/2009	11/20/2009	12/21/2009
21-603058	4	242.5	247.5	2/5/2009	4/15/2009	6/18/2009	7/16/2009	8/18/2009	9/15/2009	10/14/2009	11/20/2009	12/21/2009
21-603058	5	339.5	344.5	2/5/2009	4/15/2009	6/18/2009	7/16/2009	8/18/2009	9/15/2009	10/14/2009	11/20/2009	12/21/2009
21-603059	1	77.5	82.5	2/8/2009	4/13/2009	6/16/2009	7/15/2009	8/14/2009	9/18/2009	10/20/2009	11/18/2009	12/16/2009
21-603059	2	112.5	117.5	—	—	—	—	—	—	—	—	—
21-603059	3	187.5	192.5	2/6/2009	4/10/2009	6/16/2009	7/15/2009	8/14/2009	9/18/2009	10/20/2009	11/18/2009	12/16/2009
21-603059	4	229.5	234.5	2/8/2009	4/20/2009	6/16/2009	7/15/2009	8/14/2009	9/18/2009	10/20/2009	11/18/2009	12/16/2009
21-603059	5	292.5	297.5	2/6/2009	4/10/2009	6/16/2009	7/15/2009	8/14/2009	9/18/2009	10/20/2009	11/18/2009	12/16/2009
21-603059	6	372.5	377.5	2/6/2009	4/13/2009	6/16/2009	7/15/2009	8/14/2009	9/18/2009	10/20/2009	11/18/2009	12/16/2009
21-607955	1	71.1	76.4	n/a	n/a	n/a	n/a	n/a	n/a	n/a	12/2/2009	12/18/2009
21-607955	2	153.8	159.7	n/a	n/a	n/a	n/a	n/a	n/a	n/a	12/3/2009	12/18/2009
21-607955	3	173.4	179	n/a	n/a	n/a	n/a	n/a	n/a	n/a	12/2/2009	12/18/2009
21-607955	4	225.9	232.1	n/a	n/a	n/a	n/a	n/a	n/a	n/a	12/2/2009	12/17/2009
21-607955	5	326.6	333.4	n/a	n/a	n/a	n/a	n/a	n/a	n/a	12/3/2009	12/17/2009
21-607955	6	353.3	359.6	n/a	n/a	n/a	n/a	n/a	n/a	n/a	12/2/2009	12/17/2009
21-607955	7	459.4	464.8	n/a	n/a	n/a	n/a	n/a	n/a	n/a	12/2/2009	12/17/2009
21-607955	8	559	565	n/a	n/a	n/a	n/a	n/a	n/a	n/a	12/2/2009	12/17/2009
21-607955	9	651.3	657.3	n/a	n/a	n/a	n/a	n/a	n/a	n/a	12/2/2009	12/18/2009
21-607955	10	797.2	803.1	n/a	n/a	n/a	n/a	n/a	n/a	n/a	12/3/2009	12/17/2009
21-607955	11	946.2	952.1	n/a	n/a	n/a	n/a	n/a	n/a	n/a	12/3/2009	12/17/2009

Note: Event IDs refer to the sample collection log and chain of custody packages provided in Appendix D.

[a] n/a = Not applicable.

[b] Single packer sample collected during drilling.

[c] — = Sample not collected.

Table 2.0-2
Summary of Pore-Gas Samples Collected at MDA T
Vapor-Monitoring Well 21-25262, June–December 2009

Sample ID	Depth (ft bgs)	Collection Date	Field QC Type	Request Number	
				Tritium	VOCs
June 2009					
MD21-09-10355	80–85	6/12/2009	n/a[a]	09-2321	09-2320
MD21-09-10356	115–120	6/12/2009	n/a	09-2321	09-2320
MD21-09-10357	232–237	6/12/2009	n/a	09-2321	09-2320
MD21-09-10358	295–300	6/12/2009	n/a	09-2321	09-2320
MD21-09-10359	329.5–334.5	6/12/2009	n/a	09-2334	09-2333
MD21-09-10360	375–380	6/12/2009	n/a	09-2334	09-2333
MD21-09-10361	472–478	6/12/2009	n/a	09-2334	09-2333
MD21-09-10362	572–577	6/12/2009	n/a	09-2334	09-2333
MD21-09-10363	686–691	6/15/2009	n/a	09-2334	09-2333
MD21-09-10364	686–691	6/15/2009	FD	09-2334	09-2333
July 2009					
MD21-09-11294	80–85	7/14/2009	n/a	09-2636	09-2635
MD21-09-11295	115–120	7/14/2009	n/a	09-2636	09-2635
MD21-09-11296	232–237	7/14/2009	n/a	09-2636	09-2635
MD21-09-11297	295–300	7/14/2009	n/a	09-2636	09-2635
MD21-09-11298	329.5–334.5	7/14/2009	n/a	09-2636	09-2635
MD21-09-11299	375–380	7/14/2009	n/a	09-2636	09-2635
MD21-09-11300	472–478	7/14/2009	n/a	09-2636	09-2635
MD21-09-11301	572–577	7/14/2009	n/a	09-2636	09-2635
MD21-09-11302	686–691	7/14/2009	n/a	09-2636	09-2635
MD21-09-11303	686–691	7/14/2009	FB	—[b]	09-2635
MD21-09-11304	686–691	7/14/2009	FD	09-2636	09-2635
August 2009					
MD21-09-11488	80–85	8/11/2009	n/a	09-2853	09-2852
MD21-09-11489	115–120	8/11/2009	n/a	09-2853	09-2852
MD21-09-11490	232–237	8/11/2009	n/a	09-2853	09-2852
MD21-09-11491	295–300	8/13/2009	n/a	09-2882	09-2881
MD21-09-11492	329.5–334.5	8/13/2009	n/a	09-2882	09-2881
MD21-09-11493	375–380	8/11/2009	n/a	09-2853	09-2852
MD21-09-11498	375–380	8/11/2009	FB	—	09-2852
MD21-09-11494	472–478	8/13/2009	n/a	09-2882	09-2881
MD21-09-11495	572–577	8/14/2009	n/a	09-2885	09-2884
MD21-09-11496	686–691	8/14/2009	n/a	09-2885	09-2884
MD21-09-11497	686–691	8/14/2009	FD	09-2885	09-2884

Table 2.0-2 (continued)

Sample ID	Depth (ft bgs)	Collection Date	Field QC Type	Request Number	
				Tritium	VOCs
September 2009					
MD21-09-12622	0–0	9/17/2009	FB	—	09-3282
MD21-09-12612	80–85	9/17/2009	n/a	09-3283	09-3282
MD21-09-12613	115–120	9/17/2009	n/a	09-3283	09-3282
MD21-09-12614	232–237	9/17/2009	n/a	09-3283	09-3282
MD21-09-12615	295–300	9/17/2009	n/a	09-3283	09-3282
MD21-09-12616	329.5–334.5	9/17/2009	n/a	09-3283	09-3282
MD21-09-12621	329.5–334.5	9/17/2009	FD	09-3283	09-3282
MD21-09-12617	375–380	9/17/2009	n/a	09-3283	09-3282
MD21-09-12618	472–478	9/17/2009	n/a	09-3283	09-3282
MD21-09-12619	572–577	9/17/2009	n/a	09-3283	09-3282
MD21-09-12620	686–691	9/17/2009	n/a	09-3283	09-3282
October 2009					
MD21-10-9	0–0	10/19/2009	FB	—	10-181
MD21-10-32	80–85	10/19/2009	n/a	10-182	10-181
MD21-10-33	115–120	10/19/2009	n/a	10-182	10-181
MD21-10-34	232–237	10/19/2009	n/a	10-182	10-181
MD21-10-35	295–300	10/19/2009	n/a	10-182	10-181
MD21-10-36	329.5–334.5	10/19/2009	n/a	10-182	10-181
MD21-10-41	329.5–334.5	10/19/2009	FD	10-182	10-181
MD21-10-37	375–380	10/19/2009	n/a	10-182	10-181
MD21-10-38	472–478	10/19/2009	n/a	10-182	10-181
MD21-10-39	572–577	10/19/2009	n/a	10-182	10-181
MD21-10-40	686–691	10/19/2009	n/a	10-182	10-181
November 2009					
MD21-10-5023	0–0	11/17/2009	FB	—	10-555
MD21-10-5007	80–85	11/17/2009	n/a	10-556	10-555
MD21-10-5008	115–120	11/17/2009	n/a	10-556	10-555
MD21-10-5009	232–237	11/17/2009	n/a	10-556	10-555
MD21-10-5010	295–300	11/17/2009	n/a	10-556	10-555
MD21-10-5011	329.5–334.5	11/17/2009	n/a	10-556	10-555
MD21-10-5022	329.5–334.5	11/17/2009	FD	10-556	10-555
MD21-10-5012	375–380	11/17/2009	n/a	10-556	10-555
MD21-10-5013	472–478	11/17/2009	n/a	10-556	10-555
MD21-10-5014	572–577	11/17/2009	n/a	10-556	10-555
MD21-10-5015	686–691	11/17/2009	n/a	10-556	10-555
December 2009					
MD21-10-8530	0–0	12/15/2009	FB	—	10-1002
MD21-10-8520	80–85	12/15/2009	n/a	10-1001	10-1002
MD21-10-8521	115–120	12/15/2009	n/a	10-1001	10-1002

Table 2.0-2 (continued)

Sample ID	Depth (ft bgs)	Collection Date	Field QC Type	Request Number	
				Tritium	VOCs
MD21-10-8522	232–237	12/15/2009	n/a	10-1001	10-1002
MD21-10-8523	295–300	12/15/2009	n/a	10-1001	10-1002
MD21-10-8524	329.5–334.5	12/15/2009	n/a	10-1001	10-1002
MD21-10-8529	329.5–334.5	12/15/2009	FD	10-1001	10-1002
MD21-10-8525	375–380	12/15/2009	n/a	10-1001	10-1002
MD21-10-8526	472–478	12/15/2009	n/a	10-1001	10-1002
MD21-10-8527	572–577	12/15/2009	n/a	10-1001	10-1002
MD21-10-8528	686–691	12/15/2009	n/a	10-1001	10-1002

[a] n/a = Not applicable.

[b] — = Sample not collected.

Table 2.0-3
Summary of Pore-Gas Samples Collected at MDA T
Vapor-Monitoring Well 21-25264, February–December 2009

Sample ID	Depth (ft bgs)	Collection Date	Field QC Type	Request Number	
				Tritium	VOCs
February 2009					
MD21-09-3564	67.5–72.5	2/4/2009	n/a[a]	09-812	09-811
MD21-09-3563	150.5–155.5	2/4/2009	n/a	09-812	09-811
MD21-09-3565	150.5–155.5	2/4/2009	FD	09-812	09-811
MD21-09-3560	222.5–227.5	2/3/2009	n/a	09-812	09-811
MD21-09-3561	323–328	2/3/2009	n/a	09-812	09-811
MD21-09-3562	349.5–354.5	2/3/2009	n/a	09-812	09-811
April 2009					
MD21-09-7164	67.5–72.5	4/16/2009	n/a	09-1505	09-1504
MD21-09-7166	150.5–155.5	4/17/2009	n/a	09-1510	09-1509
MD21-09-7168	222.5–227.5	4/17/2009	n/a	09-1510	09-1509
MD21-09-7167	323–328	4/17/2009	n/a	09-1510	09-1509
MD21-09-7165	349.5–354.5	4/16/2009	n/a	09-1505	09-1504
MD21-09-7174	349.5–354.5	4/16/2009	FD	09-1505	09-1504
June 2009					
MD21-09-10354	n/a	6/18/2009	FB	—[b]	09-2406
MD21-09-10344	67.5–72.5	6/17/2009	n/a	09-2363	09-2362
MD21-09-10345	150.5–155.5	6/17/2009	n/a	09-2363	09-2362
MD21-09-10353	150.5–155.5	6/17/2009	FD	09-2363	09-2362
MD21-09-10346	222.5–227.5	6/17/2009	n/a	09-2363	09-2362
MD21-09-10347	323–328	6/17/2009	n/a	09-2363	09-2362
MD21-09-10348	349.5–354.5	6/17/2009	n/a	09-2363	09-2362
July 2009					
MD21-09-11292	n/a	7/17/2009	FB	—	09-2683
MD21-09-11283	67.5–72.5	7/17/2009	n/a	09-2684	09-2683
MD21-09-11284	150.5–155.5	7/17/2009	n/a	09-2684	09-2683
MD21-09-11293	150.5–155.5	7/17/2009	FD	09-2684	09-2683
MD21-09-11285	222.5–227.5	7/17/2009	n/a	09-2684	09-2683
MD21-09-11286	323–328	7/17/2009	n/a	09-2684	09-2683
MD21-09-11287	349.5–354.5	7/17/2009	n/a	09-2684	09-2683
August 2009					
MD21-09-11477	67.5–72.5	8/19/2009	n/a	09-2947	09-2946
MD21-09-11478	150.5–155.5	8/19/2009	n/a	09-2947	09-2946
MD21-09-11486	150.5–155.5	8/19/2009	FD	09-2947	09-2946
MD21-09-11479	222.5–227.5	8/19/2009	n/a	09-2947	09-2946
MD21-09-11480	323–328	8/19/2009	n/a	09-2947	09-2946

Table 2.0-3 (continued)

Sample ID	Depth (ft bgs)	Collection Date	Field QC Type	Request Number	
				Tritium	VOCs
MD21-09-11481	349.5–354.5	8/19/2009	n/a	09-2947	09-2946
MD21-09-11483	349.5–354.5	8/19/2009	FB	—	09-2946
September 2009					
MD21-09-12611	0–0	9/16/2009	FB	—	09-3260
MD21-09-12605	67.5–72.5	9/16/2009	n/a	09-3261	09-3260
MD21-09-12606	150.5–155.5	9/16/2009	n/a	09-3261	09-3260
MD21-09-12610	150.5–155.5	9/16/2009	FD	09-3261	09-3260
MD21-09-12607	222.5–227.5	9/16/2009	n/a	09-3261	09-3260
MD21-09-12608	323–328	9/16/2009	n/a	09-3261	09-3260
MD21-09-12609	349.5–354.5	9/16/2009	n/a	09-3261	09-3260
October 2009					
MD21-10-31	0–0	10/16/2009	FB	—	10-157
MD21-10-25	67.5–72.5	10/16/2009	n/a	10-158	10-157
MD21-10-26	150.5–155.5	10/16/2009	n/a	10-158	10-157
MD21-10-30	150.5–155.5	10/16/2009	FD	10-158	10-157
MD21-10-27	222.5–227.5	10/16/2009	n/a	10-158	10-157
MD21-10-28	323–328	10/16/2009	n/a	10-158	10-157
MD21-10-29	349.5–354.5	10/16/2009	n/a	10-158	10-157
November 2009					
MD21-10-5021	0–0	11/19/2009	FB	—	10-627
MD21-10-5002	67.5–72.5	11/19/2009	n/a	10-628	10-627
MD21-10-5003	150.5–155.5	11/19/2009	n/a	10-628	10-627
MD21-10-5020	150.5–155.5	11/19/2009	FD	10-628	10-627
MD21-10-5004	222.5–227.5	11/19/2009	n/a	10-628	10-627
MD21-10-5005	323–328	11/19/2009	n/a	10-628	10-627
MD21-10-5006	349.5–354.5	11/19/2009	n/a	10-628	10-627
December 2009					
MD21-10-8519	0–0	12/22/2009	FB	—	10-1061
MD21-10-8509	67.5–72.5	12/22/2009	n/a	10-1062	10-1061
MD21-10-8510	150.5–155.5	12/22/2009	n/a	10-1062	10-1061
MD21-10-8511	222.5–227.5	12/22/2009	n/a	10-1062	10-1061
MD21-10-8512	323–328	12/22/2009	n/a	10-1062	10-1061
MD21-10-8513	349.5–354.5	12/22/2009	n/a	10-1062	10-1061

[a] n/a = Not applicable.

[b] — = Sample not collected.

Table 2.0-4
Summary of Pore-Gas Samples Collected at MDA T
Vapor-Monitoring Well 21-603058, February–December 2009

Sample ID	Depth (ft bgs)	Collection Date	Field QC Type	Request Number	
				Tritium	VOCs
February 2009					
MD21-09-3559	n/a[a]	2/8/2009	FB	—[b]	09-842
MD21-09-3553	67.5–72.5	2/5/2009	n/a	09-836	09-835
MD21-09-3554	217–222	2/5/2009	n/a	09-836	09-835
MD21-09-3558	217–222	2/5/2009	FD	09-836	09-835
MD21-09-3555	242.5–247.5	2/5/2009	n/a	09-836	09-835
MD21-09-3556	339.5–344.5	2/5/2009	n/a	09-836	09-835
April 2009					
MD21-09-7169	n/a	4/15/2009	FB	—	09-1494
MD21-09-7159	67.5–72.5	4/14/2009	n/a	09-1491	09-1476
MD21-09-7160	217–222	4/14/2009	n/a	09-1491	09-1476
MD21-09-7162	242.5–247.5	4/15/2009	n/a	09-1495	09-1494
MD21-09-7161	339.5–344.5	4/15/2009	n/a	09-1495	09-1494
MD21-09-7172	339.5–344.5	4/15/2009	FD	09-1495	09-1494
June 2009					
MD21-09-10352	n/a	6/18/2009	FB	—	09-2406
MD21-09-10339	67.5–72.5	6/18/2009	n/a	09-2407	09-2406
MD21-09-10341	217–222	6/18/2009	n/a	09-2407	09-2406
MD21-09-10351	217–222	6/18/2009	FD	09-2407	09-2406
MD21-09-10342	242.5–247.5	6/18/2009	n/a	09-2407	09-2406
MD21-09-10343	339.5–344.5	6/18/2009	n/a	09-2407	09-2406
July 2009					
MD21-09-11290	n/a	7/16/2009	FB	—	09-2669
MD21-09-11278	67.5–72.5	7/16/2009	n/a	09-2670	09-2669
MD21-09-11280	217–222	7/16/2009	n/a	09-2670	09-2669
MD21-09-11291	217–222	7/16/2009	FD	09-2670	09-2669
MD21-09-11281	242.5–247.5	7/16/2009	n/a	09-2670	09-2669
MD21-09-11282	339.5–344.5	7/16/2009	n/a	09-2670	09-2669
August 2009					
MD21-09-11472	67.5–72.5	8/18/2009	n/a	09-2920	09-2919
MD21-09-11484	217–222	8/18/2009	FD	09-2920	09-2919
MD21-09-11473	217–222	8/18/2009	n/a	09-2920	09-2919
MD21-09-11474	242.5–247.5	8/18/2009	n/a	09-2920	09-2919
MD21-09-11485	339.5–344.5	8/18/2009	FB	—	09-2919
MD21-09-11475	339.5–344.5	8/18/2009	n/a	09-2920	09-2919

Table 2.0-4 (continued)

Sample ID	Depth (ft bgs)	Collection Date	Field QC Type	Request Number	
				Tritium	VOCs
September 2009					
MD21-09-12598	67.5–72.5	9/15/2009	n/a	09-3228	09-3227
MD21-09-12600	217–222	9/15/2009	n/a	09-3228	09-3227
MD21-09-12603	242.5–247.5	9/15/2009	FD	09-3228	09-3227
MD21-09-12601	242.5–247.5	9/15/2009	n/a	09-3228	09-3227
MD21-09-12602	339.5–344.5	9/15/2009	n/a	09-3228	09-3227
October 2009					
MD21-10-18	67.5–72.5	10/14/2009	n/a	10-139	10-138
MD21-10-20	217–222	10/14/2009	n/a	10-139	10-138
MD21-10-21	242.5–247.5	10/14/2009	n/a	10-139	10-138
MD21-10-23	242.5–247.5	10/14/2009	FD	10-139	10-138
MD21-10-22	339.5–344.5	10/14/2009	n/a	10-139	10-138
November 2009					
MD21-10-5019	0–0	11/20/2009	FB	—	10-651
MD21-10-4997	67.5–72.5	11/20/2009	n/a	10-652	10-651
MD21-10-4998	217–222	11/20/2009	n/a	10-652	10-651
MD21-10-4999	242.5–247.5	11/20/2009	n/a	10-652	10-651
MD21-10-5018	242.5–247.5	11/20/2009	FD	10-652	10-651
MD21-10-5000	339.5–344.5	11/20/2009	n/a	10-652	10-651
December 2009					
MD21-10-8517	0–0	12/21/2009	FB	—	10-1034
MD21-10-8504	67.5–72.5	12/21/2009	n/a	10-1033	10-1034
MD21-10-8506	217–222	12/21/2009	n/a	10-1033	10-1034
MD21-10-8507	242.5–247.5	12/21/2009	n/a	10-1033	10-1034
MD21-10-8516	242.5–247.5	12/21/2009	FD	10-1033	10-1034
MD21-10-8508	339.5–344.5	12/21/2009	n/a	10-1033	10-1034

[a] n/a = Not applicable.

[b] — = Sample not collected.

Table 2.0-5
Summary of Pore-Gas Samples Collected at MDA T
Vapor-Monitoring Well 21-603059, February–December 2009

Sample ID	Depth (ft bgs)	Collection Date	Field QC Type	Request Number	
				Tritium	VOCs
February 2009					
MD21-09-3552	n/a[a]	2/6/2009	FB	—[b]	09-842
MD21-09-3546	77.5–82.5	2/8/2009	n/a	09-843	09-842
MD21-09-3545	187.5–192.5	2/6/2009	n/a	09-843	09-842
MD21-09-3547	229.5–234.5	2/8/2009	n/a	09-843	09-842
MD21-09-3549	292.5–297.5	2/6/2009	n/a	09-836	09-835
MD21-09-3550	372.5–377.5	2/6/2009	n/a	09-836	09-835
April 2009					
MD21-09-7170	n/a	4/20/2009	FB	—	09-1513
MD21-09-7155	77.5–82.5	4/13/2009	n/a	09-1455	09-1454
MD21-09-7154	187.5–192.5	4/10/2009	n/a	09-1453	09-1452
MD21-09-7157	229.5–234.5	4/13/2009	n/a	09-1455	09-1454
MD21-09-7163	229.5–234.5	4/20/2009	n/a	09-1514	09-1513
MD21-09-7153	292.5–297.5	4/10/2009	n/a	09-1453	09-1452
MD21-09-7156	372.5–377.5	4/13/2009	n/a	09-1455	09-1454
June 2009					
MD21-09-10350	n/a	6/18/2009	FB	—	09-2406
MD21-09-10333	77.5–82.5	6/16/2009	n/a	09-2343	09-2342
MD21-09-10334	187.5–192.5	6/16/2009	n/a	09-2343	09-2342
MD21-09-10335	229.5–234.5	6/16/2009	n/a	09-2343	09-2342
MD21-09-10336	292.5–297.5	6/16/2009	n/a	09-2343	09-2342
MD21-09-10349	292.5–297.5	6/16/2009	FD	09-2343	09-2342
MD21-09-10337	372.5–377.5	6/16/2009	n/a	09-2343	09-2342
July 2009					
MD21-09-11272	77.5–82.5	7/15/2009	n/a	09-2655	09-2654
MD21-09-11273	187.5–192.5	7/15/2009	n/a	09-2655	09-2654
MD21-09-11274	229.5–234.5	7/15/2009	n/a	09-2655	09-2654
MD21-09-11275	292.5–297.5	7/15/2009	n/a	09-2655	09-2654
MD21-09-11276	372.5–377.5	7/15/2009	n/a	09-2655	09-2654
MD21-09-11289	372.5–377.5	7/15/2009	FD	09-2655	09-2654
August 2009					
MD21-09-11469	77.5–82.5	8/14/2009	n/a	09-2901	09-2900
MD21-09-11470	187.5–192.5	8/14/2009	n/a	09-2901	09-2900
MD21-09-11471	229.5–234.5	8/14/2009	n/a	09-2901	09-2900
MD21-09-11468	292.5–297.5	8/14/2009	n/a	09-2901	09-2900

Table 2.0-5 (continued)

Sample ID	Depth (ft bgs)	Collection Date	Field QC Type	Request Number	
				Tritium	VOCs
MD21-09-11467	372.5–377.5	8/14/2009	n/a	09-2901	09-2900
MD21-09-11482	372.5–377.5	8/14/2009	FD	09-2901	09-2900
September 2009					
MD21-09-12630	0–0	9/18/2009	FB	—	09-3289
MD21-09-12623	77.5–82.5	9/18/2009	n/a	09-3290	09-3289
MD21-09-12624	187.5–192.5	9/18/2009	n/a	09-3290	09-3289
MD21-09-12625	229.5–234.5	9/18/2009	n/a	09-3290	09-3289
MD21-09-12626	292.5–297.5	9/18/2009	n/a	09-3290	09-3289
MD21-09-12627	372.5–377.5	9/18/2009	n/a	09-3290	09-3289
MD21-09-12629	372.5–377.5	9/18/2009	FD	09-3290	09-3289
October 2009					
MD21-10-17	0–0	10/20/2009	FB	—	10-195
MD21-10-10	77.5–82.5	10/20/2009	n/a	10-196	10-195
MD21-10-11	187.5–192.5	10/20/2009	n/a	10-196	10-195
MD21-10-12	229.5–234.5	10/20/2009	n/a	10-196	10-195
MD21-10-13	292.5–297.5	10/20/2009	n/a	10-196	10-195
MD21-10-14	372.5–377.5	10/20/2009	n/a	10-196	10-195
MD21-10-16	372.5–377.5	10/20/2009	FD	10-196	10-195
November 2009					
MD21-10-5017	0–0	11/18/2009	FB	—	10-586
MD21-10-4991	77.5–82.5	11/18/2009	n/a	10-587	10-586
MD21-10-4993	187.5–192.5	11/18/2009	n/a	10-587	10-586
MD21-10-4994	229.5–234.5	11/18/2009	n/a	10-587	10-586
MD21-10-4995	292.5–297.5	11/18/2009	n/a	10-587	10-586
MD21-10-4996	372.5–377.5	11/18/2009	n/a	10-587	10-586
MD21-10-5016	372.5–377.5	11/18/2009	FD	10-587	10-586
December 2009					
MD21-10-8515	0–0	12/16/2009	FB	—	10-1006
MD21-10-8498	77.5–82.5	12/16/2009	n/a	10-980	10-981
MD21-10-8499	187.5–192.5	12/16/2009	n/a	10-980	10-981
MD21-10-8500	229.5–234.5	12/16/2009	n/a	10-980	10-981
MD21-10-8501	292.5–297.5	12/16/2009	n/a	10-980	10-981
MD21-10-8502	372.5–377.5	12/16/2009	n/a	10-980	10-981
MD21-10-8514	372.5–377.5	12/16/2009	FD	10-980	10-981

[a] n/a = Not applicable.

[b] — = Sample not collected.

Table 2.0-6
Summary of Pore-Gas Samples Collected at MDA T
Vapor-Monitoring Well 21-607955, November–December 2009

Sample ID	Depth (ft bgs)	Collection Date	Field QC Type	Request Number	
				Tritium	VOCs
November 2009					
MD21-10-7578	0–0	12/3/2009	FB	—[a]	10-793
MD21-10-7567	71.1–76.4	12/2/2009	n/a[b]	10-765	10-764
MD21-10-7568	153.8–159.7	12/3/2009	n/a	10-794	10-793
MD21-10-7569	173.4–179	12/2/2009	n/a	10-765	10-764
MD21-10-7570	225.9–232.1	12/2/2009	n/a	10-765	10-764
MD21-10-7571	326.6–333.4	12/3/2009	n/a	10-794	10-793
MD21-10-7579	326.6–333.4	12/3/2009	FD	10-794	10-793
MD21-10-7572	353.3–359.6	12/2/2009	n/a	10-765	10-764
MD21-10-7573	459.4–464.8	12/2/2009	n/a	10-765	10-764
MD21-10-7574	559–565	12/2/2009	n/a	10-765	10-764
MD21-10-7575	651.3–657.3	12/2/2009	n/a	10-765	10-764
MD21-10-7576	797.2–803.1	12/3/2009	n/a	10-794	10-793
MD21-10-7577	946.2–952.1	12/3/2009	n/a	10-794	10-793
December 2009					
MD21-10-8111	0–0	12/18/2009	FB	—	10-1008
MD21-10-8099	71.1–76.4	12/18/2009	n/a	10-1007	10-1008
MD21-10-8100	153.8–159.7	12/18/2009	n/a	10-1007	10-1008
MD21-10-8101	173.4–179	12/18/2009	n/a	10-1007	10-1008
MD21-10-8102	225.9–232.1	12/17/2009	n/a	10-1003	10-1004
MD21-10-8103	326.6–333.4	12/17/2009	n/a	10-1003	10-1004
MD21-10-8110	326.6–333.4	12/17/2009	FD	10-1003	10-1004
MD21-10-8104	353.3–359.6	12/17/2009	n/a	10-1003	10-1004
MD21-10-8105	459.4–464.8	12/17/2009	n/a	10-1003	10-1004
MD21-10-8106	559–565	12/17/2009	n/a	10-1003	10-1004
MD21-10-8107	651.3–657.3	12/18/2009	n/a	10-1007	10-1008
MD21-10-8108	797.2–803.1	12/17/2009	n/a	10-1003	10-1004
MD21-10-8109	946.2–952.1	12/17/2009	n/a	10-1003	10-1004

[a] — = Sample not collected.

[b] n/a = Not applicable.

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

VOC	Henry's Law Constant[a] (dimensionless)	Groundwater Screening Level (µg/L)	Calculated Concentrations in Pore Gas Corresponding to Groundwater Standard[b] (µg/m³)
Acetone	0.0016	22,000[c]	35,200
Benzene	0.228	5[d]	1140
Bromodichloromethane	0.087	1.2[c]	104
Bromomethane	0.256	8.7[c]	2227
2-Butanone	0.0023	7100[c]	16,330
Carbon Disulfide	0.59	1000[c]	590,000
Carbon Tetrachloride	1.1	5[d]	5500
Chloroform	0.15	100[e]	15,000
Chloromethane	0.36	190[c]	68,400
Cyclohexane	6.1[c]	13,000[c]	79,300,000
1,4-Dichlorobenzene	0.0996	75[d]	7470
Dichlorodifluoromethane	14	390[c]	5,460,000
1,2-Dichloroethane	0.048	5[d]	240
1,1-Dichloroethene	1.1	5[e]	5500
cis-1,2-Dichloroethane	0.17	70[d]	11,900
Ethanol	na[f]	na	na
Hexane	74	880[c]	65,120,000
Methylene chloride	0.13	5[d]	650
n-Heptane[g]	74	880	65,120,000
2-Propanol	0.00033[c]	na	na
Propylene	8[c]	na	na
Tetrachloroethene	0.72	5[d]	3600
Toluene	0.272	750[e]	204,000
1,1,2-Trichloro-1,2,2-trifluoroethane	22	59,000[c]	1,298,000,000
1,1,1-Trichloroethane	0.705	60[e]	42,300
1,1,2-Trichloroethane	0.034	5[d]	170
Trichloroethene	0.4	5[d]	2000
1,2,4-Trimethylbenzene	0.25[c]	15[c]	3750
1,3-Xylene+1,4-Xylene	0.27	620[e]	167,400

[a] NMED (2009, 106420, Appendix B) unless otherwise noted.

[b] Derived from denominator of Equation 3.0-3.

[c] Henry's law constant and tap water screening levels from EPA regional screening tables (http://www.epa.gov/region09/superfund/prg).

[d] EPA MCL (40 Code of Federal Regulations 141.61).

[e] NMWQCC groundwater standard (20.6.2.3103 New Mexico Administrative Code).

[f] na = Not available.

[g] Hexane used as a surrogate, based on structural similarity.

Table 4.0-1
Summary of Pore-Gas Field-Screening Results, October–December 2009

Event ID	Collection Date	Sampling Round	Location ID	Sampling Port Number	Top Depth (ft bgs)	Bottom Depth (ft bgs)	% CO_2	% O_2
2280	10/19/2009	11	21-25262	1	80	85	0.9	19.7
2434	11/17/2009	12	21-25262	1	80	85	0.8	20.9
2512	12/15/2009	13	21-25262	1	80	85	1.0	22.4
2280	10/19/2009	11	21-25262	2	115	120	0.5	19.9
2434	11/17/2009	12	21-25262	2	115	120	0.5	21.4
2512	12/15/2009	13	21-25262	2	115	120	0.7	22.4
2280	10/19/2009	11	21-25262	3	232	237	0.9	19.5
2434	11/17/2009	12	21-25262	3	232	237	0.5	21.6
2512	12/15/2009	13	21-25262	3	232	237	1.1	22.4
2280	10/19/2009	11	21-25262	4	295	300	1	19.3
2434	11/17/2009	12	21-25262	4	295	300	0.4	21.7
2512	12/15/2009	13	21-25262	4	295	300	1.2	22.1
2280	10/19/2009	11	21-25262	5	329.5	334.5	0.8	19.4
2434	11/17/2009	12	21-25262	5	329.5	334.5	0.3	22.1
2512	12/15/2009	13	21-25262	5	329.5	334.5	0.7	23.3
2280	10/19/2009	11	21-25262	6	375	380	0.3	19.1
2434	11/17/2009	12	21-25262	6	375	380	0.2	22
2512	12/15/2009	13	21-25262	6	375	380	0.5	22.8
2280	10/19/2009	11	21-25262	7	472	478	0.2	18.9
2434	11/17/2009	12	21-25262	7	472	478	0.1	21.8
2512	12/15/2009	13	21-25262	7	472	478	0.3	23.3
2280	10/19/2009	11	21-25262	8	572	577	0.1	18.8
2434	11/17/2009	12	21-25262	8	572	577	0	22.1
2512	12/15/2009	13	21-25262	8	572	577	0.3	23.3
2280	10/19/2009	11	21-25262	9	686	691	0	19.2
2434	11/17/2009	12	21-25262	9	686	691	0	22.2
2512	12/15/2009	13	21-25262	9	686	691	0.2	23.2
2280	10/16/2009	11	21-25264	1	67.5	72.5	0.5	20.6
2434	11/19/2009	12	21-25264	1	67.5	72.5	0.8	21.3
2512	12/22/2009	13	21-25264	1	67.5	72.5	1.1	21.8
2280	10/16/2009	11	21-25264	2	150.5	155.5	0.8	20.3
2434	11/19/2009	12	21-25264	2	150.5	155.5	0.9	21.6
2512	12/22/2009	13	21-25264	2	150.5	155.5	0.5	22.6
2280	10/16/2009	11	21-25264	3	222.5	227.5	0.4	20.7
2434	11/19/2009	12	21-25264	3	222.5	227.5	0.9	21.7
2512	12/22/2009	13	21-25264	3	222.5	227.5	1.0	22.7

Table 4.0-1 (continued)

Event ID	Collection Date	Sampling Round	Location ID	Sampling Port Number	Top Depth (ft bgs)	Bottom Depth (ft bgs)	% CO_2	% O_2
2280	10/16/2009	11	21-25264	4	323	328	0.1	20.7
2434	11/19/2009	12	21-25264	4	323	328	0.7	21.8
2512	12/22/2009	13	21-25264	4	323	328	0.8	22.8
2280	10/16/2009	11	21-25264	5	349.5	354.5	0.1	20.7
2434	11/19/2009	12	21-25264	5	349.5	354.5	0.5	21.8
2512	12/22/2009	13	21-25264	5	349.5	354.5	0.7	23.1
2280	10/14/2009	11	21-603058	1	67.5	72.5	1	19.8
2434	11/20/2009	12	21-603058	1	67.5	72.5	1	20.1
2512	12/21/2009	13	21-603058	1	67.5	72.5	0.0	22.1
2280	10/14/2009	11	21-603058	3	217	222	0.7	20.3
2434	11/20/2009	12	21-603058	3	217	222	0.4	20.8
2512	12/21/2009	13	21-603058	3	217	222	0.0	22.0
2280	10/14/2009	11	21-603058	4	242.5	247.5	0.6	20.5
2434	11/20/2009	12	21-603058	4	242.5	247.5	0.2	21.4
2512	12/21/2009	13	21-603058	4	242.5	247.5	0.5	21.6
2280	10/14/2009	11	21-603058	5	339.5	344.5	0.5	20.9
2434	11/20/2009	12	21-603058	5	339.5	344.5	0.3	21.5
2512	12/21/2009	13	21-603058	5	339.5	344.5	0.0	21.8
2280	10/20/2009	11	21-603059	1	77.5	82.5	0.8	19.9
2434	11/18/2009	12	21-603059	1	77.5	82.5	0.7	20
2512	12/16/2009	13	21-603059	1	77.5	82.5	0.9	23.1
2280	10/20/2009	11	21-603059	3	187.5	192.5	0.8	19.8
2434	11/18/2009	12	21-603059	3	187.5	192.5	0.7	20.2
2512	12/16/2009	13	21-603059	3	187.5	192.5	0.9	22.9
2280	10/20/2009	11	21-603059	4	229.5	234.5	1.1	19.4
2434	11/18/2009	12	21-603059	4	229.5	234.5	1	20.4
2512	12/16/2009	13	21-603059	4	229.5	234.5	0.1	23.5
2280	10/20/2009	11	21-603059	5	292.5	297.5	1.1	19.2
2434	11/18/2009	12	21-603059	5	292.5	297.5	1	20.3
2512	12/16/2009	13	21-603059	5	292.5	297.5	0.1	23.5
2280	10/20/2009	11	21-603059	6	372.5	377.5	0.4	19.2
2434	11/18/2009	12	21-603059	6	372.5	377.5	0.4	21.1
2512	12/16/2009	13	21-603059	6	372.5	377.5	0.1	23.5
2487	12/2/2009	12	21-607955	1	71.1	76.4	1.1	23.2
2502	12/18/2009	13	21-607955	1	71.1	76.4	0.9	22.1
2487	12/3/2009	12	21-607955	2	153.8	159.7	0.8	22.5
2502	12/18/2009	13	21-607955	2	153.8	159.7	0.7	22.7

Table 4.0-1 (continued)

Event ID	Collection Date	Sampling Round	Location ID	Sampling Port Number	Top Depth (ft bgs)	Bottom Depth (ft bgs)	% CO_2	% O_2
2487	12/2/2009	12	21-607955	3	173.4	179	0.2	23.9
2502	12/18/2009	13	21-607955	3	173.4	179	0.7	22.5
2487	12/2/2009	12	21-607955	4	225.9	232.1	0.5	23.2
2502	12/17/2009	13	21-607955	4	225.9	232.1	0.7	22.1
2487	12/3/2009	12	21-607955	5	326.6	333.4	0.2	24.1
2502	12/17/2009	13	21-607955	5	326.6	333.4	0.4	22.0
2487	12/2/2009	12	21-607955	6	353.3	359.6	0.7	23.1
2502	12/17/2009	13	21-607955	6	353.3	359.6	0.0	22.2
2487	12/2/2009	12	21-607955	7	459.4	464.8	0.5	23.6
2502	12/17/2009	13	21-607955	7	459.4	464.8	0.0	22.5
2487	12/2/2009	12	21-607955	8	559	565	0.4	23.3
2502	12/17/2009	13	21-607955	8	559	565	0.0	23.3
2487	12/2/2009	12	21-607955	9	651.3	657.3	0.3	23.3
2502	12/18/2009	13	21-607955	9	651.3	657.3	0.0	23.2
2487	12/3/2009	12	21-607955	10	797.2	803.1	0.2	23.8
2502	12/17/2009	13	21-607955	10	797.2	803.1	0.0	23.6
2487	12/3/2009	12	21-607955	11	946.2	952.1	0.1	24.7
2502	12/17/2009	13	21-607955	11	946.2	952.1	0.0	23.5

Note: Percent CO_2 and O_2 readings are within acceptable limits based on LANDTEC calibration procedures described in Appendix B.

Table 4.0-2
Barometric Pressure, Relative Humidity, and Temperature at Los Alamos Airport during Sample Collection, October–December 2009

Sampling Round	Date/Time of Measurement	Barometric Pressure (in. Hg)	Relative Humidity (%)	Temperature (°F)
October 2009	10/14/09 at 9:10	30.21	36	55
	10/14/09 at 14:30	30.15	28	66
	10/15/09 at 9:10	30.28	58	52
	10/16/09 at 8:30	30.38	46	48
	10/16/09 at 11:30	30.38	41	55
	10/19/09 at 10:10	30.21	59	57
	10/19/09 at 14:10	30.10	26	68
	10/20/09 at 8:30	30.01	30	54
November 2009	11/16/09 at 9:10	30.37	47	28
	11/17/09 at 7:50	30.30	59	28
	11/17/09 at 12:10	30.25	31	45
	11/17/09 at 12:30	30.23	31	45
	11/18/09 at 8:10	30.11	52	36
	11/19/09 at 8:10	30.10	44	34
	11/19/09 at 10:50	30.12	36	43
	11/20/09 at 9:30	30.31	45	39
	11/20/09 at 14:30	30.22	28	50
	12/01/09 at 9:10	29.90	74	28
	12/02/09 at 7:30	29.88	69	28
	12/03/09 at 8:30	29.96	93	16
	12/03/09 at 10:30	29.96	31	45
December 2009	12/14/09 at 9:50	30.08	75	30
	12/15.09 at 9:50	30.4	55	28
	12/15/09 at 11:50	30.39	55	32
	12/16/09 at 9:10	30.38	59	25
	12/16/09 at 15:50	30.3	42	29
	12/17/09 at 9:10	30.25	37	32
	12/18/09 at 8:30	30.19	64	28
	12/18/09 at 10:10	30.1	60	32
	12/18/09 at 10:25	30.21	60	32
	12/18/09 at 12:50	30.14	52	36
	12/18/09 at 14:50	30.12	48	37
	12/21/09 at 8:50	30.31	45	39
	12/21/09 at 11:10	30.13	45	37
	12/21/09 at 11:30	30.11	42	39
	12/22/09 at 9:10	29.87	45	37
	12/22/09 at 12:00	29.84	55	30

Note: Data obtained from http://www.srh.noaa.gov/data/obhistory/KLAM.html.

Table 5.1-1
Summary of VOCs Detected in Pore-Gas Samples at MDA T Vapor-Monitoring Well 21-25262, June–December 2009

Sample ID	Depth (ft)	Collection Date	Acetone	Benzene	Bromodichloromethane	Bromomethane	Butadiene[1,3-]	Butanol[1-]	Butanone[2-]	Carbon Disulfide	Carbon Tetrachloride	Chloroform	Chloromethae	Cyclohexane	Dichlorobenzene[1,4-]	Dichlorodifluoromethane	Dichloroethane[1,2-]	Dichloroethene[1,1-]	Dichloroethene[cis-1,2-]	Hexane	Methanol	Methylene Chloride	n-Heptane	Propanol[2-]	Propylene	Tetrachloroethene	Tetrahydrofuran	Toluene	Trichloro-1,2,2-trifluoroethane[1,1,2-]	Trichloroethane[1,1,1-]	Trichloroethane[1,1,2-]	Trichloroethene
June 2009																																
MD21-09-10355	80–85	06/12/09	—*	—	—	—	—	—	—	3.2	57	930	—	—	—	4.7	—	—	—	—	—	3.8	—	—	—	1500	—	—	—	17	—	580
MD21-09-10356	115–120	06/12/09	—	—	—	—	—	—	—	—	41	330	—	—	—	4.5	—	—	—	—	—	5.1	—	—	—	360	—	—	—	11	—	240
MD21-09-10357	232–237	06/12/09	37	—	—	—	—	—	4.4	—	56	160	—	—	—	—	—	—	—	—	—	8.1	—	—	—	57	—	—	—	5.8	—	100
MD21-09-10358	295–300	06/12/09	26	—	—	—	—	—	2.8	—	170	160	—	—	—	—	—	5.7	—	—	—	67	—	—	—	39	—	—	10	6.3	—	280
MD21-09-10359	329.5–334.5	06/12/09	12	—	7.8	—	—	—	—	6.2	490	450	—	—	—	6	6	20	3.6	—	—	320	—	—	—	97	—	—	27	16	24	820
MD21-09-10360	375–380	06/12/09	24	—	7.9	—	—	—	4.1	—	410	570	—	—	—	—	9.4	36	—	—	—	680	—	—	—	63	—	3.9	14	8.3	55	880
MD21-09-10361	472–478	06/12/09	14	—	—	—	—	—	—	4.9	340	830	—	—	—	—	16	61	—	—	—	1300	—	—	—	41	—	4.5	9.3	—	110	880
MD21-09-10362	572–577	06/12/09	—	—	—	—	—	—	—	5.2	160	910	—	—	—	—	15	63	—	—	—	1500	—	—	—	17	—	—	—	—	66	670
MD21-09-10363	686–691	06/15/09	22	—	—	—	—	—	6	3.5	—	74	—	—	—	—	—	—	—	—	—	77	—	—	9.2	—	—	—	—	—	14	19
July 2009																																
MD21-09-11294	80–85	07/14/09	—	—	—	—	—	—	—	3.6	45	730	—	—	—	4.9	—	—	—	—	—	—	—	—	—	1300	—	—	—	12	—	450
MD21-09-11295	115–120	07/14/09	—	—	—	—	—	—	—	—	44	380	—	—	—	4.9	—	—	—	—	—	5.8	—	—	—	430	—	—	—	12	—	270
MD21-09-11296	232–237	07/14/09	—	—	6.3	—	—	—	—	3.2	220	520	—	—	—	7.4	—	6	—	—	—	30	—	—	—	240	—	—	21	21	—	390
MD21-09-11297	295–300	07/14/09	—	—	11	—	—	—	—	8.2	830	740	—	—	—	11	5.1	29	4.5	—	—	310	—	—	—	210	—	—	56	31	16	1300
MD21-09-11298	329.5–334.5	07/14/09	—	—	14	—	—	—	—	4.6	780	720	—	—	—	8.4	9.4	35	4.8	—	—	520	—	—	—	180	—	—	50	25	44	1400
MD21-09-11299	375–380	07/14/09	—	3.9	15	—	—	—	—	5.1	700	930	—	—	7.4	5.1	17	62	5.5	—	—	1200	—	—	—	120	3.7	—	26	14	100	1500
MD21-09-11300	472–478	07/14/09	—	—	—	—	—	36	—	19	600	1400	—	—	—	—	27	100	—	—	—	2100	—	—	—	74	—	—	18	—	200	1500
MD21-09-11301	572–577	07/14/09	—	—	—	—	—	—	—	—	190	1000	—	—	—	—	17	71	—	—	—	1700	—	—	13	23	—	—	—	—	85	780
MD21-09-11302	686–691	07/14/09	—	13	—	—	7.4	—	—	4.8	—	120	—	—	—	—	—	7.1	—	5.6	—	140	—	—	120	—	—	—	—	—	21	34
August 2009																																
MD21-09-11488	80–85	08/11/09	20	—	—	—	—	12(J)	—	3.9	53	880	—	—	—	4.5	—	—	—	—	—	3.1	—	—	—	1600	—	8.9	—	14	—	560
MD21-09-11489	115–120	08/11/09	20	—	—	—	—	—	3.6	—	38	350	—	—	—	—	—	—	—	—	—	4.4	—	—	—	400	—	5.9	—	10	—	240
MD21-09-11490	232–237	08/11/09	16	—	—	—	—	—	—	—	17	110	—	—	—	—	—	—	—	—	—	7.2	—	—	—	29	—	12	—	—	—	52
MD21-09-11491	295–300	08/13/09	13	—	8.5	—	—	—	3	11	680	600	—	—	—	9	—	22	—	—	—	210	—	—	—	180	—	8.8	54	24	14	1200
MD21-09-11492	329.5–334.5	08/13/09	8.9	—	9.6	—	—	—	—	12	640	590	—	—	—	6.5	7.1	28	4.2	—	—	400	—	—	—	160	—	4.9	50	20	40	1200
MD21-09-11493	375–380	08/11/09	37	—	—	—	—	—	3.4	4.6	190	310	—	—	—	—	5.6	18	—	—	—	400	—	—	—	33	—	18	8.6	—	35	470
MD21-09-11494	472–478	08/13/09	—	4.8	9.1	—	—	62(J)	4.9	14	460	1100	—	—	9.3	—	—	78	—	—	—	1500	—	—	—	70	—	8	16	—	170	1300

Table 5.1-1 (continued)

Sample ID	Depth (ft)	Collection Date	Acetone	Benzene	Bromodichloromethane	Bromomethane	Butadiene[1,3-]	Butanol[1-]	Butanone[2-]	Carbon Disulfide	Carbon Tetrachloride	Chloroform	Chloromethae	Cyclohexane	Dichlorobenzene[1,4-]	Dichlorodifluoromethane	Dichloroethane[1,2-]	Dichloroethene[1,1-]	Dichloroethene[cis-1,2-]	Hexane	Methanol	Methylene Chloride	n-Heptane	Propanol[2-]	Propylene	Tetrachloroethene	Tetrahydrofuran	Toluene	Trichloro-1,2,2-trifluoroethane[1,1,2-]	Trichloroethane[1,1,1-]	Trichloroethane[1,1,2-]	Trichloroethene
MD21-09-11495	572–577	08/14/09	—	—	—	—	—	—	—	—	260	1400	—	—	—	—	20	94	—	—	—	2100	—	—	—	30	—	7.6	—	—	120	1100
MD21-09-11496	686–691	08/14/09	18	—	—	—	—	—	3.9	3.6	8.6	220	—	—	—	—	—	17	—	—	—	260	—	—	—	—	—	—	—	—	37	70
September 2009																																
MD21-09-12612	80–85	09/17/09	—	—	—	—	—	—	—	3.3	64	1000	—	3.4	—	4.9	—	—	—	—	—	3	—	—	—	2200	—	—	—	18	—	680
MD21-09-12613	115–120	09/17/09	22	—	—	—	—	—	—	—	46	400	—	—	—	4.3	—	—	—	—	—	6.3	—	—	—	510	—	18	—	13	—	290
MD21-09-12614	232–237	09/17/09	43	—	—	—	—	—	4.2	—	170	430	—	—	—	6.2	—	4.4	—	—	—	22	—	—	—	210	—	—	18	17	—	310
MD21-09-12615	295–300	09/17/09	27	—	6	—	—	—	6	—	390	410	—	—	—	6.3	—	14	—	—	—	140	—	—	—	110	—	—	28	14	10	730
MD21-09-12616	329.5–334.5	09/17/09	—	—	7	—	—	—	—	13	380	400	—	—	—	5	5.2	17	—	—	—	280	—	—	—	100	—	3.4	26	12	30	760
MD21-09-12617	375–380	09/17/09	28	—	8.9	—	—	—	3.6	—	410	590	—	—	—	—	10	38	4	—	120(J)	710	—	—	—	80	—	5	18	8.3	73	1000
MD21-09-12618	472–478	09/17/09	—	3.4	6.1	—	—	—	—	5.3	300	740	—	—	5.7	—	14	55	—	—	—	1100	—	—	—	46	—	4.2	9.6	—	120	840
MD21-09-12619	572–577	09/17/09	36	—	—	—	—	—	7.5	—	160	950	—	—	—	—	15	63	—	—	—	1600	—	—	—	20	—	—	—	—	88	720
MD21-09-12620	686–691	09/17/09	24	—	—	—	—	—	3	—	—	120	—	—	—	—	—	11	—	—	—	140	—	—	—	—	—	—	—	—	21	44
October 2009																																
MD21-10-32	80–85	10/19/09	13	—	—	—	—	—	—	5.4	64	1300	—	—	—	6.8	—	—	—	—	—	5.2	—	—	—	2800	—	—	11	17	—	890
MD21-10-33	115–120	10/19/09	31	—	—	—	—	—	4.6	—	54	620	—	—	—	6.1	—	—	—	—	—	9.6	—	—	—	780	—	—	9.9	15	—	460
MD21-10-34	232–237	10/19/09	37	—	7	—	—	—	3.5	4.2	280	710	—	—	—	9.8	—	13	—	—	—	55	—	—	—	350	—	—	44	25	—	620
MD21-10-35	295–300	10/19/09	46	—	12	—	—	—	5.9	7.3	770	790	—	—	—	14	4.5	39	4.6(J+)	—	—	350	—	—	—	230	—	—	88	28	18	1600
MD21-10-36	329.5–334.5	10/19/09	76	3.1	14	—	—	—	7.2	3.5	760	770	—	—	—	10	9	44	5.5(J+)	—	—	660	—	—	—	190	—	5.2	76	22	54	1600
MD21-10-37	375–380	10/19/09	45	—	15	—	—	—	—	—	600	890	—	—	—	—	16	75	—	—	—	1300	—	—	—	120	—	6.9	42	12	120	1700
MD21-10-38	472–478	10/19/09	23	6.7	13	—	—	—	—	6.9	510	1400	—	—	11	—	27	130	—	—	—	2400	—	—	—	84	—	7.4	27	—	240	1700
MD21-10-39	572–577	10/19/09	—	—	—	—	—	—	—	—	230	1200	—	—	13	—	21	65(J)	—	—	—	1800(J-)	—	—	—	32	—	—	—	—	130	1000
MD21-10-40	686–691	10/19/09	31	—	—	6.7	—	—	6.4	—	16	290	—	—	—	—	—	20(J)	—	—	—	190(J-)	—	—	—	—	—	—	—	—	43	98
November 2009																																
MD21-10-5007	80–85	11/17/09	—	—	—	—	—	—	—	—	61	1100	—	3.2(J)	—	5.5	—	—	—	5.5	—	—	—	—	—	2200	—	4.6	—	17	—	600
MD21-10-5008	115–120	11/17/09	—	—	—	—	—	—	—	—	48	470	—	—	—	5	—	—	—	—	—	7.2	—	—	—	510	—	—	—	14	—	290
MD21-10-5009	232–237	11/17/09	—	—	—	—	—	—	—	—	140	380	—	—	—	5.7	—	4.5	—	—	—	24	—	—	—	170	—	—	14(J-)	14	—	270
MD21-10-5010	295–300	11/17/09	—	—	—	—	—	—	—	—	320	360	—	—	—	5.8	—	12	—	—	—	110	—	—	—	92	—	—	21(J-)	12	—	590
MD21-10-5011	329.5–334.5	11/17/09	9.7	—	8.2	—	—	—	—	—	410	430	—	—	—	6.3	5.6	19	—	—	—	320	—	—	—	100	—	3.3	26(J-)	12	31	760
MD21-10-5012	375–380	11/17/09	9.2	—	7.4	—	—	—	—	—	310	490	—	—	—	—	7.9	32	—	—	—	630	—	—	—	55	—	3.7	13(J-)	6.2	55	740
MD21-10-5013	472–478	11/17/09	—	—	—	—	—	—	—	9.7	360	960	—	—	—	—	16	73	—	—	—	1600	—	—	—	51	—	—	—	—	140	1000

Table 5.1-1 (continued)

Sample ID	Depth (ft)	Collection Date	Acetone	Benzene	Bromodichloromethane	Bromomethane	Butadiene[1,3-]	Butanol[1-]	Butanone[2-]	Carbon Disulfide	Carbon Tetrachloride	Chloroform	Chloromethae	Cyclohexane	Dichlorobenzene[1,4-]	Dichlorodifluoromethane	Dichloroethane[1,2-]	Dichloroethene[1,1-]	Dichloroethene[cis-1,2-]	Hexane	Methanol	Methylene Chloride	n-Heptane	Propanol[2-]	Propylene	Tetrachloroethene	Tetrahydrofuran	Toluene	Trichloro-1,2,2-trifluoroethane[1,1,2-]	Trichloroethane[1,1,1-]	Trichloroethane[1,1,2-]	Trichloroethene
MD21-10-5014	572–577	11/17/09	—	—	—	—	—	—	—	—	100	740	—	—	—	—	12	48	—	—	—	1400	—	—	—	13	—	—	—	—	66	500
MD21-10-5015	686–691	11/17/09	25	—	—	—	—	—	3.8	—	6.4	120	—	—	—	—	—	10	—	—	—	160	—	—	—	—	—	—	—	—	20	43
December 2009																																
MD21-10-8520	80–85	12/15/09	100	—	—	—	—	—	5.1	15	54	950	—	2.8	—	4.7	—	—	—	—	NA	3.1	—	—	—	2000	—	3.8	—	15	—	560
MD21-10-8521	115–120	12/15/09	—	—	—	—	—	—	—	—	47	450	—	—	—	4.8	—	—	—	—	NA	6.7	—	170	—	520	—	—	—	13	—	300
MD21-10-8522	232–237	12/15/09	—	—	—	—	—	—	2.7	2.7	200	500	—	—	—	6.4	—	4.1	—	—	NA	29	—	—	—	250	—	—	18	20	—	370
MD21-10-8523	295–300	12/15/09	—	—	8.7	—	—	—	—	—	640	610	—	—	—	8.9	3.5	20	—	9.2	NA	130	—	—	—	190	—	—	44	24	15	1100
MD21-10-8524	329.5–334.5	12/15/09	—	—	11	—	—	—	6.1	3	540	550	14	—	—	5.5	7.9	20	4.1	9.8	NA	210	4.7	—	—	160	—	—	25	17	41	1100
MD21-10-8525	375–380	12/15/09	—	3.1	12	—	—	—	3.2	—	550	760	—	—	6.4	—	14	44	4.3	—	NA	930	—	—	—	100	—	5.3	22	11	90	1200
MD21-10-8526	472–478	12/15/09	—	—	—	—	—	—	—	—	500	1200	—	—	—	—	26	75	—	11	NA	1800	—	—	—	72	—	—	15	—	200	1400
MD21-10-8527	572–577	12/15/09	—	5.6 (J)	—	—	—	—	—	—	270	1400	—	—	10	—	23	87	—	—	NA	2300	—	—	—	33	—	—	—	—	110	1200
MD21-10-8528	686–691	12/15/09	—	—	—	—	—	—	—	6.4	24	360	—	—	—	—	—	31	—	—	NA	290	—	—	10	—	—	—	—	—	54	150

Notes: Results are in µg/m^3. See Appendix A for data qualifier definitions.

* — = Not detected.

Table 5.1-2
Summary of VOCs Detected in Pore-Gas Samples at MDA T Vapor-Monitoring Well 21-25264, February–December 2009

Sample ID	Depth (ft)	Collection Date	Acetone	Benzene	Bromodichloromethane	Butanone[2-]	Carbon Disulfide	Carbon Tetrachloride	Chloroform	Cyclohexane	Dichlorobenzene[1,4-]	Dichlorodifluoromethane	Dichloroethane[1,2-]	Dichloroethene[1,1-]	Ethanol	Hexane	Methylene Chloride	Propylene	n-Heptane	Tetrachloroethene	Toluene	Trichloro-1,2,2-trifluoroethane[1,1,2-]	Trichloroethane[1,1,1-]	Trichloroethane[1,1,2-]	Trichloroethene
February 2009																									
MD21-09-3564	67.5–72.5	2/4/09	—*	—	—	—	—	170	500	—	—	15	—	—	—	—	20	—	—	2900	—	—	31	—	1200
MD21-09-3563	150.5–155.5	2/4/09	14	2.8	—	4.3	—	200	450	5.8	—	13	3.8	—	—	—	240	9.4	—	520	—	8	29	—	620
MD21-09-3560	222.5–227.5	2/3/09	23	—	7.7	3.5	—	370	580	7.6	—	11	12	6.7	—	—	810	16	—	240	—	12	28	5	760
MD21-09-3561	323–328	2/3/09	—	—	—	—	—	500	840	—	—	9.2	22	11	—	—	1800	22	—	90	—	16	12	—	850
MD21-09-3562	349.5–354.5	2/3/09	—	—	—	—	—	390	950	—	—	—	25	13	—	—	2000	19	—	30	—	—	—	—	740
April 2009																									
MD21-09-7164	67.5–72.5	4/16/09	—	—	—	—	—	150	490	—	—	19	—	—	—	—	21	—	—	3500	—	—	24	—	1200
MD21-09-7166	150.5–155.5	4/17/09	—	—	—	—	—	170	430	6.1	—	11	—	8.5	—	—	190	—	—	480	—	7.8	19	—	580
MD21-09-7168	222.5–227.5	4/17/09	—	—	6.8	—	—	320	570	7.3	—	9	10	11	—	—	690	—	—	230	—	13	18	—	710
MD21-09-7167	323–328	4/17/09	—	—	—	—	—	410	760	—	—	—	18	12	—	—	1500	—	—	78	—	14	—	—	810
MD21-09-7165	349.5–354.5	4/16/09	22	—	—	6.4	—	410	1000	—	11	—	28	14	—	—	2200	—	—	39	—	—	—	—	880
June 2009																									
MD21-09-10344	67.5–72.5	6/17/09	11	—	—	—	—	77	230	—	—	8.4	—	—	—	—	9.5	—	—	1500	—	—	15	—	590
MD21-09-10345	150.5–155.5	6/17/09	10	—	—	—	—	95	230	—	—	7.1	—	—	—	—	110	—	—	270	7.3	—	15	—	320
MD21-09-10346	222.5–227.5	6/17/09	10	—	—	—	—	140	250	—	—	5.9	5.4	—	—	—	350	—	—	94	8	—	11	—	310
MD21-09-10347	323–328	6/17/09	12	—	—	—	—	140	260	—	—	4.4	6.6	—	—	—	540	—	—	23	6.8	—	—	—	260
MD21-09-10348	349.5–354.5	6/17/09	34	—	—	5	—	130	330	—	—	—	9.6	4.4	—	—	740	—	—	10	5.9	—	—	—	270
July 2009																									
MD21-09-11283	67.5–72.5	7/17/09	—	—	—	—	—	180	500	—	—	17	—	—	—	—	18	—	—	3600	—	—	32	—	1300
MD21-09-11284	150.5–155.5	7/17/09	—	—	—	—	—	210	470	—	—	14	3.9	—	—	—	210	—	—	570	—	8.3	30	—	650
MD21-09-11285	222.5–227.5	7/17/09	—	—	—	—	—	230	420	—	—	8.6	9.1	3.8	—	—	570	—	—	160	—	—	17	—	510
MD21-09-11286	323–328	7/17/09	—	—	—	9.6	—	310	570	—	5.2(J)	7.1	16	7.8	—	—	1100	—	—	50	—	8.3	7.1	—	570
MD21-09-11287	349.5–354.5	7/17/09	—	—	—	—	—	180	460	—	—	—	17	6.1	—	—	1000	—	—	18	—	—	—	—	370
August 2009																									
MD21-09-11477	67.5–72.5	8/19/09	—	11	—	—	8.2	140	380	—	—	12	—	—	—	—	14	—	—	3400	16	—	24	—	1000
MD21-09-11478	150.5–155.5	8/19/09	45	—	—	5.4	—	160	370	4.8	—	9.9	—	—	—	—	150	—	—	500	—	8.2	23	—	540
MD21-09-11479	222.5–227.5	8/19/09	—	—	5.9	—	4.3	340	510	6.3	—	9.2	10	5.7	—	—	630	—	—	230	—	12	23	—	690

Table 5.1-2 (continued)

Sample ID	Depth (ft)	Collection Date	Acetone	Benzene	Bromodichloromethane	Butanone[2-]	Carbon Disulfide	Carbon Tetrachloride	Chloroform	Cyclohexane	Dichlorobenzene[1,4-]	Dichlorodifluoromethane	Dichloroethane[1,2-]	Dichloroethene[1,1-]	Ethanol	Hexane	Methylene Chloride	Propylene	n-Heptane	Tetrachloroethene	Toluene	Trichloro-1,2,2-trifluoroethane[1,1,2-]	Trichloroethane[1,1,1-]	Trichloroethane[1,1,2-]	Trichloroethene
MD21-09-11480	323–328	8/19/09	—	—	—	—	—	460	730	—	—	—	18	8.7	—	—	1300	—	—	76	—	15	10	—	800
MD21-09-11481	349.5–354.5	8/19/09	—	—	—	—	—	430	950	—	—	—	26	13	—	—	1900	—	—	36	—	—	—	—	840
September 2009																									
MD21-09-12605	67.5–72.5	9/16/09	—	—	—	4.3	41	100	310	—	—	11	—	—	—	—	11	—	—	2600	—	—	19	—	840
MD21-09-12606	150.5–155.5	9/16/09	12	—	—	2.9	—	140	330	4.3	—	8.6	—	—	—	—	140	—	—	460	—	7.4	22	—	500
MD21-09-12607	222.5–227.5	9/16/09	17	—	—	2.9	—	210	360	3.9	—	6.8	7.7	3.9	—	—	480	—	—	160	—	8.2	16	—	480
MD21-09-12608	323–328	9/16/09	10	—	—	—	—	230	420	—	—	5.1	11	5.6	—	—	800	—	—	42	—	7.9	5.7	—	440
MD21-09-12609	349.5–354.5	9/16/09	—	—	—	—	—	200	520	—	—	—	16	7.2	—	—	1100	—	—	19	—	—	—	—	440
October 2009																									
MD21-10-25	67.5–72.5	10/16/09	9	—	—	—	—	87	320	—	—	9.3	—	—	—	—	16	—	—	2400	—	8.1	16	—	910
MD21-10-26	150.5–155.5	10/16/09	57	—	—	5	—	140	390	4.4	—	11	—	5.1	—	—	210	—	—	500	—	10	21	—	600
MD21-10-27	222.5–227.5	10/16/09	48	—	—	5.3	—	130	320	—	—	5.8	7.2	4.3	21	—	560	—	—	110	—	—	9.9	—	380
MD21-10-28	323–328	10/16/09	12	—	—	—	—	110	280	—	—	—	8.2	4.6	25	—	720	—	—	22	—	—	—	—	290
MD21-10-29	349.5–354.5	10/16/09	11	—	—	—	—	73	280	—	—	—	11	4.2	23	—	860	—	—	9.1	—	—	—	—	240
November 2009																									
MD21-10-5002	67.5–72.5	11/19/09	—	—	—	—	—	120	350	—	—	12	—	—	—	—	13	—	—	3000	—	—	21	—	900
MD21-10-5003	150.5–155.5	11/19/09	12	—	—	—	—	150	370	4.2	—	11	—	—	—	—	160	—	—	460	—	—	21	—	480
MD21-10-5004	222.5–227.5	11/19/09	15	—	—	3.5	—	310	520	5.1	—	11	9.5	5.6	—	—	700	—	—	200	—	12	22	5.6	650
MD21-10-5005	323–328	11/19/09	17	—	—	—	—	400	750	—	—	8.3	17	10	—	—	1500	—	—	65	—	13	9.4	—	750
MD21-10-5006	349.5–354.5	11/19/09	—	—	—	—	—	370	950	—	—	—	24	13	—	—	2200	—	—	32	—	—	—	—	770
December 2009																									
MD21-10-8509	67.5–72.5	12/22/09	-	-	-	-	-	120	380	-	—	12	—	—	—	—	15	—	—	3300	—	—	22	—	990
MD21-10-8510	150.5–155.5	12/22/09	16	-	-	-	-	-	-	-	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
MD21-10-8511	222.5–227.5	12/22/09	-	-	5.8	-	-	300	500	5.7	—	10	10	5.6	—	11	690	—	4.1	220	—	10	22	—	650
MD21-10-8512	323–328	12/22/09	-	-	-	-	-	400	720	-	—	—	20	8.9	—	—	1300	—	—	74	—	—	9.8	—	760
MD21-10-8513	349.5–354.5	12/22/09	-	-	-	-	-	88	220	-	—	—	6.6	—	—	8.9	500	—	3.6	53	—	—	—	—	190

Notes: Results are in µg/m^3. See Appendix A for data qualifier definitions.

* — = Not detected.

Table 5.1-3
Summary of VOCs Detected in Pore-Gas Samples at MDA T Vapor-Monitoring Well 21-603058, February–December 2009

Sample ID	Depth (ft)	Collection Date	Acetone	Benzene	Bromodichloromethane	Butanone[2-]	Carbon Disulfide	Carbon Tetrachloride	Chloroform	Dichlorobenzene[1,2-]	Dichlorobenzene[1,4-]	Dichlorodifluoromethane	Dichloroethane[1,2-]	Dichloroethene[1,1-]	Dichloroethene[cis-1,2-]	Ethanol	Hexane	Methylene Chloride	Propylene	n-Heptane	Tetrachloroethene	Toluene	Trichloro-1,2,2-trifluoroethane[1,1,2-]	Trichloroethane[1,1,1-]	Trichloroethane[1,1,2-]	Trichloroethene
February 2009																										
MD21-09-3553	67.5–72.5	2/5/09	—*	—	—	—	—	80	590	—	—	6	—	—	—	—	—	6.6	—	—	790	—	7.9	24	—	370
MD21-09-3554	217–222	2/5/09	—	—	6.2	—	—	480	890	—	6.1	8.5	7.7	13	—	14	—	540	—	—	300	—	29	42	17	1000
MD21-09-3555	242.5–247.5	2/5/09	—	—	—	—	—	740	1300	—	14	—	22	19	—	46	—	1500	—	—	200	—	37	41	45	1400
MD21-09-3556	339.5–344.5	2/5/09	—	—	—	—	—	750	1500	—	25	—	33	22	—	43	—	2400	—	—	96	—	33	17	42	1400
April 2009																										
MD21-09-7159	67.5–72.5	4/14/09	—	—	—	—	—	74	630	—	—	7	—	5.6	—	—	—	5.6	—	—	810	—	7.5	17	—	350
MD21-09-7160	217–222	4/14/09	—	—	—	—	—	500	1100	—	5.8	11	6.9	21	—	—	—	470	—	—	310	—	32	32	17	1000
MD21-09-7162	242.5–247.5	4/15/09	—	—	—	—	—	520	950	—	12	—	15	18	—	—	—	1100	—	—	140	—	31	25	35	1000
MD21-09-7161	339.5–344.5	4/15/09	—	—	—	—	—	660	1400	—	20	—	23	21	—	—	—	2100	—	—	74	—	36	13	23	1300
June 2009																										
MD21-09-10339	67.5–72.5	6/18/09	—	—	—	—	—	58	430	—	—	5	—	—	—	—	—	4.2	—	—	570	—	—	17	—	270
MD21-09-10341	217–222	6/18/09	—	—	—	—	—	210	400	—	—	5.3	—	5.2	—	—	—	230	—	—	120	—	12	19	6.8	440
MD21-09-10342	242.5–247.5	6/18/09	—	—	—	—	—	470	810	—	8.6	6.7	14	12	3.6	—	—	960	—	—	130	—	22	26	29	950
MD21-09-10343	339.5–344.5	6/18/09	—	—	—	5.8	—	390	830	—	14	—	18	14	—	—	—	1600	—	—	57	—	23	—	23	810
July 2009																										
MD21-09-11278	67.5–72.5	7/16/09	29	—	—	4.8	—	68	520	—	—	5.8	—	—	—	—	—	5.6	—	—	740	14	—	20	—	330
MD21-09-11280	217–222	7/16/09	—	3.1	—	—	—	310	670	—	—	6.7	7.8	8	—	—	—	420	—	—	210	3.7	17	27	14	720
MD21-09-11281	242.5–247.5	7/16/09	15	—	—	5.4	29	200	460	83	16	5.2	8.9	6.2	—	—	—	620	—	—	68	4.8	9.5	12	17	1200
MD21-09-11282	339.5–344.5	7/16/09	22	—	—	—	—	350	730	—	8.9	5	17	11	—	—	—	1300	—	—	44	—	16	7.7	18	700
August 2009																										
MD21-09-11472	67.5–72.5	8/18/09	—	—	—	—	—	58	440	—	—	4.9	—	—	—	—	—	3.6	—	—	710	6.7	—	17	—	290
MD21-09-11473	217–222	8/18/09	16	—	—	—	—	340	670	—	—	6.6	5.3	8.5	—	—	—	380	—	—	250	—	24	30	13	770
MD21-09-11474	242.5–247.5	8/18/09	—	3.2	—	—	3.4	560	950	—	13	7.8	16	15	6	—	—	1100	—	—	180	—	34	29	40	1200
MD21-09-11475	339.5–344.5	8/18/09	—	—	—	—	—	560	1100	—	19	—	25	17	—	—	—	1800	—	—	85	—	29	12	33	1200

Table 5.1-3 (continued)

Sample ID	Depth (ft)	Collection Date	Acetone	Benzene	Bromodichloromethane	Butanone[2-]	Carbon Disulfide	Carbon Tetrachloride	Chloroform	Dichlorobenzene[1,2-]	Dichlorobenzene[1,4-]	Dichlorodifluoromethane	Dichloroethane[1,2-]	Dichloroethene[1,1-]	Dichloroethene[cis-1,2-]	Ethanol	Hexane	Methylene Chloride	Propylene	n-Heptane	Tetrachloroethene	Toluene	Trichloro-1,2,2-trifluoroethane[1,1,2-]	Trichloroethane[1,1,1-]	Trichloroethane[1,1,2-]	Trichloroethene
September 2009																										
MD21-09-12598	67.5–72.5	9/15/09	—	—	—	—	—	48	390	—	—	4.4	—	—	—	—	—	4	—	—	570	—	—	15	—	240
MD21-09-12600	217–222	9/15/09	—	—	—	—	—	400	800	—	—	7.4	6.1	9.4	—	—	—	460	—	—	280	—	26	33	16	880
MD21-09-12601	242.5–247.5	9/15/09	15	2.8	—	3.9	—	530	960	—	9.7	7.1	16	14	5.4	—	—	1100	—	—	160	—	31	29	39	1100
MD21-09-12602	339.5–344.5	9/15/09	—	—	—	—	7.9	670	1300	—	20	—	29	19	—	—	—	2200	—	—	94	—	35	16	38	1300
October 2009																										
MD21-10-18	67.5–72.5	10/14/09	93	—	—	14	—	68	600	—	—	6.1	—	—	—	—	—	6.5	—	—	980	—	11	20	—	400
MD21-10-20	217–222	10/14/09	20	—	—	—	—	400	900	—	—	8.1	7.3	17	—	—	—	610	—	13	330	—	39	34	20	1100
MD21-10-21	242.5–247.5	10/14/09	43	—	—	6	—	480	1000	—	11	7.6	17	21	6(J+)	—	—	1400	—	23	180	—	43	26	45	1300
MD21-10-22	339.5–344.5	10/14/09	32	—	—	—	—	460	1000	—	—	—	25	20	—	—	—	2200	—	—	79	—	37	—	32	1100
November 2009																										
MD21-10-4997	67.5–72.5	11/20/09	—	—	—	—	—	56	440	—	—	5.1	—	—	—	—	—	5.4	—	—	640	—	—	16	—	260
MD21-10-4998	217–222	11/20/09	13	—	—	—	—	200	500	—	—	4.8	4.1	5.4	—	—	—	310	—	—	160	—	12	18	10	520
MD21-10-4999	242.5–247.5	11/20/09	—	—	—	—	4.3	160	400	—	—	—	6.5	5.4	—	—	—	550	—	—	56	—	8.5	8.8	17	400
MD21-10-5000	339.5–344.5	11/20/09	—	—	—	—	—	340	750	—	—	—	14	11	—	58(J)	—	1400	—	—	44	—	17	—	18	690
December 2009																										
MD21-10-8504	67.5–72.5	12/21/09	9.5	—	—	—	—	—	—	—	—	—	—	—	—	—	9	—	4.3	—	—	—	—	—	—	—
MD21-10-8507	242.5–247.5	12/21/09	—	—	—	—	—	400	780	—	8.6	7	13	11	3.5 (J)	—	—	960	—	—	130	—	22	22	34	920
MD21-10-8508	339.5–344.5	12/21/09	—	—	—	—	—	6.5	—	—	—	—	—	—	—	—	—	4.7	—	—	—	—	—	—	—	—

Notes: Results are in µg/m^3. See Appendix A for data qualifier definitions.

* — = Not detected.;

Table 5.1-4
Summary of VOCs Detected in Pore-Gas Samples at MDA T Vapor-Monitoring Well 21-603059, February–December 2009

Sample ID	Depth (ft)	Collection Date	Acetone	Benzene	Bromodichloromethane	Butanol[1-]	Butanone[2-]	Carbon Disulfide	Carbon Tetrachloride	Chloroform	Cyclohexane	Dichlorobenzene[1,4-]	Dichlorodifluoromethane	Dichloroethane[1,2-]	Dichloroethene[1,1-]	Dichloroethene[cis-1,2-]	Ethanol	Hexane	Methanol	Methylene Chloride	Propanol[2-]	Propylene	Tetrachloroethene	Toluene	Trichloro-1,2,2-trifluoroethane[1,1,2-]	Trichloroethane[1,1,1-]	Trichloroethane[1,1,2-]	Trichloroethene	Trimethylbenzene[1,2,4-]	Xylene[1,3-]+Xylene[1,4-]
February 2009																														
MD21-09-3546	77.5–82.5	2/8/09	—*	—	6.4	—	—	—	73	1100	—	—	6.4	—	—	—	—	—	—	4	—	—	1600	—	—	22	—	820	—	—
MD21-09-3545	187.5–192.5	2/6/09	—	—	8.7	—	4.1	6.8	170	700	—	—	7.8	—	7.2	—	—	—	—	29	—	—	390	—	18	30	—	550	—	—
MD21-09-3547	229.5–234.5	2/8/09	9	—	8.6	—	—	—	440	770	3.1(J)	—	10	—	19	—	—	—	—	80	—	—	290	—	39	33	—	810	—	—
MD21-09-3549	292.5–297.5	2/6/09	—	—	11	—	—	—	750	740	—	—	11	6.1	30	—	13	—	—	360	—	—	210	4.8	57	31	25	1300	—	—
MD21-09-3550	372.5–377.5	2/6/09	—	4.1	14	—	—	—	670	900	—	7.8	5.3	19	65	4.1	54	—	—	1100	—	—	120	7.5	28	15	120	1400	—	—
April 2009																														
MD21-09-7155	77.5–82.5	4/13/09	—	—	—	—	—	—	—	560	—	—	—	—	—	—	—	—	—	—	—	—	920	—	—	—	—	380	—	—
MD21-09-7154	187.5–192.5	4/10/09	—	—	—	—	—	—	120	620	—	—	—	—	—	—	—	—	—	—	—	—	310	—	—	—	—	460	—	—
MD21-09-7157	229.5–234.5	4/13/09	—	—	—	—	—	—	130	400	—	—	—	—	—	—	—	—	—	—	—	—	130	—	—	—	—	320	—	—
MD21-09-7163	229.5–234.5	4/20/09	37	—	7.6	—	10	—	320	710	—	—	8.3	—	19	—	—	—	—	58	—	—	270	—	34	22	—	670	—	—
MD21-09-7153	292.5–297.5	4/10/09	—	—	—	—	—	—	480	610	—	—	—	—	—	—	—	—	—	280	—	—	170	—	—	—	—	980	—	—
MD21-09-7156	372.5–377.5	4/13/09	—	—	—	—	—	—	—	94	—	—	—	—	—	—	—	—	—	160	—	—	—	—	—	—	—	91	—	—
June 2009																														
MD21-09-10333	77.5–82.5	6/16/09	—	—	—	—	—	—	50	850	—	—	5.1	—	—	—	—	—	—	—	—	—	1200	—	—	16	—	560	—	—
MD21-09-10334	187.5–192.5	6/16/09	—	—	—	—	—	3.3	110	480	—	—	6.1	—	4.3	—	—	—	—	19	—	—	260	—	9.7	20	—	360	—	—
MD21-09-10335	229.5–234.5	6/16/09	—	—	—	—	2.7	—	220	440	—	—	6.2	—	8.8	—	—	—	—	29	—	—	170	—	20	19	—	410	—	—
MD21-09-10336	292.5–297.5	6/16/09	—	—	—	—	—	—	440	450	—	—	7.1	—	17	—	—	—	—	200	—	—	120	—	32	18	13	740	—	—
MD21-09-10337	372.5–377.5	6/16/09	—	—	7.6	—	2.6	—	400	520	—	—	—	11	35	—	—	—	—	610	—	—	67	4.6	15	8.8	67	820	—	—
July 2009																														
MD21-09-11272	77.5–82.5	7/15/09	44	—	6.2	12	5.4	—	64	1100	—	—	5.9	—	—	—	—	—	—	4	—	—	1600	200	—	18	—	720	—	—
MD21-09-11273	187.5–192.5	7/15/09	43	—	6.2	—	5.4	—	120	530	—	—	7	—	5.5	—	—	5.5	—	24	—	—	310	21	14	22	—	400	—	—
MD21-09-11274	229.5–234.5	7/15/09	13	—	—	—	—	—	210	480	—	—	6.8	—	8.4	—	—	—	—	37	—	—	190	—	18	18	—	440	—	—
MD21-09-11275	292.5–297.5	7/15/09	15	—	11	—	—	4.2	690	690	—	—	11	5.3	26	7	—	—	—	320	—	—	200	6.1	51	28	23	1200	—	—
MD21-09-11276	372.5–377.5	7/15/09	12	—	10	—	—	4.6	380	600	—	6	—	13	35	—	—	—	—	760	—	—	72	9.5	14	8.2	85	850	—	—
August 2009																														
MD21-09-11469	77.5–82.5	8/14/09	22	—	—	—	4.6	18	61	1000	—	—	5.1	—	—	—	—	—	—	—	—	—	1800	—	—	17	—	700	—	—
MD21-09-11470	187.5–192.5	8/14/09	8.7	—	6.8	—	3.1	38	140	580	—	—	7	—	5.6	—	—	—	—	24	—	—	380	—	17	24	—	470	—	—

Table 5.1-4 (continued)

Sample ID	Depth (ft)	Collection Date	Acetone	Benzene	Bromodichloromethane	Butanol[1-]	Butanone[2-]	Carbon Disulfide	Carbon Tetrachloride	Chloroform	Cyclohexane	Dichlorobenzene[1,4-]	Dichlorodifluoromethane	Dichloroethane[1,2-]	Dichloroethene[1,1-]	Dichloroethene[cis-1,2-]	Ethanol	Hexane	Methanol	Methylene Chloride	Propanol[2-]	Propylene	Tetrachloroethene	Toluene	Trichloro-1,2,2-trifluoroethane[1,1,2-]	Trichloroethane[1,1,1-]	Trichloroethane[1,1,2-]	Trichloroethene	Trimethylbenzene[1,2,4-]	Xylene[1,3-]+Xylene[1,4-]
MD21-09-11471	229.5–234.5	8/14/09	28	—	—	—	5	—	170	320	4.1	30	5.2	—	6.4	—	—	—	—	42	8.3(J)	—	140	40	18	13	—	320	—	—
MD21-09-11468	292.5–297.5	8/14/09	51	—	9.1	—	9	—	640	630	—	—	9.3	4.6	22	—	—	—	—	280	—	—	190	3.7	52	25	21	1100	—	—
MD21-09-11467	372.5–377.5	8/14/09	40	3.1	11	—	7.2	—	530	700	—	7	—	13	48	4.4	—	—	—	800	—	—	100	6.5	27	11	100	1200	—	—
September 2009																														
MD21-09-12623	77.5–82.5	9/18/09	12	—	—	—	—	—	59	1000	—	—	—	—	—	—	—	—	—	—	—	—	1800	—	—	18	—	700	—	—
MD21-09-12624	187.5–192.5	9/18/09	11	—	6	—	—	26	140	580	—	—	6.4	—	5.6	—	—	—	—	24	—	—	360	—	16	24	—	460	—	—
MD21-09-12625	229.5–234.5	9/18/09	—	—	6.9	—	—	—	340	660	—	—	8.3	—	13	—	—	—	—	47	—	—	280	—	35	28	—	660	—	—
MD21-09-12626	292.5–297.5	9/18/09	10	—	9.2	—	—	—	670	670	—	—	11	5.2	31	—	—	—	—	300	—	—	190	3.6	**67**	26	20	1200	—	—
MD21-09-12627	372.5–377.5	9/18/09	19	2.8	11	—	—	—	520	700	—	5.8	—	14	54	4.5	—	—	140(J)	720	—	—	94	5.9	27	11	95	1100	—	—
October 2009																														
MD21-10-10	77.5–82.5	10/20/09	—	—	—	—	3.5	—	58	1000	—	—	5.2	—	—	—	—	—	NA	—	—	—	1500	—	—	17	—	630	—	—
MD21-10-11	187.5–192.5	10/20/09	—	—	6.4	—	4.5	—	130	580	—	—	6.2	—	4.6(J)	—	—	—	NA	—	—	8.4	340	—	12(J)	24	—	430	—	—
MD21-10-12	229.5–234.5	10/20/09	—	—	7.1	—	—	—	390	700	—	—	8.8	—	12(J)	—	—	—	NA	54(J-)	—	14	260	—	28(J)	28	—	660	—	—
MD21-10-13	292.5–297.5	10/20/09	—	—	8.8	—	—	—	580	630	—	—	9	4.2	17(J)	3.8	—	—	NA	140(J-)	—	18	180	—	35(J)	24	22	960	—	—
MD21-10-14	372.5–377.5	10/20/09	—	2.8(J)	11	—	2.6	—	480	670	—	8.2	—	12	33(J)	3.9	—	—	NA	730(J-)	—	12	99	5.6	17(J)	10	100	1000	—	—
November 2009																														
MD21-10-4991	77.5–82.5	11/18/09	20	—	—	—	3.3	—	52	1000	—	—	5.4	—	—	—	—	—	NA	3.3(J-)	—	—	1700	—	—	15	—	600	—	—
MD21-10-4993	187.5–192.5	11/18/09	—	—	6.1	—	—	—	120	560	—	—	6.4	—	5.4(J-)	—	—	—	NA	24(J-)	—	7.4	320	—	14	21	—	410	—	—
MD21-10-4994	229.5–234.5	11/18/09	13	—	6.9	—	3.3	—	290	640	—	—	8.4	—	13(J-)	—	—	—	NA	40(J-)	—	13	240	—	30	24	—	570	—	—
MD21-10-4995	292.5–297.5	11/18/09	—	—	7.8	—	—	—	560	610	—	—	9.4	4	23(J-)	—	—	—	NA	270(J-)	—	18	170	4.1	47	22	20	980	—	—
MD21-10-4996	372.5–377.5	11/18/09	—	2.7	10	—	—	—	500	700	—	7	4.4	12	51(J-)	4.2	—	—	NA	880(J-)	—	13	91	5.3	24	10	96	1100	—	—
December 2009																														
MD21-10-8498	77.5–82.5	12/16/09	—	—	—	—	—	—	53	940	—	—	4.7	—	—	—	—	—	NA	3.1	—	—	1700	—	—	16	—	600	—	—
MD21-10-8499	187.5–192.5	12/16/09	—	—	6.3	—	—	—	120	550	—	—	5.9	—	5.5	—	—	—	NA	24	—	—	370	—	15	22	—	420	—	—
MD21-10-8500	229.5–234.5	12/16/09	—	—	—	—	—	—	200	520	—	—	6.4	—	8.9	—	—	—	NA	33	—	—	240	3.4	20	20	—	440	6.3	4.4
MD21-10-8501	292.5–297.5	12/16/09	—	—	8.3	—	—	—	550	610	—	—	8.8	4.4	23	3.5	—	—	NA	280	—	—	180	3.3	44	23	20	970	—	—
MD21-10-8502	372.5–377.5	12/16/09	13	—	7.2	—	—	—	330	490	—	5.4	—	9.2	34	—	—	—	NA	600	—	—	78	4.2	15	7.7	70	780	—	—

Notes: Results are in µg/m^3. See Appendix A for data qualifier definitions.

* — = Not detected.

Table 5.1-5
Summary of VOCs Detected in Pore-Gas Samples at MDA T Vapor-Monitoring Well 21-607955, November–December 2009

Sample ID	Depth (ft)	Collection Date	Acetone	Benzene	Bromodichloromethane	Butanone[2-]	Carbon Disulfide	Carbon Tetrachloride	Chloroform	Cyclohexane	Dichlorodifluoromethane	Dichloroethane[1,2-]	Dichloroethene[1,1-]	Hexane	Methylene Chloride	Propylene	Tetrachloroethene	Toluene	Trichloro-1,2,2-trifluoroethane[1,1,2-]	Trichloroethane[1,1,1-]	Trichloroethane[1,1,2-]	Trichloroethene
November/December 2009																						
MD21-10-7567	71.1–76.4	12/2/09	—*	—	—	—	9.4	89	680	—	—	—	—	—	66	—	2000	29	—	16	—	430
MD21-10-7568	153.8–159.7	12/3/09	—	—	—	—	4.6	190	560	—	8	4.4	—	—	290	—	390	22	9.8	18	6.3	490
MD21-10-7569	173.4–179	12/2/09	31	—	—	—	—	—	19	—	—	—	—	—	25	—	—	—	—	—	—	20
MD21-10-7570	225.9–232.1	12/2/09	100	3	5.5	2.6	20	340	680	3.6	7.4	11	8	2.9	880	—	220	90	16	17	16	710
MD21-10-7571	326.6–333.4	12/3/09	18	—	—	—	4.5	130	350	—	4.6	7.5	4	—	660	—	110	9.4	—	9.4	6.6	290
MD21-10-7572	353.3–359.6	12/2/09	16	—	—	—	5.6	360	1000	—	—	21	15	—	2100	—	29	83	13	—	15	760
MD21-10-7573	459.4–464.8	12/2/09	—	—	—	—	—	26	91	—	—	—	—	—	180	—	—	12	—	—	—	57
MD21-10-7574	559–565	12/2/09	8.9	3.4	—	—	4.5	100	540	—	—	—	24	5.2	710	—	—	100	—	—	—	320
MD21-10-7575	651.3–657.3	12/2/09	—	—	—	—	6.1	—	29	—	—	—	3.8	3.9	17	—	—	100	—	—	—	18
MD21-10-7576	797.2–803.1	12/3/09	17	—	—	—	3.3	—	—	—	—	—	—	—	—	8.6	—	11	—	—	—	—
MD21-10-7577	946.2–952.1	12/3/09	30,000	—	—	—	—	—	—	—	—	—	—	—	—	—	—	690	—	—	—	—
December 2009																						
MD21-10-8099	71.1–76.4	12/18/09	—	—	—	—	—	65	520	—	—	—	—	—	33	—	1800	22	—	—	—	350
MD21-10-8100	153.8–159.7	12/18/09	9.1	—	—	—	6.1	170	610	—	9.2	3.9	—	—	220	—	430	18	9.6	19	5.3	500
MD21-10-8101	173.4–179	12/18/09	16	—	—	—	7.2	220	680	—	9.2	5.2	4.1	—	370	—	420	42	11	22	9.2	580
MD21-10-8102	225.9–232.1	12/17/09	14	2.9	—	—	12	340	730	—	7.9	12	8.1	—	870	—	230	74	15	19	17	760
MD21-10-8103	326.6–333.4	12/17/09	8.4	—	—	—	7.6	180	450	—	4.7	9.7	5	—	850	—	100	13	8.3	5.4	8.7	390
MD21-10-8104	353.3–359.6	12/17/09	—	—	—	—	—	100	260	—	—	5	4.9	—	530	—	8.9	18	—	—	—	210
MD21-10-8105	459.4–464.8	12/17/09	—	—	—	—	—	160	560	—	—	9.5	8.7	—	950	—	10	22	—	—	—	390
MD21-10-8106	559–565	12/17/09	11	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
MD21-10-8107	651.3–657.3	12/18/09	—	—	—	—	3.4	—	48	—	—	—	6.5	—	24	8.3	—	39	—	—	—	29
MD21-10-8108	797.2–803.1	12/17/09	14	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
MD21-10-8109	946.2–952.1	12/17/09	1400	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

Note: Results are in $\mu g/m^3$.

* — = Not detected.

Table 5.2-1
Screening of VOCs Detected in Pore Gas at MDA T, October–December 2009

VOC	Maximum Pore Gas Concentration (µg/m³)	Groundwater SL (µg/L)	Calculated Concentrations in Pore Gas Corresponding to Groundwater Standard (µg/m³)	SV (unitless)
Acetone	30,000	22,000[a]	35,200	8.52E-01
Benzene	6.7	5[b]	1140	5.88E-03
Bromodichloromethane	15	1.2[a]	104	1.44E-01
Bromomethane	6.7	8.7[a]	2227	3.01E-03
2-Butanone	14	7100[a]	16,330	8.57E-04
Carbon Disulfide	20	1000[a]	590,000	3.39E-05
Carbon Tetrachloride	770	5[b]	5500	1.40E-01
Chloroform	1400	100[c]	15,000	9.33E-02
Chloromethane	14	190[a]	68,400	2.05E-04
Cyclohexane	5.7	13,000[a]	79,300,000	7.19E-08
1,4-Dichlorobenzene	13	75[b]	7470	1.74E-03
Dichlorodifluoromethane	14	390[a]	5,460,000	2.56E-06
1,2-Dichloroethane	27	5[b]	240	1.13E-01
1,1-Dichloroethene	130	5[c]	5500	2.36E-02
cis-1,2-Dichloroethane	6	70[b]	11,900	5.04E-04
Hexane	11	880[a]	65,120,000	1.69E-07
Methylene chloride	2400	5[b]	650	**3.69E+00**
n-Heptane	4.7	880[d]	65,120,000	7.22E-08
Tetrachloroethene	3300	5[b]	3600	9.17E-01
Toluene	690	750[c]	204,000	3.38E-03
1,1,2-Trichloro-1,2,2-trifluoroethane	88	59,000[a]	1,298,000,000	6.78E-08
1,1,1-Trichloroethane	34	60[c]	42,300	8.04E-04
1,1,2-Trichloroethane	240	5[b]	170	**1.41E+00**
Trichloroethene	1700	5[b]	2000	8.50E-01
1,2,4-Trimethylbenzene	6.3	15[a]	3750	1.68E-03
1,3-Xylene+1,4-Xylene	4.4	620[c]	167,400	2.63E-05

Notes: Calculated concentrations in pore gas corresponding to groundwater standard derived from denominator of Equation 3.0-3. Values in bold are greater than 1.0.

[a] EPA regional tap water screening levels (http://www.epa.gov/region09/superfund/prg/).

[b] EPA MCL (40 Code of Federal Regulations 141.61).

[c] NMWQCC groundwater standard (20.6.2.3103 New Mexico Administrative Code).

[d] Hexane used as a surrogate, based on structural similarity.

Table 5.3-1
Summary of Detected Tritium Results in Pore-Gas Samples at MDA T Vapor-Monitoring Well 21-25262, June–December 2009

Sample ID	Depth (ft)	Collection Date	Tritium
June 2009			
MD21-09-10357	232–237	6/12/09	19570.9
MD21-09-10358	295–300	6/12/09	901.051
MD21-09-10359	329.5–334.5	6/12/09	3062.27
MD21-09-10360	375–380	6/12/09	13958.3
July 2009			
MD21-09-11294	80–85	7/14/09	1041.73
MD21-09-11295	115–120	7/14/09	441.102
MD21-09-11296	232–237	7/14/09	556.992
MD21-09-11297	295–300	7/14/09	3199.46
MD21-09-11298	329.5–334.5	7/14/09	6803.85
MD21-09-11299	375–380	7/14/09	37413.2
MD21-09-11301	572–577	7/14/09	321.425
MD21-09-11302	686–691	7/14/09	420.838
August 2009			
MD21-09-11488	80–85	8/11/09	1129.79
MD21-09-11489	115–120	8/11/09	516.154
MD21-09-11490	232–237	8/11/09	930.317
MD21-09-11491	295–300	8/13/09	3885.76
MD21-09-11493	375–380	8/11/09	40119.3
MD21-09-11492	329.5–334.5	8/13/09	5167.16
MD21-09-11494	472–478	8/13/09	1401.18
MD21-09-11495	572–577	8/14/09	33963.9
MD21-09-11496	686–691	8/14/09	721.544
September 2009			
MD21-09-12612	80–85	9/17/09	950.746
MD21-09-12613	115–120	9/17/09	1566.48
MD21-09-12614	232–237	9/17/09	638.959
MD21-09-12615	295–300	9/17/09	3571.87
MD21-09-12616	329.5–334.5	9/17/09	6374.78
MD21-09-12617	375–380	9/17/09	58756.5
MD21-09-12618	472–478	9/17/09	397.554
October 2009			
MD21-10-35	295–300	10/19/09	5711.58 (J)
MD21-10-36	329.5–334.5	10/19/09	7315.18 (J)
MD21-10-37	375–380	10/19/09	73332.4

Table 5.3-1 (continued)

Sample ID	Depth (ft)	Collection Date	Tritium
November 2009			
MD21-10-5010	295–300	11/17/09	3194.14
MD21-10-5011	329.5–334.5	11/17/09	4274.57
MD21-10-5012	375–380	11/17/09	32455
December 2009			
MD21-10-8520	80–85	12/15/09	708.364
MD21-10-8521	115–120	12/15/09	637.912
MD21-10-8523	295–300	12/15/09	2905.18
MD21-10-8524	329.5–334.5	12/15/09	3352.27
MD21-10-8525	375–380	12/15/09	31335.5
MD21-10-8526	472–478	12/15/09	593.241
MD21-10-8527	572–577	12/15/09	251.682

Notes: Units are in pCi/L. See Appendix A for data qualifier definitions.

Table 5.3-2
Summary of Detected Tritium Results in Pore-Gas Samples at MDA T Vapor-Monitoring Well 21-25264, February–December 2009

Sample ID	Depth (ft)	Collection Date	Tritium
February 2009			
MD21-09-3564	67.5–72.5	02/04/09	6608.33
MD21-09-3563	150.5–155.5	02/04/09	88523.8
MD21-09-3560	222.5–227.5	02/03/09	91886.9
MD21-09-3561	323–328	02/03/09	3613.93
MD21-09-3562	349.5–354.5	02/03/09	2228.43
April 2009			
MD21-09-7164	67.5–72.5	04/16/09	5647
MD21-09-7166	150.5–155.5	04/17/09	120741
MD21-09-7168	222.5–227.5	04/17/09	80587.5
MD21-09-7167	323–328	04/17/09	1421.08
MD21-09-7165	349.5–354.5	04/16/09	1557.89
June 2009			
MD21-09-10344	67.5–72.5	06/17/09	142818
MD21-09-10345	150.5–155.5	06/17/09	133254
MD21-09-10346	222.5–227.5	06/17/09	2093.28
MD21-09-10347	323–328	06/17/09	3952.86
MD21-09-10348	349.5–354.5	06/17/09	2873.74
July 2009			
MD21-09-11283	67.5–72.5	07/17/09	10560.3
MD21-09-11284	150.5–155.5	07/17/09	173113
MD21-09-11285	222.5–227.5	07/17/09	123530
MD21-09-11286	323–328	07/17/09	2323.85
MD21-09-11287	349.5–354.5	07/17/09	7802.76
August 2009			
MD21-09-11477	67.5–72.5	08/19/09	12.3201
MD21-09-11478	150.5–155.5	08/19/09	198.29
MD21-09-11479	222.5–227.5	08/19/09	143.559
MD21-09-11480	323–328	08/19/09	2.95949
MD21-09-11481	349.5–354.5	08/19/09	3.10597
September 2009			
MD21-09-12605	67.5–72.5	09/16/09	8471.59
MD21-09-12606	150.5–155.5	09/16/09	128286
MD21-09-12607	222.5–227.5	09/16/09	98443.1
MD21-09-12608	323–328	09/16/09	1847.38
MD21-09-12609	349.5–354.5	09/16/09	2511.64

Table 5.3-2 (continued)

Sample ID	Depth (ft)	Collection Date	Tritium
October 2009			
MD21-10-25	67.5–72.5	10/16/09	7391.34 (J)
MD21-10-26	150.5–155.5	10/16/09	127242
MD21-10-27	222.5–227.5	10/16/09	88576.4
MD21-10-29	349.5–354.5	10/16/09	2091.07 (J)
November 2009			
MD21-10-5002	67.5–72.5	11/19/09	6934.95
MD21-10-5003	150.5–155.5	11/19/09	129340
MD21-10-5004	222.5–227.5	11/19/09	87464.5
MD21-10-5005	323–328	11/19/09	2339.12
MD21-10-5006	349.5–354.5	11/19/09	2621.98
December 2009			
MD21-10-8509	67.5–72.5	12/22/09	6826.61
MD21-10-8510	150.5–155.5	12/22/09	83723
MD21-10-8511	222.5–227.5	12/22/09	57334
MD21-10-8512	323–328	12/22/09	2319.62
MD21-10-8513	349.5–354.5	12/22/09	1744.05

Notes: Units are in pCi/L. See Appendix A for data qualifier definitions.

Table 5.3-3
Summary of Detected Tritium Results in Pore-Gas Samples at MDA T Vapor-Monitoring Well 21-603058, February–December 2009

Sample ID	Depth (ft)	Collection Date	Tritium
February 2009			
MD21-09-3553	67.5–72.5	2/5/09	3346.86
MD21-09-3554	217–222	2/5/09	6339.59
MD21-09-3555	242.5–247.5	2/5/09	2155.65
MD21-09-3556	339.5–344.5	2/5/09	581.996
April 2009			
MD21-09-7159	67.5–72.5	4/14/09	812.322
MD21-09-7160	217–222	4/14/09	390.326
MD21-09-7162	242.5–247.5	4/15/09	1172.45
MD21-09-7161	339.5–344.5	4/15/09	997.037
June 2009			
MD21-09-10339	67.5–72.5	6/18/09	545.965
MD21-09-10341	217–222	6/18/09	2627.8
MD21-09-10342	242.5–247.5	6/18/09	3203.44
MD21-09-10343	339.5–344.5	6/18/09	530.518
July 2009			
MD21-09-11280	217–222	7/16/09	980.78
MD21-09-11281	242.5–247.5	7/16/09	3253.15
August 2009			
MD21-09-11472	67.5–72.5	8/18/09	258.446
MD21-09-11473	217–222	8/18/09	991.636
MD21-09-11474	242.5–247.5	8/18/09	2949.12
September 2009			
MD21-09-12598	67.5–72.5	9/15/09	1706.59
MD21-09-12600	217–222	9/15/09	1936.29
MD21-09-12601	242.5–247.5	9/15/09	1787.14
November 2009			
MD21-10-4997	67.5–72.5	11/20/09	1394.73
MD21-10-4998	217–222	11/20/09	1380.68
MD21-10-4999	242.5–247.5	11/20/09	116521
MD21-10-5000	339.5–344.5	11/20/09	368.266
December 2009			
MD21-10-8504	67.5–72.5	12/21/09	482.944
MD21-10-8506	217–222	12/21/09	1101.48
MD21-10-8507	242.5–247.5	12/21/09	1591.23

Note: Units are in pCi/L.

Table 5.3-4
Summary of Detected Tritium Results in Pore-Gas Samples at MDA T Vapor-Monitoring Well 21-603059, February–December 2009

Sample ID	Depth (ft)	Collection Date	Tritium
February 2009			
MD21-09-3546	77.5–82.5	2/8/09	6357.79
MD21-09-3545	187.5–192.5	2/6/09	556.668
MD21-09-3547	229.5–234.5	2/8/09	1368.89
MD21-09-3549	292.5–297.5	2/6/09	4105.41
MD21-09-3550	372.5–377.5	2/6/09	5277.58
April 2009			
MD21-09-7155	77.5–82.5	4/13/09	353.451
MD21-09-7157	229.5–234.5	4/13/09	756.393
MD21-09-7163	229.5–234.5	4/20/09	1332.55
MD21-09-7153	292.5–297.5	4/10/09	1284.11
MD21-09-7156	372.5–377.5	4/13/09	1420.85
June 2009			
MD21-09-10333	77.5–82.5	6/16/09	334.831
MD21-09-10334	187.5–192.5	6/16/09	628.593
MD21-09-10335	229.5–234.5	6/16/09	1660.84
MD21-09-10336	292.5–297.5	6/16/09	4605.51
MD21-09-10337	372.5–377.5	6/16/09	6449.81
July 2009			
MD21-09-11273	187.5–192.5	7/15/09	601.61
MD21-09-11274	229.5–234.5	7/15/09	1428.52
MD21-09-11275	292.5–297.5	7/15/09	4776.39
MD21-09-11276	372.5–377.5	7/15/09	6527.3
August 2009			
MD21-09-11469	77.5–82.5	8/14/09	501.312
MD21-09-11470	187.5–192.5	8/14/09	538.605
MD21-09-11471	229.5–234.5	8/14/09	1529.32
MD21-09-11468	292.5–297.5	8/14/09	6175.57
MD21-09-11467	372.5–377.5	8/14/09	6520.03
September 2009			
MD21-09-12623	77.5–82.5	9/18/09	889.354
MD21-09-12624	187.5–192.5	9/18/09	376.235
MD21-09-12625	229.5–234.5	9/18/09	1400.04
MD21-09-12626	292.5–297.5	9/18/09	5764.99
MD21-09-12627	372.5–377.5	9/18/09	1279.39

Table 5.3-4 (continued)

Sample ID	Depth (ft)	Collection Date	Tritium
October 2009			
MD21-10-13	292.5–297.5	10/20/09	2720.89 (J)
MD21-10-14	372.5–377.5	10/20/09	4812.58 (J)
November 2009			
MD21-10-4991	77.5–82.5	11/18/09	569.51
MD21-10-4993	187.5–192.5	11/18/09	835.233
MD21-10-4994	229.5–234.5	11/18/09	2006.55
MD21-10-4995	292.5–297.5	11/18/09	3811.4
MD21-10-4996	372.5–377.5	11/18/09	5400.51
December 2009			
MD21-10-8498	77.5–82.5	12/16/09	412.571
MD21-10-8499	187.5–192.5	12/16/09	904.787
MD21-10-8500	229.5–234.5	12/16/09	23765.4
MD21-10-8501	292.5–297.5	12/16/09	2450.99
MD21-10-8502	372.5–377.5	12/16/09	6361.8

Notes: Units are in pCi/L. See Appendix A for data qualifier definitions.

Table 5.3-5
Summary of Detected Tritium Results in Pore-Gas Samples at
MDA T Vapor-Monitoring Well 21-607955, November–December 2009

Sample ID	Depth (ft)	Collection Date	Tritium
November/December 2009			
MD21-10-7567	71.1–76.4	12/2/2009	1005.55
MD21-10-7568	153.8–159.7	12/3/2009	3022.43
MD21-10-7569	173.4–179	12/2/2009	1350.52
MD21-10-7570	225.9–232.1	12/2/2009	4580.07
MD21-10-7571	326.6–333.4	12/3/2009	1201.62
MD21-10-7572	353.3–359.6	12/2/2009	694.773
MD21-10-7573	459.4–464.8	12/2/2009	424.773
MD21-10-7574	559–565	12/2/2009	1143.6
MD21-10-7577	946.2–952.1	12/3/2009	844.549
December 2009			
MD21-10-8099	71.1–76.4	12/18/09	1699.46
MD21-10-8100	153.8–159.7	12/18/09	20563
MD21-10-8101	173.4–179	12/18/09	1280.33
MD21-10-8102	225.9–232.1	12/17/09	5367.56
MD21-10-8103	326.6–333.4	12/17/09	551.331
MD21-10-8106	559–565	12/17/09	626.66
MD21-10-8107	651–657	12/18/09	504.147

Note: Units are in pCi/L.

Table 5.4-1
Screening of VOCs Detected in Pore Gas at MDA T, December 2009

VOC	Maximum Pore Gas Concentration (µg/m3)	Groundwater SL (µg/L)	Calculated Concentrations in Pore Gas Corresponding to Groundwater Standard (µg/m3)	SV (unitless)
Acetone	30,000	22,000[a]	35,200	3.98E-02
Benzene	6.7	5[b]	1140	4.91E-03
Bromodichloromethane	15	1.2[a]	104	1.15E-01
2-Butanone	14	7100[a]	16,330	3.74E-04
Carbon Disulfide	20	1000[a]	590,000	2.54E-05
Carbon Tetrachloride	770	5[b]	5500	1.16E-01
Chloroform	1400	100[c]	15,000	9.33E-02
Chloromethane	14	190[a]	68,400	2.05E-04
Cyclohexane	5.7	13,000[a]	79,300,000	7.19E-08
1,4-Dichlorobenzene	13	75[b]	7470	1.34E-03
Dichlorodifluoromethane	14	390[a]	5,460,000	2.20E-06
1,2-Dichloroethane	27	5[b]	240	1.08E-01
1,1-Dichloroethene	130	5[c]	5500	1.58E-02
cis-1,2-Dichloroethane	6	70[b]	11,900	3.61E-04
Hexane	11	880[a]	65,120,000	1.69E-07
Methylene chloride	2400	5[b]	650	**3.54E+00**
n-Heptane	4.7	880[d]	65,120,000	7.22E-08
Tetrachloroethene	3300	5[b]	3600	9.17E-01
Toluene	690	750[c]	204,000	3.63E-04
1,1,2-Trichloro-1,2,2-trifluoroethane	88	59,000[a]	1,298,000,000	3.39E-08
1,1,1-Trichloroethane	34	60[c]	42,300	5.67E-04
1,1,2-Trichloroethane	240	5[b]	170	**1.18E+00**
Trichloroethene	1700	5[b]	2000	7.00E-01
1,2,4-Trimethylbenzene	6.3	15[a]	3750	1.68E-03
1,3-Xylene+1,4-Xylene	4.4	620[c]	167,400	2.63E-05

Notes: Calculated concentrations in pore gas corresponding to groundwater standard derived from denominator of Equation 3.0-3. Values in bold are greater than 1.0.

[a] EPA regional tap water screening levels (http://www.epa.gov/region09/superfund/prg/).

[b] EPA MCL (40 Code of Federal Regulations 141.61).

[c] NMWQCC groundwater standard (20.6.2.3103 New Mexico Administrative Code).

[d] Hexane used as a surrogate, based on structural similarity.

Appendix A

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

A-1.0 ACRONYMS AND ABBREVIATIONS

$\%CO_2$	percent carbon dioxide
$\%O_2$	percent oxygen
%R	percent recovery
bgs	below ground surface
COC	chain of custody
DER	duplicate error ratio
DOE	Department of Energy (U.S.)
EPA	Environmental Protection Agency (U.S.)
FB	field blank
FD	field duplicate
ICV	initial calibration verification
LAL	lower acceptance limit
LANL	Los Alamos National Laboratory
LCS	laboratory control sample
MCL	maximum contaminant level
MDA	material disposal area
MDC	minimum detectable concentration
NMED	New Mexico Environment Department
NMWQCC	New Mexico Water Quality Control Commission
MS	matrix spike
PB	performance blank
PCE	tetrachloroethene
QA	quality assurance
QC	quality control
RACER	Risk Analysis, Communication, Evaluation, and Reduction
RPF	Records Processing Facility
SCL	sample collection log
SL	screening level
SMO	Sample Management Office
SOP	standard operating procedures
SOW	statement of work
SQL	standard quantitation limit
SV	screening value
TA	technical area

TCE	trichloroethene
TD	total depth
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 (µm)	0.0000394	inches (in.)
square kilometers (km^2)	0.3861	square miles (mi^2)
hectares (ha)	2.5	acres
square meters (m^2)	10.764	square feet (ft^2)
cubic meters (m^3)	35.31	cubic feet (ft^3)
kilograms (kg)	2.2046	pounds (lb)
grams (g)	0.0353	ounces (oz)
grams per cubic centimeter (g/cm^3)	62.422	pounds per cubic foot (lb/ft^3)
milligrams per kilogram (mg/kg)	1	parts per million (ppm)
micrograms per gram (µg/g)	1	parts per million (ppm)
liters (L)	0.26	gallons (gal.)
milligrams per liter (mg/L)	1	parts per million (ppm)
degrees Celsius (°C)	9/5 + 32	degrees Fahrenheit (°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

Field Methods

B-1.0 INTRODUCTION

This appendix summarizes the field methods used during the October−December 2009 quarterly sampling activities 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). All activities were conducted in accordance with the applicable standard operating procedures (SOPs), quality procedures, Laboratory implementation requirements, and Laboratory procedural requirements. Table B-1.0-1 provides a summary of the field methods used, and Table B-1.0-2 lists the applicable procedures.

B-2.0 FIELD METHODS

All work was conducted per a site-specific health and safety plan and an integrated work document. Field activities conducted according to SOPs are discussed below.

B-2.1 Volatile Organic Compound Pore-Gas Field-Screening and Sample Collection

All volatile organic compound (VOC) samples were collected and screened in accordance with the current version of the EP-ERSS-SOP-5074, Sampling for Sub-Atmospheric Air.

Before each sampling event, each sample port was purged and monitored with a LANDTEC GEM 2000 instrument (or equivalent) until the percent carbon dioxide (%CO_2) and percent oxygen (%O_2) levels stabilized at values representative of subsurface pore-gas conditions. Each instrument rental was shipped factory calibrated to the Laboratory and then returned to a LANDTEC authorized service facility for service/calibration as needed. As described in the LANDTEC documentation, accuracies for percent oxygen and carbon dioxide for Landtec instrumentation are +/- 1.0% and +/- 3.0%, respectively. Air was drawn from the sampling interval through the line to purge vapor-sample tubing of stagnant air. To ensure the sample collected was representative of the subsurface air at depth, every sampling activity included a purge cycle. Once purging and field screening were complete, vapor samples for VOC analysis were collected with the use of SUMMA canisters, and the sample information was recorded in the appropriate sample collection log (SCL). Field-screening results were also recorded in the appropriate SCL and/or in the field logbook. Field chains of custody (COCs) and SCLs are provided in Appendix D (on CD).

The screening %CO_2 and %O_2 levels are presented in Table 4.0-1 of this report. The calibrations of CO_2 and O_2 levels were within the manufacturer's acceptable calibration limits. The December %CO_2 levels ranged from 0.0% to 1.1%, are within acceptable limits, and are representative of subsurface pore-gas conditions. The December %O_2 levels ranged from 22.1% to 23.6%, are within acceptable limits, and are representative of subsurface pore-gas conditions. In addition to the characterization samples, two types of quality assurance/quality control (QA/QC) samples were collected and analyzed for VOCs with the use of SUMMA canisters: field duplicate (FD) samples and field blanks (FB) of ultra-pure nitrogen. The FD and FB samples were collected at a frequency greater than or equal to 10% per sampling event in accordance with the current version of EP-ERSS-SOP-5059, Field Quality Control Samples. Summaries of all October–December 2009 analytical and QA/QC samples collected from vapor-monitoring wells 21-603058, 21-603059, 21-25264, 21-25262, 21-607955, and their requested analyses, are presented in Tables 2.0-2 through 2.0-6 of the report.

All samples were submitted to the Sample Management Office (SMO) for processing and transport to off-site contract analytical laboratories.

B-2.2 Tritium Pore-Gas Sample Collection

All tritium samples were collected in accordance with the current version of EP-ERSS-SOP-5074. Water vapor intended for tritium analysis was collected from pore gas by means of pulling a pore-gas sample through a canister of silica gel and the sample information recorded on the appropriate SCL (Appendix D [on CD]). Silica gel column FD samples were also collected at a frequency greater than or equal to 10% per sampling event in accordance with the current version of EP-ERSS-SOP-5059.

Following delivery of the canister and silica gel sample to the analytical laboratory, the silica gel was heated and the moisture driven off was collected for liquid scintillation counting. Silica gel was prepared for sampling by drying at a temperature above 100°C. Before sample collection, the amount of silica gel used in each sample was weighed (typically about 135 g), as well as the sample canister with silica gel. EP-ERSS-SOP-5074 requires that at least 5 g of moisture be collected. After sampling, sample canister with silica gel was weighed again.

The sample (canister plus silica gel) was shipped to the analytical laboratory, where the canister with silica gel 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 analytical 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 concentration 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 involved standard sampling equipment, personal protective equipment, waste management, and site-control equipment/materials. The procedure covers premobilization 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 QA. Specific requirements were met for each sample and were printed in the sample collection logs provided by the Laboratory's SMO (size and type of container, preservatives, etc.). All samples were preserved by placement in insulated containers with ice to maintain a temperature of 4°C.
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 QC Samples	Field QC samples were collected as follows: FDs were collected at a frequency of 10% at the same time as a regular sample and submitted for the same analyses. FBs 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 of Sub-Atmospheric Air	Vapor sampling was performed on three monitoring wells in accordance with the current version of EP-ERSS-SOP-5074 and analyzed for VOCs and tritium. This SOP describes the process of sampling subatmospheric air from vapor ports in monitoring wells and boreholes. The vapor-sampling procedure covered 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, and 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 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

Document Number	LANL Procedure Title
EP-ERSS-SOP-5055	General Instructions for Field Investigations
EP-ERSS-SOP-5056	Sample Containers and Preservation
EP-ERSS-SOP-5057	Handling, Packaging, and Transporting Field Samples
EP-ERSS-SOP-5058	Sample Control and Field Documentation
EP-ERSS-SOP-5059	Field Quality Control Samples
EP-ERSS-SOP-5061	Field Decontamination of Equipment
EP-ERSS-SOP-5074	Sampling for Sub-Atmospheric Air
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 Documentation for Environmental Restoration Technical Activities
SOP-5228	ADEP Reporting Requirements for Abnormal Events

Appendix C

Quality Assurance/Quality Control Program

C-1.0 INTRODUCTION

This appendix presents the analytical methods and summarizes the data quality review for the October, November, and December 2009 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 "Quality Assurance Project Plan Requirements for Sampling and Analysis" (LANL 1996, 054609), and the Laboratory's statement of work (SOW) for analytical services (LANL 2000, 071233). 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, matrix spikes (MSs), laboratory control samples (LCSs), internal standards, initial calibration verifications (ICVs) and continuing calibration verifications (CCVs), surrogates, and tracers, were used to assess analytical laboratory accuracy and bias.

The type and frequency of QC analyses are described in the analytical services SOW (LANL 2000, 071233). Other QC factors such as sample preservation and holding times were also assessed. The requirements for sample preservation and holding times are presented in the standard operating procedure (SOP) EP-ERSS-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 results. 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 Appendix D (on CD).

Analytical data were reviewed and evaluated based on U.S. Environmental Protection Agency (EPA) national functional guidelines for organic chemical data review, where applicable (EPA 1994, 048639; EPA 1999, 066649). Data have also been assessed using guidelines established in 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-2.0 ANALYTICAL DATA ORGANIZATION AND VINTAGE

The October–December 2009 pore-gas analytical data were obtained from 117 samples (91 characterization and 26 QA/QC) collected during three sampling events (October, November, and December 2009) from vapor-monitoring well locations 21-25262, 21-25264, 21-603058, and 21-603059 and two sampling events (early and mid-December 2009) from vapor-monitoring well 21-607955. Complete data packages and sample documentation for the 2009 samples are provided in Appendix D (on CD).

C-3.0 ORGANIC CHEMICAL ANALYSIS METHODS

Pore-gas samples were submitted for analysis of volatile organic compounds (VOCs) using EPA Method TO-15 (Table C-3.0-1). Tables 2.0-2 through 2.0-6 of the periodic monitoring report summarize all October–December 2009 pore-gas samples collected at MDA T and the requested analyses, in addition to February–September 2009 data, which are included for comparison purposes. All VOC results are provided on CD in Appendix D.

C-3.1 Organic Chemical QA/QC Samples

The QC samples are designed to produce a qualitative measure of the reliability of a specific part of an analytical procedure. The methods for validating organic chemical results on the basis of the various QA/QC sample types are specified in the SOPs. The validation of organic chemical data using QA/QC samples and other methods may have resulted in the rejection of the data or the assignment of various qualifiers to individual sample results.

Calibration verifications, LCSs, method blanks, surrogates, and internal standards were analyzed to assess the accuracy and precision of organic chemical analyses. Each of these QA/QC sample types is defined in the analytical services SOW (LANL 2000, 071233), described in the applicable validation SOPs, and summarized below.

Calibration verification is the establishment of a quantitative relationship between the response of the analytical instrument and the concentration of the target analyte. There are two aspects of calibration verification: initial and continuing. The initial calibration verifies the linearity of the calibration curve as well as the individual calibration standards used to perform the calibration. The continuing calibration verifies the initial calibration is still linear and valid. The continuing calibration also serves to determine that analyte identification criteria, such as retention times and spectral matching, are being met.

The LCS is a sample of the same matrix spiked with the target analytes and serves to monitor the overall performance. Following Laboratory SOP guidance, analytical results were qualified if the individual LCS recoveries were not within method-specific acceptance criteria.

A method blank is an analyte-free matrix to which 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.

A surrogate compound (surrogate) is an organic chemical used in the analyses of target analytes. The surrogate is similar in composition and behavior to the target analytes but is not normally found in environmental samples. Surrogates are added to every blank, sample, and spike to evaluate the efficiency with which analytes are recovered during extraction and analysis. The recovery percentage of the surrogates must be within specified ranges, or the sample may be rejected or assigned a qualifier.

Internal standards are chemical compounds added to every blank, sample, and standard extract at a known concentration. Internal standards are used as the basis for quantitation of target analytes. The percent recovery (%R) for internal standards should be within the range of 50% to 200%.

The data quality of the October–December 2009 MDA T VOC pore-gas data is summarized below.

C-3.1.1 MDA T Pore-Gas VOC Data

During the October–December 2009 monitoring period, 91 characterization samples and 26 QA/QC samples were collected and submitted for VOC analysis.

No VOC data were rejected.

Three VOC results (one benzene; one cis-1,2-dichloroethene; and one cyclohexane) were qualified as J because the analytical laboratory qualified the result as estimated and requalification of the data via data validation did not occur because of QC requirements.

Eleven results (six 1,1-dichloroethene; one ethanol; and four 1,1,2-trichloro-1,2,2-trifluoroethane) were qualified as estimated (J) because the ICV and/or continuing CCV were recovered outside the method-specific limits.

Twenty-four results (five 1,1-dichloroethene; fourteen methylene chloride; and five 1,1,2-trichloro-1,2,2-trifluoroethane) were qualified as estimated (J−) because the LCS %R was less than the lower acceptance level (LAL) but greater than 10%.

Three results (cis-1,2-dichloroethene) were qualified as estimated (J+) because the LCS %R was greater than the upper acceptance level.

There were 5338 VOC results that qualified as U or UJ for one of the following reasons.

- The analytical laboratory qualified the result as a non-detect, and requalification of the data via data validation did not occur because of QC requirements.
- The LCS %R was less than the LAL but greater than 10%.
- The result was less than or equal to 5 times the concentration of the related analyte in the method blank, indicating that the reported detection was indistinguishable from contamination in the blank.
- The VOCs were analyzed with an ICV that exceeded the %R standard deviation criteria and/or the associated multipoint calibration correlation coefficient was less than 0.995.
- The ICV and/or CCV were recovered outside the method-specific limits.
- The mass spectrum did not meet specifications.

C-4.0 RADIONUCLIDE ANALYSIS METHODS

The vapor samples collected in October–December 2009 were analyzed by EPA Method 906.0 for tritium (Table C-3.0-1). Tables 2.0-2 through 2.0-6 of the periodic monitoring report summarize all October–December 2009 pore-gas samples collected at MDA T and the requested analyses, in addition to February–September 2009 data, which are included for comparison purposes. All tritium results are provided on CD in Appendix D.

C-4.1 Radionuclide QA/QC Samples

The minimum detectable concentration (MDC) for tritium in performance blanks (PBs), method blanks, laboratory duplicates, tracer/carrier recovery, LCSs, and MS samples was analyzed to assess the accuracy and precision of the radionuclide analysis. The qualifiers and sample types for radionuclides are defined in the analytical services SOW (LANL 1995, 049738; LANL 2000, 071233), described in the applicable validation SOPs, and discussed briefly below. The validation of radionuclide data using QA/QC samples and other methods may have resulted in the rejection of data or the assignment of various qualifiers to individual sample results.

The MDC for each radionuclide is defined as the minimum activity concentration the analytical laboratory equipment can detect in 95% of the analyzed samples and is used to assess analytical performance.

Uncertainty and MDC results for tritium have been modified in the same manner as the analytical results to account for the bound water found in silica gel used for sample collection.

The PBs and method blanks are used to measure bias and assess potential cross-contamination of samples during preparation and analysis. Blank results should be less than the MDC for each radionuclide.

Laboratory duplicates are used to assess or demonstrate acceptable laboratory method precision at the time of analysis, as well as to assess the long-term precision of an analytical method on various matrices. Duplicate results are used to calculate a duplicate error ratio (DER). The DER is based on 1 standard deviation of the sample and the duplicate sample and should be less than 4.

The LCS serves as a monitor of the overall performance of each step during the analysis, and the acceptance criteria for LCSs are method-specific. For radionuclide methods, LCS %Rs should fall within the control limits of 80% to 120%.

The accuracy of radionuclide analyses is also assessed using MS samples. These samples are designed to provide information about the effect of the sample matrix on the sample preparation procedures and analytical technique. The MS %Rs should be within the acceptance range of 75% to 125%; however, if the sampling result is more than 4 times the amount of the spike added, these acceptance criteria do not apply.

The data quality of the October–December 2009 MDA T tritium data is summarized below.

C-4.1.1 MDA T Pore-Gas Tritium Data

During the October–December 2009 monitoring period, 80 characterization samples and 13 QA/QC samples were collected and submitted for tritium analysis.

Eight tritium results were qualified as estimated (J) because the concentration was greater than five times the concentration of the related analyte in the method blank.

A total of 26 tritium results were qualified as U either because (1) the associated sample concentration was less than or equal to the MDC, or (2) the associated sample concentration was less than or equal to five times the concentration of the related analyte in the method blank.

All tritium data collected in October–December 2009 from MDA T pore gas were used to evaluate tritium trends over the monitoring period.

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), July 1995. “Statement of Work (Formerly Called "Requirements Document") - Analytical Support, (RFP number 9-XS1-Q4257), (Revision 2 - July, 1995),” Los Alamos National Laboratory, Los Alamos, New Mexico. (LANL 1995, 049738)

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), December 2000. “University of California, Los Alamos National Laboratory (LANL), I8980SOW0-8S, Statement of Work for Analytical Laboratories,” Rev. 1, Los Alamos National Laboratory, Los Alamos, New Mexico. (LANL 2000, 071233)

Table C-1.0-1
Data Validation Procedures

Procedure	Title	Effective Date
SOP-5161, Rev. 0	Routine Validation of Volatile Organic Compound Analytical Data	6/10/2008
SOP-5166, Rev. 0	Routine Validation of Gamma Spectroscopy, Chemical Separation Alpha Spectrometry, Gas Proportional Counting, and Liquid Scintillation Analytical Data	6/30/2008

Table C-3.0-1
Analytical Methods for MDA T Pore-Gas Samples

Analytical Method	Analytical Description	Analytical Suite
EPA Method TO-15	Gas Chromatography/Mass Spectrometry	VOC
EPA Method 906	Liquid Scintillation	Tritium

Appendix D

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