EXECUTIVE SUMMARY

This periodic monitoring report summarizes vapor-monitoring activities conducted during the fourth quarter of fiscal year (FY) 2011 at Material Disposal Area (MDA) L, Solid Waste Management Unit 54-006, in Technical Area 54, at Los Alamos National Laboratory. The objectives of vapor monitoring at MDA L are to (1) collect additional vapor samples from vapor-monitoring wells at MDA L and (2) compare sampling results with previously detected volatile organic compound (VOC) concentrations and tritium activities in pore gas beneath and surrounding MDA L.

Vapor monitoring included field screening and collecting vapor samples from 28 and 25 vapor-monitoring wells, respectively. Vapor samples were submitted for laboratory analysis of VOCs and tritium. The results of the detected VOCs in MDA L pore gas during the fourth quarter of FY2011 were generally similar to previous sampling results. The VOC screening evaluation identified 14 VOCs in MDA L pore gas at concentrations exceeding screening levels that are based on groundwater screening levels.

The results of the detected tritium activities in MDA L pore vapor during the fourth quarter of FY2011 were similar to previous sampling results.

In a letter submitted to NMED on November 1, 2011, the U.S. Department of Energy and Los Alamos National Security, LLC, requested to discontinue quarterly vapor sampling at MDA L and recommended biannual vapor sampling at MDA L. A letter was received from NMED on November 14, 2011, granting the suspension of vapor sampling activities until the implementation phase for the selected remedy at MDA L.

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1.0 INTRODUCTION

This periodic monitoring report (PMR) presents the results of vapor-monitoring activities conducted during the fourth quarter of fiscal year (FY) 2011 at Material Disposal Area (MDA) L, Solid Waste Management Unit 54-006, in Technical Area 54 (TA-54), at Los Alamos National Laboratory (LANL or the Laboratory). These activities are being conducted per the requirements outlined in the MDA L vapor-monitoring plan (LANL 2007, 099372), approved with modifications by the New Mexico Environment Department (NMED) (2007, 098999), and the revised table of monitoring wells submitted to NMED in May 2008 (McInroy 2008, 104475) and includes results from monitoring well 54-610786 (NMED 2009, 107653).

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

This report discusses the results obtained during the latest quarterly monitoring activities; however, for comparison, vapor data from the previous three quarterly PMRs, first, second, and third quarters of FY2011 (LANL 2011, 202268; LANL 2011, 204889; LANL 2011, 206490), at MDA L are also included in the data evaluation section of this report. Vapor monitoring included field screening and collecting vapor samples from stainless-steel sampling ports and one packer sampling port in vapor-monitoring wells. All pore-gas samples were submitted for off-site analysis of VOCs and tritium.

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

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

1.1 Site Location and Description

MDA L is located in the east-central portion of the Laboratory (Figure 1.1-1) on Mesita del Buey. It consists of 1 inactive subsurface disposal pit (Pit A), 3 inactive subsurface treatment and disposal impoundments (Impoundments B, C, and D), and 34 inactive disposal shafts (Shafts 1 to 34) (Figure 1.1-2). Although no longer in use, Impoundments B, C, and D and Shafts 1, 13 to 17, and 19 to 34 are considered regulated units under the Resource Conservation and Recovery Act. Pore-gas monitoring has indicated two source areas of the subsurface vapor-phase plume currently being monitored: the eastern source area (Shafts 1 to 28) and the western source area (Shafts 29 to 34) (LANL 2010, 110852). Area L is relatively flat, and most of the overlying surface is paved with asphalt to house ongoing waste management activities, including storage of chemical, hazardous, and mixed low-level wastes managed within container storage units. The regional aquifer beneath MDA L is estimated to be an average depth of approximately 950 ft below ground surface (bgs), based on water-level data from regional well R-38, which is located northeast of MDA L (Koch and Schmeer 2010, 108926).

2.0 SCOPE OF ACTIVITIES

The following activities were completed at MDA L during the fourth quarter of FY2011. Vapor-monitoring activities were conducted from July 14 to August 30, 2011. Table 2.0-1 outlines the NMED-approved vapor-monitoring locations, port depths, and corresponding sampling intervals.

- Samples were field screened and collected in accordance with the current version of Standard Operating Procedure 5074, Sampling Subsurface Vapor.
- Field screening was conducted using a MultiRAE IR Multi-Gas Monitor equipped with a photoionization detector (PID) to measure percent carbon dioxide (%CO_2), percent oxygen (%O_2), and VOC concentrations in parts per million.
- Vapor samples were submitted to off-site analytical laboratories in SUMMA canisters for VOC analysis using U.S. Environmental Protection Agency (EPA) Method TO-15 and in silica-gel columns for tritium analysis using EPA Method 906.
- A total of 183 ports in 28 vapor-monitoring wells (Figure 1.1-2) were field screened for VOCs using the MultiRAE IR PID.
- A total of 105 pore-gas samples (86 characterization and 19 quality assurance [QA]/quality control [QC]) were collected for VOC analysis from 86 ports in 25 vapor-monitoring wells.
- A total of 105 samples (85 characterization and 20 QA/QC) were collected for tritium analysis from 85 ports in 24 vapor-monitoring wells.

All analytical data were subject to QA/QC and data validation reviews in accordance with Laboratory guidance and procedures. Field duplicate samples were collected at a minimum frequency of 1 for every 10 samples. The QA/QC and data validation reviews for MDA L pore-gas data are presented in Appendix C.

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

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

The pore-gas field-screening results are discussed in section 4, and the pore-gas analytical results are discussed in section 5. Any deviations from the scope of activities presented in the approved MDA L vapor-monitoring plan (LANL 2007, 099372), approved with modifications by NMED (2007, 098999), and the revised table of monitoring wells submitted to NMED in May 2008 (McInroy 2008, 104475) are discussed in the following section.

2.1 Deviations

Five ports listed for field screening within Table 2.0-1 were not field screened. These ports were not field screened because of a blockage. The ports include vapor-monitoring wells 54-02001 at 180 ft bgs, 54-02016 at 18 ft bgs, 54-02023 at 60 and 120 ft bgs, and 54-02024 at 120 ft bgs. Field screening of these ports will be attempted again if any future vapor monitoring at MDA L is required.

VOC samples were not collected from vapor-monitoring well 54-02024 at 120 ft bgs because of a blockage; however, a sample was taken at the next port depth of 140 ft bgs.

Borehole 54-24399 was sampled over a shorter depth interval than at which it was historically sampled (Table 2.0-1). For the fourth quarter of FY2011 sampling event, a dual-packer system was used to sample the borehole over an interval from 550 to 551 ft bgs rather than the single-packer system, which has historically been used to sample over the open interval in the borehole from 550 to 608 ft bgs. Any future samples will be collected from the NMED-approved vapor-monitoring sampling interval.

A tritium sample was not collected in vapor-monitoring well 54-24238 at 64 ft bgs. Sampling at this location will be planned if any future vapor monitoring at MDA L is required.

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 L. Because the primary pathway of concern for subsurface VOC vapors is migration to groundwater, an analysis was conducted to evaluate the potential for contamination of groundwater by VOCs in pore gas using SLs based on groundwater SLs. The analysis evaluated the groundwater concentration that would be in equilibrium with the maximum pore-gas concentrations of VOCs detected at MDA L.

The equilibrium relationship between air (pore-gas) 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' = the dimensionless form of Henry's law constant.

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

The screening evaluation was based on groundwater standards or tap water SLs and Henry's law constants that describe the equilibrium relationship between vapor and water concentrations. The source of the Henry's law constants is the NMED technical background document (NMED 2009, 108070) or the EPA regional screening tables (http://www.epa.gov/region6/6pd/rcra_c/pd-n/screen.htm). 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} is in units of μg/m^3, SL is in units of μg/L, and 1000 is a conversion factor from L to m^3. The SLs are the groundwater standards or tap water SLs. The groundwater standards are the EPA maximum contaminant level (MCL) or New Mexico Water Quality Control Commission (NMWQCC) groundwater standard, whichever is lower. If no MCL or NMWQCC standard is available, the NMED tap water SL should be used (NMED 2009, 108070). If no NMED tap water SL is available, the EPA regional tap water SL (http://www.epa.gov/region6/6pd/rcra_c/pd-n/screen.htm) is used. If EPA SLs for carcinogens are used, they should be adjusted to 10^{-5} risk. The numerator in Equation 3.0-3 is the actual concentration of the VOC in pore gas, and the denominator represents the pore-gas concentration needed to exceed the groundwater SL. Therefore, if the SV is less than 1, the concentration of the VOC in groundwater would not exceed the SL, even if the VOC plume were to come in contact with groundwater. Table 3.0-1 presents the calculated concentrations of contaminants in pore gas corresponding to groundwater SLs for the latest and previous three monitoring periods.

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

4.0 FIELD-SCREENING RESULTS

Field screening for the fourth quarter of FY2011 was conducted using a MultiRAE IR Multi-Gas Monitor equipped with a PID to measure %CO_2, %O_2, and VOC concentrations in parts per million. Before each port was sampled, it was purged of stagnant air to ensure formation air was being collected. Each sampling port was then monitored until CO_2 and O_2 readings stabilized at levels representative of subsurface pore-gas conditions. Tables of all field-screening results obtained during the first, second, third, and fourth quarters FY2011 sampling events at MDA L are provided in Appendix D and sorted by vapor-monitoring well ID and depth. The CO_2, O_2, and PID field-screening methods and results are discussed further in Appendix B.

5.0 ANALYTICAL DATA RESULTS

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

5.1 VOC Results and Screening Evaluation

VOC results from the fourth quarter of FY2011 and the previous three vapor-monitoring quarters are summarized in tables and are provided in Appendix D. Plate 1 shows VOCs detected by vapor-monitoring well location during the fourth quarter of FY2011 sampling. Data associated with the previous three monitoring quarters (first, second, and third quarter of FY2011) are included for comparison purposes only.

A total of 29 VOCs were detected in MDA L pore gas during the fourth quarter of FY2011, and the results are generally similar to previous sampling results. The VOCs consistently detected each quarter and at most locations include carbon tetrachloride; chloroform; dichlorodifluoromethane; 1,1-dichloroethane; 1,2-dichloroethane; 1,1-dichloroethene; 1,2-dichloropropane; methylene chloride; tetrachloroethene (PCE); 1,1,2-trichloro-1,2,2-trifluoroethane; 1,1,1-trichloroethane (TCA); trichloroethene (TCE); and trichlorofluoromethane. All VOC concentrations decrease with depth to total depth (TD) in the deeper ports sampled (332.5 ft bgs in 54-27641, 338 ft bgs in 54-27642, and 354 ft bgs in 54-27643). An anomalous increase in concentrations for multiple VOCs was reported in the deep borehole 54-24399. The field team noted that the site was being paved while sampling was conducted, which may have impacted the sample collected from this open borehole.

The screening evaluation included the 29 detected VOCs in MDA L samples for which there are MCLs, NMWQCC standards, NMED tap water SLs, or EPA regional tap water SLs (Table 3.0-1). Ethyltoluene[4-], n-heptane, and tetrahydrofuran were detected but do not have MCLs, NMWQCC standards, or tap water SLs and were not evaluated.

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

- Dichloroethane[1,2-] was detected in 71 of 86 samples. An SV greater than 1 was observed in 62 samples. The maximum SV calculated was 2500 in vapor-monitoring well 54-02089 at 31 ft bgs.
- Dioxane[1,4-] was detected in 2 of 86 samples. An SV greater than 1 was observed in two samples. The maximum SV calculated was 900 in vapor-monitoring well 54-24241 at 73 ft bgs.
- TCE was detected in 84 of 86 samples. An SV greater than 1 was observed in 81 samples. The maximum SV calculated was 750 in vapor-monitoring well 54-24240 at 28 ft bgs.
- Dichloropropane[1,2-] was detected in 75 of 86 samples. An SV greater than 1 was observed in 58 samples. The maximum SV calculated was 467 in vapor-monitoring well 54-24238 at 64 ft bgs.
- PCE was detected in 83 of 86 samples. An SV greater than 1 was observed in 61 samples. The maximum SV calculated was 211 in vapor-monitoring well 54-24242 at 25 ft bgs.
- Methylene chloride was detected in 54 of 86 samples. An SV greater than 1 was observed in 42 samples. The maximum SV calculated was 185 in vapor-monitoring well 54-24238 at 64 ft bgs.
- TCA was detected in 85 of 86 samples. An SV greater than 1 was observed in 73 samples. The maximum SV calculated was 54.4 in vapor-monitoring well 54-02089 at 31 ft bgs.
- Dichloroethane[1,1-] was detected in 83 of 86 samples. An SV greater than 1 was observed in 45 samples. The maximum SV calculated was 12.3 in vapor-monitoring well 54-02089 at 31 ft bgs.
- Dichloroethene[1,1-] was detected in 85 of 86 samples. An SV greater than 1 was observed in 61 samples. The maximum SV calculated was 11.8 in vapor-monitoring well 54-27642 at 175 ft bgs.
- Trichloroethane[1,1,2-] was detected in 1 of 86 samples. All other samples were nondetects. An SV greater than 1 was observed in one sample. The maximum SV calculated was 10 in vapor-monitoring well 54-24239 at 25 ft bgs.
- Chloroform was detected in 83 of 86 samples. An SV greater than 1 was observed in 25 samples. The maximum SV calculated was 8 in vapor-monitoring well 54-27642 at 30 ft bgs.
- Trimethylbenzene[1,2,4-] was detected in 1 of 86 samples. All other samples were nondetects. An SV greater than 1 was observed in one sample. The maximum SV calculated was 4.27 in vapor-monitoring well 54-02022 at 40 ft bgs.
- Benzene was detected in 34 of 86 samples. An SV greater than 1 was observed in 12 samples. The maximum SV calculated was 2.89 in vapor-monitoring well 54-27642 at 175 ft bgs.
- Carbon tetrachloride was detected in 65 of 86 samples. An SV greater than 1 was observed in six samples. The maximum SV calculated was 2 in vapor-monitoring well 54-02089 at 31 ft bgs.

SVs calculated during the fourth quarter of FY2011 were generally similar to SVs presented in previous quarterly PMRs. An anomalous SV >1 was reported for PCE in the deep borehole 54-24399 at 550 ft bgs. VOCs with SVs greater than 1 decrease in concentration with depth in the deeper ports sampled (332.5 ft bgs in 54-27641, 338 ft bgs in 54-27642, and 354 ft bgs in 54-27643).

5.2 Tritium Results

Tritium results from the fourth quarter of FY2011 and previous three vapor-monitoring quarters are summarized in tables and provided on CD in Appendix D. Plate 2 shows tritium detected during the latest sampling quarter by vapor-monitoring well location. Tritium activities detected during the fourth quarter of FY2011 are similar to activities reported during previous sampling events. The maximum tritium activity reported was 327,740 pCi/L in vapor-monitoring well 54-24243 at 75 ft bgs.

6.0 SUMMARY

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

- A total of 29 VOCs were detected in the pore gas beneath MDA L. Thirteen of the 29 VOCs are consistently detected each quarter and at most locations at MDA L. VOC concentrations decrease with depth to TD in the deeper ports sampled (332.5 ft bgs in 54-27641, 338 ft bgs in 54-27642, and 354 ft bgs in 54-27643).
- Fourteen detected VOCs had SVs greater than 1. Similar to previously reported data, the maximum SV calculated was for 1,2-dichloroethane. No regulatory criteria exist for pore gas; therefore, the screening evaluation is a conservative comparison with groundwater SLs to help evaluate any potential for groundwater contamination by VOCs.
- A TCE result exceeding the SL was detected at borehole 54-24399. Although this result is higher than for the previous nine samples collected since 2009, it is consistent with the normal range of variability for this location. The fourth quarter of FY2011 result may differ from more recent results because the sample was collected over a shorter depth interval than previous samples (section 2.1, Table 2.0-1). This most recent sample result does not, however, affect the recommendations for remedial alternatives presented in the September 2011 Corrective Measures Evaluation Report for Material Disposal Area L, Revision 2. (LANL 2011, 205756).
- Tritium was detected in the pore vapor beneath MDA L. The results are similar to previous sampling results.

In a letter submitted to NMED on November 1, 2011 (LANL 2011, 207416), DOE and Los Alamos National Security, LLC, requested to discontinue quarterly vapor sampling at MDA L and recommended biannual vapor sampling at MDA L. A letter was received from NMED on November 14, 2011 (NMED 2011, 207576), granting the suspension of vapor sampling activities until the implementation phase for the selected remedy at MDA L.

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.

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LANL (Los Alamos National Laboratory), October 2007. "Interim Subsurface Vapor-Monitoring Plan for Material Disposal Area L at Technical Area 54, Revision 1," Los Alamos National Laboratory document LA-UR-07-7040, Los Alamos, New Mexico. (LANL 2007, 099372)

LANL (Los Alamos National Laboratory), October 2010. "Corrective Measures Evaluation Report for Material Disposal Area L, Solid Waste Management Unit 54-006, at Technical Area 54, Revision 1," Los Alamos National Laboratory document LA-UR-10-6506, Los Alamos, New Mexico. (LANL 2010, 110852)

LANL (Los Alamos National Laboratory), April 2011. "Periodic Monitoring Report for Vapor-Sampling Activities at Material Disposal Area L, Solid Waste Management Unit 54-006, at Technical Area 54, First Quarter Fiscal Year 2011," Los Alamos National Laboratory document LA-UR-11-2084, Los Alamos, New Mexico. (LANL 2011, 202268)

LANL (Los Alamos National Laboratory), July 2011. "Periodic Monitoring Report for Vapor-Sampling Activities at Material Disposal Area L, Solid Waste Management Unit 54-006, at Technical Area 54, Second Quarter Fiscal Year 2011," Los Alamos National Laboratory document LA-UR-11-4246, Los Alamos, New Mexico. (LANL 2011, 204889)

LANL (Los Alamos National Laboratory), September 2011. "Periodic Monitoring Report for Vapor-Sampling Activities at Material Disposal Area L, Solid Waste Management Unit 54-006, at Technical Area 54, Third Quarter Fiscal Year 2011," Los Alamos National Laboratory document LA-UR-11-0303, Los Alamos, New Mexico. (LANL 2011, 206490)

LANL (Los Alamos National Laboratory), September 2011. "Corrective Measures Evaluation Report for Material Disposal Area L, Solid Waste Management Unit 54-006, at Technical Area 54, Revision 2," Los Alamos National Laboratory document LA-UR-11-4798, Los Alamos, New Mexico. (LANL 2011, 205756)

LANL (Los Alamos National Laboratory), November 1, 2011. "Request to Discontinue Quarterly Vapor Sampling at Material Disposal Area L," Los Alamos National Laboratory letter (EP2011-0360) to J. Kieling (NMED-HWB) from M.J. Graham (LANL) and G.J. Rael (DOE-LASO), Los Alamos, New Mexico. (LANL 2011, 207416)

McInroy, D., May 22, 2008. RE: Clarification NMED Letter Re: MDA L Subsurface V-M Plan Approval w/ Mods. E-mail message to D. Cobrain (NMED) and S. Paris (LANL) from D. McInroy (LANL), Los Alamos, New Mexico. (McInroy 2008, 104475)

NMED (New Mexico Environment Department), November 8, 2007. “Approval with Modifications for the Interim Subsurface Vapor-Monitoring Plan for Material Disposal Area (MDA) L, Solid Waste Management Unit 54-006, at Technical Area 54, Revision 1,” 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, 098999)

NMED (New Mexico Environment Department), September 16, 2009. “Notice of Approval for the Vapor-Monitoring Well Installation Work Plan for Material Disposal Area H, Solid Waste Management Unit 54-004, at Technical Area 54,” 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, 107653)

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

NMED (New Mexico Environment Department), November 14, 2011. “Approval, Request to Discontinue Quarterly Vapor Sampling at Material Disposal Area L,” New Mexico Environment Department letter to G.J. Rael (DOE-LASO) and M.J. Graham (LANL) from J.E. Kieling (NMED-HWB), Santa Fe, New Mexico. (NMED 2011, 207576)

7.2 Map Data Sources

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

Legend Item/Type	Data Source
LANL boundary	LANL Areas Used and Occupied; Los Alamos National Laboratory, Site Planning & Project Initiation Group, Infrastructure Planning Office; 19 September 2007; as published 13 August 2010.
TA boundary	Technical Area Boundaries; Los Alamos National Laboratory, Site Planning & Project Initiation Group, Infrastructure Planning Office; September 2007; as published 13 August 2010.
ER projects	ER Project Locations; Los Alamos National Laboratory, ESH&Q Waste and Environmental Services Division, 2010-2E; 1:2,500 Scale Data; 04 October 2010.
MDAs	Materials Disposal Areas; Los Alamos National Laboratory, ENV Environmental Remediation and Surveillance Program; ER2004-0221; 1:2,500 Scale Data; 23 April 2004.
Paved parking	Paved Parking; Los Alamos National Laboratory, KSL Site Support Services, Planning, Locating and Mapping Section; 06 January 2004; as published 29 November 2010.
Paved road	Paved Road Arcs; Los Alamos National Laboratory, KSL Site Support Services, Planning, Locating and Mapping Section; 06 January 2004; as published 29 November 2010.
Dirt road	Dirt Road Arcs; Los Alamos National Laboratory, KSL Site Support Services, Planning, Locating and Mapping Section; 06 January 2004; as published 29 November 2010.
Road centerlines	Road Centerlines; Los Alamos National Laboratory, KSL Site Support Services, Planning, Locating and Mapping Section; 15 December 2005; as published 29 November 2010.

Legend Item/Type	Data Source
Structure	Structures; Los Alamos National Laboratory, KSL Site Support Services, Planning, Locating and Mapping Section; 06 January 2004; as published 29 November 2010.
Contours	Hypsography, 10 and 100 Foot Contour Interval; Los Alamos National Laboratory, ENV Environmental Remediation and Surveillance Program; 1991.
Fence	Security and Industrial Fences and Gates; Los Alamos National Laboratory, KSL Site Support Services, Planning, Locating and Mapping Section; 06 January 2004; as published 29 November 2010.
Drainage	Modeled Surface Drainage, 1991; Los Alamos National Laboratory, ENV Environmental Remediation and Surveillance Program, ER2002-0591; 1:24,000 Scale Data; Unknown publication date.

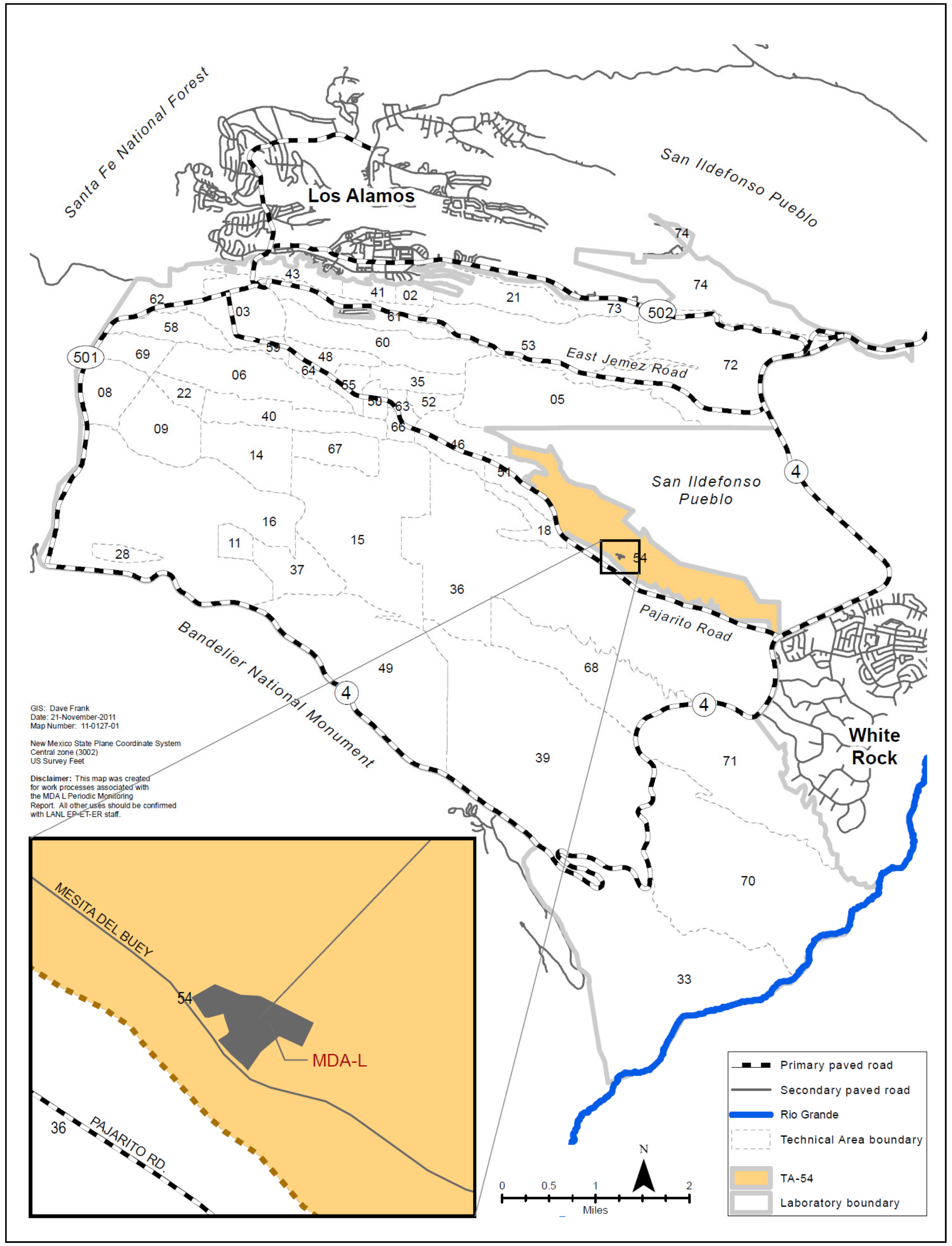

Figure 1.1-1 Location of MDA L in TA-54 with respect to Laboratory TAs and surrounding landholdings

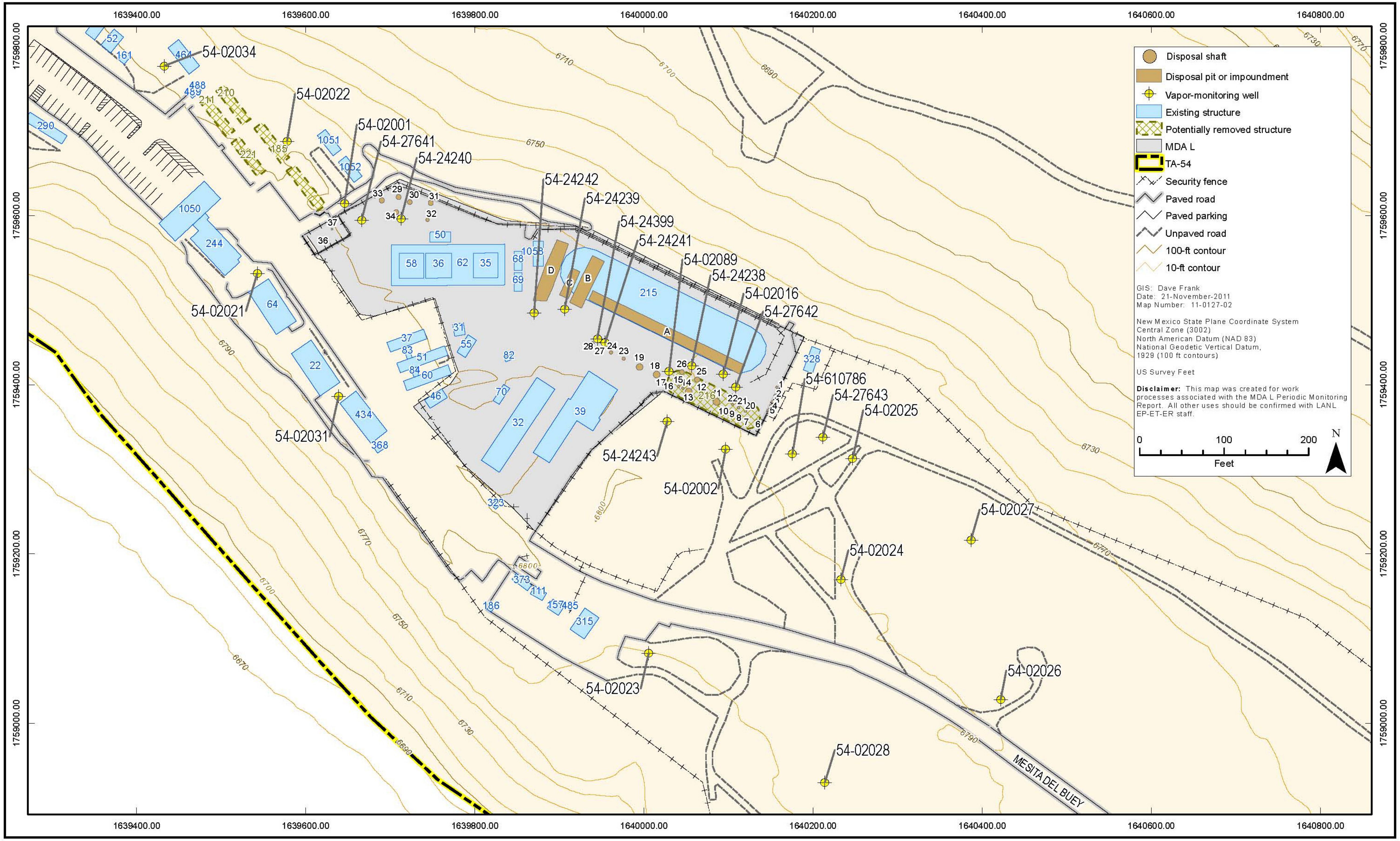

Figure 1.1-2 Locations of MDA L vapor-monitoring wells and associated structures and features

Table 2.0-1
NMED-Approved MDA L Subsurface Vapor-Monitoring Locations, Port Depths, and Corresponding Sampling Intervals

Vapor-Monitoring Well ID	VOC and Tritium Sampling Port-Depth Intervals (ft bgs)
54-01015[a]	37.6 (36–46), 165.4 (182–192), 308.3 (340–352), 333.3 (375–385), 377.7 (425–435), 426.5 (480–490), 462.1 (520–530)
54-01016[a]	30.8 (30–40), 162.2 (178–190), 274.7 (318–324), 336.3 (386–396), 414.3 (473–483), 459.5 (530–540), 517.6 (592–602)
54-02001	20 (17.5–22.5), **40 (37.5–42.5)**, 60 (57.5–62.5), **80 (77.5–82.5)**, 100 (97.5–102.5), **120 (117.5–122.5)**, **140 (137.5–142.5)**, 160 (157.5–162.5), 180 (177.5–182.5)[b], 200 (197.5–202.5)
54-02002	20 (17.5–22.5), **40 (37.5–42.5)**, 60 (57.5–62.5), 80 (77.5–82.5), **100 (97.5–102.5)**, **120 (117.5–122.5)**, 140 (137.5–142.5), 157 (154.5–159.5), **180 (177.5–182.5)**, 200 (197.5–202.5)
54-02016	18 (15.5–20.5)[b], **31 (28.5–33.5), 82 (79.5–84.5)**
54-02020	20 (10–30), 40 (30–50), 60 (50–70), 80 (70–90), 95 (90–110), 120 (110–130), 140 (130–150), 160 (150–170), 180 (170–190), 200 (190–210)
54-02021	**20 (10–30)**, 40 (30–50), 60 (50–70), 80 (70–90), **100 (90–110), 120 (110–130)**, **140 (130–150),** 160 (150–170), 180 (170–190), 198 (190–210)
54-02022	20 (17.5–22.5), **40 (37.5–42.5)**, 60 (57.5–62.5), **80 (77.5–82.5)**, 100 (97.5–102.5), **120 (117.5–122.5)**, **140 (137.5–142.5)**, 160 (157.5–162.5), 180 (177.5–182.5), 200 (197.5–202.5)
54-02023	20 (10–30), **40 (30–50)**, 60 (50–70)[b], 80 (70–90), **100 (90–110), 120 (110–130)**[b], 140 (130–149), **159 (149–169)**, 180 (170–190), 200 (190–210)
54-02024	20 (10–30), **40 (30–50)**, 60 (50–70), 80 (70–90), **100 (90–110)**, **120 (110–130)**[b], 140 (130–150), **160 (150–170)**, 180 (170–190), 200 (190–210)
54-02025	**20 (20)**, 60 (60), **100 (100)**, **160 (160)**, 190 (190)
54-02026	**20 (20)**, 60 (60), **100 (100)**, **160 (160)**, 200 (200), 215 (215)
54-02027	**20 (20)**, 60 (60), **100 (100)**, 160 (160), **200 (200)**, 220 (220), 250 (250)
54-02028	**20 (20)**, 60 (60), **100 (100)**, **160 (160)**, 200 (200), 220 (220), 250 (250)
54-02031	**20 (20)**, 60 (60), **100 (100)**, **160 (160)**, 200 (200), 220 (220), **260 (260)**
54-02034	**20 (20)**, **60 (60),**100 (100), **160 (160)**, 200 (200), 220 (220), **260 (260)**, **300 (300)**
54-02089	13 (13), **31 (31)**, **46 (46)**, 86 (86)
54-24238	44 (43–45), **64 (63–65)**[b], 84 (83–85)
54-24239	**25 (24–26)**, 50 (49–51), **75 (74–76)**, 99.5 (98.5–100.5)
54-24240	**28 (27–29)**, **53 (52–54)**, 78 (77–79), 103 (102–104), **128 (127–129)**, **153 (152–154)**
54-24241	**73 (71–74)**, 93 (92–94), **113 (112–114)**, **133 (132–134)**, 153 (152–154), 173 (172–174), 193 (192–194)
54-24242	**25 (24–26)**, **50 (49–51)**, 75 (74–76), 100 (99–101), 110.5 (109.5–111.5)

Table 2.0-1 (continued)

Vapor-Monitoring Well ID	VOC and Tritium Sampling Port-Depth Interval (ft bgs)
54-24243	**25 (24–26)**, 50 (49–51), **75 (74–76)**, 100 (99–101), **125 (124–126)**
54-24244	plugged and abandoned in January 2010, replaced by 54-610786
54-24399[c]	**550 (550–608)**[d]
54-27641	**32 (29.5–34.5)**, **82 (79.5–84.5)**, **115 (112.5–117.5)**, **182 (179.5–184.5)**, 232 (229.5–234.5), **271 (268.5–273.5)**, **332.5 (330–335)**
54-27642	**30 (27.5–32.5)**, **75 (71.5–76.5)**, **116 (114.5–119.5)**, **175 (172.5–177.5)**, 235 (232.5–237.5), **275 (272.5–277.5)**, **338 (335.5–340.5)**
54-27643	**30 (27.5–32.5)**, **74 (71.5–76.5)**, **117 (114.5–119.5)**, **167 (164.5–169.5)**, 235 (232.5–237.5), **275 (272.5–277.5)**, **354 (351.5–356.5)**
54-610786	**25 (22.5-27.5),** 50 (47.5-52.5), 75 (72.5-77.5), **100 (97.5-102.5), 118.5 (116-121)**

Notes: All depth intervals are to be field screened. Depths highlighted in bold denote intervals where VOC and tritium samples are to be collected.

[a] Vapor-monitoring well is angled. Port depth is depth below ground surface. Port-depth interval is length along borehole.

[b] Field screening not performed and/or sample not collected during the fourth quarter of FY2011.

[c] Open borehole.

[d] During the fourth quarter of FY2011, a dual packer was used. The actual sample depth was 550-551 ft bgs.

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

VOC	Henry's Law Constant[a] (dimensionless)	Groundwater Screening Level (µg/L)	Calculated Concentrations in Pore Gas Corresponding to Groundwater Standard[b] (µg/m³)
Acetone	0.0016	21,800[a]	34,900
Benzene	0.228	5[c]	1140
Butanol[1-]	0.00036[d]	3700[d]	1330
Carbon Tetrachloride	1.1	5[c]	5500
Chlorobenzene	0.13	100[c]	13,000
Chloroform	0.15	80[c]	15,000
Cyclohexane	6.1[d]	13,000[d]	79,300,000
Dichlorodifluoromethane	14	395[a]	5,520,000
Dichloroethane[1,1-]	0.23	25[e]	5750
Dichloroethane[1,2-]	0.048	5[c]	240
Dichloroethene[1,1-]	1.1	5[e]	5500
Dichloroethene[cis-1,2-]	0.17	70[c]	11,900
Dichloroethene[trans-1,2-]	0.38	100[c]	38,000
Dichloropropane[1,2-]	0.12	5[c]	600
Dioxane[1,4-]	0.0002	61.1[a]	12.2
Ethanol	na[f]	na	na
Ethylbenzene	0.323	700[c]	226,000
Ethyltoluene[4-]	na	na	na
Hexane	74	876[a]	64,800,000
Methyl tert-Butyl Ether	0.024	125[a]	2990
Methylene Chloride	0.13	5[c]	650
n-Heptane	na	na	na
Propylene	8[d]	na	na
Tetrachloroethene	0.72	5[c]	3600
Tetrahydrofuran	na	na	na
Toluene	0.272	750[e]	204,000
Trichloro-1,2,2-trifluoroethane[1,1,2-]	22	59,200[a]	1,300,000,000
Trichloroethane[1,1,1-]	0.705	60[e]	42,300
Trichloroethane[1,1,2-]	0.034	5[c]	170

Table 3.0-1 (continued)

VOC	Henry's Law Constant[a] (dimensionless)	Groundwater Screening Level (µg/L)	Calculated Concentrations in Pore Gas Corresponding to Groundwater Standard[b] ($\mu g/m^3$)
Trichloroethene	0.4	5[c]	2000
Trichlorofluoromethane	4	1290[a]	5,150,000
Trimethylbenzene[1,2,4-]	0.25[d]	15[d]	3750
Trimethylbenzene[1,3,5-]	0.36	370[d]	133,000
Vinyl Chloride	1.11	1[e]	1110
Xylene[1,2-]	0.213	620[e]	132,000
Xylene[1,3-]+Xylene[1,4-]	0.28	620[e]	174,000

[a] Henry’s law constants and SLs from NMED (2009, 108070) unless otherwise noted.

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

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

[d] Henry’s law constants and SLs from EPA regional screening tables (http://www.epa.gov/region06/6pd/rcra_c/pd-n/screen.htm). Adjusted to 10^{-5} risk for carcinogens.

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

[f] na = Not available.

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

VOC	Maximum Pore-Gas Concentration ($\mu g/m^3$)	Calculated Concentrations in Pore Gas Corresponding to Groundwater Standard ($\mu g/m^3$)[a]	SV (unitless)[b]
Benzene	3300	1140	**2.89**
Carbon Tetrachloride	11,000	5500	**2**
Chlorobenzene	1400	13,000	0.108
Chloroform	120,000	15,000	**8**
Cyclohexane	7400	79,300,000	0.0000933
Dichlorodifluoromethane	36,000	5,524,324	0.00652
Dichloroethane[1,1-]	71,000	5750	**12.3**
Dichloroethane[1,2-]	600,000	240	**2500**
Dichloroethene[1,1-]	65,000	5500	**11.8**
Dichloroethene[trans-1,2-]	1800	38,000	0.0474
Dichloropropane[1,2-]	280,000	600	**467**
Dioxane[1,4-]	11,000	12	**900**
Ethylbenzene	5000	226,100	0.0221
Ethyltoluene[4-]	13,000	na[c]	na
Hexane	9700	64,824,000	0.00015
Methylene Chloride	120,000	650	**185**
n-Heptane	4300	na	na
Tetrachloroethene	760,000	3600	**211**
Tetrahydrofuran	33,000	na	na
Toluene	17,000	204,000	0.0833
Trichloro-1,2,2-	1,200,000	1,302,162,162	0.000922
Trichloroethane[1,1,1-]	2,300,000	42,300	**54.4**
Trichloroethane[1,1,2-]	1700	170	**10**
Trichloroethene	1,500,000	2000	**750**
Trichlorofluoromethane	22,000	5,152,941	0.00427
Trimethylbenzene[1,2,4-]	16,000	3750	**4.27**
Trimethylbenzene[1,3,5-]	5300	133,200	0.0398
Xylene[1,2-]	11,000	132,060	0.0833
Xylene[1,3-]+Xylene[1,4-]	33,000	174,000	0.190

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

[b] Calculated using Equation 3.0-3. If the SV is less than 1, the concentration of the VOC in pore gas does not have the potential to exceed the groundwater screening level. Screening values greater than 1 are in bold.

[c] na = Not available.