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Periodic Monitoring Report for Vapor-Sampling Activities at Material Disposal Area V, Consolidated Unit 21-018(a)-99, at Technical Area 21, November 2009

Los Alamos
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Prepared by the Environmental Programs Directorate

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EXECUTIVE SUMMARY

This periodic monitoring report summarizes the latest results of the vapor-monitoring activities conducted during November 2009 at Material Disposal Area (MDA) V, Consolidated Unit 21-018(a)-99, within Technical Area 21 at Los Alamos National Laboratory. The objectives of vapor monitoring at MDA V were (1) to collect additional samples from vapor-monitoring wells previously sampled at MDA V and (2) to compare the results with previously detected tritium activities in pore gas beneath MDA V.

To define the vertical extent of tritium and to measure tritium activity over time, two new vapor-monitoring wells were installed in 2009 within 10 ft of the location of borehole 21-24524, which was plugged and abandoned in June 2006. These new wells retained the location identification number of 21-24524, with an additional designation of west (21-24524W) and south (21-24524S) to indicate their locations relative to former location 21-24524.

To date, vapor monitoring wells 21-24524W and 21-24524S have been sampled for two quarters. The first quarterly sampling was completed in August and October 2009 and consisted of one sampling event. The second quarterly sampling was completed in November 2009 and consisted of one sampling event. This report presents sample data collected during the second quarter.

Vapor data collected from second quarter samples are presented and compared in this report. Pore-gas data from the previous quarter of vapor sampling at MDA V (August and October 2009) and initial site sampling results from years 2005–2006 are also presented and compared with the second quarter data, as appropriate, for assessing trends over time.

Tritium activities measured from the second quarter samples collected from vapor-monitoring wells 21-24524W and 21-24524S are similar to those reported during the first quarter with two peak occurrences of tritium activity followed by decreases in activity with increased depth. Both quarterly sampling activities are lower than sampling activities reported during the 2005–2006 investigation.

Quarterly sampling of vapor-monitoring wells 21-24524W and 21-24524S will continue, and the results will be presented in the July and October 2010 periodic monitoring reports

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1.0 INTRODUCTION

This report presents the results of vapor-monitoring activities conducted during November 2009 at Material Disposal Area (MDA) V, Consolidated Unit 21-018(a)-99, in Technical Area 21 (TA-21) at Los Alamos National Laboratory (LANL or the Laboratory) (Figure 1.0-1). These activities were conducted per the requirements outlined in the approved MDA V well installation work plan (LANL 2009, 106760; NMED 2009, 107304). Information on radioactive materials and radionuclides, including the results of sampling and analysis of radioactive constituents, is voluntarily provided to New Mexico Environment Department (NMED) in accordance with U.S. Department of Energy policy.

The objectives of the MDA V vapor-monitoring activities were (1) to collect additional vapor samples from vapor-monitoring wells previously sampled at MDA V and (2) to compare the results with previously detected tritium activities beneath MDA V.

To define the vertical extent of tritium and to measure tritium activity over time, new vapor-monitoring wells were installed in 2009 within 10 ft of the location of borehole 21-24524, which was plugged and abandoned in June 2006. These wells retained the location identification number of 21-24524, but with an additional designation of west (21-24524W) and south (21-24524S) to indicate their locations relative to former location 21-24524 (Figure 1.0-2). Vapor-monitoring well 21-24524W has seven ports with depths from 45 ft below ground surface (bgs) to 380 ft bgs, and vapor-monitoring well 21-24524S has two ports located at depths of 680 ft bgs and 715 ft bgs. Figure 1.0-3 shows a schematic design of the vapor-monitoring wells. Data collected from these two well locations are presented as a single well system in this report.

To date, vapor-monitoring wells 21-24524W and 21-24524S have been sampled for two quarters. The first quarterly sampling was completed in August and October 2009 (LANL 2009, 108134) and consisted of one sampling event. The second quarterly sampling was completed in 2009 and consisted of one sampling event. This report presents sample data collected during the second quarter.

Table 1.0-1 summarizes and clarifies MDA V vapor-monitoring well 21-24524 sampling quarters, events, and dates. All pore-gas samples were submitted for off-site analysis of tritium.

This report primarily presents and discusses all results obtained during the second quarter monitoring activities; however, first quarter vapor data and vapor data collected in the 2005 and 2006 investigations (LANL 2006, 094361) are also included in the data evaluation section of this report, as appropriate, for comparison and for assessing trends over time.

1.1 Site Location and Description

MDA V is located within TA-21 on DP Mesa (Figure 1.0-1). This MDA included three cobble- and gravel-filled absorption beds measuring 25 ft × 220 ft × 5–6 ft that were removed in 2005 and replaced by soil covered with aggregate-based graveled pavement and native grasses. The entire MDA V site measures approximately 0.88 acres in size. A recently constructed haul road for MDA B runs along the northwest perimeter.

The edge of BV Canyon, which is a tributary to Los Alamos Canyon, is approximately 75 ft south of the location of the former absorption beds. The entire site was regraded following sampling and removal activities in 2005 and has best management practices installed, including straw waddles and revegetation with native grass seed. The top of the regional aquifer is approximately 1300 ft bgs at MDA V, based on nearby water-level information from regional wells R-7, Otowi-4, and R-8 (LANL 2004, 087358; Kleinfelder 2005, 091693).

The MDA V investigation report (LANL 2007, 098942) presents further details regarding historical operations and past investigation activities.

2.0 SCOPE OF ACTIVITIES

As directed by the approved MDA V well installation work plan (LANL 2009, 106760; NMED 2009, 107304), two quarterly pore-gas field-screening and sampling activities have been completed at vapor-monitoring wells 21-24524W and 21-24524S (Figure 1.0-2 and Table 2.0-1).

During November 2009, 10 pore-gas samples (9 characterization and 1 quality assurance/quality control (QA/QC) were collected for tritium analysis from seven of seven ports in well 21-24524W, and two of two ports in well 21-24524S. Field duplicate (FD) samples were collected at a minimum frequency of 1 for every 10 samples. Table 2.0-1 summarizes the November 2009 pore-gas sampling depths and sample collection dates by well location. Table 2.0-2 summarizes the November 2009 samples collected at MDA V vapor-monitoring wells 21-24524W and 21-24524S 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 an off-site analytical laboratory for tritium analysis using U.S. Environmental Protection Agency (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 (COC) forms and sample collection logs (SCLs) are provided on a CD (Appendix D). No investigation-derived waste was generated during execution of vapor-monitoring activities at MDA V.

The November 2009 pore-gas field-screening results are presented in section 4, and the November 2009 pore-gas analytical results are presented in section 5. Any deviations from the scope of activities presented in the approved MDA V well installation work plan (LANL 2009, 106760; NMED 2009, 107304) are presented in the following section.

2.1 Deviations

There were no deviations from the approved MDA V well installation work plan (LANL 2009, 106760; NMED 2009, 107304).

3.0 REGULATORY CRITERIA

There are no applicable standards for tritium extracted from pore vapor.

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 oxygen ($\%O_2$) levels at each sampling port had stabilized at values representative of subsurface pore-gas conditions. Further details are provided in Appendix B. Table 4.0-1 presents a summary of all field-screening results obtained during the November 2009 sampling events at vapor-monitoring wells 21-24524W and 21-24524S.

Atmospheric information was obtained from http://www.wunderground.com/history/airport/KLAM for the day of sampling using the closest Laboratory weather station to MDA V (KLAM Weather Station, Los Alamos Airport, latitude 35.83°, longitude 106.22°). Table 4.0-2 summarizes the barometric pressure, temperature, and relative humidity for the sampling date.

5.0 ANALYTICAL DATA RESULTS

Analytical results for tritium were produced from laboratory analysis of vapor collected in silica gel columns and analyzed using EPA Method 906.0. 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 the November 2009 MDA V pore-gas data are presented in Appendix C. All validated analytical results from pore-gas sampling during this sampling period are presented on a CD in Appendix D.

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

5.1 Pore-Vapor Tritium Results

The results of all tritium data collected at vapor-monitoring well location 21-24524 are summarized in Table 5.1-1. For clarity, data in Figure 5.1-1 are presented as undifferentiated for vapor-monitoring well 21-24524 rather than for 21-24524W and 21-24524S individually. Certain activity trends observed during the November 2009 sampling period in vapor-monitoring wells 21-24524W and 21-24524S (Figure 5.1-1) are similar to those reported in August and October 2009 (LANL 2009, 108134).

Consistent with the first quarter (August and October 2009) results discussed below, second quarter results (November 2009) include the following.

- Vapor-port samples collected between depths of 45 and 302.5 ft bgs (ports 1–5) indicated two peaks in tritium activity. The first peak of 44,020 pCi/L was detected at a depth of 42.5 to 47.5 ft bgs (port 1), and the second peak of 67,924 pCi/L was detected at a depth of 300 to 305 ft bgs (port 5).
- Tritium activity decreased to 7649 pCi/L at 327.5 to 332.5 ft bgs (port 6), increased slightly to 10,458 pCi/L at a depth of 377.5 to 382.5 ft bgs (port 7), and decreased to 349 pCi/L and 464 pCi/L, respectively, at depths of 677.5 to 682.5 ft bgs (port 10) and 712.5 to 717.5 ft bgs (port 11).

Comparisons between the first quarter (August and October 2009) and second quarter (November 2009) vapor-port monitoring samples as well as samples from the 2005 and 2006 investigations are presented below.

- Second quarter tritium results indicate a similar trend to those seen in the first quarter results.
- There was a peak of tritium activity (18,980 pCi/L in August and October 2009 and 44,020 pCi/L in November 2009) at a depth of 42.5 to 47.5 ft bgs (port 1).
- There was a higher peak of tritium activity (46,830 pCi/L in August and October 2009 and 67,924 pCi/L in November 2009) occurring at a depth of 300 to 305 ft bgs (port 5).
- Below port 5, tritium activities decreased toward total depth (TD).
- The highest tritium activity from the second quarter sampling of 67,924 pCi/L showed an increase from the first quarter sampling of 46,830 pCi/L, occurring at 300 to 305 ft bgs (port 5).
- Two samples collected during second quarter sampling (one from each of the deepest vapor ports [10 and 11] at depths of 677.5 to 682.5 ft bgs and 712.5 to 717.5 ft bgs, respectively), had activities of 349 pCi/L and 464 pCi/L during November 2009 sampling. The August and October 2009 samples from ports 10 and 11 had activities of 495 pCi/L and 1713 pCi/L, respectively.

- The second quarter tritium activities were higher than those of the first quarter results, from a depth of 45 to 302.5 ft bgs; however, they were lower in the bottom two depths sampled. The largest change observed occurred at depths between 42.5 to 47.5 ft bgs (port 1), which had an activity of 18,980 pCi/L in August and October 2009 and 44,020 pCi/L in November 2009.
- Second and first quarter tritium activities continue to be lower than activities from samples collected during the 2005 and 2006 investigations. The maximum tritium activity during the 2005 and 2006 investigations was 271,192 pCi/L at depths between 379 to 380 ft bgs. In comparison, tritium activities from the first and second quarter data at depths between 377.5 to 382.5 ft bgs were 9808 pCi/L and 10,458 pCi/L, respectively.

6.0 SUMMARY

Vapor-monitoring wells 21-24524W and 21-24524S were sampled in November 2009 and the results of the second quarter monitoring activities indicate trends similar to those reported during first quarter monitoring activities (LANL 2009, 108134).

Consistent with previous results, the highest tritium activities occurred at depths between 300 to 305 ft bgs (port 5), at activities of 46,830 pCi/L in August and October 2009 and 67,924 pCi/L in November 2009. Below port 6, tritium activities decreased toward TD.

Quarterly vapor-monitoring activities will continue at MDA V per the requirements outlined in the approved MDA V well installation work plan (LANL 2009, 106760; NMED 2009, 107304). Sampling of vapor-monitoring wells 21-24524W and 21-24524S will continue and the results will be presented in the July and October 2010 periodic monitoring reports.

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), June 2004. "Investigation Work Plan for Consolidated Unit 21-018(a)-99, Material Disposal Area V, at Technical Area 21," Los Alamos National Laboratory document LA-UR-04-3699, Los Alamos, New Mexico. (LANL 2004, 087358)

LANL (Los Alamos National Laboratory), October 2006. "Investigation Report for Consolidated Unit 21-018(a)-99, Material Disposal Area V, at Technical Area 21," Los Alamos National Laboratory document LA-UR-06-6609, Los Alamos, New Mexico. (LANL 2006, 094361)

LANL (Los Alamos National Laboratory), July 2007. "Investigation Report for Consolidated Unit 21-018(a)-99, Material Disposal Area V, at Technical Area 21, Revision 1," Los Alamos National Laboratory document LA-UR-07-4390, Los Alamos, New Mexico. (LANL 2007, 098942)

LANL (Los Alamos National Laboratory), August 2009. "Vadose Zone Subsurface Characterization and Vapor-Monitoring Well Installation Work Plan for Material Disposal Area V, Consolidated Unit 21-018(a)-99, Revision 1," Los Alamos National Laboratory document LA-UR-09-5021, Los Alamos, New Mexico. (LANL 2009, 106760)

LANL (Los Alamos National Laboratory), December 2009. "Periodic Monitoring Report for Vapor-Sampling Activities at Material Disposal Area V, Consolidated Unit 21-018(a)-99, at Technical Area 21, June to October 2009," Los Alamos National Laboratory document LA-UR-09-8123, Los Alamos, New Mexico. (LANL 2009, 108134)

NMED (New Mexico Environment Department), September 3, 2009. "Approval with Modifications, Vadose Zone Subsurface Characterization and Vapor-Monitoring Well Installation Work Plan for Material Disposal Area V, Consolidated Unit 21-018(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, 107304)

7.2 Map Data Sources

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

Data sources of existing figures used in this report are identified below:

Drainage; County of Los Alamos, Information Services; as published 16 May 2006.

Former Structures of the Los Alamos Site; Los Alamos National Laboratory, Waste and Environmental Services Division, EP2008-0441; 1:2,500 Scale Data; 08 August 2008.

Materials Disposal Areas; Los Alamos National Laboratory, ENV Environmental Remediation and Surveillance Program; ER2004-0221; 1:2,500 Scale Data; 23 April 2004.

Paved Road Arcs; Los Alamos National Laboratory, KSL Site Support Services, Planning, Locating and Mapping Section; 06 January 2004; as published 15 January 2009.

Point Feature Locations of the Environmental Restoration Project Database; Los Alamos National Laboratory, Waste and Environmental Services Division, EP2008-0592; 04 November 2008.

Potential Release Sites; Los Alamos National Laboratory, Waste and Environmental Services Division, Environmental Data and Analysis Group, EP2008-0623; 1:2,500 Scale Data; 10 December 2008.

Security and Industrial Fences and Gates; Los Alamos National Laboratory, KSL Site Support Services, Planning, Locating and Mapping Section; 06 January 2004; as published 15 January 2009.

Structures; Los Alamos National Laboratory, KSL Site Support Services, Planning, Locating and Mapping Section; 06 January 2004; as published 15 January 2009.

Technical Area Boundaries; Los Alamos National Laboratory, Site Planning & Project Initiation Group, Infrastructure Planning Office; September 2007; as published 04 December 2008.

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.

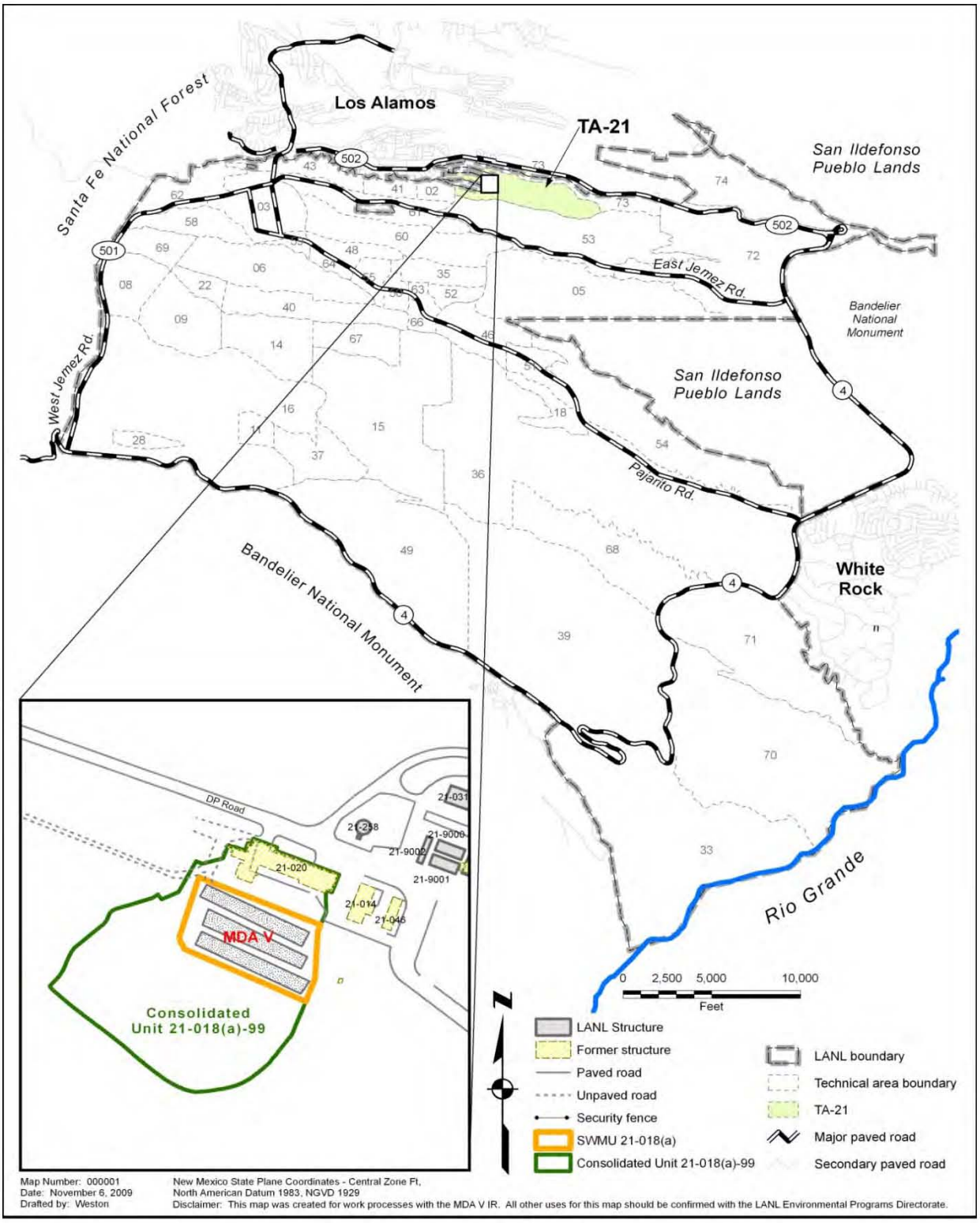

Figure 1.0-1 Location of MDA V at TA-21

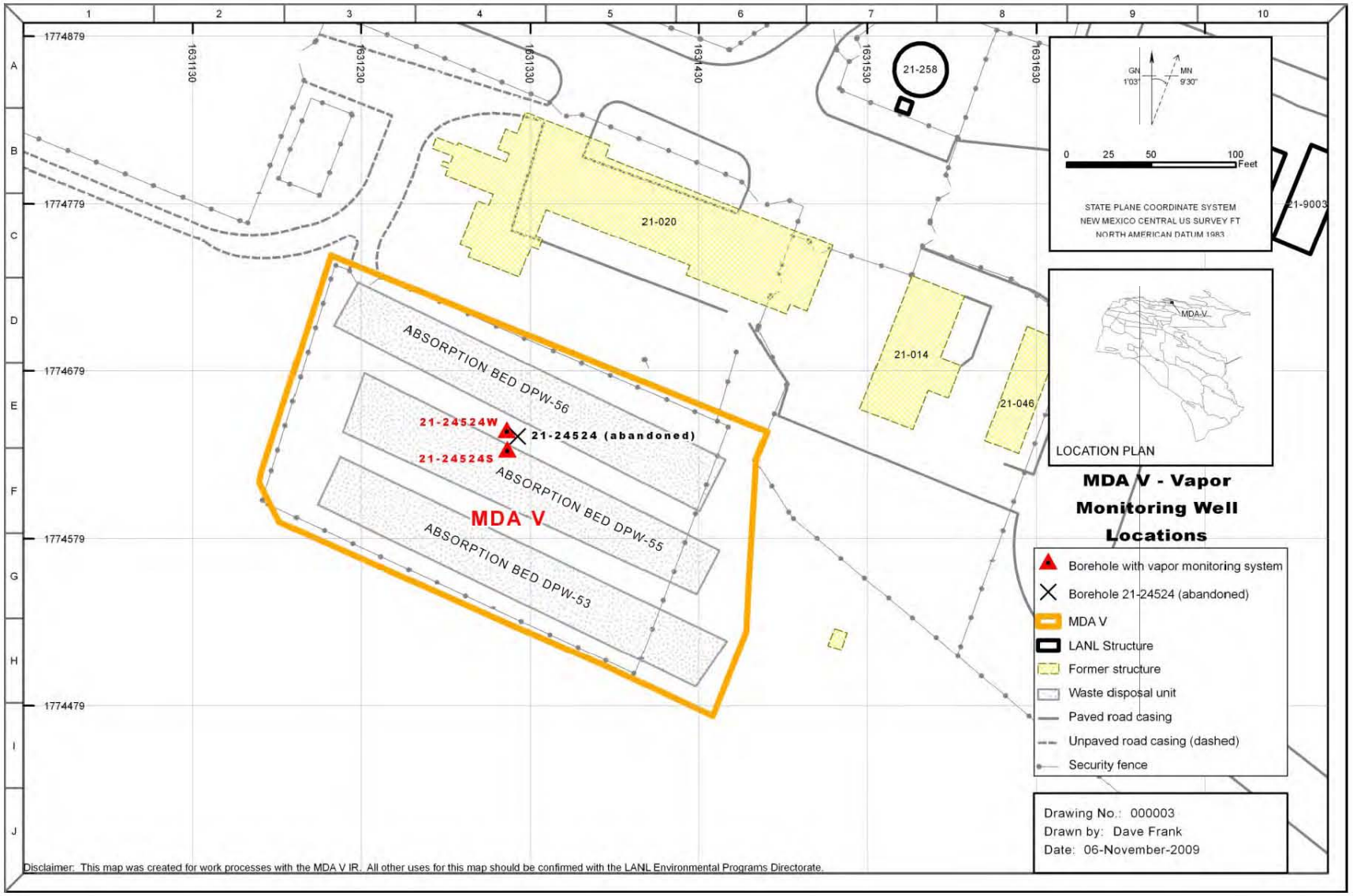

Figure 1.0-2 Locations of MDA V vapor-monitoring wells and associated structures and features

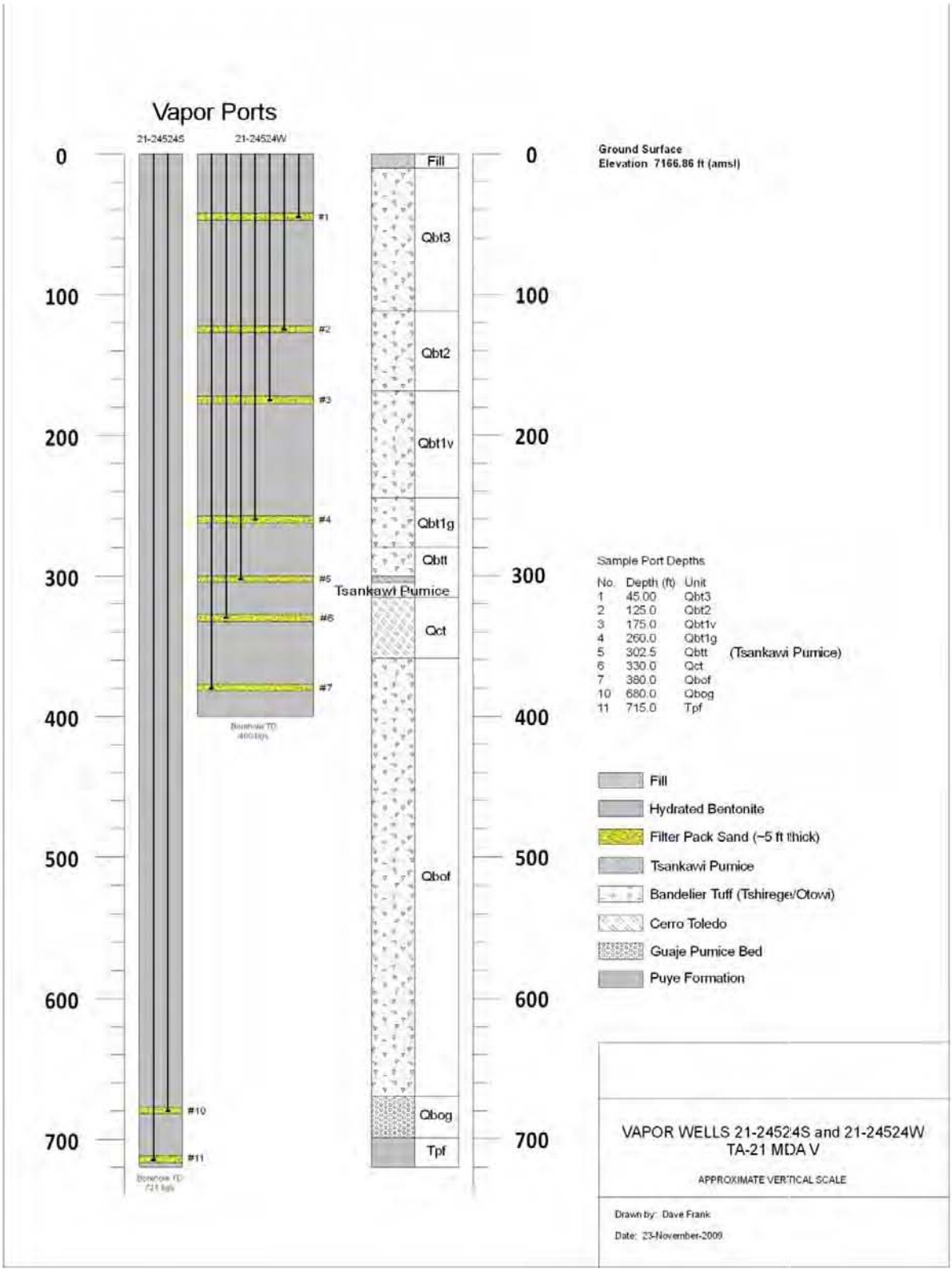

Figure 1.0-3 Schematic of vapor-monitoring wells 21-24524W/21-24524S installation at MDA V

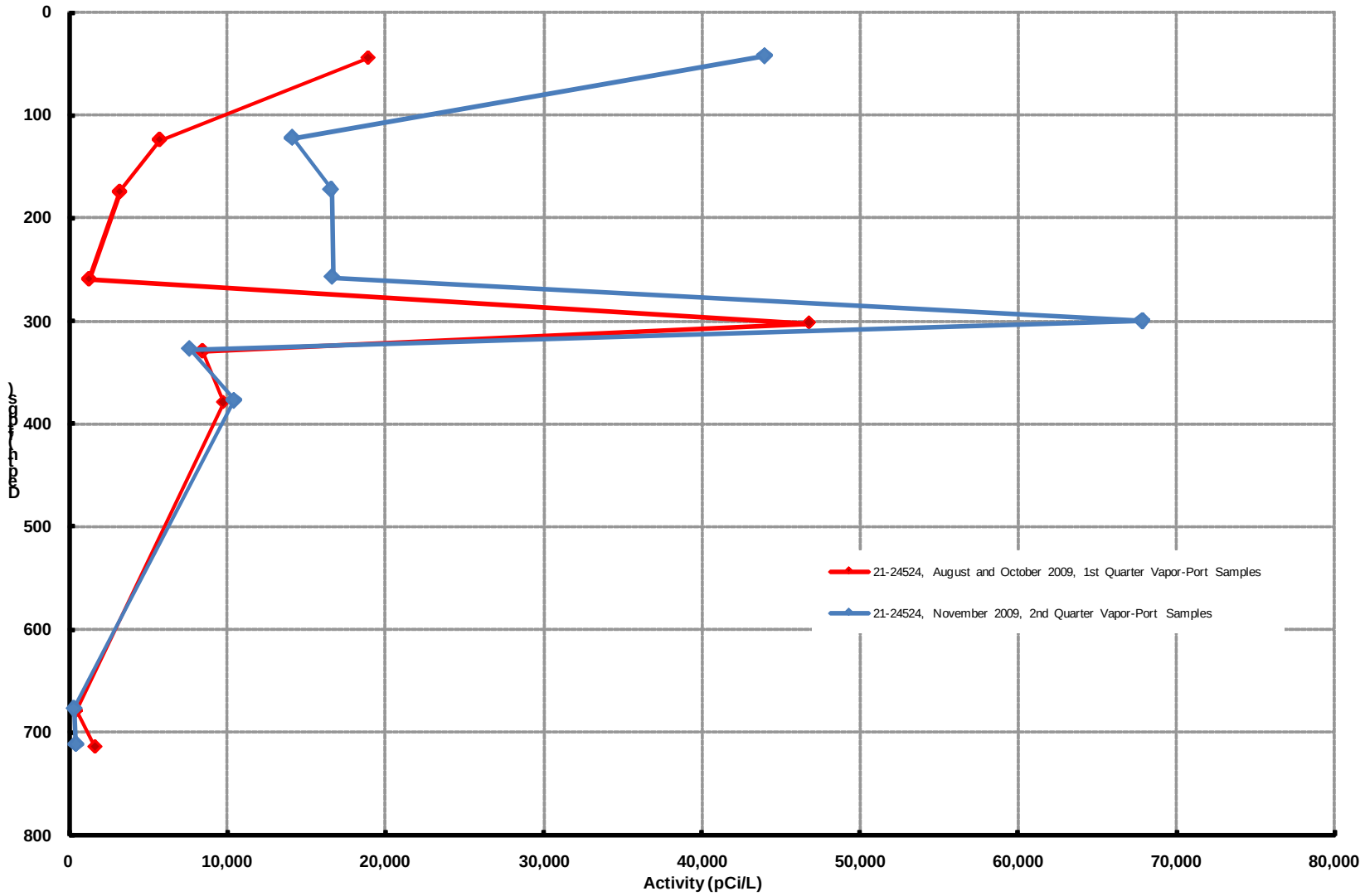

Figure 5.1-1 Vertical profile of tritium vapor-port samples from vapor-monitoring wells 21-24524W and 21-24524S, August, October, and November 2009 sampling

Table 1.0-1
History of Vapor-Monitoring Events at Vapor-Monitoring Well 21-24524

Quarter/Monitoring Event	Months Sampled	Event ID	Vapor-Monitoring Wells Sampled	Associated Report Title
2nd Quarter	November 2009	2442	21-24524S/ 21-24524W	Periodic Monitoring Report for Vapor-Sampling Activities at Material Disposal Area V, Consolidated Unit 21-018(a)-99, at Technical Area 21, November 2009
1st Quarter	August and October 2009	2215/756	21-24524S/ 21-24524W[a]	Periodic Monitoring Report for Vapor-Sampling Activities at Material Disposal Area V, Consolidated Unit 21-018(a)-99, at Technical Area 21, June-October 2009 (LANL 2009, 108134)
2006 Investigation	May–June 2006	9902	21-24524[b]	Investigation Report for Consolidated Unit 21-018(a)-99, Material Disposal Area V, at Technical Area 21 (LANL 2006, 094361)
2005 Investigation	July–August 2005	5782	21-24524	Investigation Report for Consolidated Unit 21-018(a)-99, Material Disposal Area V, at Technical Area 21 (LANL 2006, 094361)

[a] Wells 21-24524S and 21-24524W were completed in 2009 and within 10 ft of original borehole location 21-24524. Wells 21-24524S and 21-24524W were evaluated as a single well.

[b] Vapor monitoring well 21-24524 was abandoned in June 2006.

Table 2.0-1
MDA V Pore-Gas Sampling Depths and Collection Dates, November 2009

Vapor-Monitoring Well ID	Sampling Port	Begin Depth (ft bgs)	End Depth (ft bgs)	First Quarter Date (Event ID 2215)	Second Quarter Collection Date (Event ID 2442)
21-24524W	1	42.5	47.5	8/20/2009	11/23/2009
21-24524W	2	122.5	127.5	8/20/2009	11/23/2009
21-24524W	3	172.5	177.5	8/20/2009	11/23/2009
21-24524W	4	257.5	262.5	8/20/2009	11/23/2009
21-24524W	5	300.0	305.0	8/20/2009	11/23/2009
21-24524W	6	327.5	332.5	8/20/2009	11/23/2009
21-24524W	7	377.5	382.5	8/20/2009	11/23/2009
21-24524S	10	677.5	682.5	10/14/2009	11/23/2009
21-24524S	11	712.5	717.5	10/14/2009	11/23/2009

Note: Event IDs refer to the SCL and COC packages provided in Appendix D.

Table 2.0-2
Summary of Tritium Vapor Samples Collected at MDA V, November 2009

Sample ID	Vapor- Monitoring Well ID	Sampling Port	Depth (ft bgs)	Collection Date	Field QC Type	Request Number
MD21-10-5343	21-24524W	1	42.5–47.5	11/23/2009	n/a[a]	10-660
MD21-10-5344	21-24524W	2	122.5–127.5	11/23/2009	n/a	10-660
MD21-10-5345	21-24524W	3	172.5–177.5	11/23/2009	n/a	10-660
MD21-10-5346	21-24524W	4	257.5–262.5	11/23/2009	n/a	10-660
MD21-10-5347	21-24524W	5	300–305	11/23/2009	n/a	10-660
MD21-10-5348	21-24524W	6	327.5–332.5	11/23/2009	n/a	10-660
MD21-10-5349	21-24524W	7	377.5–382.5	11/23/2009	n/a	10-660
MD21-10-5350	21-24524S	10	677.5–682.5	11/23/2009	n/a	10-660
MD21-10-5351	21-24524S	11	712.5–717.5	11/23/2009	n/a	10-660
MD21-10-5352	21-24524W	5	300–305	11/23/2009	FD[b]	10-660

[a] n/a = Not applicable.

[b] FD = Field duplicate.

Table 4.0-1
Summary of Field-Screening Results, November 2009

Event ID	Collection Date	Sampling Quarter	Location ID	Sampling Port Number	Top Depth (ft bgs)	Bottom Depth (ft bgs)	Percent $\%CO_2$	Percent $\%O_2$
2242	11/23/2009	Second	21-24524W	1	42.5	47.5	2.7	18.5
2242	11/23/2009	Second	21-24524W	2	122.5	127.5	0.4	21.2
2242	11/23/2009	Second	21-24524W	3	172.5	177.5	0.4	20.6
2242	11/23/2009	Second	21-24524W	4	257.5	262.5	0.5	20.2
2242	11/23/2009	Second	21-24524W	5	300.0	305.0	0.4	20.4
2242	11/23/2009	Second	21-24524W	6	327.5	332.5	0.0	20.8
2242	11/23/2009	Second	21-24524W	7	377.5	382.5	0.3	20.4
2242	11/23/2009	Second	21-24524S	10	677.5	682.5	0.1	20.9
2242	11/23/2009	Second	21-24524S	11	712.5	717.5	0.3	19.4

Note: Event IDs refer to the SCL and COC packages provided in Appendix D.

Table 4.0-2
Barometric Pressure, Relative Humidity, and Temperature at KLAM Weather Station during Sample Collection, November 2009

Sampling Quarter	Date of Measurement	Average Barometric Pressure (in Hg)*	Average Relative Humidity (%)*	Average Temperature (°F)*
Second Quarter	11/23/2009	29.98	28	42

* Data obtained from: http://www.wunderground.com/history/airport/KLAM

Table 5.1-1
Summary of Tritium Results for Vapor Samples Collected at Monitoring Well 21-24524, July 2005–November 2009

Sample ID	Vapor-Monitoring Well ID	Depth (ft bgs)	Collection Date	Tritium Result (pCi/L)
2005–2006 Investigation Samples				
MD21-05-61752	21-24524	14–15	07/08/2005	45,334
MD21-06-71202	21-24524	14–15	05/06/2006	134,634
MD21-06-71201	21-24524	379–380	05/06/2006	271,192
1st Quarter, August and October 2009 Samples				
MD21-09-12336	21-24524W	42.5–47.5	8/20/2009	18,980
MD21-09-12337	21-24524W	122.5–127.5	8/20/2009	5791
MD21-09-12338	21-24524W	172.5–177.5	8/20/2009	3268
MD21-09-12339	21-24524W	257.5–262.5	8/20/2009	1324
MD21-09-12340	21-24524W	300–305	8/20/2009	46,830
MD21-09-12341	21-24524W	327.5–332.5	8/20/2009	8495
MD21-09-12342	21-24524W	377.5–382.5	8/20/2009	9808
MD21-09-12343	21-24524S	677.5–682.5	10/14/2009	495
MD21-09-12344	21-24524S	712.5–717.5	10/14/2009	1713
2nd Quarter, November 2009 Samples				
MD21-10-5343	21-24524W	42.5–47.5	11/23/2009	44,020
MD21-10-5344	21-24524W	122.5–127.5	11/23/2009	14,159
MD21-10-5345	21-24524W	172.5–177.5	11/23/2009	16,601
MD21-10-5346	21-24524W	257.5–262.5	11/23/2009	16,664
MD21-10-5347	21-24524W	300–305	11/23/2009	67,924
MD21-10-5348	21-24524W	327.5–332.5	11/23/2009	7649
MD21-10-5349	21-24524W	377.5–382.5	11/23/2009	10,458
MD21-10-5350	21-24524S	677.5–682.5	11/23/2009	349
MD21-10-5351	21-24524S	712.5–717.5	11/23/2009	464

Appendix A

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

A-1.0 ACRONYMS AND ABBREVIATIONS

%R	percent recoveries
bgs	below ground surface
CCV	continuing calibration verification
COC	chain of custody
DER	duplicate error ratio
EPA	Environmental Protection Agency (U.S.)
FD	field duplicate
LANL	Los Alamos National Laboratory
LCS	laboratory control sample
MDA	material disposal area
MDC	minimum detectable concentration
NMED	New Mexico Environment Department
MS	matrix spike
PB	performance blank
QA	quality assurance
QC	quality control
RPF	Records Processing Facility
SCL	sample collection log
SMO	Sample Management Office
SOP	standard operating procedures
SOW	statement of work
TA	technical area
TD	total depth

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 November 2009 sampling activities at Material Disposal Area (MDA) V, Consolidated Unit 21-018(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 Tritium Pore-Gas Field Screening

Field screening was done in accordance with the current version of EP-ERSS-SOP-5074. Before each sampling event, each sample port was purged and monitored with a Landtec GEM2000 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 comes factory-calibrated and is returned to a LANDTEC authorized service facility for service/calibration as needed. As described in Landtec documentation, accuracies for %O_2 and %CO_2 for Landtec instrumentation are +/- 0.5-1.0% and +/-0.3-3.0%, respectively.

All CO_2 and O_2 levels for November 2009 were acceptable. Once purging and field screening was complete, vapor samples for tritium analysis were collected. Field-screening results were recorded on the appropriate sample collection log (SCL) and/or in the field logbook. Field chains of custody (COCs) and SCLs are provided in Appendix D.

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 pulling a pore-gas sample through a canister of silica gel and the sample information recorded on the appropriate SCL (Appendix D). Silica gel column field duplicate samples were also collected at a frequency greater than or equal to 10% per sampling event in accordance with the current version of 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 it at a temperature above 100^{o}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 required that at least 5 g of moisture be collected. After sampling, the 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^{o}C, driving moisture off the silica gel. This moisture was collected and analyzed for tritium by liquid scintillation. The laboratory also weighed the empty canister and calculated the percent moisture of the sample, as the amount of moisture collected divided by the calculated weight of the wet silica gel. The value of the tritium 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 that were performed before, during, and after field investigations. The procedure covers premobilization activities; mobilization to the site; documentation and sample collection activities; sample media evaluation; surveillance; and completion of lessons learned. It is assumed that field investigations involved the use of standard sampling equipment, personal protective equipment, waste management equipment/procedures, and site-control equipment/materials.
Sample Containers and Preservation	Specific requirements/processes for sample containers, preservation techniques, and holding times were based on the U.S. Environmental Protection Agency guidance for environmental sampling, preservation, and quality assurance. Specific requirements were met for each sample and were printed in the sample collection logs provided by the Laboratory's SMO (size and type of container, preservatives, etc.). All samples were preserved by placing them 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 chain of custody. 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 included 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 quality control 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.
Sampling of Sub-Atmospheric Air	Vapor sampling was performed on two monitoring wells in accordance with the current version of EP-ERSS-SOP-5074 and analyzed for tritium. This SOP describes the process of sampling subatmospheric air from vapor ports in monitoring wells and boreholes. The procedure covers presampling activities; SUMMA sampling (a passive collection and containment system of laboratory-quality air samples); adsorbent column sampling; and postsampling activities.

Table B-1.0-2
List of Applicable General Procedures for MDA V 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 November 2009 pore gas samples collected at Material Disposal Area (MDA) V, Consolidated Unit 21-018(a)-99, at 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 blanks, duplicates, matrix spikes (MSs), laboratory control samples (LCSs), initial calibration verifications (ICVs) and continuing calibration verifications (CCVs) 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). 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 November 2009 pore-gas analytical data were obtained from 10 samples (9 characterization samples and 1 field duplicate sample) collected during the second quarter sampling event from vapor-monitoring well locations 21-24524W and 21-24524S. Complete data packages and sample documentation for the second quarter samples are provided in Appendix D (on CD).

C-3.0 RADIONUCLIDE ANALYSIS METHODS

The vapor samples collected in November 2009 were analyzed by EPA Method 906 for tritium (Table C-3.0-1). Table 2.0-2 summarizes all samples collected and the requested analyses. All tritium results are provided on CD in Appendix D.

C-3.1 Radionuclide QA/QC Samples

The minimum detectable concentration (MDC) for tritium in performance blanks (PBs), method blanks, laboratory duplicates, LCSs, and MS samples were 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 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 were 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 were 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 were 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 served as a monitor of the overall performance of each step during the analysis, and the acceptance criteria for LCSs were method-specific. For radionuclide methods, LCS percent recoveries (%Rs) should fall within the control limits of 80% to 120%.

The accuracy of radionuclide analyses was 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 was more than 4 times the amount of the spike added, these acceptance criteria do not apply.

The data quality of the November 2009 MDA V tritium data is summarized below.

C-3.1.1 Tritium Qualified Data

During the November 2009 monitoring period, 10 pore-gas samples (including 1 field duplicate) were collected and submitted for tritium analysis.

No tritium data were rejected and no data quality issues were identified.

No tritium results were qualified.

All validated tritium investigation pore-gas data collected in November 2009 from MDA V pore gas were used to evaluate tritium.

C-4.0 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.

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-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 V Pore-Gas Samples

Analytical Method	Analytical Description	Analytical Suite
EPA Method 906	Liquid Scintillation	Tritium

Appendix D

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