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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, February 2011

Los Alamos
NATIONAL LABORATORY
EST. 1943

Prepared by the Environmental Programs Directorate

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Responsible project manager:

Bruce Wedgeworth		Project Manager	Environmental Programs	5/23/11
Printed Name	Signature	Title	Organization	Date

Responsible LANS representative:

Michael J. Graham		Associate Director	Environmental Programs	5/25/11
Printed Name	Signature	Title	Organization	Date

Responsible DOE representative:

George J. Rael	for	Manager	DOE-LASO	5/26/11
Printed Name	Signature	Title	Organization	Date

EXECUTIVE SUMMARY

This periodic monitoring report summarizes vapor-monitoring activities conducted during February 2011 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). The objectives of vapor monitoring at MDA V are to (1) collect additional vapor samples from vapor-monitoring wells at MDA V and (2) compare sampling results with previously detected tritium activities beneath and surrounding MDA V.

Vapor monitoring included field screening and collecting vapor samples from two vapor-monitoring wells. Vapor samples were submitted for laboratory analysis of tritium. The results of the detected tritium activities in MDA V pore gas during February 2011 were similar to previous sampling results.

The Laboratory will continue quarterly vapor monitoring in connection with remedial actions currently in progress at MDA B.

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1.0 INTRODUCTION

This periodic monitoring report (PMR) presents the results of vapor-monitoring activities conducted during February 2011 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). These activities are being conducted per the requirements outlined in the approved MDA V well installation work plan (LANL 2007, 098944; NMED 2007, 098946) and the New Mexico Environment Department's (NMED's) November 23, 2010, and March 8, 2011, letters to the Laboratory (NMED 2010, 111393; NMED 2011, 201232).

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

This report discusses the results obtained during the latest monitoring activities; however, for comparison, vapor data from the previous three PMRs, November 2009, February 2010, and April 2010 (LANL 2010, 109094; LANL 2010, 109832; LANL 2010, 110834), for MDA V are also included in the data evaluation section of this report. Vapor monitoring included field screening and collecting vapor samples from stainless-steel sampling ports in vapor-monitoring wells. All pore-gas samples were submitted for off-site analysis of tritium.

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 policy.

1.1 Site Location and Description

MDA V is located within TA-21 on DP Mesa (Figure 1.1-1). This MDA included three cobble- and gravel-filled absorption beds measuring 25 ft × 220 ft × 5–6 ft deep 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; a 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 best management practices have been installed, including straw wattles and revegetation with native grass seed. The top of the regional aquifer is approximately 1300 ft below ground surface (bgs) at MDA V, based on nearby water-level information from regional wells R-6, R-7, Otowi-4, and R-8 (LANL 2004, 087358; Kleinfelder 2005, 091693).

2.0 SCOPE OF ACTIVITIES

The following activities were completed at MDA V during February 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 to measure percent carbon dioxide (%CO_2) and percent oxygen (%O_2).
- Vapor samples were submitted to off-site analytical laboratories in silica gel columns for tritium analysis using U.S. Environmental Protection Agency (EPA) Method 906.

- A total of 9 ports in 2 vapor-monitoring wells (Figure 2.0-1) were field screened using the MultiRAE IR Multi-Gas Monitor.
- A total of 11 samples (9 characterization and 2 quality assurance [QA]/quality control [QC]) were collected for tritium analysis from 9 ports in 2 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 V pore-gas data are presented in Appendix C.

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

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 4.0, and the pore-gas analytical results are discussed in section 5.0. Any deviations from the scope of activities presented in the approved MDA V well installation work plan (LANL 2007, 098944; NMED 2007, 098946) and NMED’s letters to the Laboratory (NMED 2010, 111393; NMED 2011, 201232) are presented in the following section.

2.1 Deviations

There were no deviations during the February 2011 sampling event.

3.0 REGULATORY CRITERIA

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

4.0 FIELD-SCREENING RESULTS

February 2011 field screening was conducted using a MultiRAE IR Multi-Gas Monitor to measure %CO_2 and %O_2. 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 November 2009, February 2010, April 2010, and February 2011 sampling events at MDA V are provided in Appendix D and sorted by vapor-monitoring well ID and depth. The CO_2 and O_2 field-screening methods and results for the February 2011 sampling event 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 silica gel columns for tritium analysis using EPA Method 906. The tritium sampling results are discussed below.

5.1 Tritium Results

Tritium results from the February 2011 sampling event and the previous three vapor-monitoring events are summarized in tables and are provided in Appendix D. Figure 5.1-1 shows tritium activities detected during the latest sampling event for vapor-monitoring wells 21-24524W and 21-24524S. Figure 5.1-2 shows a vertical profile of tritium for the February 2011 sampling event and the previous three vapor-monitoring events; data are presented for one vapor-monitoring well system rather than separately for 21-24524W and 21-24524S. Tritium activities detected during the February 2011 sampling event are similar to activities reported during previous sampling events. Two peaks in tritium activity are reported, one at 45 ft bgs and a larger peak at 302.5 ft bgs. Tritium activities reported from samples collected below 302.5 ft bgs are considerably lower. For the February 2011 sampling event, the maximum tritium activity of 49,600 pCi/L was reported from 302.5 ft bgs.

6.0 SUMMARY

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

Additional monitoring of tritium vapor is not needed to support corrective action decisions for MDA V. Additional vapor-monitoring activities will be performed at MDA V to support remediation of MDA B, as described in NMED's November 23, 2010, and March 8, 2011, letters to the Laboratory (NMED 2010, 111393; NMED 2011, 201232), and results will be presented in subsequent 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 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), April 2010. "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 National Laboratory document LA-UR-10-1758, Los Alamos, New Mexico. (LANL 2010, 109094)

LANL (Los Alamos National Laboratory), July 2010. "Periodic Monitoring Report for Vapor-Sampling Activities at Material Disposal Area V, Consolidated Unit 21-018(a)-99, at Technical Area 21, February 2010," Los Alamos National Laboratory document LA-UR-10-3951, Los Alamos, New Mexico. (LANL 2010, 109832)

LANL (Los Alamos National Laboratory), October 2010. "Periodic Monitoring Report for Vapor-Sampling Activities at Material Disposal Area V, Consolidated Unit 21-018(a)-99, at Technical Area 21, April 2010," Los Alamos National Laboratory document LA-UR-10-6036, Los Alamos, New Mexico. (LANL 2010, 110834)

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), November 24, 2010. "Periodic Monitoring Report for Vapor-Sampling Activities at Material Disposal Area V, Consolidated Unit 21-018(a)-99, at Technical Area 21, April 2010," New Mexico Environment Department letter to G.J. Rael (DOE-LASO) and M. Graham (LANL) from J.P. Bearzi (NMED-HWB), Santa Fe, New Mexico. (NMED 2010, 111393)

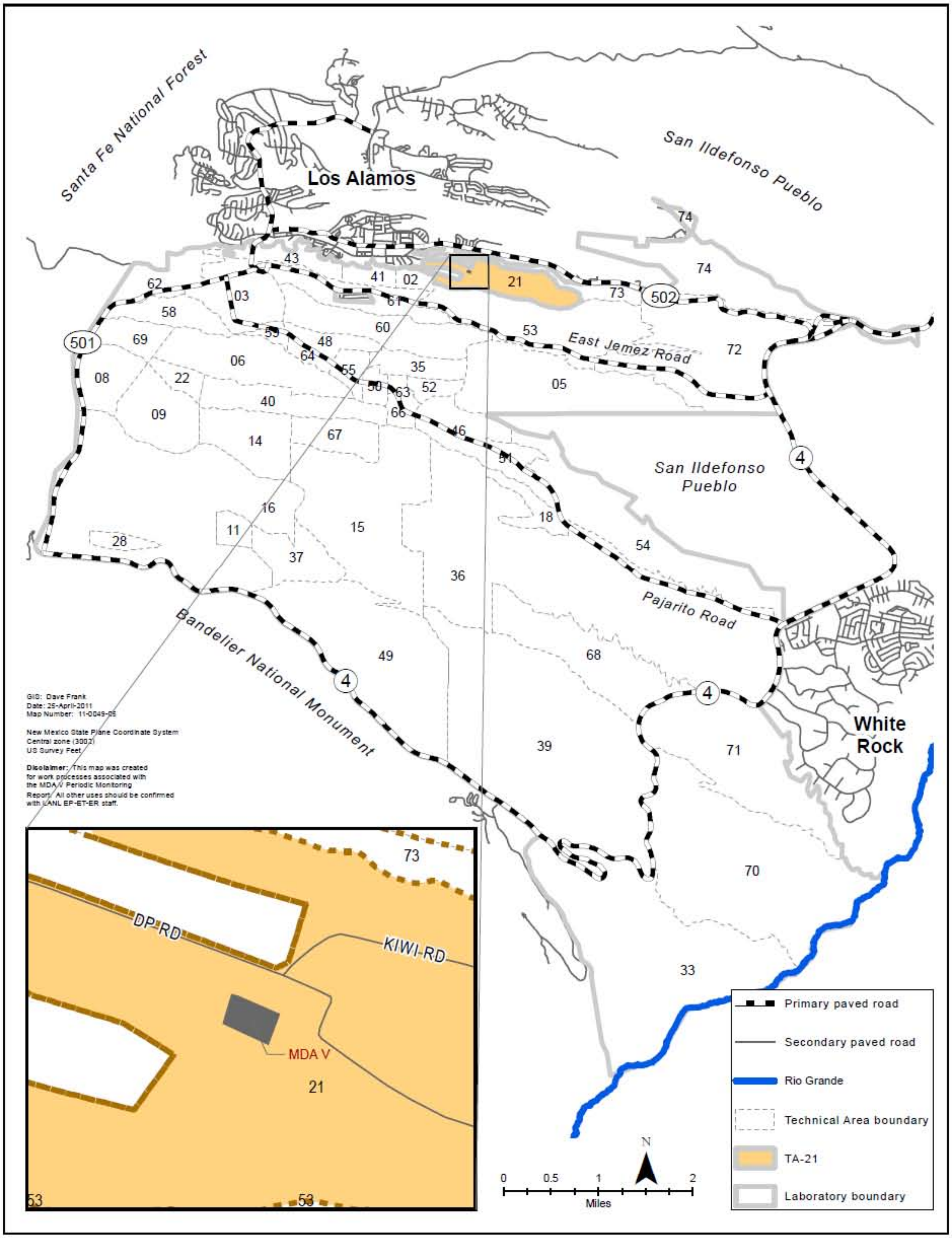
NMED (New Mexico Environment Department), March 8, 2011. "Extended Tritium Vapor Sampling, Material Disposal Area (MDA) V, Technical Area 21," New Mexico Environment Department letter to G.J. Rael (DOE-LASO) and M. Graham (LANL) from J.P. Bearzi (NMED-HWB), Santa Fe, New Mexico. (NMED 2011, 201232)

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.

Legend Item/Type	Data Source
Dirt road	Dirt Road Arcs; Los Alamos National Laboratory, KSL Site Support Services, Planning, Locating and Mapping Section; 06 January 2004; as published 29 November 2010.
Road centerlines	Road Centerlines; Los Alamos National Laboratory, KSL Site Support Services, Planning, Locating and Mapping Section; 15 December 2005; as published 29 November 2010.
Structure	Structures; Los Alamos National Laboratory, KSL Site Support Services, Planning, Locating and Mapping Section; 06 January 2004; as published 29 November 2010.
Contours	Hypsography, 10 and 100 Foot Contour Interval; Los Alamos National Laboratory, ENV Environmental Remediation and Surveillance Program; 1991.
Fence	Security and Industrial Fences and Gates; Los Alamos National Laboratory, KSL Site Support Services, Planning, Locating and Mapping Section; 06 January 2004; as published 29 November 2010.
Drainage	Modeled Surface Drainage, 1991; Los Alamos National Laboratory, ENV Environmental Remediation and Surveillance Program, ER2002-0591; 1:24,000 Scale Data; Unknown publication date.



GIS: Dave Frank
Date: 25-April-2011
Map Number: 11-0049-05

New Mexico State Plane Coordinate System
Central zone (3002)
US Survey Feet

Disclaimer: This map was created for work processes associated with the MDA V Periodic Monitoring Report. All other uses should be confirmed with LANL EP-ET-ER staff.

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

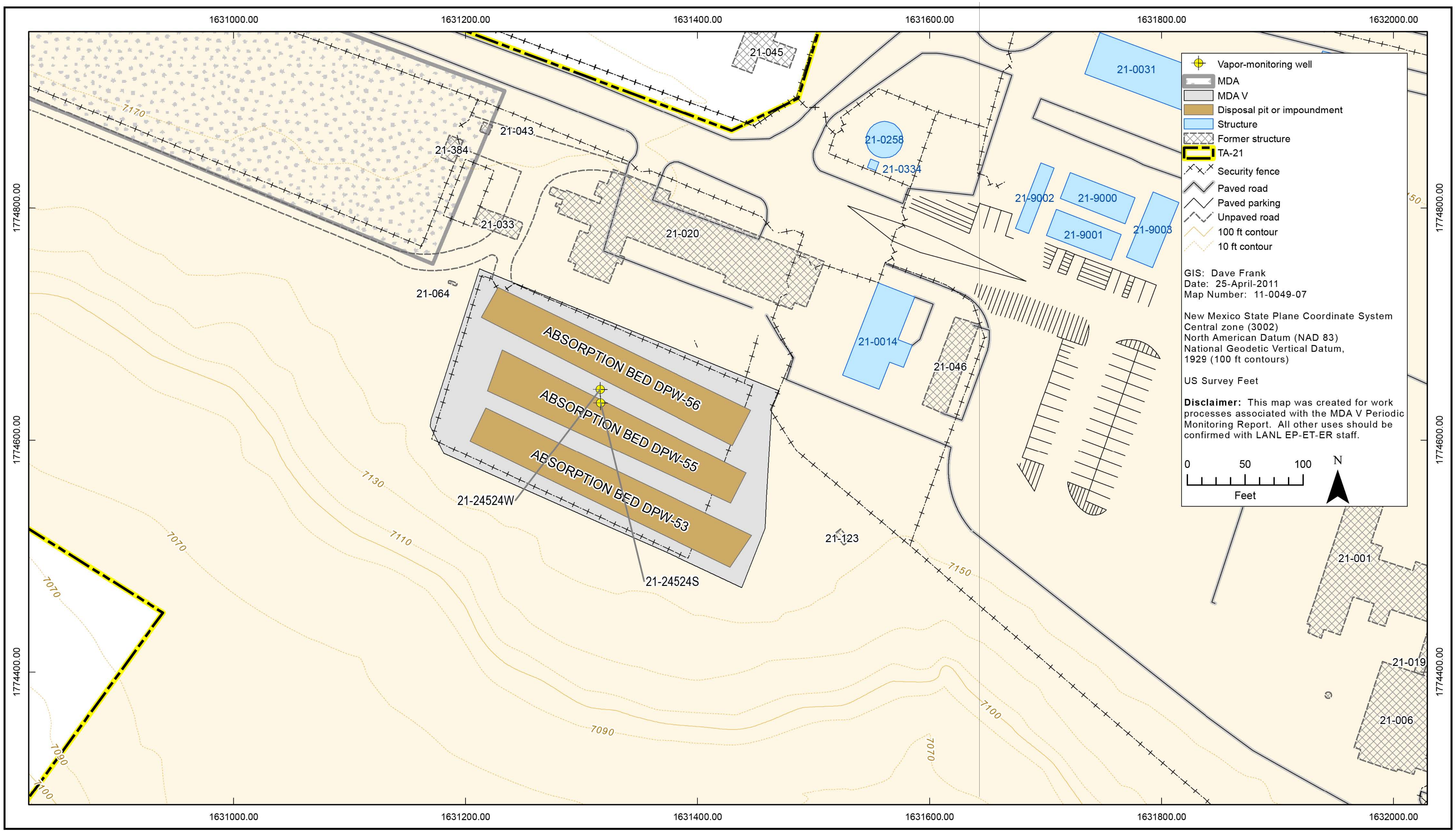


Figure 2.0-1 Locations of MDA V vapor-monitoring wells and associated structures and features

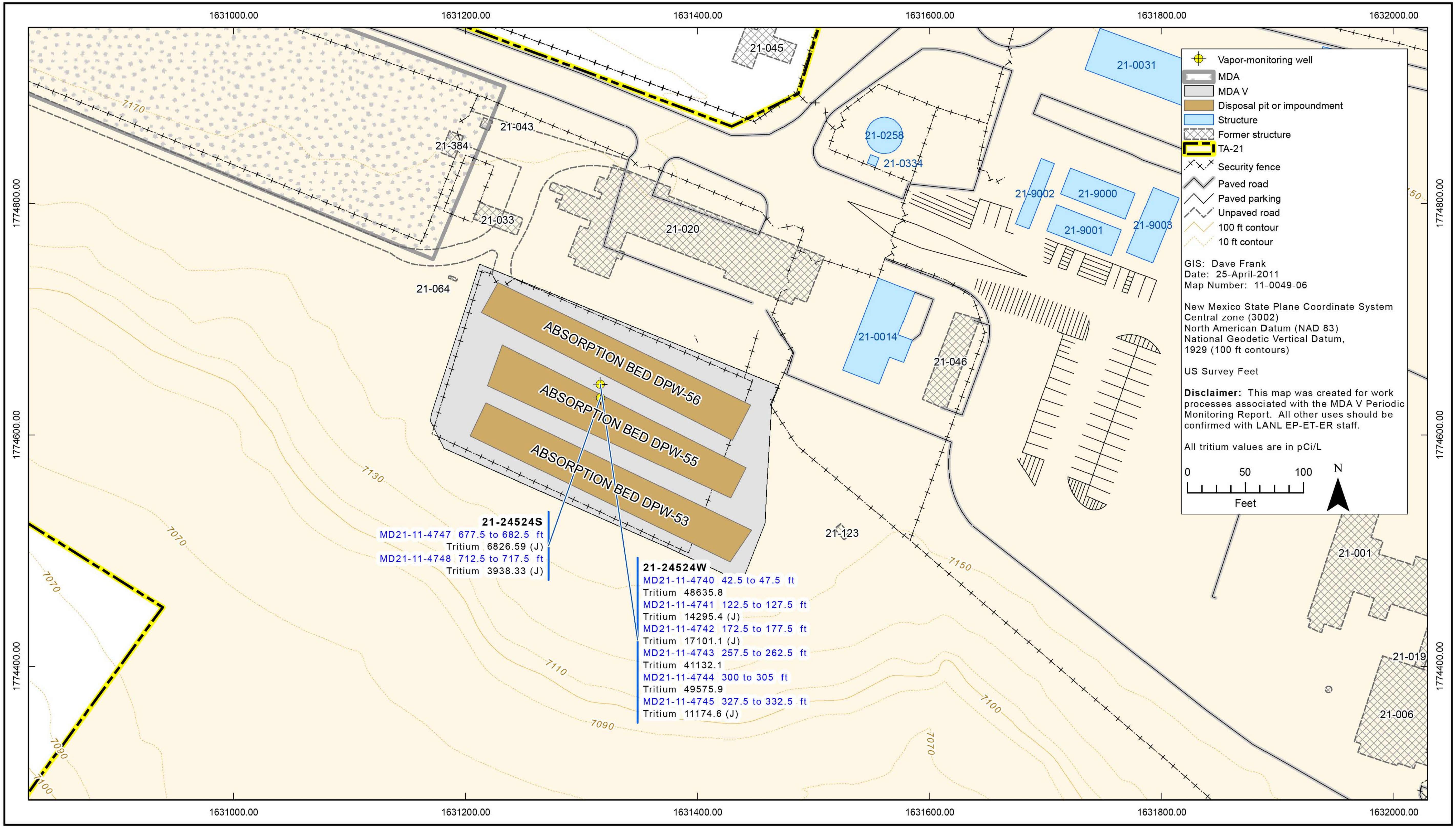


Figure 5.1-1 Tritium detected in vapor samples at MDA V

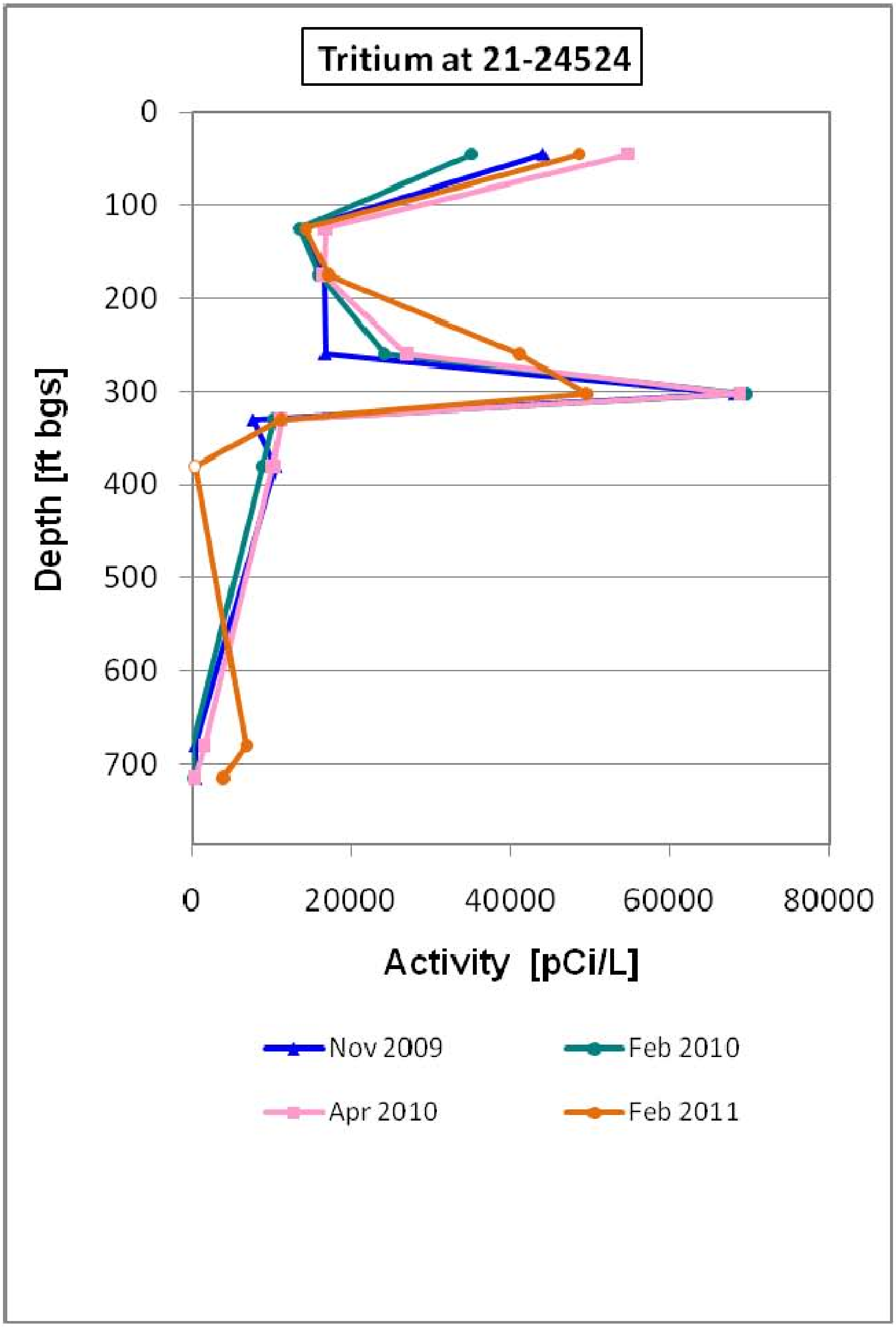


Figure 5.1-2 **Vertical profile of tritium in vapor-monitoring well 21-24524**

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

Vapor-Monitoring Well ID	Tritium Sampling-Port Depths and Intervals (ft bgs)
21-24524W	**45 (42.5–47.5), 125 (122.5–127.5), 175 (172.5–177.5), 260 (257.5–262.5), 302.5 (300–305), 330 (327.5–332.5), 380 (377.5–382.5)**
21-24524S	**680 (677.5–682.5), 715 (712.5–717.5)**

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

Appendix A

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

A-1.0 ACRONYMS AND ABBREVIATIONS

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

A-2.0 METRIC CONVERSION TABLE

Multiply SI (Metric) Unit	by	To Obtain U.S. Customary Unit
kilometers (km)	0.622	miles (mi)
kilometers (km)	3281	feet (ft)
meters (m)	3.281	feet (ft)
meters (m)	39.37	inches (in.)
centimeters (cm)	0.03281	feet (ft)
centimeters (cm)	0.394	inches (in.)
millimeters (mm)	0.0394	inches (in.)
micrometers or microns (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(°C) + 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 February 2011 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, and Laboratory implementation and procedural requirements. Table B-1.0-1 summarizes the field methods used, and Table B-1.0-2 lists the applicable procedures.

B-2.0 FIELD METHODS

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

B-2.1 Pore-Gas Field Screening

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

B-2.1.1 MultiRAE IR Multi-Gas Monitor

Before each sampling event, each sample port was purged of stagnant air and then monitored with a MultiRAE IR Multi-Gas Monitor until the percent carbon dioxide (%CO_2) and percent oxygen (%O_2) levels stabilized at values representative of subsurface pore-gas conditions. Each rented instrument was shipped factory-calibrated to the subcontractor, and the calibration was checked daily.

The MultiRAE IR Multi-Gas Monitor can also be calibrated using a two-point process using “fresh air” and a standard gas. The first point calibration is the fresh air calibration that determines the zero point of the calibration curve for lower explosive limit, volatile organic compound (VOC), and toxic gas sensors. The fresh air calibration uses air containing a 20.9% oxygen concentration and is void of toxic gases and other impurities. The standard gas calibration sets the second point of the sensor calibration curve. The CO, CO_2, and O_2 sensors are zeroed during this two-point calibration process.

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

- Unit 2375 was calibrated on January 6, 2011, at Geotech Environmental Equipment, Inc., in Denver, Colorado. The zero points were set for CO_2 and O_2. Percent oxygen was set to read ambient air at 20.9%.

Oxygen values should be near the zero point for O_2. An alarm sounds if %O_2 exceeds a range of 19.5% to 23.5%, thereby identifying the need for calibration. The CO_2 reading should be near zero.

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

The %CO_2 and %O_2 screening levels are presented in Appendix D. The February 2011 %CO_2 and %O_2 levels ranged from 0.29% to 1.56% and from 15.9% to 20.9%, respectively. These values are representative of subsurface pore-gas conditions.

B-2.2 Tritium Pore-Gas Sample Collection

All tritium samples were collected in accordance with the current version of 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 (silica-gel column), and the sample information was recorded on the appropriate SCL (Appendix D). Silica gel was the medium used at the Laboratory to collect moisture from pore-gas samples. The moisture was analyzed for tritium using liquid scintillation counting. Silica gel column field duplicate samples were also collected at a frequency greater than or equal to 10% per sampling event in accordance with the current version of SOP-5059.

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

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

Table B-1.0-1
Summary of Field Methods

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

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

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

*ADEP = Environmental Programs Directorate.

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 February 2011 pore-gas samples collected 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).

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

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

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

C-1.1 Maintenance of Chain of Custody

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

C-1.2 Sample Documentation

Establishing sample documentation acceptability, as described in WES-EDA-QP-210, Sample Control and Field Documentation, is the first step toward verifying that an analytical system has produced data of known quality. Documentation depends on the accessibility of review items that accurately and completely describe the work performed. In the absence of adequate sample documentation, data quality cannot be independently verified.

C-1.3 Sample Preservation

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

C-1.4 Holding Time

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

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

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

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

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

C-1.7 Analyte Quantitation

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

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

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

C-1.8 Method Blank

A method blank is an analyte-free matrix to which all reagents are added in the same volumes or proportions as those used in the environmental sample processing and is extracted and analyzed in the same manner as the corresponding environmental samples. Method blanks are used to assess the potential for sample contamination during extraction and analysis. All target analytes should be below the contract-required detection limit in the method blank (LANL 2008, 109962).

C-1.9 Matrix Spike Recoveries

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

C-1.10 Surrogate

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

C-1.11 Internal Standard Responses and Carrier Recoveries

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

C-1.12 LCS Recoveries

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

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

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

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

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

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

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

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

C-2.0 LABORATORY ANALYSIS SUMMARY

During the February 2011 sampling event, 9 tritium samples, 1 field blank sample, and 1 field duplicate sample were collected. Analysis of pore gas was conducted for tritium using EPA Method 906.0. Table C-2.0-1 lists the analytical methods used for tritium analyses. All QC procedures were followed, as required by the analytical services scope of work (LANL 2008, 109962).

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

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

C-3.0 RADIONUCLIDE ANALYSES

No tritium results were rejected during the February 2011 sampling event. Chain of custody, field documentation, and holding times were properly maintained for all samples. No sample preservation is required for tritium. The LCS recoveries were within acceptable limits for all tritium analyses.

Five tritium results were qualified as J, considered estimated and biased high, because this analyte was identified in the method blank but was greater than 5 times.

One tritium result was qualified as U because the associated sample concentration was less than or equal to the minimum detectable concentration.

C-6.0 REFERENCES

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

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

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

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

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

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

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

Table C-1.0-1
Data Validation Procedure

Procedure	Title	Effective Date
SOP-5166, R0	Routine Validation of Gamma Spectroscopy, Chemical Separation Alpha Spectrometry, Gas Proportional Counting, and Liquid Scintillation Analytical Data	6/30/2008

Table C-2.0-1
Analytical Method Used for Sample Analyses

Analytical Method	Analytical Description	Target Compound List
EPA Method 906.0	Tritium in pore gas	Tritium

Appendix D

Field-Screening Results and Detected Tritium

D-1.0 INTRODUCTION

This appendix summarizes the field-screening results as well as detected tritium activities for the February 2011 sampling event at Material Disposal Area (MDA) V. The tables listed below are included in this appendix and are organized by vapor-monitoring well ID and depth.

- Table D-1.0-1, Field-Screening Results Using a MultiRAE IR Multi-Gas Monitor at MDA V
- Table D-1.0-2, Summary of Tritium Results at MDA V

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

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

Table D-1.0-1
Field-Screening Results Using a MultiRAE IR Multi-Gas Monitor at MDA V

Vapor-Monitoring Well ID	Begin Depth (ft bgs[a])	End Depth (ft bgs)	Analyte	November 2009		February 2010		April 2010		February 2011	
				Date	Result (%)	Date	Result (%)	Date	Result (%)	Date	Result (%)
21-24524W	Ambient	Ambient	CO_2	11/23/09	NS[b]	02/01/10	NS	04/30/10	NS	02/07/11	NS
			O_2	11/23/09	NS	02/01/10	NS	04/30/10	NS	02/07/11	NS
	42.5	47.5	CO_2	11/23/09	2.7	02/01/10	1.6	04/30/10	2.2	02/07/11	1.56
			O_2	11/23/09	18.5	02/01/10	19.0	04/30/10	18.2	02/07/11	15.9
	122.5	127.5	CO_2	11/23/09	0.4	02/01/10	0.4	04/30/10	4.1	02/07/11	0.32
			O_2	11/23/09	21.2	02/01/10	20.2	04/30/10	20.1	02/07/11	20.9
	172.5	177.5	CO_2	11/23/09	0.4	02/02/10	0.4	04/30/10	4.4	02/07/11	0.46
			O_2	11/23/09	20.6	02/02/10	20.2	04/30/10	20.1	02/07/11	20.9
	257.5	262.5	CO_2	11/23/09	0.5	02/01/10	0.2	04/30/10	4.8	02/07/11	0.37
			O_2	11/23/09	20.2	02/01/10	20.4	04/30/10	20.0	02/07/11	20.9
	300	305	CO_2	11/23/09	0.4	02/01/10	0.0	04/30/10	4.8	02/07/11	0.36
			O_2	11/23/09	20.4	02/01/10	20.6	04/30/10	20.2	02/07/11	20.9
	327.5	332.5	CO_2	11/23/09	0.0	02/02/10	0.2	04/30/10	4.3	02/07/11	0.40
			O_2	11/23/09	20.8	02/02/10	20.4	04/30/10	20.1	02/07/11	20.9
	377.5	382.5	CO_2	11/23/09	0.3	02/01/10	0.2	04/30/10	4.3	02/07/11	0.34
			O_2	11/23/09	20.4	02/01/10	20.5	04/30/10	20.1	02/07/11	20.9
21-24524S	677.5	682.5	CO_2	11/23/09	0.1	02/01/10	0.0	04/30/10	3.0	02/07/11	0.30
			O_2	11/23/09	20.9	02/01/10	20.1	04/30/10	20.3	02/07/11	20.9
	712.5	717.5	CO_2	11/23/09	0.3	02/01/10	0.4	04/30/10	5.2	02/07/11	0.29
			O_2	11/23/09	19.4	02/01/10	19.8	04/30/10	19.7	02/07/11	20.9

[a] bgs = Below ground surface.

[b] NS = Not sampled.

Table D-1.0-2
Summary of Tritium Results at MDA V

Vapor-Monitoring Well ID	Begin Depth (ft bgs[a])	End Depth (ft bgs)	November 2009		February 2010		April 2010		February 2011	
			Collection Date	Result (pCi/L)	Collection Date	Result (pCi/L)	Collection Date	Result (pCi/L)	Collection Date	Result (pCi/L)
21-24524W	42.5	47.5	11/23/09	44000	02/01/10	35100	04/30/10	54800	02/08/11	48600
	122.5	127.5	11/23/09	14200	02/01/10	13500	04/30/10	16700	02/08/11	14300 (J)
	172.5	177.5	11/23/09	16600	02/02/10	16000	04/30/10	16600	02/08/11	17100 (J)
	257.5	262.5	11/23/09	16700	02/01/10	24200	04/30/10	26900	02/08/11	41100
	300	305	11/23/09	67900	02/01/10	69600	04/30/10	68700	02/08/11	49600
	327.5	332.5	11/23/09	7650	02/02/10	10300	04/30/10	11200	02/08/11	11200 (J)
	377.5	382.5	11/23/09	10500	02/01/10	8870	04/30/10	10100	02/08/11	ND[b]
21-24524S	677.5	682.5	11/23/09	349	02/01/10	ND	04/30/10	1550	02/08/11	6830 (J)
	712.5	717.5	11/23/09	464	02/01/10	ND	04/30/10	347	02/08/11	3940 (J)

[a] bgs = Below ground surface.

[b] ND = Not detected.

Attachment D-1

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