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Date: January 28, 2009
Refer To: EP2009-0005

James P. Bearzi, Bureau Chief
Hazardous Waste Bureau
New Mexico Environment Department
2905 Rodeo Park Drive East, Building 1
Santa Fe, NM 87505-6303

Subject: Submittal of the Periodic Monitoring Report for Vapor-Sampling Activities at Material Disposal Area H, Solid Waste Management Unit 54-004, at Technical Area 54, Fiscal Year 2008

Dear Mr. Bearzi:

Enclosed please find two hard copies with electronic files of the Periodic Monitoring Report for Vapor-Sampling Activities at Material Disposal Area H, Solid Waste Management Unit 54-004, at Technical Area 54, Fiscal Year 2008.

If you have any questions, please contact Steve Paris at (505) 606-0915 (smparis@lanl.gov) or Ed Worth at (505) 606-0398 (eworth@doeal.gov).

Sincerely,

Michael J. Graham, Associate Director
Environmental Programs
Los Alamos National Laboratory

Sincerely,

David R. Gregory, Project Director
Environmental Operations
Los Alamos Site Office

MG/DG/DM/SP:sm

Enclosures: 1) Two hard copies with electronic files - Periodic Monitoring Report for Vapor-Sampling Activities at Material Disposal Area H, Solid Waste Management Unit 54-004, at Technical Area 54, Fiscal Year 2008 (LA-UR-09-0473)

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LA-UR-09-0473
January 2009
EP2009-0005

Periodic Monitoring Report for Vapor-Sampling Activities at Material Disposal Area H, Solid Waste Management Unit 54-004, at Technical Area 54, Fiscal Year 2008

Prepared by the Environmental Programs Directorate

LA-UR-09-0473
EP2009-0005

Periodic Monitoring Report for Vapor-Sampling Activities at Material Disposal Area H, Solid Waste Management Unit 54-004, at Technical Area 54, Fiscal Year 2008

January 2009

Responsible project leader:

Printed Name	Signature	Title	Organization	Date
Steve Paris	[signature]	Project Leader	Environmental Programs	1/27/09

Responsible LANS representative:

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Michael J. Graham	[signature]	Associate Director	Environmental Programs	1/27/09

Responsible DOE representative:

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David R. Gregory	[signature]	Project Director	DOE-LASO	1/28/09

EXECUTIVE SUMMARY

This periodic monitoring report summarizes monitoring activities conducted at Material Disposal Area (MDA) H, Solid Waste Management Unit 54-004, during fiscal year (FY) 2008. MDA H is located in Technical Area 54 at Los Alamos National Laboratory. The objective of the monitoring is to evaluate trends in volatile organic compound (VOC) and tritium activities in subsurface vapor at MDA H over time.

During FY2008, monitoring was performed in accordance with the New Mexico Environment Department direction provided in 2004. During each round of quarterly sampling, subsurface vapor samples are collected from three depths in borehole location 54-15461 and from six depths in borehole locations 54-15462 and 54-01023. All vapor samples are collected in SUMMA canisters for laboratory analysis of VOCs and in silica gel cartridges for laboratory analysis of tritium. The boreholes were sampled using packers prior to being instrumented with dedicated sampling equipment before sampling in the third quarter of FY2006.

Validated analytical results confirm the presence of VOCs at low concentrations and tritium in all vapor samples. This finding is consistent with the results of the 2001 Resource Conservation and Recovery Act facility investigation. Concentrations of all VOCs are below screening levels and do not pose an immediate potential source of groundwater contamination.

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1.0 INTRODUCTION

This report presents the annual subsurface pore-gas field-screening and sampling results at Los Alamos National Laboratory (LANL or the Laboratory), Material Disposal Area (MDA) H, Solid Waste Management Unit (SWMU) 54-004, at Technical Area 54 (TA-54). MDA H is located in the east-central portion of the Laboratory at TA-54 on Mesita del Buey (Figure 1.0-1). MDA H is a 70-ft by 200-ft (0.3-acre) fenced area consisting of nine inactive vertical disposal shafts, arranged in line approximately 15 ft within and parallel to its southern fence line. Each shaft is cylindrical, 6 ft in diameter, and 60 ft deep. The shafts are filled with solid-form waste to a depth of 6 ft below ground surface (bgs). The waste in Shafts 1 to 8 is covered by a 3-ft layer of concrete placed over 3 ft of crushed tuff, the waste in Shaft 9 is covered by 6 ft of concrete. The regional aquifer at MDA H is estimated to be at an average depth of approximately 1040 ft bgs, based on data from nearby wells and predictions of the hydrogeologic conceptual model for the Pajarito Plateau (LANL 1998, 059599).

From May 1960 to August 1986, MDA H functioned as the Laboratory's primary disposal area for classified solid-form waste. Between periods of waste disposal, each shaft was covered with a padlocked steel plate to prevent unauthorized access to classified materials. Much of the classified waste was nonhazardous; however, various hazardous chemicals, radionuclide-contaminated materials, and materials contaminated by high explosives were also disposed of at MDA H. These materials included scraps and shapes contaminated with depleted uranium, drummed radioactive waste, fuel elements, a unit contaminated with tritium, plutonium-contaminated shapes, and decontamination and decommissioning scrap.

Pore-gas monitoring at MDA H has been conducted since the second quarter of fiscal year (FY) 2005. A summary of this monitoring follows.

- On April 11, 2003, the New Mexico Environment Department (NMED) sent a letter (NMED 2003, 075939) approving the Resource Conservation and Recovery Act (RCRA) facility investigation (RFI) report for MDA H (LANL 2001, 070158) and subsequent addendum to the report (LANL 2002, 073270).
- In May 2003, the Laboratory submitted the corrective measures study for MDA H (LANL 2003, 076039) identifying a preferred remedy. Comments were received from NMED, and the report was reissued in June 2005 (LANL 2005, 089332).
- In December 2004, NMED sent a letter (NMED 2004, 092217) requesting that the Laboratory collect quarterly subsurface vapor-monitoring samples from borehole locations 54-15461, 54-15462, and 54-01023 to provide data to facilitate NMED's selection of an appropriate remedy for MDA H.
- In May 2005, NMED sent a letter (NMED 2005, 092219) requesting that the Laboratory continue to collect quarterly subsurface vapor-monitoring samples from borehole locations 54-15461, 54-15462, and 54-01023.
- In February 2005, the Laboratory began quarterly pore-gas monitoring using the Packer sampling system. In March 2006, the Laboratory installed flexible liner underground technology (FLUTe) sampling membranes into each MDA H pore-gas monitoring location (Figure 1.0-2).
- NMED reviewed the 2007 pore-gas monitoring report and, based on packer sampling results for trichloroethene (TCE) in pore-gas samples collected before installing dedicated sampling equipment (FLUTe), suggested that the FLUTe was adsorbing volatile organic compounds (VOCs) (NMED 2007, 099277; NMED 2008, 100480). A comparison of TCE in subsurface vapor

samples was conducted during the second and third quarters of FY2008. The purpose of the test was to compare TCE concentrations using the FLUTe system versus using the packer system to collect subsurface vapor samples. This test compared vapor-sampling results between the FLUTe systems currently used at MDA H with the packer sampling system used at MDA H from 2001 to 2006. The results of this test are reported in “Pilot Test Report for Comparing Packer and FLUTe Vapor-Sampling Systems at Material Disposal Area H” (LANL 2008, 103889).

- During fourth quarter sampling activities in December 2008, field crews observed that one tube at borehole 54-15462 connecting the FLUTe membrane’s sampling port to the manifold did not correspond to the correct fitting on the manifold. The FLUTe membrane was removed, repaired, and reinstalled following second quarter sampling in support of the Packer/FLUTe pilot test discussed above. The FLUTe membrane was removed after the fourth quarter sampling event, and further investigation revealed that five of the six port tubes had not been connected to the correct fittings on the manifold. The Laboratory corrected the problem at the manifold, revised field documentation, and updated laboratory records to present accurate results for ports at this location. These results are presented in this report.

Subsurface vapor-field screening and sampling are being performed by the Laboratory’s Environmental Programs Directorate–Corrective Actions Projects to characterize VOC and tritium trends in subsurface vapor over time. Field-screening data and analytical laboratory results for FY2008 are presented in this report. 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.

2.0 SCOPE OF ACTIVITIES

During FY2008, the following sampling activities were completed at MDA H, as directed by NMED in a December 21, 2004, letter to the Laboratory (NMED 2004, 092217) and in a May 17, 2005, letter to the Laboratory (NMED 2005, 092219). The borehole locations are shown in Figure 2.0-1.

- Vapor samples for laboratory analyses were collected from the following ports.
  - ❖ Borehole location 54-15461: 10 ft bgs, directly below the surface completion; 60 ft bgs, corresponding to the base of the shafts; and at total depth of 95 ft bgs.
  - ❖ Borehole location 54-15462: 10 ft bgs, directly below the surface completion; 60 ft bgs, corresponding to the base of the shafts; depths of 100, 150, and 200 ft bgs; and the Cerro Toledo interval at 254 ft bgs.
  - ❖ Borehole location 54-01023: the 10 ft bgs, directly below the surface completion; 60 ft bgs, corresponding to the base of the shafts; depths of 100, 150, and 200 ft bgs; and the Cerro Toledo interval at 247 ft bgs.
- As directed by NMED in a December 2007 letter (NMED 2008, 099277), a comparison of TCE in subsurface vapor samples was conducted during the second and third quarters of FY2008. The purpose of the test was to compare TCE concentrations measured using the FLUTe system versus using the packer system to collect subsurface vapor samples. The “Pilot Test Report for Comparing Packer and FLUTe Vapor-Sampling Systems at Material Disposal Area H” describes the results of this study (LANL 2008, 103889).

No investigation-derived waste was generated during quarterly monitoring.

3.0 REGULATORY CRITERIA

The March 1, 2005, Compliance Order on Consent (the Consent Order) does not identify any cleanup standards, risk-based screening levels, risk-based cleanup goals, or other regulatory criteria for pore gas. Therefore, an analysis was conducted to evaluate the potential for contamination of groundwater by VOCs in pore gas using screening levels (SLs) based on groundwater cleanup levels. The analysis evaluated the water concentration that will be in equilibrium with the maximum concentrations of VOCs detected at MDA H during the most recent round of monitoring.

$$C_{water} = C_{air}/\text{Henry's law constant } (H') \qquad \textbf{Equation 3.0-1}$$

If the concentration of the VOC in water is less than the SL, then no potential exists for exceedances of groundwater cleanup levels. Because no SLs are available for pore gas that address the potential for groundwater contamination, the screening evaluation was based on groundwater cleanup levels contained in the Consent Order 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 soil screening level technical background document (NMED 2006, 092513). The following dimensionless form of Henry's law constant was used:

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

where C_{air} is the volumetric concentration of contaminant in air and C_{water} is the volumetric concentration of contaminant in water. Equation 3.0-2 can be used to calculate the following screening value (SV):

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

Where C_{air} is the concentration of VOC in the pore-gas sample (µg/m^3), H' is the dimensionless Henry's law constant, SL is the screening level (µg/L), and 1000 is a conversion factor from L to m^3. The SLs are the groundwater standards or tap water SLs. These levels are the U.S. Environmental Protection Agency (EPA) maximum contaminant level (MCL) or New Mexico Water Quality Control Commission (NMWQCC) groundwater standard, whichever is lower. If no MCL or NMWQCC standard exists, the EPA regional tap water SL (http://www.epa.gov/region09/superfund/prg/pdf/composite_sl_table_run_12SEP2008.pdf) is used and adjusted to 10^{-5} risk for carcinogens. The numerator in Equation 3.0-3 is the actual concentration of VOC in pore gas, and the denominator represents the concentration in pore gas needed to exceed the SL. Table 3.0-1 presents the concentrations of contaminants in pore gas that would exceed groundwater standards. Therefore, if the SV is less than 1, the concentration of VOC in pore gas would not be sufficiently high to cause the water SL to be exceeded, even if the VOC plume were in contact with groundwater.

4.0 MONITORING RESULTS

Field screening for VOCs, carbon dioxide, and oxygen was conducted at MDA H for four quarters in FY2008. First quarter field screening was conducted only for carbon dioxide and oxygen (Table 4.0-1) from December 13 to December 17, 2007; second-quarter field screening was conducted from April 9 to April 25, 2008; third quarter field screening was conducted from June 23 to June 27, 2008; and fourth quarter field screening was conducted from September 9 to September 11, 2008. Field screening at

MDA H during FY2008 included field analyses of subsurface vapor for carbon dioxide (CO_2) and oxygen (O_2).

Subsurface vapor-field screening was conducted at the locations and intervals described in section 2. Each depth location was purged to ensure formation air was sampled in accordance with Environmental Programs Directorate's standard operating procedure EP-ERSS-SOP-5074, Sampling of Sub-Atmospheric Air. During purging, the subsurface vapor was monitored for percent carbon dioxide and oxygen using a Landtec GEM-500 (Table 4.0-1). Pore gas from each interval was field screened for VOCs using a Brüel and Kræjer (B&K) Type 1302 multigas photoacoustic analyzer (Table 4.0-2). Analytical samples were collected after measurements from field-screening instruments stabilized.

5.0 ANALYTICAL DATA RESULTS

Subsurface vapor samples were collected at MDA H for four quarters in FY2008 Along with field-screening data. Samples were collected in SUMMA canisters for laboratory analysis of VOCs using EPA Method TO-15 and in silica gel cartridges for analysis of tritium using EPA Method 906.0.

Tritium and VOC analytical data from these sampling events are presented in Tables 5.0-1 and 5.0-2, respectively. The quality assurance/quality control program used to review the data is presented in Appendix B. Analytical data and reports for FY2008 are included in Appendix C (on CD included with this document).

The maximum tritium activities were consistently detected in samples collected from borehole location 54-01023, the location nearest MDA H, indicating a tritium source at MDA H. During FY2008 sampling, tritium activities in moisture extracted from this borehole ranged from 40,506 pCi/L at 10 ft bgs to 10,233,200 pCi/L at 10 ft bgs (Table 5.0-1). The 10,233,200 pCi/L is 10% above activities detected during FY2007 (LANL 2007, 099140). FY2008 tritium activities in borehole locations 54-15461 and 54-15462 ranged from nondetect to detected at 79,600 pCi/L. Tritium activities are greatest near the disposal shafts, decrease with distance from MDA H, and are representative of a diffusive plume.

Thirty-six VOCs were detected in vapor samples collected from MDA H during the FY2008 sampling events (Table 5.0-2). Freon-11 was the most frequently detected VOC in the 89 samples collected during FY2008 (detected in 71 out of 89 samples). Acetone was detected in 62 samples, dichlorodifluoromethane was detected in 59 samples, 1,1,1-trichloroethane (TCA) was detected in 54 samples, and 1,1,2-trichloro-1,2,2-trifluoroethane was detected in 47 samples. Tetrachloroethane (PCE) was detected in 14 samples ranging from 2.7 $\mu g/m^3$ to 62 $\mu g/m^{3.}$ Acetone, detected in 62 of 89 samples, was detected at the highest concentration in borehole location 54-15461 at the 10-ft interval during the second quarter, reaching a maximum concentration of 2100 $\mu g/m^3$. The next highest VOC concentration was for toluene (730 $\mu g/m^3$), which was detected at borehole location 54-01023 at 247 ft bgs during the third quarter. The VOC results are generally stable over the four quarterly FY2008 sampling events. Reported results do not show consistent increasing or decreasing trends over time and do not show strong increasing or decreasing trends with depth.

Equation 3.0-3 was used to screen the maximum concentrations of VOCs detected in pore-gas samples at MDA H during FY2008 sampling. The evaluation included the 33 VOCs detected in MDA H samples for which there are MCLs, NMWQCC standards, or EPA regional tap water SLs. As shown in Table 5.0-3, all maximum concentrations resulted in SVs below 1.0; the maximum SV was 0.10. Based on this evaluation, the concentrations of VOCs in pore gas at MDA H do not pose an immediate potential source of groundwater contamination.

6.0 SUMMARY

The purpose of the quarterly pore gas monitoring activities at MDA H is to evaluate trends in volatile organic compound (VOC) and tritium activities in subsurface vapor at MDA H over time. The results from the four quarters of monitoring events in FY2008 activities are summarized as follows.

- Sampling was conducted during the first, second, third, and fourth quarters of FY2008, as specified in the December 21, 2004, letter NMED sent to the Laboratory (NMED 2004, 092217).
- VOCs continue to be present at low concentrations in subsurface vapor.
- VOCs are detected at concentrations consistent with the results from FY2007 and from the last two quarters of FY2006.
- All tritium activities detected in borehole location 54-01023, during FY2008, are of the same magnitude as activities detected during vapor-sampling activities FY2006 and FY2007. One concentration resulted in a detection 10% higher than activities of FY2006 and FY2007.
- Tritium activities detected in borehole locations 54-15461 and 54-15462 during FY2008 sampling of the same magnitude of activities detected during FY2006 and FY2007.
- Concentrations of VOCs in pore gas collected using instrumented membrane sampling are all below the SVs.
- Tritium activities from borehole location 54-01023 are 2 to 3 orders of magnitude greater than activities from borehole locations 54-15461 and 54-15462 at similar depths.
- The comparison of TCE data from the FLUTe and packer sampling systems does not indicate that the FLUTe sampling system is removing VOCs from the extracted air.

Tritium activities and VOC concentrations detected from current analyses are consistent with the results of earlier sampling activities. New releases or unexpected decreases of VOCs and tritium are not evident in the monitoring data. Monitoring activities at MDA H indicate that the bases of the results and conclusions made in the MDA H corrective measures study (LANL 2005, 089332) have not changed and are consistent with current conditions. During FY2008, FY2007, and the last two quarters of FY2006, no VOCs were detected at concentrations high enough to partition into groundwater and theoretically result in aqueous concentrations greater than groundwater cleanup standards.

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.

LANL (Los Alamos National Laboratory), May 22, 1998. “Hydrogeologic Workplan,” Los Alamos National Laboratory document LA-UR-01-6511, Los Alamos, New Mexico. (LANL 1998, 059599)

LANL (Los Alamos National Laboratory), May 2001. “RFI Report for Material Disposal Area H at Technical Area 54,” Los Alamos National Laboratory document LA-UR-01-1208, Los Alamos, New Mexico. (LANL 2001, 070158)

LANL (Los Alamos National Laboratory), October 2002. “Addendum to the RFI Report for Material Disposal Area H (Solid Waste Management Unit 54-004) at Technical Area 54,” Los Alamos National Laboratory document LA-UR-02-3397, Los Alamos, New Mexico. (LANL 2002, 073270)

LANL (Los Alamos National Laboratory), May 2003. “Corrective Measures Study Report for Material Disposal Area H, Solid Waste Management Unit 54-004, at Technical Area 54,” Los Alamos National Laboratory document LA-UR-03-3354, Los Alamos, New Mexico. (LANL 2003, 076039)

LANL (Los Alamos National Laboratory), June 2005. “Corrective Measures Study Report for Material Disposal Area H, Solid Waste Management Unit 54-004, at Technical Area 54, Revision 1,” Los Alamos National Laboratory document LA-UR-05-0203, Los Alamos, New Mexico. (LANL 2005, 089332)

LANL (Los Alamos National Laboratory), November 2007. “Periodic Monitoring Report for Vapor-Sampling Activities at Material Disposal Area H, Solid Waste Management Unit 54-004, at Technical Area 54, Fiscal Year 2007,” Los Alamos National Laboratory document LA-UR-07-7803, Los Alamos, New Mexico. (LANL 2007, 099140)

LANL (Los Alamos National Laboratory), September 2008. “Pilot Test Report for Comparing Packer and FLUTe Vapor-Sampling Systems at Material Disposal Area H,” Los Alamos National Laboratory document LA-UR-08-5872, Los Alamos, New Mexico. (LANL 2008, 103889)

NMED (New Mexico Environment Department), April 11, 2003. “Approval of RCRA Facility Investigation Report for Material Disposal Area H,” New Mexico Environment Department letter to P. Nanos (LANL Interim Director), and D. Gregory (DOE-OLASO) from J. Young (NMED), Santa Fe, New Mexico. (NMED 2003, 075939)

NMED (New Mexico Environment Department), December 21, 2004. “Notification to Collect Additional Vapor Monitoring Data at MDA H, SWMU 54-004, at TA-54,” New Mexico Environment Department letter to D. Gregory (DOE LASO) and G.P. Nanos (LANL Director) from N. Dhawan (NMED-HWB), Santa Fe, New Mexico. (NMED 2004, 092217)

NMED (New Mexico Environment Department), May 17, 2005. “Notification for Additional Information for MDA H, SWMU 54-004, at TA-54,” New Mexico Environment Department letter to D. Gregory (DOE LASO) and G.P. Nanos (LANL Director) from N. Dhawan (NMED-HWB), Santa Fe, New Mexico. (NMED 2005, 092219)

NMED (New Mexico Environment Department), June 2006. “Technical Background Document for Development of Soil Screening Levels, Revision 4.0, Volume 1, Tier 1: Soil Screening Guidance Technical Background Document,” New Mexico Environment Department, Hazardous Waste Bureau and Ground Water Quality Bureau Voluntary Remediation Program, Santa Fe, New Mexico. (NMED 2006, 092513)

NMED (New Mexico Environment Department), December 21, 2007. "Review of Periodic Monitoring Report for Vapor-Sampling Activities at Material Disposal Area H, Solid Waste Management Unit 54-004, at Technical Area 54, Fiscal Year 2007," 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, 099277)

NMED (New Mexico Environment Department), February 26, 2008. "Status of Remedy Selection at 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 2008, 100480)

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	Data Source
Disposal pit	Waste Storage Features; LANL, Environment and Remediation Support Services Division, GIS/Geotechnical Services Group, EP2007-0032; 1:2,500 Scale Data; 13 April 2007.
Disposal shaft	Waste Storage Features; LANL, Environment and Remediation Support Services Division, GIS/Geotechnical Services Group, EP2007-0032; 1:2,500 Scale Data; 13 April 2007.
Elevation contour	Hypsography, 10, 20, & 100 Foot Contour Intervals; LANL, ENV Environmental Remediation and Surveillance Program; 1991.
Fence	Security and Industrial Fences and Gates; LANL, KSL Site Support Services, Planning, Locating and Mapping Section; 06 January 2004; as published 10 September 2007.
LANL boundary	LANL Areas Used and Occupied; LANL, Site Planning & Project Initiation Group, Infrastructure Planning Division; 19 October 2008.
MDA	Materials Disposal Areas; LANL, ENV Environmental Remediation and Surveillance Program; ER2004-0221; 1:2,500 Scale Data; 23 April 2004.
Paved road	Paved Road Arcs; LANL, KSL Site Support Services, Planning, Locating and Mapping Section; 06 January 2004; as published 10 September 2007.
Structure	Structures; LANL, KSL Site Support Services, Planning, Locating and Mapping Section; 06 January 2004; as published 10 September 2007.
TA boundary	Technical Area Boundaries; LANL, Site Planning & Project Initiation Group, Infrastructure Planning Division; 19 September 2007.
Unpaved road	Dirt Road Arcs; LANL, KSL Site Support Services, Planning, Locating and Mapping Section; 06 January 2004; as published 10 September 2007.
Vapor-monitoring well	Point Feature Locations of the Environmental Restoration Project Database; LANL, Environment and Remediation Support Services Division, EP2007-0754; 30 November 2007.

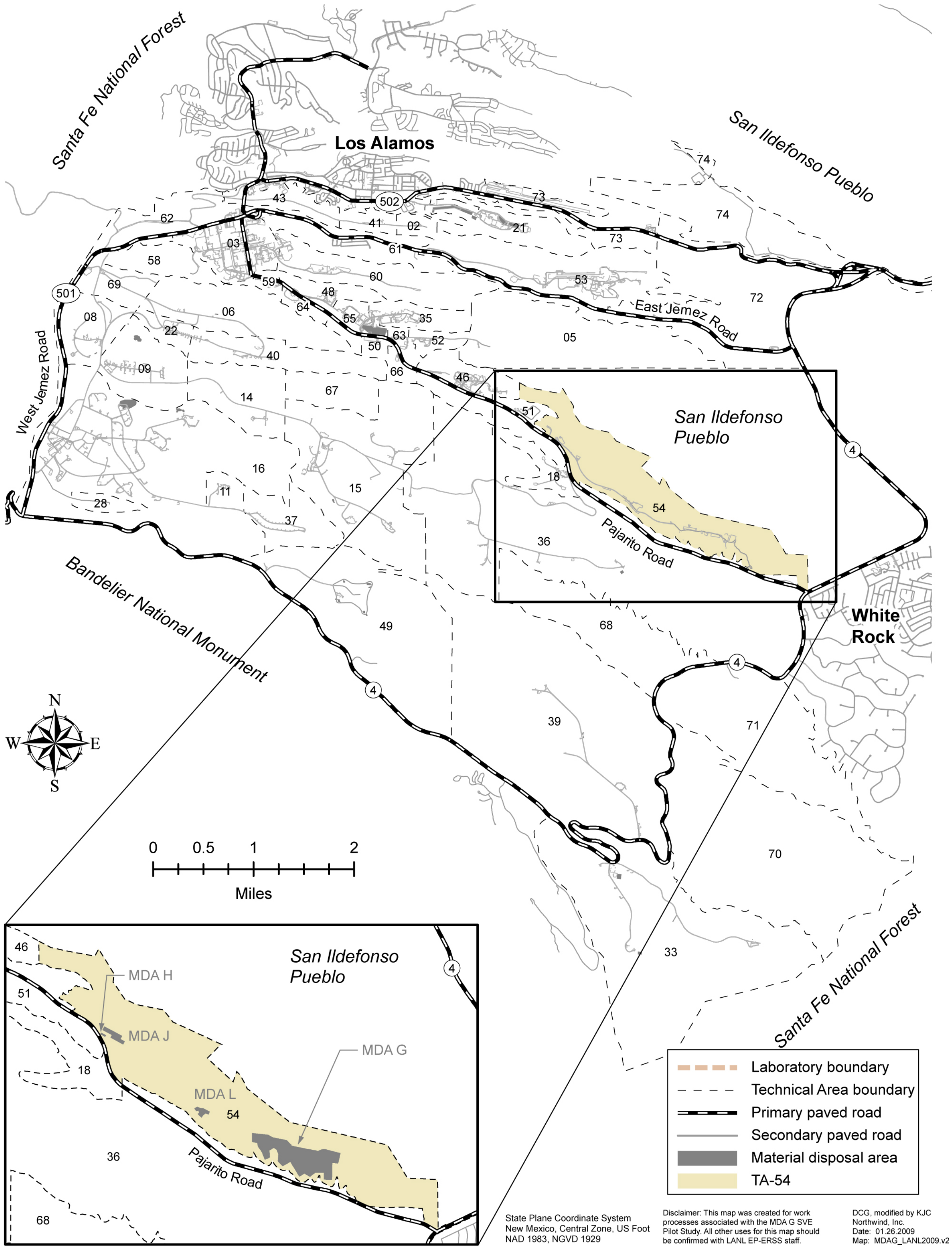

Figure 1.0-1 Location of MDA H in TA-54 with respect to Laboratory TAs and surrounding land holdings

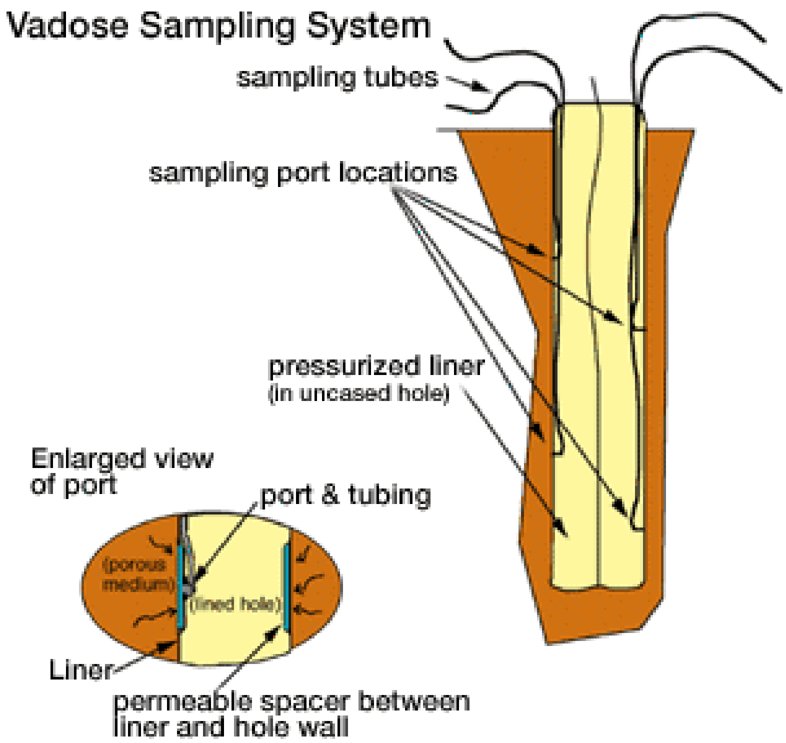

Figure 1.0-2 FLUTe sampling system

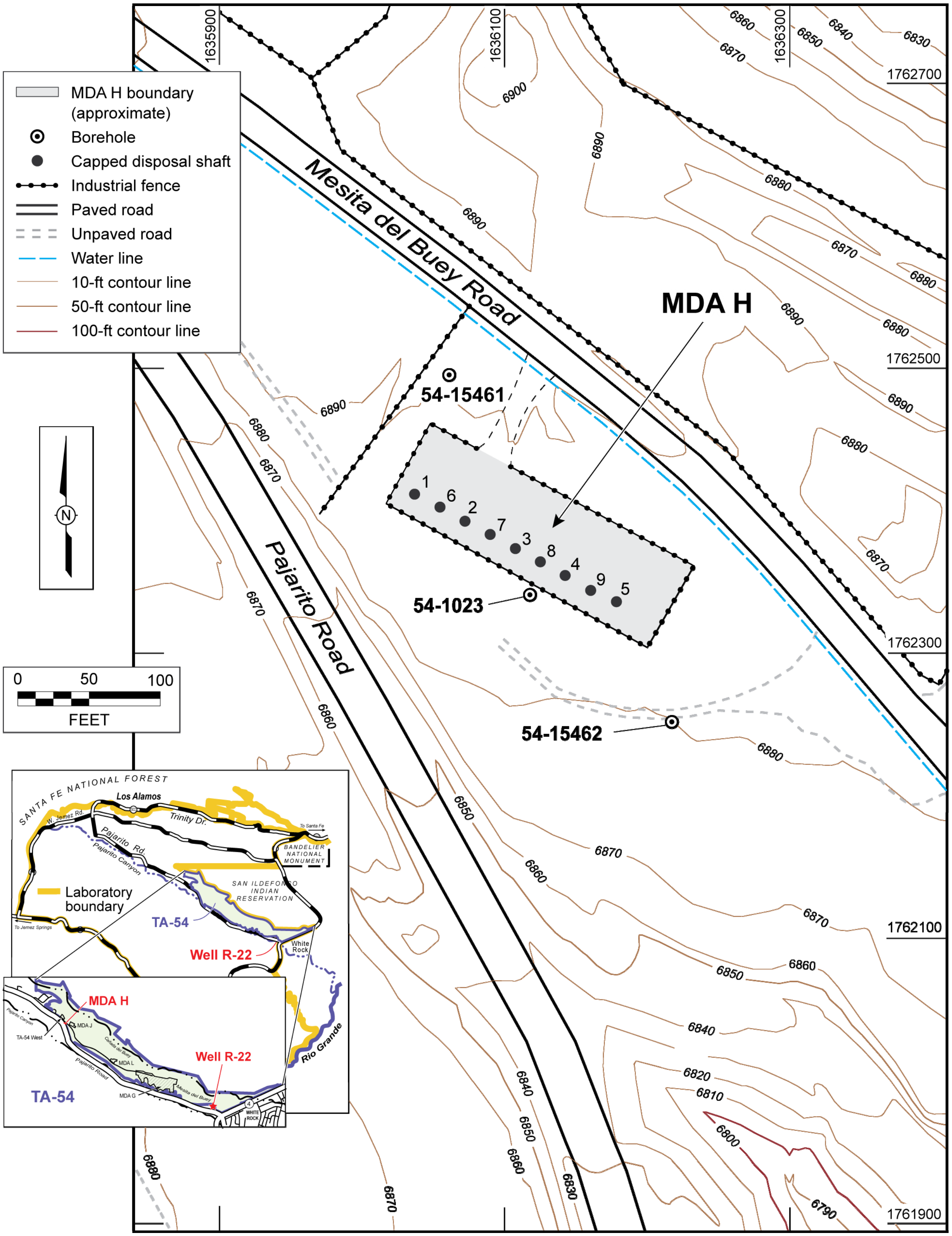

Figure 2.0-1 Locations of inactive disposal shafts and RFI boreholes at MDA H

Table 3.0-1
Henry's Law Constants, Groundwater Standards, and Calculated Concentrations Exceeding Groundwater Standards for Selected VOCs

VOC	Henry's Law Constant (H') (dimensionless)	Groundwater Standard (µg/L)	Calculated Concentration in Pore Gas Exceeding Groundwater Standard (µg/L)
Acetone	0.0016	22,000[a]	35,2000
Benzene	0.228	5[b]	1140
Butadiene[1,3-]	7.3	0.13	949
Butanone[2-]	0.0011	7100[a]	7810
Carbon Disulfide	1.2	1000[a]	1,200,000
Carbon Tetrachloride	1.25	5[b]	6250
Chlorobenzene	0.15	100	15,000
Chlorodifluoromethane	4.1	100,000	410,000,000
Chloroform	0.15	100	15,000
Chloromethane	na[d]	na	na
Cyclohexane	8.2	13,000	106,600,000
Dichlorodifluoromethane	4.1	350[a]	1,435,000
Dichloroethane[1,1-]	0.23	25[c]	5750
Dichloroethene[1,1-]	1.1	5[c]	5500
Ethanol	200	na	na
Ethylbenzene	0.323	700[b]	226,100
Ethyltoluene[4-]	na	na	na
Hexane	5	880[a]	4,400,000
Methanol	0.00011	18,000	1980
Methylene Chloride	0.09	15	1350
n-Heptane	0.0012	na	na
Propylene	na	na	na
Styrene	0.11	100	11,000
PCE	0.754	5[b]	3770
Toluene	0.272	750[c]	204,000
Trichloro-1,2,2-trifluoroethane[1,1,2-]	21.4	59,000[a]	1,262,600,000
TCA	0.705	60[c]	42300
TCE	0.422	5[b]	2110
Freon-11	4	1300[a]	5,200,000
Trimethylbenzene[1,2,4-]	0.23	15[a]	3450
Trimethylbenzene[1,3,5-]	0.32	12[a]	3840
Xylene[1,2-]	0.213	10,000[b]	2,130,000
Xylene[1,3-]+Xylene[1,4-]	0.3	10,000[a]	3,000,000

Note: Calculated concentrations in pore gas exceeding groundwater standard derived using denominator from Equation 3.0-3.

[a] EPA regional tap water SL (http://www.epa.gov/region09/superfund/prg/pdf/composite_sl_table_run_12SEP2008.pdf).

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

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

[d] na = Not available.

Table 4.0-1
Field-Screening Results Using a Landtec GEM-500

Borehole	Sampling Port Depth (ft bgs)	Analyte	Q1 FY2008 (%)	Q2 FY2008 (%)	Q3 FY2008 (%)	Q4 FY2008 (%)
54-01023	10	CO_2	0.5	0	0.5	0.7
54-01023	10	O_2	20.5	20.9	20	19.7
54-01023	60	CO_2	0.7	0	0.2	0.6
54-01023	60	O_2	20.5	20.8	20	19.6
54-01023	100	CO_2	0.5	0	0.4	0
54-01023	100	O_2	20.5	21	20.3	20
54-01023	150	CO_2	NA*	0	0.1	0.3
54-01023	150	O_2	NA	21.1	20.3	20
54-01023	200	CO_2	0.4	0	0.2	0.2
54-01023	200	O_2	20.5	21	21.1	20
54-01023	247	CO_2	0.2	0	0.5	0.2
54-01023	247	O_2	20.6	21.3	21.2	20
54-15461	10	CO_2	0.9	0.7	0.6	0.3
54-15461	10	O_2	20.1	19.4	21.2	20
54-15461	60	CO_2	0.9	0.7	0.3	NA
54-15461	60	O_2	20	19.2	21.2	NA
54-15461	95	CO_2	0.8	0.8	0.4	NA
54-15461	95	O_2	20	19.2	21.2	NA
54-15462	10	CO_2	0.4	0.6	0.2	0
54-15462	10	O_2	20.2	20.3	21.4	16.7
54-15462	60	CO_2	0.6	0.7	0.1	NA
54-15462	60	O_2	20.1	20.2	21.2	NA
54-15462	100	CO_2	0.6	0.6	0	0.1
54-15462	100	O_2	20.1	20.4	21.2	19.2
54-15462	150	CO_2	0.2	0.5	0.3	0
54-15462	150	O_2	20.6	20.5	21.2	19.8
54-15462	200	CO_2	0.2	0.4	0.3	0
54-15462	200	O_2	20.6	20.5	21.2	19.4
54-15462	254	CO_2	0.1	0.4	0	0
54-15462	254	O_2	20.7	20.5	21.6	20.2

*NA = Not analyzed.

Table 4.0-2
Field-Screening Results Using a B&K Multigas Analyzer

Borehole	Sampling Port Depth (ft bgs)	Analyte	B&K Result Q2 FY2008 (ppm[a])	B&K Result Q3 FY2008 (ppm)	B&K Result Q4 FY2008 (ppm)
54-01023	10	Freon-11	0.031	–0.031	0.107
54-01023	10	PCE	0.227	–0.026	–0.241
54-01023	10	TCA	2.2	–0.142	–1
54-01023	10	TCE	0.198	0.512	–0.17
54-01023	60	Freon-11	0.013	–0.088	0.0863
54-01023	60	PCE	0.155	0.182	–0.32
54-01023	60	TCA	–0.248	0.15	–0.919
54-01023	60	TCE	0.049	0.435	–0.036
54-01023	100	Freon-11	0.002	–0.043	0.166
54-01023	100	PCE	0.108	0.014	–0.113
54-01023	100	TCA	–0.133	0.328	–1.2
54-01023	100	TCE	0.098	0.499	–0.645
54-01023	150	Freon-11	0.005	–0.029	–0.095
54-01023	150	PCE	0.001	–0.117	–0.218
54-01023	150	TCA	–0.131	0.913	–0.206
54-01023	150	TCE	0.078	0.253	0.242
54-01023	200	Freon-11	0.013	–0.078	–0.028
54-01023	200	PCE	0.13	–0.004	–0.163
54-01023	200	TCA	–0.177	0.498	0.389
54-01023	200	TCE	0.047	0.212	0.244
54-01023	247	Freon-11	–0.056	–0.403	–0.011
54-01023	247	PCE	–0.037	0.561	–0.237
54-01023	247	TCA	–0.136	–0.282	0.405
54-01023	247	TCE	0.233	1.16	0.137
54-15461	10	Freon-11	–0.048	–0.143	0.012
54-15461	10	PCE	0.018	–0.166	0.103
54-15461	10	TCA	–4.5	1.06	–4
54-15461	10	TCE	–0.145	1.24	0.243
54-15461	60	Freon-11	–0.001	0.0275	0.021
54-15461	60	PCE	0.021	–0.133	0.11
54-15461	60	TCA	–4.9	–0.2	–3.4
54-15461	60	TCE	–0.149	0.0975	0.596
54-15461	95	Freon-11	0.114	–0.183	–0.073
54-15461	95	PCE	0.355	–0.593	0.031
54-15461	95	TCA	–4.4	2.6	–2.5

Table 4.0-2 (continued)

Borehole	Sampling Port Depth (ft bgs)	Analyte	B&K Result Q2 FY2008 (ppm[a])	B&K Result Q3 FY2008 (ppm)	B&K Result Q4 FY2008 (ppm)
54-15461	95	TCE	–0.688	–0.252	0.439
54-15462	10	Freon-11	0.00164	–0.159	0.0712
54-15462	10	PCE	0.161	1.12	–0.215
54-15462	10	TCA	–5.4	–0.207	–0.29
54-15462	10	TCE	0.251	0.164	–0.207
54-15462	60	Freon-11	–0.003	0.0251	na[b]
54-15462	60	PCE	0.133	0.908	na
54-15462	60	TCA	–4.8	–0.433	na
54-15462	60	TCE	0.197	–0.366	na
54-15462	100	Freon-11	0.00169	–0.108	–0.047
54-15462	100	PCE	0.15	–0.902	–0.226
54-15462	100	TCA	–4.6	0.253	–0.677
54-15462	100	TCE	0.136	0.774	0.267
54-15462	150	Freon-11	0.00187	–0.101	0.0602
54-15462	150	PCE	0.215	0.407	–0.149
54-15462	150	TCA	–3.3	0.0941	–0.687
54-15462	150	TCE	0.111	–0.381	–0.263
54-15462	200	Freon-11	–0.036	–0.144	0.0414
54-15462	200	PCE	0.0743	0.0267	–0.254
54-15462	200	TCA	–3.2	0.553	–0.841
54-15462	200	TCE	0.226	1.59	–0.255
54-15462	254	Freon-11	–0.0058	–0.024	0.0821
54-15462	254	PCE	0.112	0.0108	–0.215
54-15462	254	TCA	–2.7	–0.205	–0.671
54-15462	254	TCE	0.154	0.354	–0.385

Note: Field screening for CO_2 and O_2 only during the first quarter.

[a] ppm = Parts per million.

[b] na = Not available.

Table 5.0-1
Detected Tritium Results for Pore-Gas Samples Collected during Monitoring Activities at MDA H

Borehole	Sampling-Top Depth (ft bgs)	Collection Date	Result (pCi/L)
54-01023	10	12/14/2007	2,989,500 (J+)
54-01023	10	4/14/2008	10,233,200 (J)
54-01023	10	6/23/2008	40,506.4 (J)
54-01023	10	9/16/2008	2,969,630
54-01023	60	12/14/2007	4,163,500 (J+)
54-01023	60	4/14/2008	4,501,410 (J)
54-01023	60	6/23/2008	8,083,560 (J)
54-01023	60	9/16/2008	4,671,370
54-01023	100	12/14/2007	2,382,650 (J+)
54-01023	100	4/14/2008	1,494,130 (J)
54-01023	100	6/23/2008	3,904,480 (J)
54-01023	100	9/16/2008	1,656,360
54-01023	150	12/14/2007	890,926 (J+)
54-01023	150	4/14/2008	1,093,620 (J)
54-01023	150	6/23/2008	1,332,380 (J)
54-01023	150	9/16/2008	890,709
54-01023	200	12/14/2007	626,251 (J+)
54-01023	200	4/14/2008	481,409 (J)
54-01023	200	6/23/2008	791,583 (J)
54-01023	200	9/16/2008	504,238
54-01023	247	12/14/2007	509,893 (J+)
54-01023	247	4/14/2008	413,005 (J)
54-01023	247	6/23/2008	47,457.7 (J)
54-01023	247	9/16/2008	407,004
54-15461	10	12/11/2007	3813.54 (J+)
54-15461	10	4/15/2008	8874.26 (J)
54-15461	10	9/15/2008	2783.65
54-15461	60	12/11/2007	611.951 (J+)
54-15461	60	4/15/2008	79,599.9 (J)
54-15461	60	9/15/2008	495.273
54-15461	95	12/11/2007	1021.59 (J+)
54-15461	95	4/15/2008	17,313.3 (J)
54-15461	95	9/15/2008	352.799
54-15462	10	12/12/2007	835.975 (J+)

Table 5.0-1 (continued)

Borehole	Sampling-Top Depth (ft bgs)	Collection Date	Result (pCi/L)
54-15462	10	9/22/2008	9197.34
54-15462	60	12/12/2007	1444.54 (J+)
54-15462	150	12/12/2007	480.082 (J+)
54-15462	200	9/22/2008	234.806
54-15462	200	12/12/2007	574.408 (J+)
54-15462	254	12/12/2007	410.129 (J+)
54-15462	254	4/16/2008	9961.95 (J)
54-15462	254	9/22/2008	2769.86

Note: Data qualifiers are defined in Appendix A.

Table 5.0-2
Detected VOC Results for Pore-Gas Samples
Collected during Monitoring Activities at MDA H

Borehole	Sampling-Top Depth (ft bgs)	Analyte	Collection Date	Results ($\mu g/m^3$)
54-01023	10	Acetone	12/19/2007	46
54-01023	10	Acetone	4/10/2008	5
54-01023	10	Acetone	4/25/2008*	95
54-01023	10	Acetone	6/20/2008*	27
54-01023	10	Acetone	6/23/2008	25
54-01023	10	Butanone[2-]	12/19/2007	3.8
54-01023	10	Butanone[2-]	4/25/2008*	18
54-01023	10	Butanone[2-]	6/20/2008*	5.2
54-01023	10	Butanone[2-]	6/23/2008	5.1
54-01023	10	Carbon Disulfide	12/19/2007	59
54-01023	10	Carbon Disulfide	6/20/2008*	11
54-01023	10	Carbon Disulfide	9/9/2008	4.8
54-01023	10	Cyclohexane	6/20/2008*	3.4
54-01023	10	Dichlorodifluoromethane	4/10/2008	27
54-01023	10	Dichlorodifluoromethane	6/20/2008*	8.4
54-01023	10	Dichlorodifluoromethane	6/23/2008	18
54-01023	10	Dichlorodifluoromethane	9/9/2008	18
54-01023	10	Ethanol	6/23/2008	79
54-01023	10	Ethylbenzene	6/20/2008*	7
54-01023	10	Ethyltoluene[4-]	6/20/2008*	7.8
54-01023	10	Freon-11	12/19/2007	38
54-01023	10	Freon-11	4/10/2008	85

Table 5.0-2 (continued)

Borehole	Sampling-Top Depth (ft bgs)	Analyte	Collection Date	Results (µg/m³)
54-01023	10	Freon-11	6/20/2008*	17
54-01023	10	Freon-11	6/23/2008	46
54-01023	10	Freon-11	9/9/2008	49
54-01023	10	Hexane	6/20/2008*	18
54-01023	10	Hexane	6/23/2008	6.3
54-01023	10	n-Heptane	6/20/2008*	8.2
54-01023	10	PCE	4/10/2008	51
54-01023	10	Propanol[2-]	6/23/2008	9.3
54-01023	10	TCA	4/10/2008	190
54-01023	10	TCA	6/20/2008*	4.8
54-01023	10	TCA	6/23/2008	11
54-01023	10	TCA	9/9/2008	5.3
54-01023	10	TCE	4/10/2008	100
54-01023	10	Toluene	4/10/2008	1.8
54-01023	10	Toluene	6/20/2008*	50
54-01023	10	Toluene	6/23/2008	44
54-01023	10	Toluene	9/9/2008	4.1
54-01023	10	Trichloro-1,2,2-trifluoroethane[1,1,2-]	4/10/2008	10
54-01023	10	Trichloro-1,2,2-trifluoroethane[1,1,2-]	6/23/2008	7.8
54-01023	10	Trimethylbenzene[1,2,4-]	6/20/2008*	8.8
54-01023	10	Xylene[1,2-]	6/20/2008*	9.1
54-01023	10	Xylene[1,3-]+Xylene[1,4-]	6/20/2008*	26
54-01023	60	Acetone	12/19/2007	13
54-01023	60	Acetone	4/10/2008	8.8
54-01023	60	Acetone	4/25/2008*	32
54-01023	60	Acetone	6/20/2008*	63
54-01023	60	Acetone	6/23/2008	100
54-01023	60	Butanol[1-]	6/23/2008	17
54-01023	60	Butanol[1-]	9/9/2008	49
54-01023	60	Butanone[2-]	4/25/2008*	9.3
54-01023	60	Butanone[2-]	6/20/2008*	13
54-01023	60	Butanone[2-]	6/23/2008	20
54-01023	60	Carbon Disulfide	6/20/2008*	28
54-01023	60	Carbon Tetrachloride	4/10/2008	4.8
54-01023	60	Chlorobenzene	6/23/2008	8.1
54-01023	60	Chlorobenzene	9/9/2008	8
54-01023	60	Chloroform	4/10/2008	2.4
54-01023	60	Cyclohexane	6/20/2008*	4.4

Table 5.0-2 (continued)

Borehole	Sampling-Top Depth (ft bgs)	Analyte	Collection Date	Results (µg/m³)
54-01023	60	Dichlorodifluoromethane	4/10/2008	26
54-01023	60	Dichlorodifluoromethane	6/20/2008*	8.9
54-01023	60	Dichlorodifluoromethane	6/23/2008	21
54-01023	60	Dichlorodifluoromethane	9/9/2008	22
54-01023	60	Dichloropropane[1,2-]	4/10/2008	1.9
54-01023	60	Ethanol	6/23/2008	10
54-01023	60	Ethylbenzene	6/20/2008*	7.8
54-01023	60	Ethyltoluene[4-]	6/20/2008*	8.6
54-01023	60	Freon-11	12/19/2007	47
54-01023	60	Freon-11	4/10/2008	66
54-01023	60	Freon-11	6/20/2008*	17
54-01023	60	Freon-11	6/23/2008	43
54-01023	60	Freon-11	9/9/2008	63
54-01023	60	Hexane	6/20/2008*	12
54-01023	60	Hexane	6/23/2008	9.2
54-01023	60	n-Heptane	6/20/2008*	8.8
54-01023	60	PCE	12/19/2007	62
54-01023	60	PCE	4/10/2008	7.4
54-01023	60	Propanol[2-]	12/19/2007	12
54-01023	60	Propanol[2-]	6/23/2008	10
54-01023	60	TCA	4/10/2008	33
54-01023	60	TCA	6/20/2008*	5.2
54-01023	60	TCA	6/23/2008	19
54-01023	60	TCA	9/9/2008	10
54-01023	60	TCE	4/10/2008	8.7
54-01023	60	TCE	6/20/2008*	5.3
54-01023	60	TCE	9/9/2008	5.6
54-01023	60	Toluene	4/10/2008	3.8
54-01023	60	Toluene	6/20/2008*	63
54-01023	60	Toluene	6/23/2008	70
54-01023	60	Trichloro-1,2,2-trifluoroethane[1,1,2-]	12/19/2007	9.9
54-01023	60	Trichloro-1,2,2-trifluoroethane[1,1,2-]	4/10/2008	14
54-01023	60	Trichloro-1,2,2-trifluoroethane[1,1,2-]	6/23/2008	11
54-01023	60	Trichloro-1,2,2-trifluoroethane[1,1,2-]	9/9/2008	10
54-01023	60	Trimethylbenzene[1,2,4-]	6/20/2008*	9.8
54-01023	60	Xylene[1,2-]	6/20/2008*	11
54-01023	60	Xylene[1,3-]+Xylene[1,4-]	6/20/2008*	32
54-01023	100	Acetone	4/25/2008*	13

Table 5.0-2 (continued)

Borehole	Sampling-Top Depth (ft bgs)	Analyte	Collection Date	Results (µg/m^3)
54-01023	100	Acetone	6/20/2008*	55
54-01023	100	Acetone	6/23/2008	34
54-01023	100	Acetone	9/9/2008	8.7
54-01023	100	Butanol[1-]	6/23/2008	25
54-01023	100	Butanol[1-]	9/9/2008	70
54-01023	100	Butanone[2-]	4/25/2008*	2.9
54-01023	100	Butanone[2-]	6/20/2008*	14
54-01023	100	Butanone[2-]	6/23/2008	7.2
54-01023	100	Butanone[2-]	9/9/2008	4.3
54-01023	100	Carbon Disulfide	6/20/2008*	28
54-01023	100	Carbon Disulfide	9/9/2008	20
54-01023	100	Carbon Tetrachloride	4/10/2008	7.1
54-01023	100	Chlorobenzene	6/23/2008	12
54-01023	100	Chlorobenzene	9/9/2008	16
54-01023	100	Chloroform	4/10/2008	2.2
54-01023	100	Cyclohexane	6/20/2008*	4.1
54-01023	100	Dichlorodifluoromethane	4/10/2008	27
54-01023	100	Dichlorodifluoromethane	6/20/2008*	6.9
54-01023	100	Dichlorodifluoromethane	6/23/2008	20
54-01023	100	Dichlorodifluoromethane	9/9/2008	13
54-01023	100	Dichloropropane[1,2-]	4/10/2008	3.9
54-01023	100	Ethanol	6/23/2008	13
54-01023	100	Ethylbenzene	6/20/2008*	8.7
54-01023	100	Ethyltoluene[4-]	6/20/2008*	9.5
54-01023	100	Freon-11	12/19/2007	36
54-01023	100	Freon-11	4/10/2008	50
54-01023	100	Freon-11	6/20/2008*	11
54-01023	100	Freon-11	6/23/2008	37
54-01023	100	Freon-11	9/9/2008	27
54-01023	100	Hexane	6/20/2008*	11
54-01023	100	Hexane	6/23/2008	13
54-01023	100	n-Heptane	6/20/2008*	8.9
54-01023	100	PCE	4/10/2008	4.6
54-01023	100	Propylene	6/20/2008*	6.4
54-01023	100	TCA	4/10/2008	34
54-01023	100	TCA	6/23/2008	20
54-01023	100	TCA	6/20/2008*	5
54-01023	100	TCA	9/9/2008	14

Table 5.0-2 (continued)

Borehole	Sampling-Top Depth (ft bgs)	Analyte	Collection Date	Results (µg/m³)
54-01023	100	TCE	4/10/2008	4.9
54-01023	100	TCE	6/20/2008*	5.2
54-01023	100	Toluene	6/20/2008*	72
54-01023	100	Toluene	6/23/2008	66
54-01023	100	Toluene	9/9/2008	3.4
54-01023	100	Trichloro-1,2,2-trifluoroethane[1,1,2-]	12/19/2007	9.2
54-01023	100	Trichloro-1,2,2-trifluoroethane[1,1,2-]	4/10/2008	15
54-01023	100	Trichloro-1,2,2-trifluoroethane[1,1,2-]	6/23/2008	11
54-01023	100	Trimethylbenzene[1,2,4-]	6/20/2008*	11
54-01023	100	Xylene[1,2-]	6/20/2008*	12
54-01023	100	Xylene[1,3-]+Xylene[1,4-]	6/20/2008*	36
54-01023	150	Acetone	12/19/2007	9
54-01023	150	Acetone	4/10/2008	7.1
54-01023	150	Acetone	4/25/2008*	13
54-01023	150	Acetone	6/20/2008*	59
54-01023	150	Acetone	6/23/2008	12
54-01023	150	Butanol[1-]	6/23/2008	41
54-01023	150	Butanol[1-]	9/9/2008	110
54-01023	150	Butanone[2-]	6/20/2008*	19
54-01023	150	Carbon Disulfide	4/10/2008	20
54-01023	150	Carbon Disulfide	6/20/2008*	37
54-01023	150	Carbon Tetrachloride	4/10/2008	14
54-01023	150	Chlorobenzene	6/23/2008	21
54-01023	150	Chlorobenzene	9/9/2008	33
54-01023	150	Chloroform	4/10/2008	2.1
54-01023	150	Cyclohexane	6/20/2008*	11
54-01023	150	Dichlorodifluoromethane	4/10/2008	32
54-01023	150	Dichlorodifluoromethane	6/20/2008*	6.1
54-01023	150	Dichlorodifluoromethane	6/23/2008	22
54-01023	150	Dichlorodifluoromethane	9/9/2008	22
54-01023	150	Dichloropropane[1,2-]	4/10/2008	8.2
54-01023	150	Ethylbenzene	6/20/2008*	19
54-01023	150	Ethyltoluene[4-]	6/20/2008*	18
54-01023	150	Ethyltoluene[4-]	9/9/2008	28
54-01023	150	Freon-11	12/19/2007	23
54-01023	150	Freon-11	4/10/2008	46
54-01023	150	Freon-11	6/20/2008*	8.9
54-01023	150	Freon-11	6/23/2008	36

Table 5.0-2 (continued)

Borehole	Sampling-Top Depth (ft bgs)	Analyte	Collection Date	Results (µg/m³)
54-01023	150	Freon-11	9/9/2008	35
54-01023	150	Hexane	6/20/2008*	34
54-01023	150	Hexane	6/23/2008	4.8
54-01023	150	n-Heptane	6/20/2008*	25
54-01023	150	PCE	4/10/2008	4.9
54-01023	150	PCE	6/20/2008*	8.2
54-01023	150	Propanol[2-]	12/19/2007	27
54-01023	150	TCA	4/10/2008	39
54-01023	150	TCE	6/20/2008*	12
54-01023	150	TCA	6/23/2008	25
54-01023	150	TCA	9/9/2008	25
54-01023	150	TCE	4/10/2008	6.3
54-01023	150	Toluene	4/10/2008	1.2
54-01023	150	Toluene	6/20/2008*	150
54-01023	150	Toluene	6/23/2008	56
54-01023	150	Toluene	9/9/2008	4.7
54-01023	150	Trichloro-1,2,2-trifluoroethane[1,1,2-]	12/19/2007	9.1
54-01023	150	Trichloro-1,2,2-trifluoroethane[1,1,2-]	4/10/2008	21
54-01023	150	Trichloro-1,2,2-trifluoroethane[1,1,2-]	6/23/2008	12
54-01023	150	Trichloro-1,2,2-trifluoroethane[1,1,2-]	9/9/2008	11
54-01023	150	Trimethylbenzene[1,2,4-]	6/20/2008*	20
54-01023	150	Trimethylbenzene[1,2,4-]	9/9/2008	44
54-01023	150	Trimethylbenzene[1,3,5-]	6/20/2008*	6.2
54-01023	150	Trimethylbenzene[1,3,5-]	9/9/2008	10
54-01023	150	Xylene[1,2-]	6/20/2008*	25
54-01023	150	Xylene[1,2-]	9/9/2008	5
54-01023	150	Xylene[1,3-]+Xylene[1,4-]	6/20/2008*	76
54-01023	150	Xylene[1,3-]+Xylene[1,4-]	9/9/2008	4.3
54-01023	200	Acetone	12/19/2007	9.6
54-01023	200	Acetone	4/10/2008	7.9
54-01023	200	Acetone	4/25/2008*	11
54-01023	200	Acetone	6/20/2008*	71
54-01023	200	Acetone	6/23/2008	30
54-01023	200	Butanone[2-]	6/20/2008*	36
54-01023	200	Butanone[2-]	6/23/2008	3.8
54-01023	200	Carbon Disulfide	4/10/2008	22
54-01023	200	Carbon Disulfide	6/20/2008*	50
54-01023	200	Carbon Tetrachloride	12/19/2007	6.6

Table 5.0-2 (continued)

Borehole	Sampling-Top Depth (ft bgs)	Analyte	Collection Date	Results (µg/m^3)
54-01023	200	Carbon Tetrachloride	4/10/2008	14
54-01023	200	Carbon Tetrachloride	9/9/2008	6.6
54-01023	200	Chloroform	4/10/2008	1.5
54-01023	200	Cyclohexane	6/20/2008*	31
54-01023	200	Dichlorodifluoromethane	4/10/2008	27
54-01023	200	Dichlorodifluoromethane	6/20/2008*	5.1
54-01023	200	Dichlorodifluoromethane	6/23/2008	23
54-01023	200	Dichlorodifluoromethane	9/9/2008	22
54-01023	200	Dichloropropane[1,2-]	4/10/2008	7.3
54-01023	200	Ethylbenzene	6/20/2008*	40
54-01023	200	Ethyltoluene[4-]	6/20/2008*	36
54-01023	200	Freon-11	12/19/2007	26
54-01023	200	Freon-11	4/10/2008	36
54-01023	200	Freon-11	6/20/2008*	6.8
54-01023	200	Freon-11	6/23/2008	42
54-01023	200	Freon-11	9/9/2008	34
54-01023	200	Hexane	6/20/2008*	110
54-01023	200	Hexane	6/23/2008	7.1
54-01023	200	n-Heptane	6/20/2008*	66
54-01023	200	PCE	4/10/2008	3.5
54-01023	200	PCE	6/20/2008*	6.3
54-01023	200	Propanol[2-]	12/19/2007	43
54-01023	200	Propylene	6/20/2008*	24
54-01023	200	TCA	4/10/2008	23
54-01023	200	TCA	6/23/2008	20
54-01023	200	TCA	9/9/2008	26
54-01023	200	TCE	4/10/2008	3.9
54-01023	200	TCE	6/20/2008*	8
54-01023	200	Toluene	4/10/2008	2.5
54-01023	200	Toluene	6/20/2008*	320
54-01023	200	Toluene	6/23/2008	48
54-01023	200	Trichloro-1,2,2-trifluoroethane[1,1,2-]	12/19/2007	9.7
54-01023	200	Trichloro-1,2,2-trifluoroethane[1,1,2-]	4/10/2008	18
54-01023	200	Trichloro-1,2,2-trifluoroethane[1,1,2-]	6/23/2008	12
54-01023	200	Trichloro-1,2,2-trifluoroethane[1,1,2-]	9/9/2008	14
54-01023	200	Trimethylbenzene[1,2,4-]	6/20/2008*	37
54-01023	200	Trimethylbenzene[1,3,5-]	6/20/2008*	12
54-01023	200	Xylene[1,2-]	6/20/2008*	54

Table 5.0-2 (continued)

Borehole	Sampling-Top Depth (ft bgs)	Analyte	Collection Date	Results (µg/m³)
54-01023	200	Xylene[1,3-]+Xylene[1,4-]	6/20/2008*	150
54-01023	247	Acetone	12/19/2007	8 (J)
54-01023	247	Acetone	4/10/2008	5.5
54-01023	247	Acetone	4/25/2008*	17
54-01023	247	Acetone	6/20/2008*	130
54-01023	247	Acetone	6/23/2008	27
54-01023	247	Benzene	9/9/2008	5.9
54-01023	247	Butadiene[1,3-]	6/20/2008*	5.6
54-01023	247	Butanol[1-]	6/23/2008	110
54-01023	247	Butanol[1-]	9/9/2008	160
54-01023	247	Butanone[2-]	4/25/2008*	3.9
54-01023	247	Butanone[2-]	6/20/2008*	120
54-01023	247	Butanone[2-]	6/23/2008	3.5
54-01023	247	Carbon Disulfide	6/20/2008*	85
54-01023	247	Carbon Disulfide	9/9/2008	8.8
54-01023	247	Carbon Tetrachloride	12/19/2007	5.7
54-01023	247	Carbon Tetrachloride	4/10/2008	14
54-01023	247	Chlorobenzene	6/23/2008	53
54-01023	247	Chlorobenzene	9/9/2008	88
54-01023	247	Chloromethane	4/10/2008	0.99
54-01023	247	Cyclohexane	6/20/2008*	89
54-01023	247	Dichlorodifluoromethane	4/10/2008	21
54-01023	247	Dichlorodifluoromethane	6/23/2008	22
54-01023	247	Dichlorodifluoromethane	9/9/2008	14
54-01023	247	Dichloropropane[1,2-]	4/10/2008	5.3
54-01023	247	Ethylbenzene	6/20/2008*	83
54-01023	247	Ethyltoluene[4-]	6/20/2008*	63
54-01023	247	Freon-11	12/19/2007	13
54-01023	247	Freon-11	4/10/2008	27
54-01023	247	Freon-11	6/23/2008	43
54-01023	247	Freon-11	9/9/2008	22
54-01023	247	Hexane	6/20/2008*	290
54-01023	247	Hexane	6/23/2008	8.1
54-01023	247	n-Heptane	6/20/2008*	160
54-01023	247	Propylene	6/20/2008*	62
54-01023	247	TCA	4/10/2008	11
54-01023	247	TCA	6/23/2008	17
54-01023	247	TCA	9/9/2008	9.6

Table 5.0-2 (continued)

Borehole	Sampling-Top Depth (ft bgs)	Analyte	Collection Date	Results (µg/m³)
54-01023	247	TCE	4/10/2008	2.6
54-01023	247	TCE	6/20/2008*	11
54-01023	247	Toluene	6/20/2008*	730
54-01023	247	Toluene	6/23/2008	53
54-01023	247	Toluene	9/9/2008	31
54-01023	247	Trichloro-1,2,2-trifluoroethane[1,1,2-]	4/10/2008	13
54-01023	247	Trichloro-1,2,2-trifluoroethane[1,1,2-]	6/23/2008	11
54-01023	247	Trichloro-1,2,2-trifluoroethane[1,1,2-]	9/9/2008	8.5
54-01023	247	Trimethylbenzene[1,2,4-]	6/20/2008*	63
54-01023	247	Trimethylbenzene[1,3,5-]	6/20/2008*	20
54-01023	247	Xylene[1,2-]	6/20/2008*	110
54-01023	247	Xylene[1,3-]+Xylene[1,4-]	6/20/2008*	300
54-15461	10	Acetone	4/9/2008	12 (J)
54-15461	10	Acetone	4/18/2008*	2100
54-15461	10	Benzene	4/18/2008*	110
54-15461	10	Butadiene[1,3-]	6/25/2008*	3.6
54-15461	10	Butanone[2-]	4/18/2008*	470
54-15461	10	Carbon Disulfide	4/9/2008	4.1
54-15461	10	Carbon Disulfide	9/9/2008	5
54-15461	10	Carbon Tetrachloride	4/9/2008	3.8
54-15461	10	Chloromethane	4/9/2008	0.9
54-15461	10	Cyclohexane	6/25/2008*	7.5
54-15461	10	Dichlorodifluoromethane	4/9/2008	27
54-15461	10	Dichlorodifluoromethane	6/26/2008	18
54-15461	10	Dichlorodifluoromethane	9/9/2008	6.8
54-15461	10	Ethanol	6/26/2008	23
54-15461	10	Ethylbenzene	6/25/2008*	9.6
54-15461	10	Ethyltoluene[4-]	6/25/2008*	22
54-15461	10	Freon-11	12/19/2007	9.3
54-15461	10	Freon-11	4/9/2008	19
54-15461	10	Freon-11	6/26/2008	16
54-15461	10	Hexane	6/25/2008*	31
54-15461	10	n-Heptane	6/25/2008*	6.7
54-15461	10	Propanol[2-]	6/26/2008	9 (J)
54-15461	10	Propylene	6/25/2008*	18
54-15461	10	TCA	4/9/2008	18
54-15461	10	TCA	6/26/2008	9.4
54-15461	10	Toluene	6/25/2008*	59

Table 5.0-2 (continued)

Borehole	Sampling-Top Depth (ft bgs)	Analyte	Collection Date	Results ($\mu g/m^3$)
54-15461	10	Toluene	6/26/2008	4.6
54-15461	10	Trichloro-1,2,2-trifluoroethane[1,1,2-]	4/9/2008	6.5
54-15461	10	Trimethylbenzene[1,2,4-]	6/25/2008*	30
54-15461	10	Trimethylbenzene[1,3,5-]	6/25/2008*	8.9
54-15461	10	Xylene[1,2-]	6/25/2008*	15
54-15461	10	Xylene[1,3-]+Xylene[1,4-]	6/25/2008*	35
54-15461	60	Acetone	12/19/2007	26
54-15461	60	Acetone	4/9/2008	8.4 (J)
54-15461	60	Butadiene[1,3-]	6/25/2008*	2.7
54-15461	60	Butanone[2-]	12/19/2007	4.5
54-15461	60	Butanone[2-]	6/25/2008*	21
54-15461	60	Carbon Disulfide	4/9/2008	3.5
54-15461	60	Carbon Disulfide	6/26/2008	4.4
54-15461	60	Carbon Tetrachloride	4/9/2008	4.5
54-15461	60	Chloromethane	4/9/2008	1.1
54-15461	60	Cyclohexane	6/25/2008*	4.1
54-15461	60	Dichlorodifluoromethane	4/9/2008	20
54-15461	60	Dichlorodifluoromethane	4/18/2008*	21
54-15461	60	Dichlorodifluoromethane	6/26/2008	11
54-15461	60	Dichlorodifluoromethane	9/9/2008	16
54-15461	60	Ethylbenzene	6/25/2008*	8.3
54-15461	60	Ethyltoluene[4-]	6/25/2008*	22
54-15461	60	Freon-11	12/19/2007	14
54-15461	60	Freon-11	4/18/2008*	19
54-15461	60	Freon-11	4/9/2008	16
54-15461	60	Freon-11	6/26/2008	7.9
54-15461	60	Freon-11	9/9/2008	14
54-15461	60	Hexane	6/25/2008*	15
54-15461	60	n-Heptane	6/25/2008*	5.6
54-15461	60	Propylene	6/25/2008*	16
54-15461	60	TCA	4/9/2008	11
54-15461	60	TCA	9/9/2008	10
54-15461	60	Toluene	6/25/2008*	44
54-15461	60	Trichloro-1,2,2-trifluoroethane[1,1,2-]	4/9/2008	5.4
54-15461	60	Trimethylbenzene[1,2,4-]	6/25/2008*	30
54-15461	60	Trimethylbenzene[1,3,5-]	6/25/2008*	8.9
54-15461	60	Xylene[1,2-]	12/19/2007	4
54-15461	60	Xylene[1,2-]	6/25/2008*	14

Table 5.0-2 (continued)

Borehole	Sampling-Top Depth (ft bgs)	Analyte	Collection Date	Results (µg/m³)
54-15461	60	Xylene[1,3-]+Xylene[1,4-]	12/19/2007	9.5
54-15461	60	Xylene[1,3-]+Xylene[1,4-]	6/25/2008*	32
54-15461	95	Acetone	12/19/2007	11
54-15461	95	Acetone	4/9/2008	7.4 (J)
54-15461	95	Acetone	9/9/2008	11
54-15461	95	Benzene	4/18/2008*	38
54-15461	95	Butadiene[1,3-]	6/25/2008*	2.5
54-15461	95	Butanone[2-]	12/19/2007	4.7
54-15461	95	Carbon Tetrachloride	4/9/2008	8.7
54-15461	95	Cyclohexane	6/25/2008*	4.4
54-15461	95	Dichlorodifluoromethane	4/9/2008	23
54-15461	95	Dichlorodifluoromethane	6/26/2008	9.7
54-15461	95	Dichlorodifluoromethane	9/9/2008	17
54-15461	95	Dichloropropane[1,2-]	4/9/2008	1.1
54-15461	95	Ethylbenzene	6/25/2008*	8.2
54-15461	95	Ethyltoluene[4-]	6/25/2008*	21
54-15461	95	Freon-11	12/19/2007	15
54-15461	95	Freon-11	4/9/2008	22
54-15461	95	Freon-11	6/26/2008	6.7
54-15461	95	Freon-11	9/9/2008	16
54-15461	95	Hexane	6/25/2008*	16
54-15461	95	n-Heptane	6/25/2008*	4.8
54-15461	95	PCE	4/9/2008	3.2
54-15461	95	Propanol[2-]	6/26/2008	430
54-15461	95	Propylene	6/25/2008*	15
54-15461	95	Propylene	6/26/2008	70
54-15461	95	TCA	4/9/2008	16
54-15461	95	TCA	6/26/2008	4.7
54-15461	95	TCA	9/9/2008	11
54-15461	95	Toluene	4/9/2008	8
54-15461	95	Toluene	6/25/2008*	40
54-15461	95	Toluene	6/26/2008	5.9
54-15461	95	Trichloro-1,2,2-trifluoroethane[1,1,2-]	4/9/2008	7.8
54-15461	95	Trimethylbenzene[1,2,4-]	6/25/2008*	28
54-15461	95	Trimethylbenzene[1,3,5-]	6/25/2008*	8.8
54-15461	95	Xylene[1,2-]	6/25/2008*	14
54-15461	95	Xylene[1,3-]+Xylene[1,4-]	6/25/2008*	32
54-15462	10	Acetone	12/19/2007	28

Table 5.0-2 (continued)

Borehole	Sampling-Top Depth (ft bgs)	Analyte	Collection Date	Results (µg/m³)
54-15462	10	Acetone	4/10/2008	4.6
54-15462	10	Acetone	4/22/2008*	300
54-15462	10	Acetone	6/24/2008*	130
54-15462	10	Acetone	6/26/2008	30
54-15462	10	Benzene	4/22/2008*	66
54-15462	10	Butanone[2-]	4/22/2008*	87
54-15462	10	Butanone[2-]	6/24/2008*	17
54-15462	10	Butanone[2-]	12/19/2007	9.8
54-15462	10	Butanone[2-]	6/26/2008	4
54-15462	10	Carbon Tetrachloride	4/10/2008	1.9
54-15462	10	Dichlorodifluoromethane	4/10/2008	24
54-15462	10	Dichlorodifluoromethane	4/22/2008*	6
54-15462	10	Dichlorodifluoromethane	6/24/2008*	7
54-15462	10	Dichlorodifluoromethane	6/26/2008	18
54-15462	10	Dichlorodifluoromethane	9/11/2008	8.1
54-15462	10	Dichloropropane[1,2-]	4/10/2008*	1.5
54-15462	10	Ethylbenzene	6/24/2008*	4.8
54-15462	10	Ethyltoluene[4-]	6/24/2008*	10
54-15462	10	Freon-11	12/19/2007	20
54-15462	10	Freon-11	4/10/2008	24
54-15462	10	Freon-11	6/24/2008*	6.5
54-15462	10	Freon-11	9/11/2008	7.3
54-15462	10	Hexane	4/22/2008*	16
54-15462	10	Hexane	6/24/2008*	4.2
54-15462	10	Hexane	6/26/2008	4.3
54-15462	10	n-Heptane	4/22/2008*	32
54-15462	10	PCE	4/10/2008	3.8
54-15462	10	Propylene	6/24/2008*	7.1
54-15462	10	Styrene	4/22/2008*	5
54-15462	10	TCA	4/10/2008	74
54-15462	10	TCA	4/22/2008*	9
54-15462	10	TCA	6/24/2008*	13
54-15462	10	TCA	6/26/2008	28
54-15462	10	TCA	9/11/2008	17
54-15462	10	TCE	4/10/2008	6
54-15462	10	Toluene	4/22/2008	10
54-15462	10	Toluene	6/24/2008*	18
54-15462	10	Toluene	6/26/2008	8.1

Table 5.0-2 (continued)

Borehole	Sampling-Top Depth (ft bgs)	Analyte	Collection Date	Results (µg/m³)
54-15462	10	Trichloro-1,2,2-trifluoroethane[1,1,2-]	12/19/2007	16
54-15462	10	Trichloro-1,2,2-trifluoroethane[1,1,2-]	4/10/2008	16
54-15462	10	Trichloro-1,2,2-trifluoroethane[1,1,2-]	6/26/2008	9
54-15462	10	Trimethylbenzene[1,2,4-]	6/24/2008*	14
54-15462	10	Xylene[1,2-]	6/24/2008*	7.7
54-15462	10	Xylene[1,3-]+Xylene[1,4-]	6/24/2008*	18
54-15462	54	Hexane	6/26/2008	7.7
54-15462	60	Acetone	12/19/2007	18
54-15462	60	Acetone	4/10/2008*	3.4
54-15462	60	Acetone	4/22/2008*	210
54-15462	60	Acetone	6/24/2008*	190
54-15462	60	Acetone	6/26/2008	20
54-15462	60	Benzene	4/22/2008*	9.6
54-15462	60	Butanone[2-]	6/24/2008*	29
54-15462	60	Butanone[2-]	6/26/2008	13
54-15462	60	Carbon Tetrachloride	4/10/2008	5.5
54-15462	60	Chloromethane	4/10/2008	1.3
54-15462	60	Dichlorodifluoromethane	4/10/2008	40
54-15462	60	Dichlorodifluoromethane	4/22/2008	12
54-15462	60	Dichlorodifluoromethane	6/24/2008*	9.7
54-15462	60	Dichlorodifluoromethane	6/26/2008	8.9
54-15462	60	Dichloroethane[1,1-]	4/10/2008	1.9
54-15462	60	Dichloroethene[1,1-]	4/10/2008	1.1
54-15462	60	Dichloropropane[1,2-]	4/10/2008	2
54-15462	60	Ethanol	6/24/2008*	13
54-15462	60	Ethanol	6/26/2008	150
54-15462	60	Ethyltoluene[4-]	6/24/2008*	11
54-15462	60	Freon-11	12/19/2007	35
54-15462	60	Freon-11	4/10/2008	38
54-15462	60	Freon-11	4/22/2008*	11
54-15462	60	Freon-11	6/24/2008*	8.1
54-15462	60	Freon-11	6/26/2008	7.6
54-15462	60	Hexane	4/22/2008*	5.5
54-15462	60	Hexane	6/26/2008	3.5
54-15462	60	Methanol	6/26/2008	200
54-15462	60	n-Heptane	4/22/2008*	12
54-15462	60	PCE	4/10/2008	5
54-15462	60	Propylene	4/22/2008*	6.7

Table 5.0-2 (continued)

Borehole	Sampling-Top Depth (ft bgs)	Analyte	Collection Date	Results (µg/m³)
54-15462	60	Propylene	6/24/2008*	9.1
54-15462	60	TCA	4/10/2008	100
54-15462	60	TCA	4/22/2008*	27
54-15462	60	TCA	6/24/2008*	16
54-15462	60	TCA	6/26/2008	14
54-15462	60	TCE	4/10/2008	8.4
54-15462	60	Toluene	4/10/2008	2.9
54-15462	60	Toluene	4/22/2008*	6
54-15462	60	Toluene	6/24/2008*	17
54-15462	60	Toluene	6/26/2008	9.5
54-15462	60	Trichloro-1,2,2-trifluoroethane[1,1,2-]	12/19/2007	25
54-15462	60	Trichloro-1,2,2-trifluoroethane[1,1,2-]	4/10/2008	27
54-15462	60	Trichloro-1,2,2-trifluoroethane[1,1,2-]	4/22/2008*	7.8
54-15462	60	Trimethylbenzene[1,2,4-]	6/24/2008*	15
54-15462	60	Xylene[1,2-]	6/24/2008*	8.2
54-15462	60	Xylene[1,3-]+Xylene[1,4-]	6/24/2008*	17
54-15462	60	Xylene[1,3-]+Xylene[1,4-]	6/26/2008	4.5
54-15462	100	Acetone	12/19/2007	27
54-15462	100	Acetone	4/10/2008	53
54-15462	100	Acetone	6/24/2008*	62
54-15462	100	Acetone	6/26/2008	140
54-15462	100	Benzene	4/22/2008*	9.4
54-15462	100	Butanone[2-]	12/19/2007	3.6
54-15462	100	Butanone[2-]	6/24/2008*	6.4
54-15462	100	Butanone[2-]	6/26/2008	520
54-15462	100	Carbon Disulfide	12/19/2007	11
54-15462	100	Carbon Disulfide	4/10/2008	15
54-15462	100	Carbon Tetrachloride	4/10/2008	7.2
54-15462	100	Chloromethane	4/10/2008	3.8
54-15462	100	Cyclohexane	6/26/2008	14
54-15462	100	Dichlorodifluoromethane	4/10/2008	44
54-15462	100	Dichlorodifluoromethane	4/22/2008*	16
54-15462	100	Dichlorodifluoromethane	6/24/2008*	12
54-15462	100	Dichlorodifluoromethane	9/11/2008	14
54-15462	100	Dichloroethane[1,1-]	12/19/2007	4.2
54-15462	100	Dichloroethane[1,1-]	4/10/2008	1.7
54-15462	100	Dichloroethene[1,1-]	4/10/2008	2.4
54-15462	100	Dichloropropane[1,2-]	4/10/2008	2.1

Table 5.0-2 (continued)

Borehole	Sampling-Top Depth (ft bgs)	Analyte	Collection Date	Results (µg/m³)
54-15462	100	Ethanol	6/26/2008	210
54-15462	100	Ethylbenzene	6/26/2008	4
54-15462	100	Ethyltoluene[4-]	6/24/2008*	6.7
54-15462	100	Ethyltoluene[4-]	6/26/2008	4.3
54-15462	100	Freon-11	12/19/2007	52
54-15462	100	Freon-11	4/10/2008	40
54-15462	100	Freon-11	4/22/2008*	15
54-15462	100	Freon-11	6/24/2008*	10
54-15462	100	Freon-11	9/11/2008	14
54-15462	100	Hexane	4/22/2008*	6.8
54-15462	100	Hexane	6/26/2008	18
54-15462	100	n-Heptane	4/22/2008*	13
54-15462	100	PCE	4/10/2008	3.3
54-15462	100	TCA	4/10/2008	88
54-15462	100	TCA	4/22/2008*	35
54-15462	100	TCA	6/24/2008*	21
54-15462	100	TCA	9/11/2008	37
54-15462	100	TCE	4/10/2008	7.2
54-15462	100	TCE	9/11/2008	5.4
54-15462	100	Toluene	4/22/2008*	8
54-15462	100	Toluene	6/24/2008*	14
54-15462	100	Toluene	6/26/2008	14
54-15462	100	Trichloro-1,2,2-trifluoroethane[1,1,2-]	12/19/2007	39
54-15462	100	Trichloro-1,2,2-trifluoroethane[1,1,2-]	4/10/2008	32
54-15462	100	Trichloro-1,2,2-trifluoroethane[1,1,2-]	4/22/2008*	9.4
54-15462	100	Trichloro-1,2,2-trifluoroethane[1,1,2-]	9/11/2008	8.6
54-15462	100	Trimethylbenzene[1,2,4-]	6/24/2008*	9.2
54-15462	100	Trimethylbenzene[1,2,4-]	6/26/2008	4.4
54-15462	100	Xylene[1,2-]	6/26/2008	4
54-15462	100	Xylene[1,3-]+Xylene[1,4-]	6/24/2008*	11
54-15462	100	Xylene[1,3-]+Xylene[1,4-]	6/26/2008	9.7
54-15462	150	Acetone	12/19/2007	81
54-15462	150	Acetone	4/10/2008	13
54-15462	150	Acetone	6/24/2008*	100
54-15462	150	Acetone	6/26/2008	26
54-15462	150	Benzene	4/22/2008*	9.1
54-15462	150	Butanone[2-]	12/19/2007	5.7
54-15462	150	Butanone[2-]	6/24/2008*	11

Table 5.0-2 (continued)

Borehole	Sampling-Top Depth (ft bgs)	Analyte	Collection Date	Results (µg/m³)
54-15462	150	Butanone[2-]	6/26/2008	21
54-15462	150	Carbon Disulfide	12/19/2007	16
54-15462	150	Carbon Disulfide	4/10/2008	3.2
54-15462	150	Carbon Disulfide	9/11/2008	3.8
54-15462	150	Carbon Tetrachloride	4/10/2008	7.2
54-15462	150	Chlorodifluoromethane	4/22/2008*	30
54-15462	150	Chloromethane	4/10/2008	1.5
54-15462	150	Cyclohexane	4/22/2008*	58
54-15462	150	Dichlorodifluoromethane	4/10/2008	41
54-15462	150	Dichlorodifluoromethane	4/22/2008*	13
54-15462	150	Dichlorodifluoromethane	6/24/2008*	6.6
54-15462	150	Dichlorodifluoromethane	6/26/2008	14
54-15462	150	Dichlorodifluoromethane	9/11/2008	22
54-15462	150	Dichloroethene[1,1-]	4/10/2008	2.3
54-15462	150	Dichloropropane[1,2-]	4/10/2008	2
54-15462	150	Ethyltoluene[4-]	6/24/2008*	9.4
54-15462	150	Freon-11	12/19/2007	22
54-15462	150	Freon-11	4/10/2008	36
54-15462	150	Freon-11	4/22/2008*	12
54-15462	150	Freon-11	6/26/2008	12
54-15462	150	Freon-11	9/11/2008	20
54-15462	150	Hexane	4/22/2008*	11
54-15462	150	Hexane	6/24/2008*	4.4
54-15462	150	Hexane	6/26/2008	5.6
54-15462	150	Methylene Chloride	4/22/2008*	6.2
54-15462	150	n-Heptane	4/22/2008*	120
54-15462	150	PCE	4/10/2008	2.9
54-15462	150	TCA	4/10/2008	74
54-15462	150	TCA	4/22/2008*	28
54-15462	150	TCA	6/24/2008*	9.8
54-15462	150	TCA	6/26/2008	27
54-15462	150	TCA	9/11/2008	43
54-15462	150	TCE	4/10/2008	6.2
54-15462	150	TCE	9/11/2008	5
54-15462	150	Toluene	4/22/2008*	13
54-15462	150	Toluene	6/24/2008*	21
54-15462	150	Toluene	6/26/2008	17
54-15462	150	Trichloro-1,2,2-trifluoroethane[1,1,2-]	12/19/2007	14

Table 5.0-2 (continued)

Borehole	Sampling-Top Depth (ft bgs)	Analyte	Collection Date	Results (µg/m³)
54-15462	150	Trichloro-1,2,2-trifluoroethane[1,1,2-]	4/10/2008	30
54-15462	150	Trichloro-1,2,2-trifluoroethane[1,1,2-]	4/22/2008*	7.8
54-15462	150	Trichloro-1,2,2-trifluoroethane[1,1,2-]	6/26/2008	7
54-15462	150	Trichloro-1,2,2-trifluoroethane[1,1,2-]	9/11/2008	13
54-15462	150	Trimethylbenzene[1,2,4-]	6/24/2008*	13
54-15462	150	Xylene[1,2-]	6/24/2008*	7.4
54-15462	150	Xylene[1,3-]+Xylene[1,4-]	4/22/2008*	4.9
54-15462	150	Xylene[1,3-]+Xylene[1,4-]	6/24/2008*	17
54-15462	150	Xylene[1,3-]+Xylene[1,4-]	6/26/2008	6.2
54-15462	200	Acetone	12/19/2007	11
54-15462	200	Acetone	4/10/2008	13
54-15462	200	Acetone	6/23/2008*	90
54-15462	200	Acetone	6/26/2008	84
54-15462	200	Benzene	4/10/2008	1.2
54-15462	200	Benzene	4/22/2008*	6.4
54-15462	200	Butanone[2-]	6/23/2008*	18
54-15462	200	Butanone[2-]	6/26/2008	19
54-15462	200	Carbon Disulfide	12/19/2007	14
54-15462	200	Carbon Disulfide	4/10/2008	35
54-15462	200	Carbon Disulfide	9/11/2008	3.2
54-15462	200	Carbon Tetrachloride	4/10/2008	6.7
54-15462	200	Chloromethane	4/10/2008	1
54-15462	200	Cyclohexane	4/22/2008*	3.5
54-15462	200	Dichlorodifluoromethane	4/10/2008	35
54-15462	200	Dichlorodifluoromethane	4/22/2008	20
54-15462	200	Dichlorodifluoromethane	6/26/2008	15
54-15462	200	Dichlorodifluoromethane	9/11/2008	28
54-15462	200	Dichloroethene[1,1-]	4/10/2008	2.2
54-15462	200	Dichloropropane[1,2-]	4/10/2008	2
54-15462	200	Ethanol	6/26/2008	7.8
54-15462	200	Freon-11	12/19/2007	15
54-15462	200	Freon-11	4/10/2008	32
54-15462	200	Freon-11	4/22/2008*	18
54-15462	200	Freon-11	6/26/2008	15
54-15462	200	Freon-11	9/11/2008	7.3
54-15462	200	Hexane	4/22/2008*	6.5
54-15462	200	Hexane	6/23/2008*	4.7
54-15462	200	Hexane	6/26/2008	3.9

Table 5.0-2 (continued)

Borehole	Sampling-Top Depth (ft bgs)	Analyte	Collection Date	Results (µg/m³)
54-15462	200	n-Heptane	4/22/2008*	16
54-15462	200	PCE	4/10/2008	2.7
54-15462	200	TCA	4/10/2008	70
54-15462	200	TCA	4/22/2008*	39
54-15462	200	TCA	6/26/2008	28
54-15462	200	TCA	9/11/2008	40
54-15462	200	TCE	4/10/2008	5.7
54-15462	200	TCE	4/22/2008*	5.3
54-15462	200	Toluene	4/10/2008	4.9
54-15462	200	Toluene	4/22/2008*	5.8
54-15462	200	Toluene	6/23/2008*	8.9
54-15462	200	Toluene	6/26/2008	9.7
54-15462	200	Trichloro-1,2,2-trifluoroethane[1,1,2-]	12/19/2007	9.7
54-15462	200	Trichloro-1,2,2-trifluoroethane[1,1,2-]	4/10/2008	25
54-15462	200	Trichloro-1,2,2-trifluoroethane[1,1,2-]	4/22/2008*	12
54-15462	200	Trichloro-1,2,2-trifluoroethane[1,1,2-]	6/26/2008	7.2
54-15462	200	Trichloro-1,2,2-trifluoroethane[1,1,2-]	9/11/2008	15
54-15462	200	Xylene[1,3-]+Xylene[1,4-]	6/26/2008	4.5
54-15462	254	Acetone	12/19/2007	21
54-15462	254	Acetone	4/10/2008	8.9
54-15462	254	Acetone	6/23/2008*	500
54-15462	254	Acetone	6/26/2008	11
54-15462	254	Benzene	4/22/2008*	10
54-15462	254	Butanol[1-]	4/22/2008*	27 (J)
54-15462	254	Butanone[2-]	12/19/2007	11
54-15462	254	Butanone[2-]	6/23/2008*	90
54-15462	254	Butanone[2-]	6/26/2008	4
54-15462	254	Carbon Disulfide	12/19/2007	9
54-15462	254	Carbon Disulfide	4/10/2008	15
54-15462	254	Carbon Disulfide	6/26/2008	12
54-15462	254	Carbon Disulfide	9/11/2008	4.9
54-15462	254	Carbon Tetrachloride	4/10/2008	7.1
54-15462	254	Chlorodifluoromethane	4/22/2008*	22
54-15462	254	Chloromethane	4/10/2008	1.1
54-15462	254	Cyclohexane	4/22/2008*	55
54-15462	254	Dichlorodifluoromethane	4/10/2008	39
54-15462	254	Dichlorodifluoromethane	4/22/2008*	14
54-15462	254	Dichlorodifluoromethane	6/26/2008	13

Table 5.0-2 (continued)

Borehole	Sampling-Top Depth (ft bgs)	Analyte	Collection Date	Results (µg/m³)
54-15462	254	Dichlorodifluoromethane	9/11/2008	20
54-15462	254	Dichloroethene[1,1-]	4/10/2008	2
54-15462	254	Dichloropropane[1,2-]	4/10/2008	1.4
54-15462	254	Ethanol	6/23/2008*	12
54-15462	254	Freon-11	12/19/2007	18
54-15462	254	Freon-11	4/10/2008	31
54-15462	254	Freon-11	4/22/2008*	11
54-15462	254	Freon-11	6/26/2008	11
54-15462	254	Freon-11	9/11/2008	16
54-15462	254	Hexane	4/22/2008*	12
54-15462	254	Hexane	6/23/2008*	7.5
54-15462	254	Methylene Chloride	4/22/2008*	4.6
54-15462	254	n-Heptane	4/22/2008*	120
54-15462	254	n-Heptane	6/23/2008*	9
54-15462	254	Propylene	6/23/2008*	14
54-15462	254	TCA	4/10/2008	49
54-15462	254	TCA	4/22/2008*	25
54-15462	254	TCA	6/26/2008	19
54-15462	254	TCA	9/11/2008	27
54-15462	254	TCE	4/10/2008	3.9
54-15462	254	TCE	4/22/2008*	4.4
54-15462	254	Toluene	12/19/2007	3.8
54-15462	254	Toluene	4/10/2008	1.4
54-15462	254	Toluene	4/22/2008*	16
54-15462	254	Toluene	6/23/2008*	16
54-15462	254	Toluene	6/26/2008	9.4
54-15462	254	Trichloro-1,2,2-trifluoroethane[1,1,2-]	12/19/2007	11
54-15462	254	Trichloro-1,2,2-trifluoroethane[1,1,2-]	4/10/2008	26
54-15462	254	Trichloro-1,2,2-trifluoroethane[1,1,2-]	4/22/2008*	7.8
54-15462	254	Trichloro-1,2,2-trifluoroethane[1,1,2-]	9/11/2008	11
54-15462	254	Xylene[1,3-]+Xylene[1,4-]	4/22/2008*	6.4
54-15462	254	Xylene[1,3-]+Xylene[1,4-]	6/23/2008*	9.7

*Sampled with Packer system.

Table 5.0-3
Screening of VOCs Detected in Pore Gas at MDA H

VOC	Maximum Pore-Gas Concentration, (µg/m³)	Henry's Law Constant (H') (dimensionless)	Screening Level (µg/L)	Screening Value (unitless)
Acetone	2100	0.0016	22,000[a]	0.059
Benzene	110	0.228	5[b]	0.096
Butadiene[1,3-]	5.6	7.3	0.13	0.0059
Butanone[2-]	520	0.0011	7100[a]	0.067
Carbon Disulfide	85	1.2	1000[a]	0.000071
Carbon Tetrachloride	14	1.25	5[b]	0.0022
Chlorobenzene	88	0.15	100	0.0059
Chlorodifluoromethane	30	4.1	100,000	0.00000007
Chloroform	2.4	0.15	100	0.00016
Chloromethane	3.8	na[d]	na	na
Cyclohexane	89	8.2	13,000	0.00000083
Dichlorodifluoromethane	44	4.1	350[a]	0.000031
Dichloroethane[1,1-]	4.2	0.23	25[c]	0.00073
Dichloroethene[1,1-]	2.4	1.1	5[c]	0.00044
Ethanol	210	200	na	na
Ethylbenzene	83	0.323	700[b]	0.00037
Ethyltoluene[4-]	63	na	na	na
Hexane	290	5	800[a]	0.000066
Methanol	200	0.00011	18,000	0.10
Methylene Chloride	6.2	0.09	15	0.0046
n-Heptane	160	0.0012	na	na
Propylene	98	na	na	na
Styrene	5	0.11	100	0.00045
PCE	62	0.754	5[b]	0.016
Toluene	730	0.272	750[c]	0.0036
Trichloro-1,2,2-trifluoroethane[1,1,2-]	39	21.4	59,000[a]	0.000000031
TCA	190	0.705	60[c]	0.0045
TCE	100	0.422	5[b]	0.047
Freon-11	85	4	1300[a]	0.000016
Trimethylbenzene[1,2,4-]	63	0.23	15[a]	0.018
Trimethylbenzene[1,3,5-]	20	0.32	12[a]	0.0052
Xylene[1,2-]	110	0.213	10,000[b]	0.000052
Xylene[1,3-]+Xylene[1,4-]	300	0.3	10,000[a]	0.0001

Note: SV derived using Equation 3.0-3.

[a] EPA regional tap water SL (http://www.epa.gov/region09/superfund/prg/pdf/composite_sl_table_run_12SEP2008.pdf).

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

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

[d] na = Not available.

Appendix A

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

A-1.0 ACRONYMS AND ABBREVIATIONS

%D	percent difference
B&K	Brüel and Kræjer
bgs	below ground surface
DER	duplicate error ratio
EQL	estimated quantitation limit
EPA	Environmental Protection Agency (U.S.)
FLUTe	flexible liner underground technology
FY	fiscal year
LANL	Los Alamos National Laboratory
LCS	laboratory control sample
MCL	maximum contaminant level
MDA	material disposal area
NMED	New Mexico Environment Department
NMWQCC	New Mexico Water Quality Control Commission
PCE	tetrachloroethene
PID	photoionization detector
ppm	part per million
QA	quality assurance
QC	quality control
RFI	RCRA facility investigation
RPD	relative percent difference
RCRA	Resource Conservation and Recovery Act
RPF	Records Processing Facility
SL	screening level
SV	screening value
SWMU	solid waste management unit
TA	technical area
TCA	1,1,1-trichloroethane
TCE	trichloroethene
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 + 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

Quality Assurance/Quality Control Program

B-1.0 INTRODUCTION

This appendix discusses the analytical methods and data quality review and summarizes the effects of data quality exceptions on the acceptability of the laboratory analytical data.

Quality assurance (QA), quality control (QC), and data validation procedures were implemented in accordance with the Los Alamos National Laboratory (LANL or the Laboratory) “Quality Assurance Project Plan Requirements for Sampling and Analysis” (LANL 1996, 054609) and the Laboratory’s statement of work for analytical services (LANL 2000, 071233). The results of the QA/QC activities were used to estimate the accuracy, bias, and precision of the analytical measurements. QC samples, including method blanks, blank spikes, matrix spikes, laboratory control samples (LCS), 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 contract. Other QC factors, such as sample preservation and holding times, were also assessed. The requirements for sample preservation and holding times are given in the Environmental Programs Directorate’s Standard Operating Procedure ER-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 (also referred to as request numbers), which included a more detailed review of the raw data results. The procedures used for data validation are given in Table B-1.0-1. Copies of the raw analytical data, laboratory logbooks, and instrument printouts are provided in data packages as part of Appendix C (on CD included with this document).

Analytical data were reviewed and evaluated based on U.S. Environmental Protection Agency (EPA) National Functional Guidelines for inorganic and organic chemical data review, where applicable (EPA 1994, 048639; EPA 1999, 066649). Data have also been assessed using guidelines established in SW-846 (EPA 1997, 057589). As a result of the data validation and assessment efforts, qualifiers have been assigned to each analytical record. Definitions for the data qualifiers used in data validation are provided in Appendix A. Data validators and reviewers made judgments about the following industry-accepted QA/QC analytical quality functions:

B-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 EP-ERSS-SOP-5058, 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 Appendix C.

B-1.2 Sample Documentation

Establishing sample documentation acceptability, described in EP-ERSS-SOP-5058, is the first step to verifying 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.

B-1.3 Sample Preservation

Sample preservation is the use of specific types of sample containers and preservation techniques as described in EP-ERSS-SOP-5056, Sample Containers and Preservation. Sample preservation is mandatory for hazardous site investigations because the integrity of any sample decreases over time. Physical factors (light, pressure, temperature, etc.), chemical factors (changes in pH, volatilization, etc.), 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.

B-1.4 Holding Time

Holding time, the maximum amount of time a sample can be stored without unacceptable changes in analyte concentrations, is described in EP-ERSS-SOP-5056. Holding times apply under prescribed conditions; deviations from these conditions may affect the holding time. 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.

B-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 as well as 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.

B-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.

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

Radionuclide results reported at less than the minimum detectable activity are not detected (U). Each radiochemical result is also compared to the corresponding 1-sigma total propagated uncertainty (TPU). If the result is not greater than three times the TPU, it is also qualified as not detected (U).

B-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 which 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 2000, 071233).

B-1.9 Matrix Spike Recoveries

A matrix spike is an aliquot of 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 2000, 071233).

B-1.10 Surrogate and Tracer Recoveries

A surrogate (an organic chemical compound) and a tracer (a radiochemical isotope) are similar in composition and behavior to target analytes but are not typically found in environmental samples. Surrogates and tracers 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 and tracers vary by method but should generally be greater than 10% for an analytical result to be usable (LANL 2000, 071233).

B-1.11 Internal Standard Responses and Carrier Recoveries

Internal standards and carriers are chemical compounds that are 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 and carrier recoveries 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%. The recoveries for carriers vary by method but should generally be greater than 10% for an analytical result to be usable (LANL 2000, 071233).

B-1.12 LCS Recoveries

An LCS is a known matrix that has been spiked with compound(s), which are 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 2000, 071233).

B-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) used to assess or demonstrate acceptable laboratory-method precision at the time of analysis. Each duplicate sample is equally representative of the original material. Duplicate analyses are also performed to generate data and to determine the long-term precision of an analytical method on various matrices. All relative percent differences (RPDs) between samples and field duplicates should be ±35% (LANL 2000, 071233). The RPD is defined by the equation RPD = [|D1 – D2| / (D1 + D2)] × 100%, where *D1* and *D2* represent analytical measurements on duplicate samples.

For radionuclides, the duplicate error ratio (DER) may also be used to quantify precision. The DER is defined by the equation DER = |S–D| / sqrt($2\sigma S^2 + 2\sigma D^2$), where *S* represents the original sample value, *D* represents the duplicate value, and *2σS* and *2σD* 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 independent samples collected as closely as possible at the same point in space and time. They are two separate samples taken from the same source, stored in separate containers, and analyzed independently.

Serial dilution checks are performed for certain inorganic analyses to determine if dilutions have been prepared correctly, and to identify any effects that may arise from characteristics of the sample matrix.

B-1.14 Field Blanks

Field blank—a sample of analyte-free medium that is 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.

B-2.0 LABORATORY ANALYSIS SUMMARY

During fiscal year (FY) 2008, 89 pore-gas volatile organic compound (VOC) samples, 12 field duplicates, 12 field blanks, 59 tritium samples, and 6 tritium field duplicate samples were collected at Solid Waste Management Unit (SWMU) 54-004, also known as Material Disposal Area (MDA) H. Analyses were conducted for VOCs using EPA Method TO-15 and for tritium using EPA Method 906.0 (Prescribed Procedures for Measurement of Radioactivity in Drinking Water, EPA/600/4-80-032). All QC procedures were followed as required by the analytical services contract. Table B-2.0-1 lists the analytical method used for organic chemical and radionuclide analyses.

Sampling locations, sampling ports, and validated analytical results are presented in Tables 5.0-1 and 5.0-2 of the periodic monitoring report. The data, including the qualified data, are usable for evaluation purposes. The entire data set meets the standards used in this report.

The analytical methods used for tritium and VOCs are summarized in the following sections. The required minimum detectable activity or estimated quantitation limit (EQL) is prescribed in the analytical services contract.

B-3.0 ORGANIC CHEMICAL ANALYSES

All QC procedures were followed as required by the analytical services contract. No data were rejected.

B-3.1 Maintenance of Chain of Custody

Chain of custody was properly maintained for all samples.

B-3.2 Sample Documentation

All samples were properly documented in the field.

B-3.3 Sample Preservation

No sample preservation is required for VOCs.

B-3.4 Holding Time

The holding times were met for all samples.

B-3.5 Initial and Continuing Calibration Verification

Initial or continuing calibration differences (%D) were greater than the method requirements affecting EPA Method TO-15 analyses of 212 organic chemical records. Affected records were qualified as either estimated, not detected (UJ), or estimated (J).

B-3.6 Analyte Identification (Including Internal Standards, and Spectra Review)

Analyte identification criteria were met for all but 55 sample analyses. The mass spectrum did not meet method specifications and associated records were qualified as not detected (U).

B-3.7 Method Blank

Method blank results for organic chemical analyses were within acceptable limits for all but 18 results. The sample results were ≤5 times the concentration of the analyte detected in the method blank and qualified as not detected (U).

B-3.8 Surrogate Recoveries

All surrogate recoveries for organic chemical analyses were within acceptable limits.

B-3.9 Internal Standard Responses

All internal standard responses for organic chemical analyses were within acceptable limits.

B-3.10 LCS Recoveries

The LCS recoveries were within acceptable limits for all but six results. The LCS recoveries were greater than the upper acceptance limit, affecting six results. Affected results were qualified as estimated, not detected (UJ).

B-3.11 Laboratory and Field Duplicates

The laboratory and field duplicates collected for organic chemical analyses indicate acceptable precision. Laboratory duplicate RPDs were less than 35% for pore gas samples collected during FY2008. During FY2008, field duplicate precision was greater than 35% for two analytes in pore gas samples at location 54-15462 at 150 ft bgs. The sample record potentially affected by larger-than-expected field duplicate RPDs are listed in Table B-3.11-1. The VOC results are not qualified based on field duplicate precision.

B-3.12 Field Blanks and Equipment Blanks

VOCs were not detected in the field blanks.

Thirty-six sample results are ≤5 times the concentration of the related analyte in the equipment blanks and are qualified as not detected (U).

B-4.0 RADIOCHEMICAL ANALYSES

Fourteen tritium results were rejected (R) because results were not detected and the associated duplicate error ratio (DER) was greater than the analytical laboratory acceptable limits.

B-4.1 Maintenance of Chain of Custody

Chain of custody was properly maintained for all samples.

B-4.2 Sample Documentation

Samples were properly documented in the field.

B-4.3 Sample Preservation

No sample preservation is required for tritium.

B-4.4 Holding Times

The holding times were met for all tritium analysis.

B-4.5 Initial and Continuing Calibration Verification

Initial and continuing calibrations are acceptable for all tritium analysis.

B-4.6 Analyte Identification

Analyte identification criteria were met for all tritium analysis.

B-4.7 Analyte Quantitation

Sixteen tritium results were detected and qualified as estimated (J) because the associated duplicate error ratio (DER) was greater than the analytical laboratory acceptable limits.

B-4.8 Method Blanks

Method blank results for tritium analysis were within acceptable limits for all sample analyses.

B-4.9 LCS Recoveries

The LCS recoveries for tritium analysis were within acceptable limits for all analyses.

B-4.10 Matrix Spike Recoveries

Fourteen tritium results were qualified as estimated, biased high (J+) because the matrix spike recovery was greater than the lower acceptance limit but greater than 10%.

B-4.11 Laboratory and Field Duplicates

Laboratory duplicate analyses indicate acceptable precision for tritium. Five field duplicates were collected during FY2008. All but one of the field duplicate analyses had DERs below 3. One detected tritium and the associated field duplicate result had a DER greater than 3. The sample record potentially affected by larger-than-expected field duplicate DER is listed in Table B-4.11-1. Sampling results are not qualified based on field duplicate precision.

B-5.0 FIELD-MONITORING SUMMARY

Field-monitoring data are less costly to generate than laboratory data and are immediately available to guide field decisions. Field-monitoring results are generated by rapid methods of analysis that provide less precision than laboratory analyses. Field-monitoring data provide analyte (or at least chemical class) identification and quantification, although the quantification may be relatively imprecise.

Field monitoring of subsurface vapor monitoring at MDA H is conducted using ER-ERSS-SOP-5074, Sampling of Sub-Atmospheric Air. This procedure covers the use of the Brüel and Kræjer (B&K) Type 1302 multigas analyzer and the Landtec GEM 500 photoionization detector (PID).

The B&K is calibrated annually by a certified calibration laboratory. The B&K is adjusted before each day's use to compensate for ambient pressure and temperature. Calibration is confirmed before each day's use by analyzing triplicate readings of ambient air and duplicate readings of known quantities of mixed organic analytes in nitrogen. These calibration verification check analyses confirm analytical stability, confirm that the instrument zero point for each analyte is correctly set, and confirm that the stored calibration curve remains applicable to current instrument response to the presence of organic chemicals. Concentrations of calibration standards analyzed before each day's use are expected be within ±20% of their known values. Additionally, during each sample analyses a low sample flow condition triggers an alarm on the B&K and VOC measurement is then not completed.

The presence of nontarget organic chemicals bias B&K target analyte results if they have an acoustic response to infrared light similar to the target analyte. Trichlorofluoromethane (Freon-11) generates a measurable acoustic signal in response to light with a wavelength of 11.6 µm proportional to its concentration. Other VOCs generating an acoustic signal to light at this wavelength include Freon-114 (CAS 76-14-2; 1,2-dichloro-1,1,2,2-tetrafluoroethane) and Freon-21 (CAS 75-43-4), which are not reported by EPA Method TO-15. Tetrachloroethene (PCE) generates an acoustic signal in response to light with a wavelength of 11.1 µm. Other VOCs responding to light at this wavelength include styrene (CAS 100-42-5) and Freon-113 (CAS 76-13-1), which are not reported by EPA Method TO-15; Freon-12 (CAS 75-71-8, dichlorodifluoromethane); ethanol (CAS 64-17-5); and 1,1-dichloroethene (CAS 75-35-4). The results indicate that 1,1-dichloroethene and Freon-113 are present in most samples at MDA H at detected concentrations that would be included in the signal interpreted as PCE. Table B-5.0-1 presents VOCs that interfere with each of the four B&K target analytes.

Data generated using the B&K Type 1302 are supported by annual calibration records that bracket the periods of analyses. Calibration information is reported below for each of the two B&K Type 1302 photoacoustic analyzers used to generate results presented in this periodic monitoring report.

- The B&K with serial number 1692083 was calibrated on July 3, 2007. The zero point was set for 1,1,1-trichloroethane (TCA), trichloroethene (TCE), Freon-11, PCE, carbon dioxide (CO_2), and water (H_2O). Span concentrations of TCA at 61.4 parts per million (ppm), TCE at 8.1 ppm, Freon-11 at 53 ppm, PCE at 19.24 ppm, and CO_2 at 1265 ppm were used to generate calibration response curves.
- The B&K with serial number 1692083 was calibrated on May 12, 2008. The zero point was set for TCA, TCE, Freon-11, PCE, CO_2, and H_2O. Span concentrations of TCA at 13.5 ppm, TCE at 10.7 ppm, Freon-11 at 106 ppm, PCE at 31.5 ppm, and CO_2 at 1250 ppm were used to generate calibration response curves.
- The B&K with serial number 1732805 was calibrated on May 12, 2008. The zero point was set for TCA, TCE, Freon-11, PCE, CO_2, and H_2O. Span concentrations of TCA at 13.1 ppm, TCE at 10.7 ppm, Freon-11 at 106 ppm, PCE at 31.5 ppm, and CO_2 at 1250 ppm were used to generate the calibration response curves.

The Landtec GEM 500 PID is calibrated annually by a certified calibration laboratory. During calibration, methane (CH_4), oxygen (O_2), and CO_2 zero points are set, and each analyte's calibration response curves is developed. The CH_4 reading is filtered to an infrared absorption frequency of 3.41 mm (nominal), the frequency specific to hydrocarbon bonds. Landtec instruments are calibrated using certified CH_4 mixtures and will give correct readings provided there are no other hydrocarbon gasses present within the sample (e.g., ethane, propane, butane). If other hydrocarbons are present, the CH_4 reading will be higher (never lower) than the actual CH_4 concentration being monitored. The extent to which the CH_4 reading is affected depends upon the concentration of the CH_4 in the sample and the concentration of the other hydrocarbons. The effect of other hydrocarbons is nonlinear and difficult to predict. The CO_2 reading is filtered to an infrared absorption frequency of 4.29 µm (nominal), the frequency specific to CO_2. Therefore, any other gases usually found on landfill sites will not affect the CO_2 reading. The O_2 sensor is a galvanic cell type and suffers no influence from CO_2, CO_2, hydrogen sulfide, nitrate, sulfide, or hydrogen.

Calibration is confirmed before each day's use by analyzing multiple readings of ambient air. Zero readings of CH_4 and CO_2 are expected. Oxygen is expected to read 20.9%. Oxygen readings within ± 25% of 20.9% are considered acceptable.

Data generated using the Landtec GEM-500 PID is supported by annual calibration records that bracket the periods of analyses. Calibration is performed by Geotech's Colorado Service Center, in Denver, CO. Calibration information is reported below for the four Landtec PIDs used to generate results presented in this periodic monitoring report.

- Unit 1138 was calibrated on December 7, 2007. The zero point was set for CH_4, CO_2, and O_2. Calibration was performed so CH_4 and CO_2 reached ±15% of a known concentration, and O_2 was set to read ambient air at 20.9%. Pump flow was confirmed to be 525 cc/min.
- Unit 1062 was calibrated on December 6, 2007. The zero point was set for CH_4, CO_2, and O_2. Calibration was performed so CH_4 and CO_2 reached ±15% of a known concentration, and O_2 was set to read ambient air at 20.9%. Pump flow was confirmed to be 500 cc/min.

- Unit 915 was calibrated on October 3, 2007. The zero point was set for CH_4, CO_2, and O_2. Calibration was performed so CH_4 and $CO2_2$ reached ±15% of a known concentration, and O_2 was set to read ambient air at 20.9%. Pump flow was confirmed to be 500 cc/min.
- Unit 1139 was calibrated on March 18, 2008. The zero point was set for CH_4, CO_2, and O_2. Calibration was performed so CH_4 and CO_2 reached ±15% of a known concentration, and O_2 was set to read ambient air at 20.9%. Pump flow was confirmed to be 500 cc/min.
- Unit 903 was calibrated on March 19, 2008. The zero point was set for CH_4, CO_2, and O_2. Calibration was performed so CH_4 and CO_2 reached ±15% of a known concentration, and O_2 was set to read ambient air at 20.9%. Pump flow was confirmed to be 500 cc/min.
- Unit 1139 was calibrated on May 13, 2008. The zero point was set for CH_4, CO_2, and O_2. Calibration was performed so CH_4 and CO_2 reached ±15% of a known concentration, and O_2 was set to read ambient air at 20.9%. Pump flow was confirmed to be 475 cc/min.
- Unit 279 was calibrated on June 3, 2008. The zero point was set for CH_4, CO_2, and O_2. Calibration was performed so CH_4 and CO_2 reached ±15% of a known concentration, and O_2 was set to read ambient air at 20.9%. Pump flow was confirmed to be 600 cc/min.

B-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," EPB-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)

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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 B-1.0-1
Data Validation Procedures

Procedure	Title	Effective Date
SOP-1561, Rev. 0	Routine Validation of Volatile Organic Compound (VOC) Analytical Data	6/10/2008
SOP-1566, Rev. 0	Routine Validation of Gamma Spectroscopy, Chemical Separation Alpha Spectrometry, Gas Proportional Counting, and Liquid Scintillation Analytical Data	6/30/2008

Table B-2.0-1
Analytical Methods Used for Sample Analyses

Analytical Method	Analytical Description	Target Compound List
EPA Method TO-15—Sampling and Analysis	VOCs in air	See analytical services statement of work (LANL 2000, 071233)
EPA Method 906.0	Tritium analysis	See analytical services statement of work (LANL 2000, 071233)

Table B-3.11-1
Sample Records with Field Duplicate RPD above 35%

Analyte	Location ID	Collection Date	Depth (ft)	Field Duplicate Result (µg/m^3)	Sample Result (µg/m^3)	RPD
Acetone	54-15462	6/26/2008	150	21	84	60%
Butanone[2-]	54-15462	6/26/2008	150	3.6	19	68%

Table B-4.11-1
Sample Records with Field Duplicate DER above 3

Location ID	Depth (ft)	Analyte	Field Duplicate Result (pCi/L)	Field Duplicate Uncertainty (pCi/L)	Sample Result (pCi/L)	Standard Uncertainty (pCi/L)	DER
54-15462	254 to 256	Tritium	7747.06	420.34	2769.86	165.912	5.506985

Table B-5.0-1
B&K Target Analytes
and Potential Interfering Analytes

Target	Potential Interfering Analyte
PCE	Styrene
PCE	Freon-113
PCE	Freon-12
PCE	DCE
PCE	Ethylene oxide
PCE	Ethanol
PCE	Dipropylnitrosamine
PCE	1,1-Dimethylhydrazine
PCE	1,4-Diethylene dioxide
PCE	Cyclohexene
PCE	tert-Butyl alcohol
PCE	m-Vinyltoluene
PCE	Vinyl chloride
PCE	Tetrahydrofurane
PCE	Silicium tetrafluoride
PCE	Nitromethane
PCE	Nitrogen trifluoride
PCE	α-Methylstyrene
PCE	Monomethyl hydrazine
PCE	Methyl iodide
PCE	n-Hexane
PCE	Acetic anhydride
PCE	1,3-Butadiene
Freon-11	Freon-114
Freon-11	Freon-21
Freon-11	Carbonyl sulphide
Freon-11	Methyl acetate
Freon-11	Chloropicrine
Freon-11	Cyclohexane
Freon-11	Dimethylnitrosamine
Freon-11	Epichlorohydrine
Freon-11	Ethane
Freon-11	Ethylene oxide
Freon-11	Ethyl formate
Freon-11	2-Nitropropane

Table B-5.0-1 (continued)

Target	Potential Interfering Analyte
Freon-11	Phosgene
Freon-11	Vinyl acetate
TCA	Fluorobenzene
TCA	Ethyl benzene
TCA	Dimethyl formamide
TCA	Dichloromethane
TCA	1,2-Dichloroethane
TCA	o-Dichlorobenzene
TCA	Dibutyl phthalate
TCA	Chloromethane
TCA	m-Xylene
TCA	1,1,2-Trichloroethane
TCA	o-Toluidine
TCA	Toluene
TCA	Phenol
TCA	Chlorobenzene
TCA	Carbon dioxide
TCA	Boron trifluoride
TCA	Aniline
TCA	Acetophenone
TCA	Hydrogen cyanide
TCA	n-Heptane
TCE	Arsine
TCE	Butanone
TCE	Freon-152
TCE	Diethyl ketone
TCE	Dinitrogendifluoride
TCE	2-Pentanone
TCE	2-Propanol
TCE	Sulfur hexafluoride
TCE	Vinyl chloride

Appendix C

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