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Interim Subsurface Vapor-Monitoring Plan for Material Disposal Area L at Technical Area 54, Revision 1

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CONTENTS

1.0 INTRODUCTION 1

2.0 HISTORICAL DATA REVIEW 1

3.0 SCOPE OF ACTIVITIES 1

4.0 METHODS..... 2

4.1 Sample Collection Methods 2
4.2 Field-screening Methods 2
4.3 Analytical Methods..... 3

5.0 REFERENCES 3

Figure

Figure 3.0-1 Proposed pore-gas monitoring locations 5

Table

Table 3.0-1 MDA L Pore-Gas Monitoring Locations 7

1.0 INTRODUCTION

The following plan describes proposed subsurface monitoring activities and the frequencies at which they will be conducted within the vadose zone beneath Material Disposal Area (MDA) L. The objective of the monitoring is to evaluate trends in volatile organic compound (VOC) and tritium concentrations over time.

2.0 HISTORICAL DATA REVIEW

Routine monitoring of VOCs in subsurface pore gas has been ongoing at MDA L from 1992 to the present. Data were last reported in the “MDA L Periodic Monitoring Report for Vapor Sampling Activities at Material Disposal Area L, Solid Waste Management Unit 54-006, at Technical Area 54, for Fourth Quarter Fiscal Year 2005 through Third Quarter Fiscal Year 2006” (LANL 2006, 093910) and the “Addendum to the Investigation Report for Material Disposal Area L, Solid Waste Management Unit 54-006, at Technical Area 54” (LANL 2007, 096409).

Results from routine monitoring indicate that 1,1,1-trichloroethane (TCA) is the dominant contaminant present as a vapor beneath MDA L, followed consistently in quantity by trichloroethene (TCE). The VOC plume (as represented by TCA screening data) has been in a near-steady state since the first quarter of fiscal year (FY) 1999. Spatial analysis of the pore-gas monitoring data indicate two unique sources, identified as the southeast shaft field composed of Shafts 1 through 28 and the northwest shaft field composed of Shafts 29 through 34. Both source areas are dominated by the presence of TCA and TCE, but the relative compositions and the concentrations of lesser compounds differ. Based on the screening results from quarterly sampling, it was determined that concentrations have remained relatively constant over time.

Monitoring and modeling have shown that VOCs migrate by vapor diffusion from the source areas, and vertical migration is affected by stratigraphy, with concentrations decreasing significantly in the Otowi Member and underlying basalt formation. Modeling results for the MDA L vapor plume have been presented in the technical report “Vadose Zone Transport of 1,1,1-Trichloroethane: Conceptual Model Validation through Numerical Simulation” (Stauffer et al. 2005, 090537). Based on the observed site data and numerical modeling results, Stauffer et al. concluded the vapor plume at MDA L is currently at a near-steady state, both in concentration and size. The plume size is predicted to decrease when the contaminant source is depleted (probably before 2040), based on estimates of a conservative TCA source. Stauffer et al. (2000, 069794) concluded the numerical model would provide a useful tool to explore the effects of potential corrective measures (e.g., passive venting or soil vapor extraction).

3.0 SCOPE OF ACTIVITIES

The pore-gas monitoring locations are shown in Figure 3.0-1 and listed in Table 3.0-1. Table 3.0-1 and Figure 3.0-1 identify pore-gas locations where pore-gas samples will be collected for laboratory analysis or monitored quarterly by field measurement of percent carbon dioxide, percent oxygen, and organic vapors using the methods described in section 4.0. These data will be compared with the historical record to confirm whether the plume remains in a steady state. The eight boreholes drilled in 2004–2005 and the three drilled in 2007 are equipped with sampling ports for pore-gas monitoring and provide complete coverage from east to west across the site and encompass all the subsurface rock units down to and including the basalt. Pore-gas samples will be collected quarterly from each of these 11 boreholes. Pore-gas samples for VOCs and tritium will be collected from one port within each geologic unit in each borehole; if two ports are in the same geologic unit in the individual borehole, the port most closely corresponding to the base of a disposal unit or containing the highest historical detects of contamination will be sampled.

Table 3.0-1 and Figure 3.0-1 identify five boreholes in MDA L not suitable for pore-gas monitoring because of redundancy in placement, distance from the source, or the method of construction, which does not allow for representative sampling. These boreholes will be evaluated for abandonment.

Quarterly pore-gas monitoring data will be reported in a quarterly periodic monitoring report according to the requirements of Section XI.D of the March 1, 2005, Compliance Order on Consent.

4.0 METHODS

Monitoring methods were selected to provide both precise and accurate data on the concentrations of tritium and VOCs in subsurface vapor beneath MDA L to determine trends through time.

4.1 Sample Collection Methods

Pore-gas samples will be collected in accordance with the current version of Environmental Programs Directorate Standard Operating Procedure (SOP) 06.31, Sampling Sub-Atmospheric Air (http://erproject.lanl.gov/docs/Quality/SOP/SOP-06%2031R2.pdf). The method for collecting pore-gas samples includes purging the sampling port, field-screening purge gas, and collecting samples in SUMMA canisters from prescribed locations for off-site laboratory analysis, as described below. The proposed frequency of sampling and the locations to be sampled are discussed in section 3.0.

Field screening and sampling will be performed in accordance with SOP-06.31. A sampling train will be installed at the sampling port to be used for all purge, field-screening measurements, and subsequent sample collection. A Landtec GEM-500 or equivalent gas monitor will be used to purge the sampling port and sampling train and to monitor percent levels of carbon dioxide and oxygen until pore-gas measurements are stabile and representative of subsurface conditions consistent with previously recorded measurements. Following this first purge and stabilization, formation air is monitored for VOCs, carbon dioxide and water vapor using a Brüel and Kjær (B&K) Type 1302 multigas analyzer. The VOCs measured using the B&K include TCA, TCE, tetrachloroethane (PCE), and trichlorofluoromethane (Freon-11). The sampling port is connected in-line to the SUMMA canister and then the B&K using the sampling train for the second purge stabilization and monitoring cycle until B&K readings are stable and representative of subsurface pore-gas conditions that are consistent with previously recorded measurements. Following purge stabilization and collection of field measurements using the B&K, pore gas is collected for subsequent laboratory analysis using SUMMA canisters and silica-gel columns. All field-screening measurements, field conditions, and sampling will be documented according to Quality Procedure (QP) 5.7, Notebook Documentation for Environmental Restoration Technical Activities. All field measurements will be collected using instrumentation with confirmed and documented operational checks in accordance with QP-5.2, Control of Measuring and Test Equipment.

4.2 Field-screening Methods

In accordance SOP-06.31, field screening will be performed in all ports listed in Table 3.0-1. For boreholes where analytical samples are to be collected, field screening will be performed before samples are collected. Each port will be purged and monitored with a Landtec GEM2000 instrument or equivalent until the percent carbon dioxide and oxygen levels have stabilized at values representative of subsurface pore-gas conditions and are consistent with previously recorded measurements. The vapor will then be screened for VOCs using a B&K multigas analyzer, Type 1302, which measures four VOCs: TCA, TCE, PCE, and Freon-11. The B&K analyzer also measures percent carbon dioxide to 0.01%.

4.3 Analytical Methods

Once sample port purging, field screening, and pore-gas sampling using SUMMA canisters and tritium columns are completed, the pore-gas samples will be submitted for VOC analysis using U.S. Environmental Protection Agency (EPA) Method TO-15 and for tritium analysis using EPA Method 906.0. During each sampling event, three types of field quality assurance (QA) samples will be collected and analyzed for VOCs using SUMMA canisters: (1) a field-duplicate sample, (2) an equipment blank of zero-grade air (air certified to be free from VOC contamination) or nitrogen drawn through the sampling apparatus in the working area, and (3) a performance evaluation sample/calibration gas sample taken from a tank of a certified gas mixture. Two types of field QA samples will be collected and analyzed for tritium: (1) a field-duplicate sample and (2) a field blank consisting of ambient air collected during pore-gas sampling. Analytical laboratory QA for EPA Method TO-15 includes internal standards, surrogates, replicates, blanks, laboratory control samples, and reference standards. Analytical laboratory QA for EPA Method 906.0 includes instrument performance checks, replicates, blanks, laboratory control samples, and reference standards.

5.0 REFERENCES

The following list includes all documents cited in this plan. Parenthetical information following each reference provides the author(s), publication date, and ER ID number. This information is also included in text citations. ER ID numbers 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; the U.S. Department of Energy–Los Alamos Site Office; the U.S. Environmental Protection Agency, Region 6; 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), September 2006. "Periodic Monitoring Report for Vapor Sampling Activities at Material Disposal Area L, Solid Waste Management Unit 54-006, at Technical Area 54, for Fourth Quarter Fiscal Year 2005 Through Third Quarter Fiscal Year 2006," Los Alamos National Laboratory document LA-UR-06-6239, Los Alamos, New Mexico. (LANL 2006, 093910)

LANL (Los Alamos National Laboratory), May 2007. "Addendum to the Investigation Report for Material Disposal Area L, Solid Waste Management Unit 54-006, at Technical Area 54," Los Alamos National Laboratory document LA-UR-07-3214, Los Alamos, New Mexico. (LANL 2007, 096409)

Stauffer, P.H., K.H. Birdsell, M. Witkowski, T. Cherry, and J. Hopkins, March 2000. "Subsurface Vapor-Phase Transport of TCA and MDA L: Model Predictions," Los Alamos National Laboratory document LA-UR-00-2080, Los Alamos, New Mexico. (Stauffer et al. 2000, 069794)

Stauffer, P.H., K.H. Birdsell, M.S. Witkowski, and J.K. Hopkins, 2005. "Vadose Zone Transport of 1,1,1-Trichloroethane: Conceptual Model Validation through Numerical Simulation," *Vadose Zone Journal,* Vol. 4, pp. 760-773. (Stauffer et al. 2005, 090537)

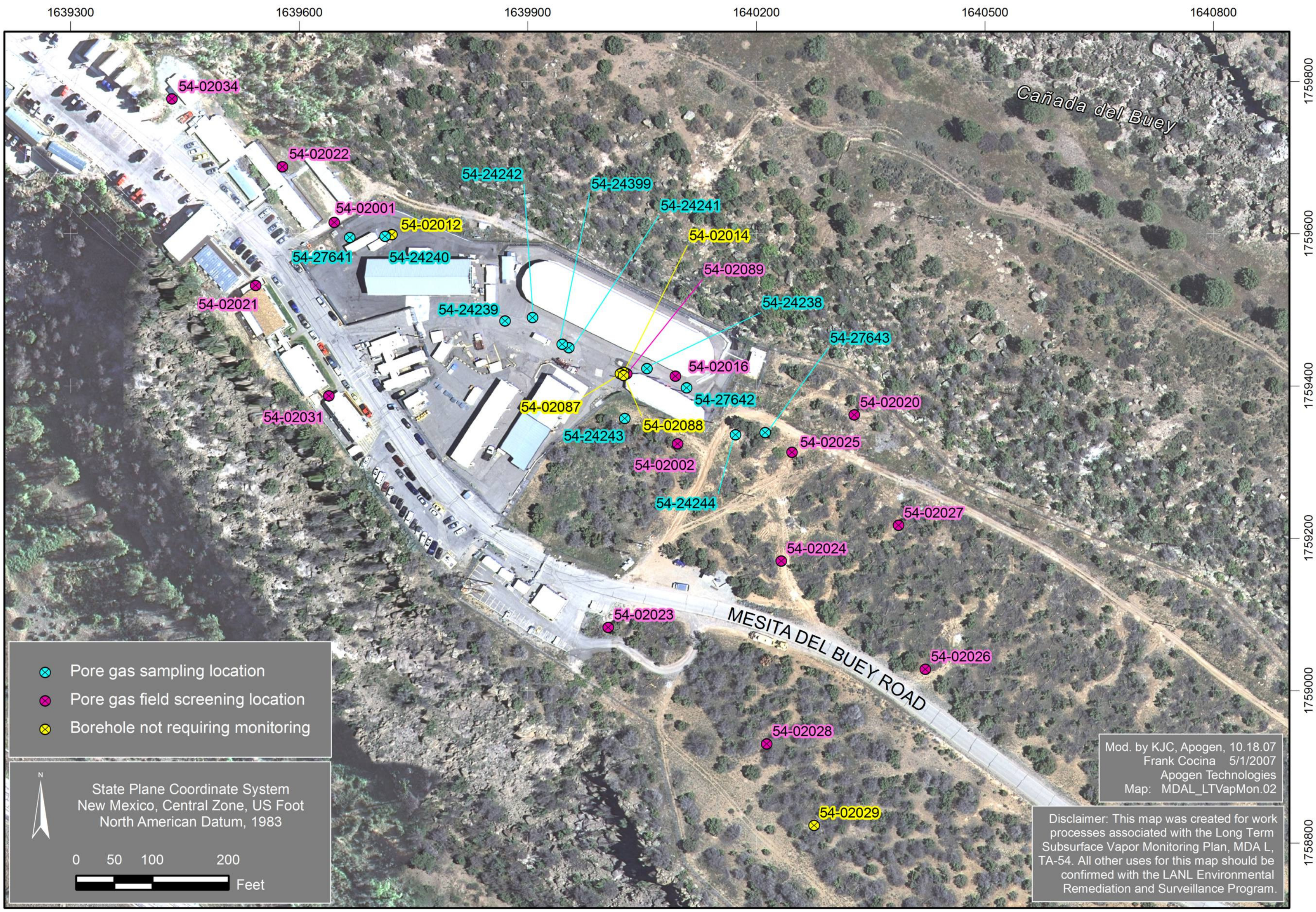

Figure 3.0-1 Proposed pore-gas monitoring locations

Table 3.0-1
MDA L Pore-Gas Monitoring Locations

Well ID	Depths of Ports (ft)
Boreholes Proposed for Field Screening and Collection of Pore-Gas Samples	
54-27641	***32***, ***82***, ***112***, ***182***, 232, ***271***, ***332.5***
54-27642	***30***, ***75***, ***116***, ***175***, 235, ***275***, ***338***
54-27643	***30***, ***74***, ***117***, ***167***, 235, ***275***, ***354***
54-24238	44, ***64***, 84
54-24239	***25***, 50, ***75***, 99.5
54-24240	***28***, 53, ***78***, 103, ***128***, ***153***
54-24241	***73***, 93, 113, 133, 153, 173, ***193***
54-24242	***25***, 50, ***75***, 100, 110
54-24243	***25***, 50, ***75***, 100, ***125***
54-24244	***25***, 50, ***75***, 100, ***118.5***
54-24399	***A straddle-packer system will be used to collect a total-hole sample (below the well casing) from the Cerros del Rio basalt.***
Boreholes Proposed for Field Screening Only	
54-01015	39.5, 164.3, 307.6, 338.3, 382.3, 426.2, 461,4
54-01016	31, 162, 274, 336, 414.4, 459.2, 517.8
54-02001	20, 40, 60, 80, 100,120,140, 160, 180, 200
54-02002	20, 40, 60, 80, 100, 120, 140, 157, 180, 200
54-02016	18, 31, 82
54-02020	20, 40, 60, 80, 95, 120, 140, 160, 180, 200
54-02021	20, 40, 60, 80, 100, 120, 140, 160, 180, 200
54-02022	20, 40, 60, 80, 100, 120, 140, 160, 180, 200
54-02023	20, 40, 60, 80, 100, 120, 140, 159, 180, 200
54-02024	20, 40, 60, 80, 100, 120, 140, 160, 180, 200
54-02025	20, 60, 100, 160, 180
54-02026	20, 60, 100, 160, 200, 215
54-02027	20, 60, 100, 160, 200, 220
54-02028	20, 60, 100, 160, 200, 220, 250
54-02030	20, 60, 100, 160, 200, 220, 243
54-02031	20, 60, 100, 160, 200, 220, 260
54-02034	20, 40, 60, 80, 100, 160, 200, 220, 260
54-02089	13, 31, 46, 86
Boreholes To Be Evaluated for Abandonment	
54-02012	8, 28, 42
54-02014	13, 31, 46, 86
54-02029	20, 60, 100, 160, 200, 220, 260, 288
54-02087	13, 31, 46, 86
54-02088	13, 31, 46, 86

Note: SUMMA samples to be collected quarterly are identified in bold italics. One sample will be collected from each geologic unit in each borehole.