ERID-256730

LA-UR-14-23104
May 2014
EP2014-0170

Interim Measures Work Plan for Soil-Vapor Extraction of Volatile Organic Compounds from Material Disposal Area L, Technical Area 54

Los Alamos
NATIONAL LABORATORY
EST. 1943

Prepared by the Environmental Programs Directorate

EP2014-0170

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Responsible project manager:

Printed Name	Signature	Title	Organization	Date
Stephani Swickley	Stephani Swickley	Project Manager	Environmental Programs	5/27/14

Responsible LANS representative:

Printed Name	Signature	Title	Organization	Date
Jeff Mousseau	Jeff Mo	Associate Director	Environmental Programs	5/27/14

Responsible DOE representative:

Printed Name	Signature	Title	Organization	Date
Peter Maggiore	[illegible]	Assistant Manager	DOE-NA-LA	5-27-2014

CONTENTS

Figures

Tables

1.0 INTRODUCTION

This interim measures work plan (IMWP) recommends activities to address a volatile organic compound (VOC) vapor plume present in the unsaturated zone (vadose zone) beneath Material Disposal Area (MDA) L (Figure 1.0-1), Technical Area 54 (TA-54), Los Alamos National Laboratory (LANL or the Laboratory). The Laboratory proposes to conduct interim measures in accordance with Section VII.B.1 of the March 1, 2005, Compliance Order on Consent (the Consent Order). The IMWP is being prepared to initiate a soil-vapor extraction (SVE) interim measure of the VOC vapor plume. Remediation of the vapor plume by SVE is recommended as part of the final remedy in the “Corrective Measures Evaluation Report for Material Disposal Area L, Solid Waste Management Unit 54-006, at Technical Area 54, Revision 2” (the CME report) to meet a remedial action objective (RAO) of preventing groundwater from being impacted above a regulatory standard by the transport of VOCs to groundwater through soil vapor (LANL 2011, 205756). The depth to regional groundwater beneath MDA L is on the order of 285 m (935 ft), whereas the vapor plume is predominantly within the Bandelier Tuff in the upper 90 m (300 ft) of the surface. The tuff units beneath the surface at MDA L are underlain by a thick (nearly 150 m [500 ft]) sequence of Cerros del Rio basalts. There is uncertainty regarding the long-term transport of vapors downward through the basalt toward the water table. Therefore, it is desirable to contain the plume above the basalt. The SVE interim measure is proposed as a proactive step to remove VOC mass, to decrease maximum VOC concentrations within the plume, to reduce the current extent of the vapor plume so it remains well contained within the upper tuff units, and to gather design information for a potential final SVE remedy.

Remediation techniques for VOC vapor plumes in deep vadose zones differ substantially from techniques used to remediate plumes in saturated zones (i.e., aquifers). One of the primary remediation techniques currently used on vadose-zone vapor plumes is SVE. SVE is appealing because of the relatively low costs associated with installation and operation, the effectiveness of remediation, and the widespread use at contaminated sites. This technique uses an applied vacuum to draw soil vapors (also called pore gas) toward an extraction hole. In a contaminated area, the extracted soil vapors will contain some fraction of VOC in addition to air, water vapor, and CO_2. As VOC vapors are removed from the subsurface, any dissolved, adsorbed, or liquid-phase VOC will tend to move into the vapor phase, thus reducing the total subsurface VOC mass (Hoeg et al. 2004, 255583).

2.0 BACKGROUND

Investigations related to the VOC plume at MDA L are summarized in the CME report (LANL 2011, 205756) and reports referenced therein. Soil-vapor monitoring boreholes located within and around MDA L have been used to characterize the nature and extent of the subsurface vapor plume at the site since 1986. Figure 1.0-1 shows the vapor-monitoring boreholes at MDA L. The most recent quarterly monitoring was conducted between 2008 and 2011 using 86 monitoring ports from 25 monitoring boreholes (Table 2.0-1). These sampling locations were agreed upon with the New Mexico Environment Department (NMED), and the data were reported in quarterly periodic monitoring reports for vapor sampling activities at MDA L (e.g., LANL 2011, 208822). During the most recent sampling event, 29 organic compounds were detected within the vapor plume at MDA L (LANL 2011, 208822). The primary constituents found in the VOC vapor plume are the organic solvents 1,1,1-trichloroethane (TCA) and trichloroethene (TCE). Figure 2.0-1 shows the distribution of TCA based on sampling data from 2009 and 2010. The figure illustrates that the highest concentrations are located within the upper Bandelier Tuff units and concentrations decrease with depth.

The investigations conducted at MDA L have determined that the continued source of the subsurface VOC plume is centered on the two disposal shaft fields located on the east and west sides of MDA L (Figures 1.0-1 and 2.0-1). The disposal shafts date from 1975 to 1985 and were used to dispose of the Laboratory's nonradioactive liquid waste. Slow leaks of VOC vapors from drums of waste in the two shaft fields have been proposed as the source of the vapor plume over the last 30-plus yr (Stauffer et al. 2005, 090537). The CME report used a screening approach, called Tier II screening, to identify the VOCs present at high enough concentrations within the vapor plume to potentially impact groundwater above a regulatory standard if they migrated to groundwater (LANL 2011, 205756). That analysis found that vapor concentrations for TCA; TCE; tetrachloroethene; methylene chloride; 1,2-dichloropropane; 1,1-dichloroethene; 1,2-dichloroethane; and 1,4-dioxane are present within the tuff units at concentrations that exceed their Tier II screening levels (LANL 2011, 205756) (Table 2.0-2).

The Laboratory performed a pilot test of SVE at MDA L in 2006. The results and analysis from this test are reported in several sources (Stauffer et al. 2007, 097871; LANL 2011, 205756; Stauffer et al. 2011, 255584). Two SVE boreholes were installed at MDA L: one near the west shaft field and one near the east shaft field (Figure 1.0-1). The pilot test showed that SVE was effective in removing VOC mass from the vapor plume with a radius of influence (ROI) of between 100 ft and 150 ft. During the 24.8 d of operation at the SVE-West test, more than 225 kg (500 lb) of VOCs was extracted from the subsurface. Figure 2.0-2 shows the TCA concentrations extracted from the western borehole during the test. The total mass removed from both boreholes during the nearly 47 d of total SVE operation in 2006 amounted to approximately 360 kg (800 lb). This mass removal is significant given that a 2010 estimate of the total VOC plume mass (not including the amount still in waste drums) is on the order of 1370 kg (3015 lb). Following the pilot test, vapor-monitoring data through 2010 were analyzed and presented in the CME report (LANL 2011, 205756). Analysis of the data indicated the 2006 pilot test had long-term impacts on soil-vapor concentrations. Concentrations of 1,2-dichloroethane; 1,2-dichloropropane; methylene chloride; TCA; and TCE all decreased in response to the SVE test, and at most locations, the decrease was still observed in 2010. The successful pilot test factored into the recommendation for an SVE remedy in the CME report (LANL 2011, 205756).

3.0 OBJECTIVES AND APPROACH

3.1 Objectives

3.1.1 VOC Mass Removal and Plume Reduction

The activities proposed under this IMWP focus on removing mass from the VOC vapor plume beneath MDA L to protect groundwater before final remedies are implemented at the site. VOC mass removal is a proactive step that will reduce both vapor concentrations and the extent of the subsurface vapor plume. Because there is uncertainty related to plume migration in the deep basalt toward the regional aquifer, SVE is recommended during this interim measure as a method for containing the vapor plume within the Bandelier Tuff. Analysis by Stauffer et al. (2011, 255548) and predictions presented in the MDA L CME (LANL 2011, 205756) both indicate that if SVE is performed, it will significantly reduce VOC concentrations and plume size. For example, simulations presented in the CME (LANL 2011, 205756), indicate that if SVE had been performed over a 3-yr period, from 2011 to 2013 in the analysis (Figure 3.1-1), both vapor-phase VOC concentrations and plume size would be significantly reduced over the next 10 to 300 yr. Much of this benefit is from the extraction of higher-concentration regions of the plume resulting from historical releases. With these concentrations remediated, concentrations are not likely to rebound to previous high values. In addition, actively extracting VOC vapors at a greater rate than they are generated will lower peak concentrations. With maximum concentrations lower in the source regions, vapor transport will reverse direction, and VOCs will diffuse from deeper in the plume back toward the surface. This reversal of the diffusion gradient would limit deeper migration into the underlying basalt and potentially toward groundwater. Implementing this interim measure before final remedy selection should increase the overall effectiveness of a final remedy.

In summary, to make progress on the RAO defined in the CME report (LANL 2011, 205756) of preventing groundwater from being impacted above a regulatory standard by the transport of VOCs to groundwater through soil vapor, the SVE interim measure has the following objectives for subsurface mass removal and plume reduction:

- Remove VOC mass from the subsurface
- Reduce maximum VOC concentrations
- Contain the vapor plume within the Bandelier Tuff units

3.1.2 SVE Design Information

Data collected on mass removal rates and concentration rebound during the interim measure will provide critical testing and feasibility information for design and operation of a longer-term SVE remedy. The short duration of the SVE pilot test in 2006 provided very useful data for illustrating the viability of SVE and for helping define the SVE remedy presented in the CME report. However, longer-term operation of SVE during an interim measure at MDA L will provide additional data to refine final design and operating conditions. Performance information will provide data on

- Mass removal rates for total VOCs and for those VOCs that exceed Tier II screening limits,
- Plume rebound to indicate VOC release rates from the east and west shaft fields,
- Feasibility of decreasing concentrations to below Tier II screening limits, and
- Extraction well ROI during longer-term pumping.

These data will support design decisions for

- Proposing the number, placement, and screened intervals of extraction wells;
- Recommending operating conditions for the SVE unit, such as, optimal extraction rates, extraction/rebound periods; and
- Defining appropriate cleanup standards.

3.2 Approach

The approach for the SVE interim measure at MDA L is described below. The first section describes the plan to generate a pre-SVE baseline data set of VOC soil-vapor concentrations. Next, the SVE equipment is described, followed by the extraction plan, which uses the two existing extraction boreholes employed during the 2006 pilot test. The plan is flexible and will be updated as data related to system performance are collected. The fourth section describes sampling that will be undertaken concurrently with SVE extraction to estimate mass removal and provide feedback on plume contraction through time. Finally, a baseline monitoring data set will be collected at the end of 1 yr of SVE operation to allow for a decision point to determine whether to continue the interim measure, and, if so, to define operating conditions for the next year.

3.2.1 VOC Baseline Sampling

Quarterly vapor monitoring at MDA L was suspended in (FY) 2012 by agreement with NMED because the available data were deemed sufficient to support the remedy selection process (LANL 2011, 207416; NMED 2011, 207576). However, to assess the impact of the proposed interim measure on the VOC vapor plume at MDA L, monitoring is proposed to provide a present-day, three-dimensional (3-D) description of the plume against which the SVE results can be compared. This IMWP proposes baseline sampling from the NMED-approved vapor-sampling ports (86 ports in 25 monitoring wells) available for VOC analysis at MDA L (Table 2.0-1). Sampling will be performed in accordance with the current version of Standard Operating Procedure 5074, Sampling Subsurface Vapor. Vapor samples will be collected in SUMMA canisters and sent off-site for analysis using U.S. Environmental Protection Agency (EPA) Method TO-15. Given some safety considerations, the 550-ft port in borehole 54-24399 may not be included in the proposed sampling campaign. The Laboratory plans to field screen the same ports using a Brüel and Kjær (B&K) Type 1302 multigas photoacoustic analyzer. Data from this baseline sampling round will allow correlation of the field-screening data (B&K) to the analytical data for TCA and TCE, the two most prevalent VOCs in the plume. If correlations can be established, the B&K instrument can be used more extensively for operational monitoring of exhaust gas during SVE.

3.2.2 SVE System

The SVE system that will be employed during the interim measure at MDA L has a main blower unit rated to 129 standard cubic feet per minute (scfm) at vacuum equal to 42.5 kPa (120 in. of water), a knock-out trap for liquid, various in-line flow and pressure measurement instruments, and an off-gas stack to the atmosphere. This type of system was used previously for a SVE test performed at MDA G in 2010 (LANL 2010, 109657). The SVE system consists of an 11-ft-long × 3-ft-wide skid-mounted Model 4L SVE SCFM Blower Package system provided by Catalytic Combustion Corp. of Bloomer, WI. The system uses a positive-displacement blower driven by a 10-horsepower electric motor. Currently, the Laboratory owns one of these units but may purchase a second identical unit so SVE can be run at both extraction boreholes independently, and transfer of the units between extraction wells will not be required.

3.2.3 SVE Plan

For the MDA L interim measure, the SVE unit(s) will initially be run continuously for 6 mo. The system may be operated at a lower extraction rate than its maximum of 129 scfm. Monitoring data will be used to generate concentration versus time plots (similar to Figure 2.0-2) and estimates of VOC mass removal with time. After 6 mo, these data will be used to determine whether SVE should be cycled off for a period to allow for plume rebound. Cycling of SVE units can be done to increase extraction efficiency, save energy, and extend equipment life. However, cycling can be labor intensive, and the SVE unit(s) may also be operated continuously, depending on the observed results. The Laboratory plans to run the interim measure for an initial 1-yr extraction period, evaluate the data, and make a decision about continuing the interim measure. A decision to continue the interim measure will be based on multiple metrics, including extraction efficiency, plume evolution, and available budget. If SVE is continued, a similar decision strategy will be revisited annually until a final remedy is implemented.

3.2.4 Sampling Plan during SVE

During operation of the SVE systems, the Laboratory will monitor the extraction gas and the vapor concentrations at ports near the two extraction wells.

- *Extraction gas monitoring*: Operational monitoring of vapor concentrations of TCA and TCE in the extraction gas using a B&K is proposed. In addition, analytical samples (i.e., using SUMMA canisters and TO-15 analysis) will be collected periodically from the extraction gas stream to confirm the B&K data and to monitor for additional VOC analytes. The SUMMA canister sampling frequency will decrease with time, probably starting at weekly and decreasing to monthly. Operational B&K monitoring will be more frequent to supplement the analytical data. Extracted vapor concentrations will be used to calculate total VOC mass removal as a function of time and to guide decisions regarding the length of time to run the SVE units before the plume is allowed to rebound.
- *Plume monitoring*: Sampling ports within the 100-ft ROIs (Figure 1.0-1) of the two extraction wells will be monitored quarterly during the first year of the interim measure. SUMMA canister samples will be collected at the NMED-approved sampling ports located within approximately the two ROIs (Table 3.2-1). In addition, borehole 54-27642, which is within a 150-ft ROI of the SVE-East extraction well, will be sampled because the borehole has ports at depths between 175 and 338 ft that can be used to monitor plume response at these deeper intervals. The boreholes within the 100-ft ROI of SVE-East do not have ports deeper than 150 ft. This sampling regime includes 14 ports in 3 boreholes near the SVE-West extraction well and 15 ports in 5 boreholes near the SVE-East extraction well. If one of the extraction wells is not used during a given quarter, the ports within that wells ROI will not be sampled. These data will be used to help guide decision points concerning SVE rates, SVE cycling, and extension of the interim measure beyond 1 yr.

3.2.5 One-Year Baseline Sampling

At the end of 1 yr of SVE operation, the Laboratory will again monitor the full set of NMED-approved vapor-sampling ports (86 ports in 25 monitoring wells) by collecting samples in SUMMA canisters and analyzing them using EPA Method TO-15. The results of data analysis will determine the overall impact of SVE on the nature and extent of the vapor plume. The results, along with the extraction data and quarterly subsurface vapor monitoring, will be used to make a decision regarding continued SVE operation.

3.2.6 Reporting

The Laboratory proposes submitting two progress reports to NMED based on the first year of operation of SVE at MDA L:

- Baseline monitoring data along with monitoring data and mass removal information collected during the first 6 mo of SVE operation will be analyzed and an informal progress report will be written and submitted to NMED approximately 8 mo after SVE begins.
- Baseline monitoring data along with monitoring data and mass removal information collected during the first year of SVE operation will be analyzed. A report documenting the first year of operation with recommendations regarding future SVE operation and monitoring at the site will be submitted to NMED 16 mo after SVE begins.

3.2.7 Air Permit

The Laboratory has submitted to NMED's Air Quality Bureau a request for review and approval of a No Permit Required (NPR) determination for the interim measure (LANL 2014, 256576). The Laboratory evaluated in a conservative manner the maximum air emissions that could be emitted from the SVE operation and has determined an air-quality construction or New Source Review permit is not required under 20.2.72 New Mexico Administrative Code, Construction Permits. Therefore, vapors extracted during SVE will be released to the atmosphere, provided NMED concurs that an NPR is appropriate for the proposed SVE operation at the site.

4.0 SCHEDULE

The proposed interim measure is a proactive, voluntary action by the Laboratory. The Laboratory is currently purchasing equipment and reinstating its vapor monitoring subcontracts to start the proposed work. The first step is to collect the baseline monitoring data described in section 3.2. Monitoring will be performed between June and July 2014. The SVE system will be installed between July and August 2014. System testing will be performed between August and September 2014. Full operations at one or both of the extraction wells will begin in September 2014, after which samples will be collected quarterly following the date when SVE operations begin.

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. 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.

Hoeg, S., H.F. Schöler, and J. Warnatz, October 2004. "Assessment of Interfacial Mass Transfer in Water-Unsaturated Soils during Vapor Extraction," *Journal of Contaminant Hydrology,* Vol. 74, No. 1–4, pp. 163–195. (Hoeg et al. 2004, 255583)

LANL (Los Alamos National Laboratory), May 2010. "Report for Supplemental Soil-Vapor Extraction Pilot Test at Material Disposal Area G, Technical Area 54," Los Alamos National Laboratory document LA-UR-10-3409, Los Alamos, New Mexico. (LANL 2010, 109657)

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

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

LANL (Los Alamos National Laboratory), December 2011. “Periodic Monitoring Report for Vapor-Sampling Activities at Material Disposal Area L, Solid Waste Management Unit 54-006, at Technical Area 54, Fourth Quarter Fiscal Year 2011,” Los Alamos National Laboratory document LA-UR-11-6491, Los Alamos, New Mexico. (LANL 2011, 208822)

LANL (Los Alamos National Laboratory), April 30, 2014. “No Permit Required Determination – TA 54 MDA L Soil Vapor Extraction,” Los Alamos National Laboratory letter (ENV-DO-14-0098) to T. Schooley (NMED) from A.R. Grieggs (LANL), Los Alamos, New Mexico. (LANL 2014, 256576)

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

Stauffer, P., K. Birdsell, and W. Rice, March 7–11, 2011. “3-D Model Validation in Support of Site Closure, Material Disposal Area L, Los Alamos, NM,” Paper 11545, Waste Management 2011 Conference, March 7–11, 2011, Phoenix, AZ. (Stauffer et al. 2011, 255584)

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)

Stauffer, P.H., J.K. Hopkins, T. Anderson, and J. Vrugt, July 11, 2007. “Soil Vapor Extraction Pilot Test at Technical Area 54, Material Disposal Area L: Numerical Modeling in Support of Decision Analysis,” Los Alamos National Laboratory document LA-UR-07-4890, Los Alamos, New Mexico. (Stauffer et al. 2007, 097871)

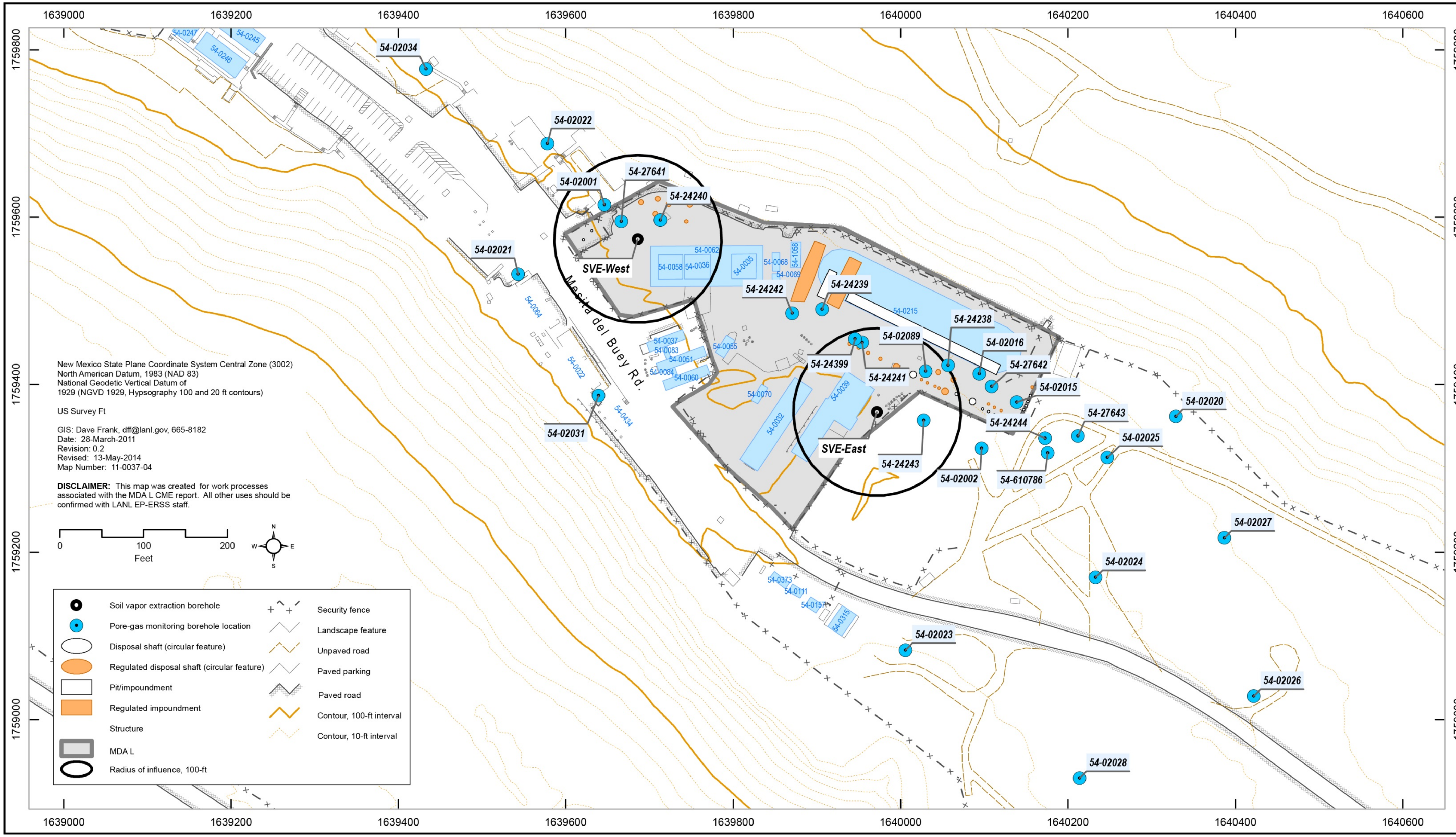
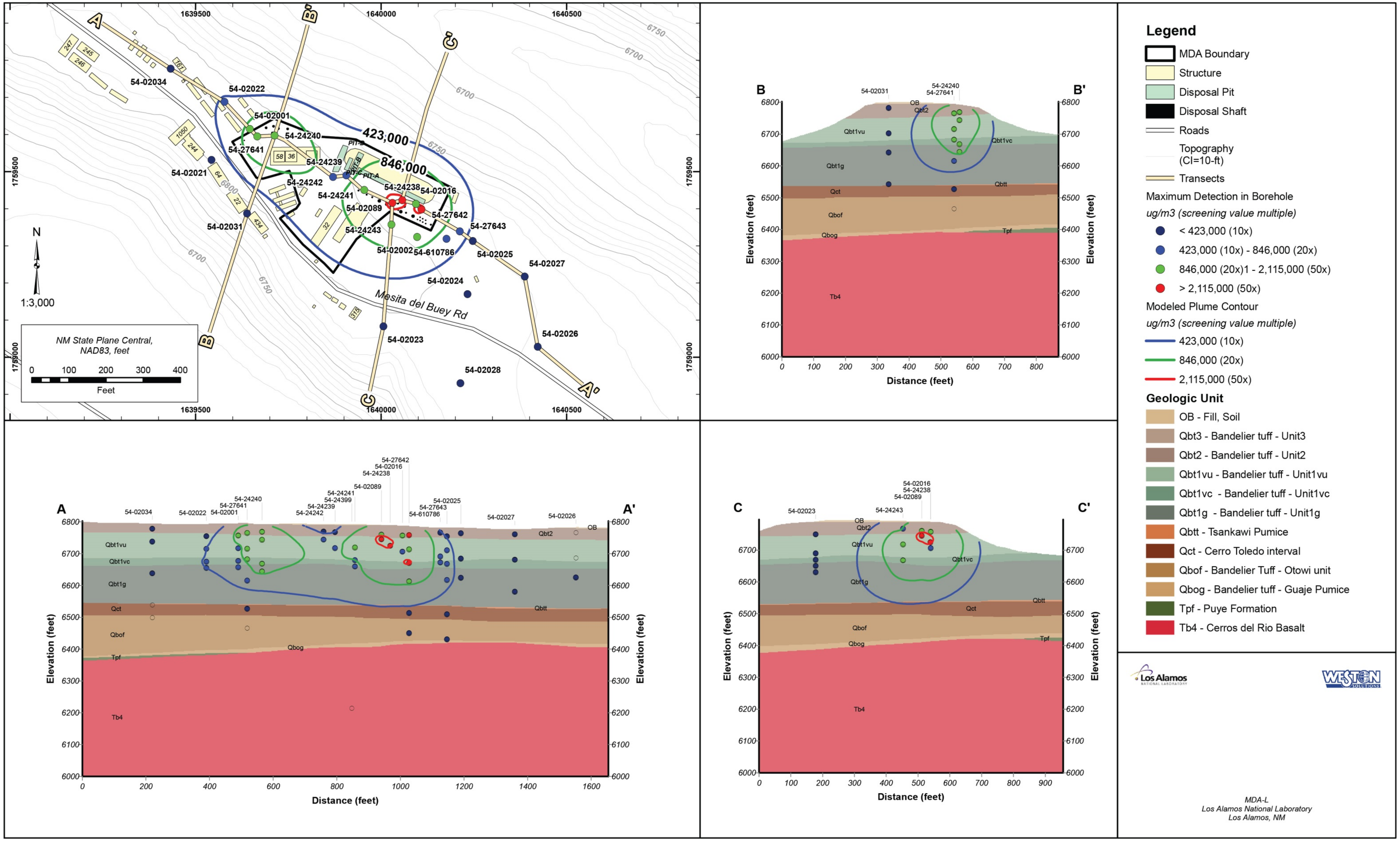
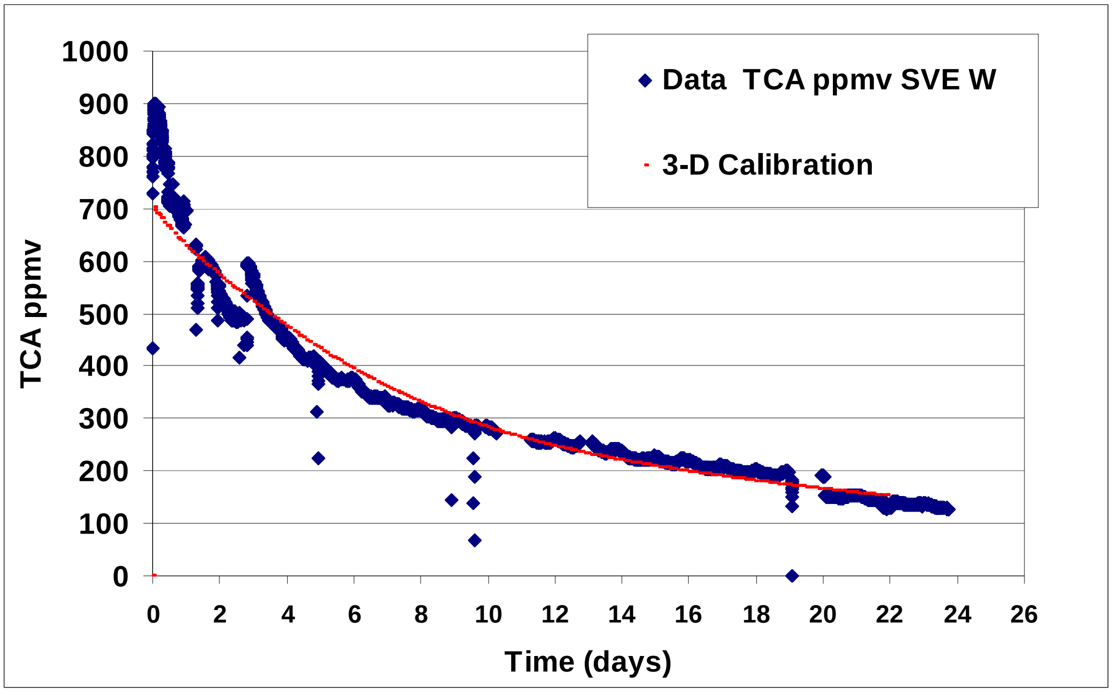


Figure 1.0-1 Map view of MDA L with disposal units, surface structures, vapor-monitoring boreholes, SVE boreholes, and 100-ft ROI of extraction wells



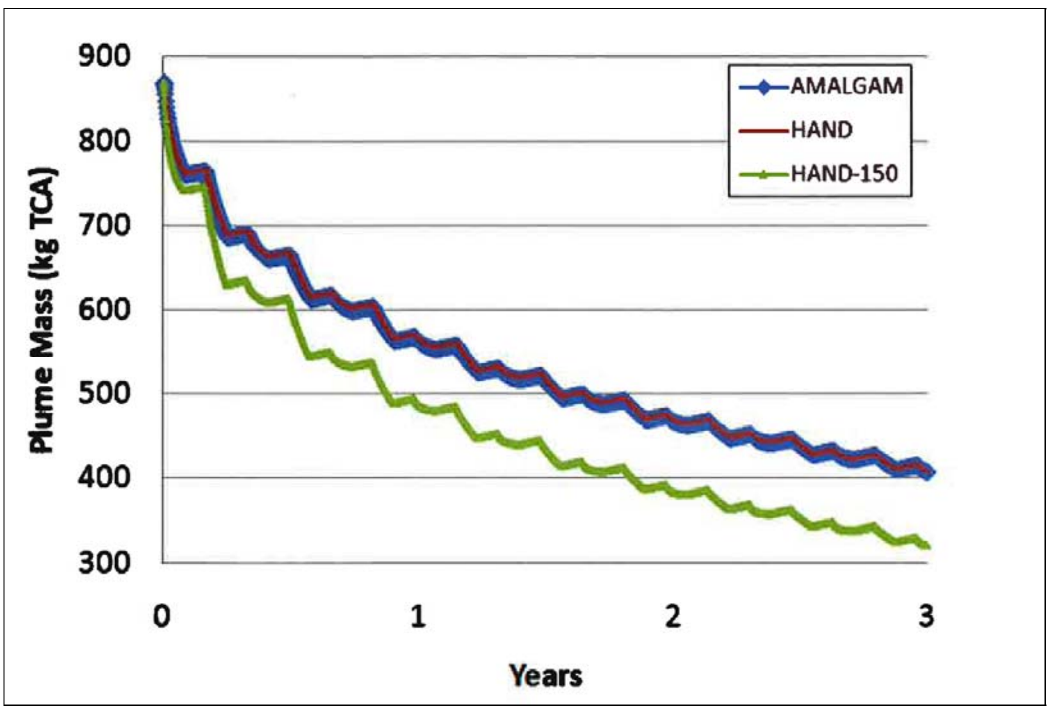
Note: TCA is the dominant component of the plume at greater than 60% by mass.

Figure 2.0-1 Subsurface distribution of 1,1,1-TCA vapors at MDA L based on the average of four quarters of monitoring (third quarter FY2009 to second quarter FY2010)



Notes: The red line is the match using a calibrated 3-D model of the site. The calibrated 3-D model is used to make predictions about the plume's evolution.

Figure 2.0-2 Mass removal during the 2006 pilot test from SVE-West at MDA L



Notes: The rate of air flow for the red and blue curves is 85 scfm, while for the green curve the system is pumping 150 scfm. SVE is active for 30 d on SVE-West, followed by a 30-d rebound period, then 30 d of SVE on SVE-East, followed by another 30-d rebound period. This cycle of 30 d × 4 d is repeated for the 3 yr of the prediction.

Figure 3.1-1 Predicted mass removal for a 3-yr SVE system as described in the MDA L CME report

Table 2.0-1
NMED-Approved Subsurface Vapor-Monitoring Locations, Port Depths, and Corresponding Sampling Intervals Proposed for Use during Baseline and Annual Monitoring

Vapor-Monitoring Well ID	VOC Sampling Port-Depth Intervals (ft bgs)
54-02001	40 (37.5–42.5), 80 (77.5–82.5), 120 (117.5–122.5), 140 (137.5–142.5)
54-02002	40 (37.5–42.5), 100 (97.5–102.5), 120 (117.5–122.5), 180 (177.5–182.5)
54-02016	31 (28.5–33.5), 82 (79.5–84.5)
54-02021	20 (10–30), 100 (90–110), 120 (110–130), 140 (130–150)
54-02022	40 (37.5–42.5), 80 (77.5–82.5), 120 (117.5–122.5), 140 (137.5–142.5)
54-02023	40 (30–50), 100 (90–110), 120 (110–130), 159 (149–169)
54-02024	40 (30–50), 100 (90–110), 120 (110–130), 160 (150–170)
54-02025	20 (20), 100 (100), 160 (160)
54-02026	20 (20), 100 (100), 160 (160)
54-02027	20 (20), 100 (100), 200 (200)
54-02028	20 (20), 100 (100), 160 (160)
54-02031	20 (20), 100 (100), 160 (160), 260 (260)
54-02034	20 (20), 60 (60), 160 (160), 260 (260), 300 (300)
54-02089	31 (31), 46 (46)
54-24238	64 (63–65)
54-24239	25 (24–26), 75 (74–76)
54-24240	28 (27–29), 53 (52–54), 128 (127–129), 153 (152–154)
54-24241	73 (71–74), 113 (112–114), 133 (132–134)
54-24242	25 (24–26), 50 (49–51)
54-24243	25 (24–26), 75 (74–76), 125 (124–126)
54-24399	550 (550–608)*
54-27641	32 (29.5–34.5), 82 (79.5–84.5), 115 (112.5–117.5), 182 (179.5–184.5), 271 (268.5–273.5), 332.5 (330–335)
54-27642	30 (27.5–32.5), 75 (71.5–76.5), 116 (114.5–119.5), 175 (172.5–177.5), 275 (272.5–277.5), 338 (335.5–340.5)
54-27643	30 (27.5–32.5), 74 (71.5–76.5), 117 (114.5–119.5), 167 (164.5–169.5), 275 (272.5–277.5), 354 (351.5–356.5)
54-610786	25 (22.5-27.5), 100 (97.5-102.5), 118.5 (116-121)

Note: All depth intervals will be both field screened and have VOC samples collected.
*Open borehole: single packer required at top of interval during sampling.

Table 2.0-2
Tier I and Tier II Screening of VOCs Detected during Second Quarter FY2010 in Pore Gas at MDA L

VOCs	Maximum Pore-Gas Concentration (µg/m³)	Calculated Concentrations in Pore Gas Corresponding to Groundwater Standard (µg/m³)	Tier I SV (unitless)	Tier I Potential for Groundwater Impact[a]	Tier II Potential for Groundwater Impact
Acetone	260	35,200	0.0074	No	No
Benzene	4400	1140	3.9	Yes	No
Carbon Tetrachloride	19,000	5500	3.5	Yes	No
Chlorobenzene	1700	13,000	0.13	No	No
Chloroform	71,000	15,000	4.7	Yes	No
Cyclohexane	19,000	79,300,000	0.00024	No	No
Dichlorodifluoromethane	21,000	5,460,000	0.0038	No	No
Dichloroethane[1,1-]	94,000	5750	16	Yes	No
Dichloroethane[1,2-]	740,000	240	3100	Yes	Yes
Dichloroethene[1,1-]	130,000	5500	24	Yes	Yes
Dichloroethene[trans-1,2-]	1300	38,000	0.034	No	No
Dichloropropane[1,2-]	400,000	600	670	Yes	Yes
Dioxane[1,4-]	4300	12.2	350	Yes	Yes[b]
Ethanol	6300	na[c]	na	No	No
Hexane	3400	65,120,000	0.000052	No	No
Methylene Chloride	130,000	650	200	Yes	Yes
Tetrachloroethene	370,000	3600	100	Yes	Yes
Tetrahydrofuran	73,000	na	na	No	No
Toluene	17,000	204,000	0.083	No	No
Trichloro-1,2,2-trifluoroethane[1,1,2-]	2,200,000	1,298,000,000	0.0017	No	No
Trichloroethane[1,1,1-]	3,900,000	42,300	92	Yes	Yes
Trichloroethane[1,1,2-]	1000	170	5.9	Yes	No
Trichloroethene	1,200,000	2000	600	Yes	Yes
Trichlorofluoromethane	41,000	5,200,000	0.0079	No	No
Xylene[1,2-]	3200	255,600	0.013	No	No
Xylene[1,3-]+Xylene[1,4-]	2100	2,700,000	0.00078	No	No

Notes: Tier I and Tier II screening results can be found in the MDA L CME report (LANL 2011, 205756). Shading denotes that analyte exceeds Tier I or Tier II screening levels (SLs).

[a] If the Tier I screening value (SV) is less than 1, the concentration of the VOC in pore gas does not have the potential to exceed the groundwater SL.

[b] Results from pore-water migration.

[c] na = Not available.

Table 3.2-1
NMED-Approved Subsurface Vapor-Monitoring Locations, Port Depths, and Corresponding Sampling Intervals within 100-ft ROIs of the Two Extraction Wells Proposed for Use during Quarterly Monitoring

Vapor-Monitoring Well ID	VOC Sampling Port-Depth Intervals (ft bgs)
54-02001	40 (37.5–42.5), 80 (77.5–82.5), 120 (117.5–122.5), 140 (137.5–142.5)
54-02089	31 (31), 46 (46)
54-24238	64 (63–65)
54-24240	28 (27–29), 53 (52–54), 128 (127–129), 153 (152–154)
54-24241	73 (71–74), 113 (112–114), 133 (132–134)
54-24243	25 (24–26), 75 (74–76), 125 (124–126)
54-27641	32 (29.5–34.5), 82 (79.5–84.5), 115 (112.5–117.5), 182 (179.5–184.5), 271 (268.5–273.5), 332.5 (330–335)
54-27642	30 (27.5–32.5), 75 (71.5–76.5), 116 (114.5–119.5), 175 (172.5–177.5), 275 (272.5–277.5), 338 (335.5–340.5)

Note: All depth intervals will be both field screened and have VOC samples collected.