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Date: August 21, 2009
Refer To: EP2009-0357

James 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 Response to the Notice of Disapproval for the Vadose Zone Subsurface Characterization and Vapor Monitoring Well Installation Work Plan for Material Disposal Area V, Consolidated Unit 21-018(a)-99 and Revision 1

Dear Mr. Bearzi:

Enclosed please find two hard copies with electronic files of the response to the notice of disapproval for the Vadose Zone Subsurface Characterization and Vapor Monitoring Well Installation Work Plan for Material Disposal Area V, Consolidated Unit 21-018(a)-99 and Revision 1 of the work plan. Also enclosed is an electronic copy of a redline/strikeout version of the work plan that includes all changes made in response to the New Mexico Environment Department's notice of disapproval.

If you have any questions, please contact Bruce Wedgeworth at (505) 231-0108 (brucew@lanl.gov) or Ed Worth at (505) 606-0398 (eworth@doeal.gov).

Sincerely,

B-G Schnell for MJG

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/BC/BW/RR:sm

Enclosures: Two hard copies with electronic files:
1) Response to the Notice of Disapproval for the Vadose Zone Subsurface Characterization and Vapor Monitoring Well Installation Work Plan for Material Disposal Area V, Consolidated Unit 21-018(a)-99 (LA-UR-09-5022)
2) Vadose Zone Subsurface Characterization and Vapor Monitoring Well Installation Work Plan for Material Disposal Area V, Consolidated Unit 21-018(a)-99, Revision 1 (LA-UR-09-5021)
3) An electronic copy of the redline-strikeout version of the plan that includes all changes and edits to the document

Cy: (w/enc.)
Neil Weber, San Ildefonso Pueblo
Bruce Wedgeworth, EP-TA-21, MS C349
Ed Worth, DOE-LASO, MS A316
RPF, MS M707 (with two CDs)
Public Reading Room, MS M992

Cy: (Letter and CD and/or DVD only)
Laurie King, EPA Region 6, Dallas, TX
Steve Yanicak, NMED-OB, White Rock, NM
Kristine Smeltz, EP-WES, MS M992

Cy: (w/o enc.)
Tom Skibitski, NMED-OB, Santa Fe, NM
Keyana DeAguero, DOE-LASO (date-stamped letter emailed)
Michael J. Graham, ADEP, MS M991
Alison M. Dorries, EP-WES, MS M996
Bill Criswell, EP-TA-21, MS C349
IRM-RMMSO, MS A150 (date-stamped letter emailed)

Response to the Notice of Disapproval for the Vadose Zone Subsurface Characterization and Vapor-Monitoring Well Installation Work Plan for Material Disposal Area V, Consolidated Unit 21-018(a)-99 Los Alamos National Laboratory, EPA ID #NM0890010515, HWB-LANL-06-021 Dated July 24, 2009

INTRODUCTION

To facilitate review of this response, the New Mexico Environment Department's (NMED's) comments are included verbatim. Los Alamos National Laboratory's (LANL's or the Laboratory's) responses follow each NMED comment.

SPECIFIC COMMENTS

NMED Comment

1. ***Drilling Approach, page 3:***

   This Section describes the approach for installation of the vapor-monitoring well at Material Disposal Area (MDA) V. The Permittees have outlined ten steps included in the installation process. However, it appears that items one (Measure and record the TD of the borehole after slough is removed) and two (Add bentonite pellets, hydrate using potable water, measure and record the depth) have been repeated on the following page. The Permittees must revise the text to remove the repetitive language in this Section.

LANL Response

1. The text was revised to remove the repetition of steps 1 and 2.

NMED Comment

2. ***Abandonment of Borehole 21-02523, page 2:***

   The Permittees have proposed to abandon borehole 21-02523 at MDA V so that the area can be prepared for staging activities associated with the field work at MDA B. NMED will allow abandonment of this borehole; however, NMED may require the Permittees to replace this borehole to support future vapor-monitoring activities at TA-21.

   Additionally, the Permittees must revise Figure 1 to include the location of borehole 21-02523.

LANL Response

2. Figure 1 has been revised to include the location of borehole 21-02523.

NMED Comment

3. Table 1, MDA V Tentative Drilling Schedule, page 9:

The Permittees must provide in the text or in Table 1 the rationale for the tentative drilling schedule. Additionally, the Permittees must explain whether or not complications in drilling and vapor-monitoring well installation were taken into account when calculating the drilling and sampling schedule. The Permittees must revise the text or Table 1 where appropriate.

LANL Response

3. A section discussing the schedule and the rational for the well installation duration has been added to the work plan. Table 1 presents the proposed schedule for well installation and subsequent quarterly monitoring reports. The duration for installing the vapor-monitoring well is based on conditions encountered at Material Disposal Area (MDA) V and experience from installing similar vapor-monitoring wells at MDA T.

   Originally planned for May 15, 2009, mobilization at MDA V began May 26, 2009, following preliminary approval of the work plan by NMED on May 20, 2009, and the Memorial Day weekend (there was a safety concern related to starting work and immediately shutting down for the long weekend). The hollow-stem auger borehole and installation of seven vapor-monitoring ports to the total depth of the original borehole 21-24524 were completed on July 27, 2009. Drilling of the air-rotary borehole began on July 28, 2009.

   The total duration of the vapor-monitoring well installation will be 130 d and includes

   - a 7-d delay in obtaining the appropriate well screens from the manufacturer,
   - a 26-d delay to correct problems with the casing/drill bit in the air-rotary borehole, and
   - a 6-d delay to correct a drill-rig electrical malfunction.

   Well completion is anticipated by October 2, 2009. This proposed completion date does not include other possible drilling delays. LANL will notify NMED should such delays occur during drilling.

Vadose Zone Subsurface Characterization and Vapor-Monitoring Well Installation Work Plan for Material Disposal Area V, Consolidated Unit 21-018(a)-99, Revision 1

Primary Purpose	This work plan describes activities needed to drill a borehole to investigate and determine the geohydrological characteristics of the unsaturated zone at the west end of Technical Area 21 (TA-21), at Material Disposal Area (MDA) V, at Los Alamos National Laboratory (LANL). Upon completion of the borehole, LANL will install a vapor-monitoring well to investigate the nature and extent of subsurface tritium contamination. The borehole and vapor-monitoring well will be installed within 10 ft of original borehole location 21-24524. (The new borehole will retain the designation of 21-24524.) This additional characterization and sampling will contribute to a better understanding of the hydrology of the vadose zone below TA-21 and will assist the U.S. Department of Energy (DOE) in characterizing the nature and extent of subsurface tritium in pore-water vapor.
Conceptual Model	Advective transport of contaminants from mesa-top sites to groundwater is generally limited by low recharge rates through the Bandelier Tuff. Two geologic properties of Bandelier Tuff that influence recharge rates are its degree of welding and devitrification; both bear the effects of the prolonged presence of residual gases and high temperatures after deposition. Cooling of the units was not uniform because the different tuff units were deposited at different temperatures. Welding tends to vary spatially both between units and within separate depositional layers. Welded tuffs tend to be more fractured than nonwelded tuffs. Fractures within the tuff, however, do not enhance the movement of dissolved contaminants unless saturated conditions exist because the fractures tend to be clay-filled, resulting in generally higher sorptive capacity. Saturated conditions do not currently exist above the groundwater table at MDA V, although they may have occurred in the past when wastewaters were being discharged to the MDA V absorption beds. The moisture content of site soils and bedrock measured during the investigation of MDA V ranged from 3% to 31.6%, with most values less than 10%. At the low moisture levels encountered at MDA V (except the 31.6% value detected in a sample collected at the base of the Tshirege unit at location 21-24524 at approximately 290 ft), the fractures beneath the site are unsaturated. Fractures will only conduct water in situations where substantial infiltration occurs from the ground surface; however, past modeling studies indicate that when fractures become discontinuous at stratigraphic subunit contacts, fracture moisture is absorbed into the tuff matrix (Soll and Birdsell 1998, 070011, pp. 200-201).
Scope and Rationale for Geohydrological Vadose Zone Borehole and Vapor-Monitoring Well Location	Only limited unsaturated geohydrological properties have been determined in the shallow (less than 400 ft of the total 1100–1200 ft-thick) vadose zone at MDA T, TA-21, and no data have been collected from the west end of the mesa. Additional vadose zone geohydrological data are critical to understanding potential contaminant transport from former releases at solid waste management units within TA-21. Geohydrologic sampling will consist of bedrock core sampling. Drilling to advance the borehole will include hollow-stem auger ([HSA] to a depth of 400 ft) and air-rotary drilling methods. The strategy is to duplicate drilling methods used in borehole 21-24524 to the near 400-ft depth. Vadose zone sampling shall include collecting core samples from approximately 20-ft intervals to a depth of 200 ft and approximately 50-ft intervals below 200-ft depth. Sampling depths shall be adjusted to include the depths required for tritium monitoring to avoid unnecessary duplication of samples. Thus, there will only be a separation of 30 ft at the 300- to 330-ft depth because of monitoring-port depth requirements, which supersede the vadose zone sampling depth requirements. The deepest sampling depth is estimated to be 715 ft or approximately 10 ft into the Puye Formation where the deepest geohydrological sample will be collected and the tritium monitoring port will be installed.

Scope and Rationale for Geohydrological Vadose Zone Borehole and Vapor-Monitoring Well Location (continued)	Samples of rock core shall be collected at each interval of the vadose zone for both volumetric and gravimetric moisture content, dry density, chloride concentration of pore water, nitrates, tritium, and perchlorate. Undisturbed core samples for unsaturated hydraulic conductivity testing (Van Genuchten properties) shall be collected at approximately 303 ft in the Tsankawi Pumice Bed, 380 ft in the Otowi Formation, 670 ft in the Guaje Pumice Bed, and 715 ft in the Puye Formation. Where samples are fragile and an undisturbed sample cannot be collected, a disturbed sample will be collected for the specified testing at the target interval. Experience gained from drilling at MDA T indicates the proposed drill rig probably cannot extend casing into the Puye Formation without getting stuck in the borehole. Therefore, a single approximately 10-ft core run will be attempted into the Puye Formation, below the casing advanced to the bottom of the Guaje Pumice Bed. If unsuccessful, sampling of and installation of a monitoring port in the Puye Formation will not be possible. MDA V is a potential source for tritium contamination because the laundry operation discharged up to 6,000,000 gal. of water annually into absorption beds. In addition, data collected to date have not defined the vertical extent of tritium below the absorption beds. Fifteen boreholes drilled in 2005 were sampled at two depth intervals for vapor-phase volatile organic compounds (VOCs) and tritium (LANL 2007, 098942, Figure 1.2-1). The shallow interval (14 to 15 ft deep) was sampled at the approximate base of the absorption beds, and the deep interval was sampled at the total depth (TD) of the borehole (379 to 380 ft deep). In 2005, samples were not collected at the drilled TD of the boreholes because all boreholes contained several feet of sloughed material that resulted from auger-flight removal and heavy-equipment traffic. In 2006, each borehole was reamed to the original depth, and the augers were left in place to allow samples to be collected at TD. In 2006, samples collected from each borehole at the two depth intervals described above were analyzed for VOCs and tritium (LANL 2007, 098942, Appendix B). In June 2006, all 15 boreholes were plugged and abandoned in accordance with the approved MDA V investigation work plan (LANL 2007, 098942, p. 22). The horizontal and vertical distribution of tritium in the subsurface was evaluated by collecting samples of subsurface pore gas containing tritiated water vapor. Pore-gas samples were collected and analyzed for tritium in both 2005 and 2006 (LANL 2007, 098942, Table B-2.4-3). In 2005, the maximum detected tritium activity (24,570 pCi/L at 14 to 15 ft below ground surface [bgs]) occurred at location 21-24524, between absorption beds 1 and 2. In 2006, location 21-24524 also had the maximum detected tritium activity of 132,100 pCi/L at TD. Most locations showed either decreased or relatively constant activities with depth. Six locations showed an increase in tritium activity with depth. Tritium activity decreased with distance away from location 21-24524 in both the 2005 and 2006 samples. However, sufficient data are not available to conclusively define the vertical extent of tritium in the fractured tuff at a depth greater than 380 ft below the former absorption beds. Figures 7.6-3 and 7.6-4 in the investigation report show tritium activity in pore water in 2005 and 2006, respectively (LANL 2007, 098942). The vapor-monitoring well will be located next to, and within 10 ft of, the now backfilled borehole 21-24524 (Figure 1) where the highest tritium activity was detected in the previous investigation (see conceptual model).
Abandonment of Borehole 21-02523	As previously approved by the New Mexico Environment Department (NMED), the open borehole, location 21-02523, will be abandoned (LANL 2007, 097448, Table 2). The cased borehole 21-02523 will be grouted from the depth of caving (320 ft of the total 660-ft depth) to the ground surface per Standard Operating Procedure (SOP) 5.03. Grout will be emplaced with a tremie pipe to penetrate as deeply as possible where the borehole is caved below the casing.

Postinstallation Vapor Sampling	Sampling of the newly installed well will begin within 14 d following installation. The data will be used to determine the vertical extent of tritium contamination at MDA V. A minimum of four quarters of sampling will be conducted at the vapor wells (initial plus three additional rounds of sampling). The results from the quarterly monitoring will be included in a status report that presents data-sampling results from previous and current rounds of sampling as well as any discussion required to qualify the sampling results. This report may include recommendations for future monitoring based on data results and trends. If decreasing trends over time are observed or other events qualify the data, LANL may recommend terminating the monitoring.
Drilling Approach	Borehole 21-24524 (Figure 1) will be drilled with a combination of HSA and air-rotary techniques. Because two types of drilling technology will be used, the well will be completed in two separate boreholes: one for the HSA portion of the borehole and one for the air-rotary portion. HSAs will be used to drill to approximately 400 ft to simulate the initial drilling of borehole 21-24524. Core samples will be collected at the location where each monitoring port will be installed, which is the approximate midpoint of the seven geologic units expected to be encountered based on the original borehole log of 21-24524: Qbt 3, Qbt 2, Qbt 1v, Qbt 1g, the Tsankawi Pumice Bed, Qct, and depth 380 ft (in Qbo). In the air-rotary-drilled borehole, four depths (480 ft bgs, 580 ft bgs, 670 ft bgs, and 715 ft bgs) will be sampled. Three of these depths will be in the Qbo, and the fourth sampling port will be installed approximately 10 ft into the Puye Formation (at approximately 715 ft bgs). There will be a total of 11 ports/depths for the two boreholes. Bedrock pore water and/or packer test water-vapor sampling results will be used to determine the vertical extent of tritium contamination before the vapor-monitoring ports are installed. This determination will be based on either a decreasing trend of tritium activity from the shallower samples collected at this borehole or a tritium value of less than 20,000 pCi/L in the deepest sampling location. If deeper ports are required in the Puye Formation, they would be installed at approximately 100-ft intervals and extended to just above the regional aquifer. The installation of additional ports will probably require a multi-well completion to facilitate construction of the monitoring ports and alternate drilling equipment to advance the borehole. After the completion of HSA drilling in the first borehole and before air-rotary drilling in the second borehole, a straddle packer will be used to isolate each depth interval to 380 ft bgs, and samples of the pore-water vapor will be collected for analysis. Because of the potential injection of air into the formations when air-rotary drilling is used, no packer tests will be performed in the air-rotary borehole, except for the anticipated TD of the borehole. Once TD is reached, the subsurface pore gas will be allowed to reequilibrate for 48 h before the vapor sample is collected. Based on the stratigraphy encountered in borehole 21-02523, the TD for borehole 21-24524 is estimated to be approximately 715 ft bgs. If perched water is present, water levels will be observed to determine if they stabilize before the well is completed. Bentonite plugs will be positioned as needed to prevent leakage of water beneath perching horizons, allowing a stable water level to be determined. The vapor-monitoring well (Figure 2) will be equipped with multiple sampling ports consisting of a nominal 0.5-in.-diameter, 12-in.-long stainless-steel well screen connected to sample tubing extending to the ground surface. The sample tubing will consist of 0.25-in.-diameter stainless-steel connected with Swagelok fittings. The 5-ft-thick sampling intervals will be filled with 10/20 silica sand. Bentonite chips will be tremied into the borehole and hydrated to isolate the sampling intervals. This process includes the following steps.

Drilling Approach (continued)	1. Measure and record the TD of the borehole after slough is removed. 2. Add bentonite pellets, hydrate using potable water, measure and record the depth. 3. Add approximately 2.5 ft of 10/20 silica sand to support the stainless-steel screen and measure and record the depth. The maximum silica sand interval is approximately 5 ft but may be adjusted based on the particular characteristics of the subsurface. 4. Lower the sampling port and enough stainless-steel tubing and screen to reach top of silica sand and measure and record the depth. 5 Add another 2.5 ft of 10/20 silica sand, measure, and record the depth. 6. Add enough bentonite pellets to reach the next screen location, measure, and record the depth. Water will be added to aid hydration of the pellets at several intervals during pellet placement. 7. Label the top of each stainless-steel tube to identify each screen and depth of screen. 8. Repeat steps 3 through 7 until the ground surface is reached. 9. Install a stainless-steel cap to contain the ends of the stainless-steel tubing. 10. Complete a cement surface, including a locking steel cap. The data collected include both tritium in pore water extracted in an off-site laboratory from core samples of soil and in rock taken from below the site and pore water in vapor phase extracted by means of a suction process using packer tests and/or vapor-monitoring extraction wells. The core samples or pore-water moisture collected in a silica gel is then sent to an off-site laboratory for analysis.
Potential Drilling Fluids, Composition, and Use	No drilling fluids will be used for the borehole or monitoring well installation; only air-rotary drilling methods will be used.
Hydrogeotechnical and Geochemical Objectives	The borehole will be logged in accordance with Section IX.B.2.c of the Compliance Order on Consent (the Consent Order), including logging by a qualified engineer or geologist in accordance with the required soil (American Society for Testing and Materials method D2488) and rock (American Geological Institute) classification methods. Core samples will be collected at the targeted intervals to characterize vadose zone chemistry, including moisture content, dry density, chlorides, and nitrates Unsaturated hydraulic conductivity tests will be conducted from a core sample obtained within each formation encountered. The data obtained will be used to understand the geohydrological setting of the vadose zone at TA-21 and to perform future modeling, as needed. Analysis will also be conducted for perchlorate using the U.S. Environmental Protection Agency (EPA) Method 6850.
Potential Groundwater Occurrence and Detection	Perched water was encountered in 1993 at an elevation of 6438 ft in the Guaje Pumice Bed in well LADP-3. The lack of perched conditions in the Guaje Pumice Bed in LADP-4 in DP Canyon and borehole 21-02523 at MDA V indicates the Guaje Pumice Bed groundwater is not a laterally extensive, sheet-like body that extends under DP Mesa. Water was not encountered at location 21-02523 at a depth of approximately 708 ft bgs, 200 ft to the east of borehole 21-24524. Groundwater lies at approximately 1200 ft bgs at MDA V and is not expected to be encountered during drilling.
Core Sampling	In each borehole, moisture-protected core samples will be collected from the targeted depths for monitoring ports.

Proposed Schedule	Table 1 presents the proposed schedule for well installation and subsequent quarterly monitoring reports. The duration for installing the vapor-monitoring well is based on conditions encountered at MDA V and experience from installing similar vapor-monitoring wells at MDA T. Originally planned for May 15, 2009, mobilization at MDA V began May 26, 2009, following preliminary approval of the work plan by NMED on May 20, 2009, and the Memorial Day weekend (there was a safety concern related to starting work and immediately shutting down for the long weekend). The HSA borehole and installation of seven vapor-monitoring ports to the total depth of the original borehole 21-24524 were completed on July 27, 2009. Drilling of the air-rotary borehole began on July 28, 2009. The total duration of the vapor-monitoring well installation will be 130 d and includes • a 7-d delay in obtaining the appropriate well screens from the manufacturer, • a 26-d delay to correct problems with the casing/drill bit in the air-rotary borehole, and • a 6-d delay to correct a drill-rig electrical malfunction. Well completion is anticipated by October 2, 2009. This proposed completion date does not include other possible drilling delays. LANL will notify NMED should such delays occur during drilling.
Investigation-Derived Waste Management	Investigation-derived waste (IDW) will be managed in accordance with EP-ERSS-SOP-5022, Characterization and Management of Environmental Restoration (ER) Project Waste (available at http://www.lanl.gov/environment/all/qa/adep.shtml). This standard operating procedure incorporates the requirements of all applicable EPA and NMED regulations, DOE orders, and LANL requirements. The primary waste streams include drill cuttings, contact waste, decontamination water, broken concrete rubble, a length of steel casing, and excess grout mix. Drill cuttings will be managed in accordance with the NMED-approved Notice of Intent Decision Tree for Land Application of IDW Solids from Construction of Wells and Boreholes (November 2007). Drill cuttings will be containerized and characterized with direct sampling. If they cannot be land-applied, the cuttings will be sent to an authorized treatment, storage, or disposal facility. Contact waste will be containerized and characterized based on the waste determination of the drill cuttings. Decontamination water will be containerized and characterized by direct sampling of the containerized waste. If found not to be contaminated, the broken concrete rubble, steel casing, and excess grout will be handled as industrial waste and sent to the county landfill for reuse. If it is contaminated, it must be managed appropriately as waste.

REFERENCES

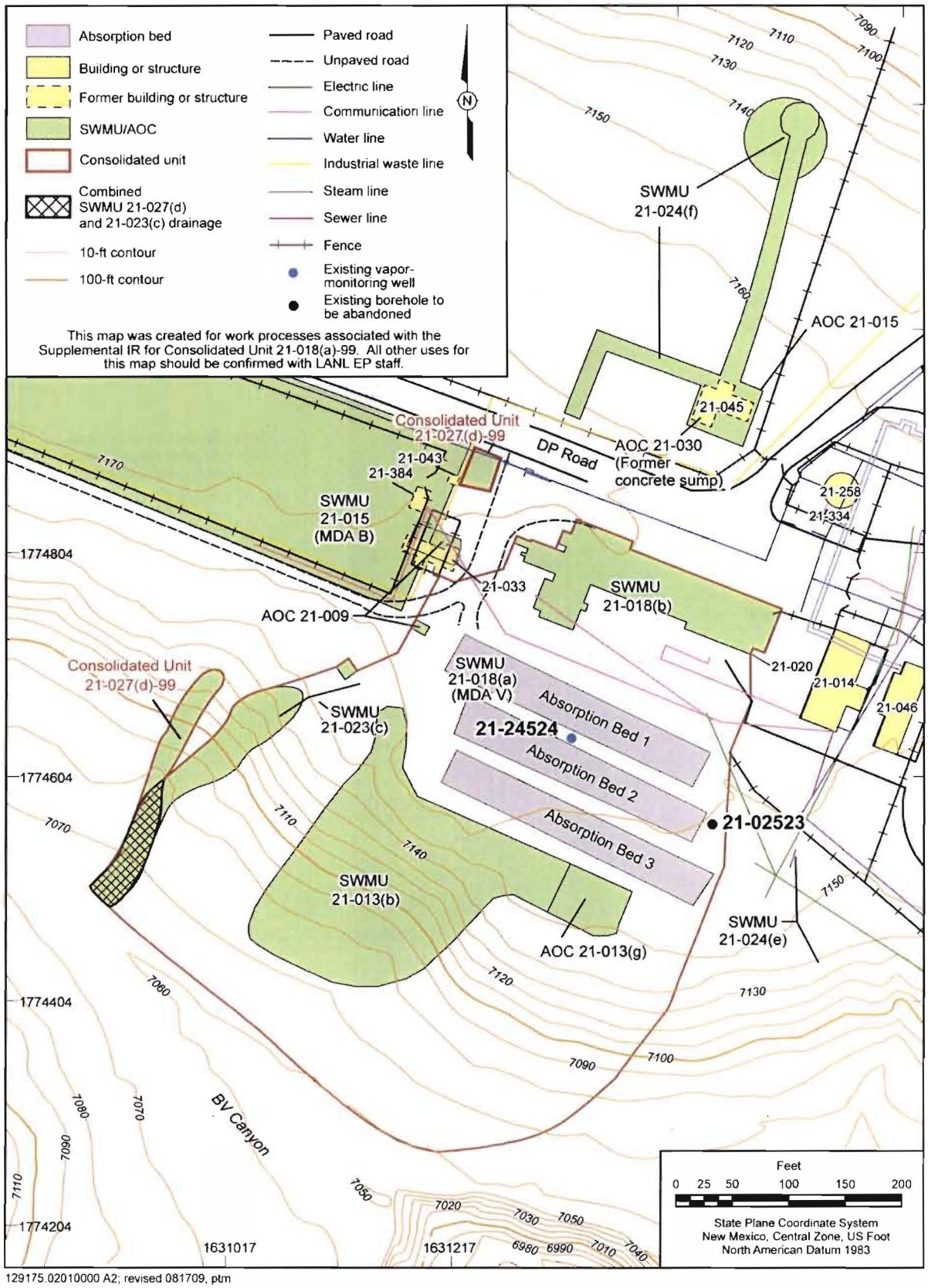
The following list includes all documents cited in this plan. Parenthetical information following each reference provides the author(s), publication date, and ER ID. This information is also included in text citations. ER IDs are assigned by the Environmental Programs Directorate's Records Processing 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.

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

LANL (Los Alamos National Laboratory), July 3, 2007. "Sampling Data for Area of Elevated Radioactivity Near Location ID 21-02523 and North of Absorption Bed 3, Consolidated Unit 21-018(a)-99, Material Disposal Area V, at Technical Area 21," Los Alamos National Laboratory letter (EP2007-0346) to J.P. Bearzi (NMED HWB) from S. Stiger (Environmental Programs Associate Director) and D. Gregory (DOE Federal Project Director), Los Alamos, New Mexico. (LANL 2007, 097448)

Soll, W., and K. Birdsell, February 1998. "The Influence of Coatings and Fills on Flow in Fractured, Unsaturated Tuff Porous Media Systems," *Water Resources Research,* Vol. 34, No. 2, pp. 193-202. (Soll and Birdsell 1998, 070011)



129175.02010000 A2; revised 081709, ptm

Figure 1 Location of borehole 21-24524 at MDA V

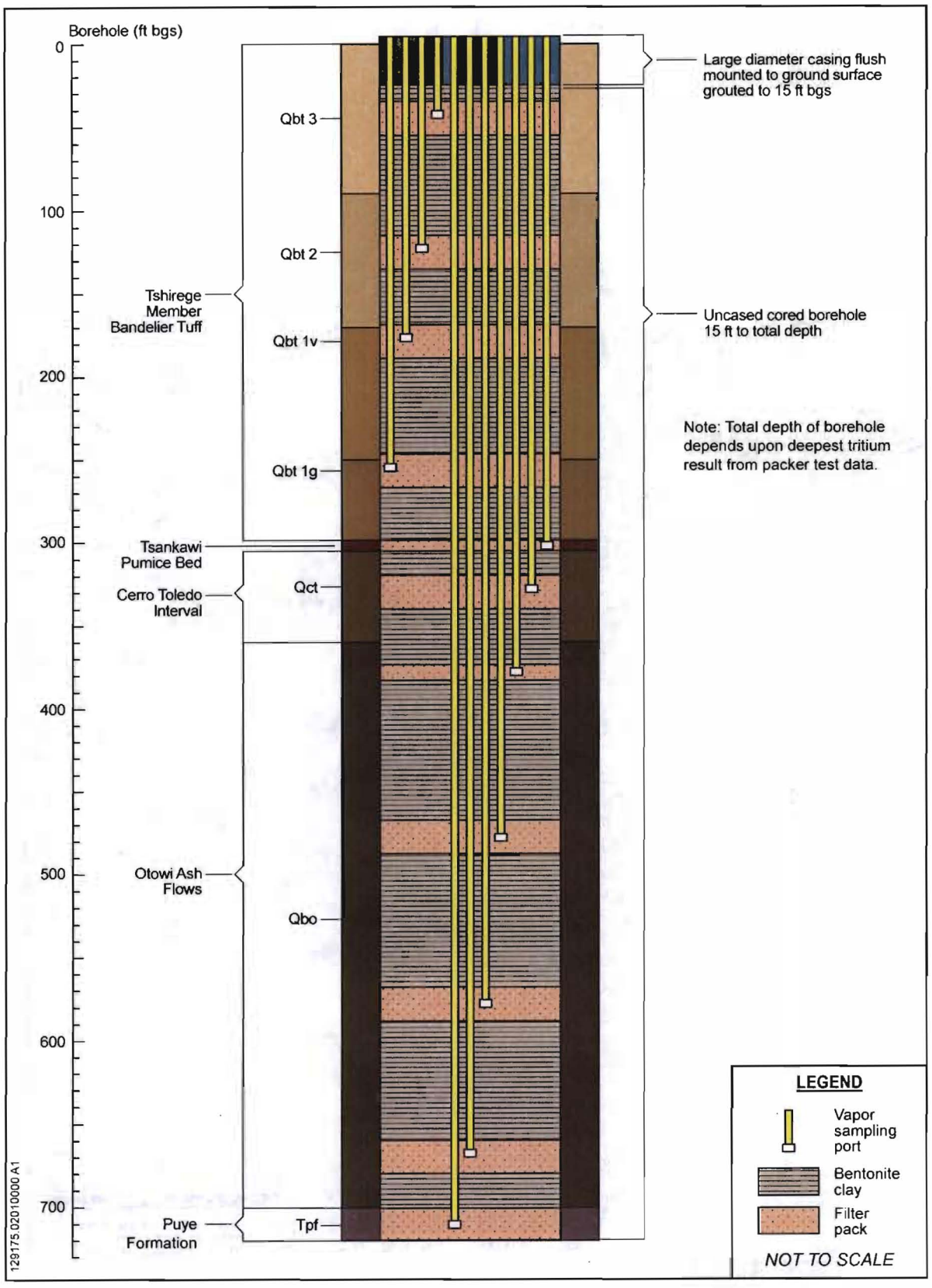


Figure 2 Proposed construction details of vapor-monitoring well at MDA V

Table 1
MDA V Proposed Drilling Schedule

Borehole 21-24524	Estimated Date	Duration (days)
Mobilization	May 26, 2009 (start)	7
Drilling of Borehole 21-24524 to 400 ft	—[a]	56
Installation of vapor-monitoring ports to 400 ft	—	7
Drilling of Borehole 21-24524 to 715 ft	—	46
Installation of vapor-monitoring ports to 715 ft	—	7
Site restoration	October 2, 2009 (finish)	7
Quarterly Vapor Sampling	—	365
1st Quarter Sampling Report	January 2, 2010[b]	—
2nd Quarter Sampling Report	April 2, 2010[b]	—
3rd Quarter Sampling Report	July 2, 2010[b]	—
4th Quarter Sampling Report	October 2, 2010[b]	—

[a] — = No date or duration determined.

[b] The sampling report dates are approximate and depend upon the actual well completion date.