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Technical Area 21 Subsurface Vapor Moisture Monitoring Plan for Tritium

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1.0 INTRODUCTION

Historical tritium research has been performed in several locations at Technical Area 21 (TA-21). Wastes from these facilities have also been disposed of on the mesa. In addition, the Omega Reactor, located in Los Alamos Canyon near the west end of the mesa, had considerable leaks of tritium into the subsurface from the adjacent creek. This creek flows in a deeply incised canyon along the south side of the mesa. Currently, potential sources of tritium include the Tritium Systems Test Assembly (TSTA) building and other associated buildings at Delta Prime (DP) East, the laundry facility and absorption beds at Material Disposal Area (MDA) V, MDA T absorption beds, and building 21-257 wastewater treatment plant (McGehee and Garcia 1999, 087442). The nearest potential for tritium from an off-site source is the Omega Reactor located west of MDA B and in the bottom of Los Alamos Canyon. As investigations performed under the Compliance Order on Consent (the Consent Order) gather subsurface data, Los Alamos National Laboratory will periodically review the data and assess the need for additional tritium monitoring to determine the nature and extent of tritium in the subsurface at TA-21. Information on radioactive materials and radionuclides, including the results of sampling and analysis of radioactive constituents, is voluntarily provided to the New Mexico Environment Department in accordance with U.S. Department of Energy (DOE) policy.

The data being collected include both tritium in water vapor 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. This additional sampling will assist DOE in characterizing the nature and extent of tritium in subsurface water vapor at TA-21. The initial additional sampling will be conducted at MDAs V and T as described in Appendixes A and B, respectively. These sites were the locations of disposal and infiltration of wastewaters containing tritium. The saturation from this method of disposal is considered the most likely means for tritium transport into the subsurface at TA-21. Based on the results from the initial monitoring and evaluation of other potential sources, any subsequent sampling and monitoring for tritium at other drier TA-21 locations (e.g., TSTA where significant amounts of water needed to transport the tritium probably were not present) will be described in future appendixes to this plan as necessary.

MDA U was a third site where potential tritium-bearing wastewater may have been disposed of on the TA-21 mesa. However, the investigation of the subsurface strata conducted in 2005 (LANL 2006, 092589) does not indicate significant tritium releases from the absorption beds. The results for tritium at MDA U, however, indicated low levels of tritium with an increasing trend laterally toward TSTA. An additional borehole directly under TSTA may be warranted, but planning for this activity is premature and needs to account for the demolition and cleanup of the existing structures before a detailed plan for tritium characterization can be developed.

2.0 MONITORING METHODS

2.1 Core Sampling Method

Samples of the soil or rock cores are obtained using split-spoon sampling methods (or equivalent). In the split-spoon method, the sampler is inserted into the borehole through hollow-stem augers and driven below the auger flight. Upon extraction from the borehole, the sampler is opened, and a portion of the core is placed into a container and sealed to retain the moisture. Shallow soil samples are collected according to Standard Operating Procedure (SOP) 06.10, and rock core samples are collected following the procedure in SOP-06.26. Samples removed from the split barrel and the stainless-steel inner sleeve are crushed in a stainless-steel bowl, homogenized over the sample interval (usually 6 in. to 1 ft), and placed in the container for shipping. Protocols for obtaining duplicate and trip blank samples are followed during these field activities.

2.2 Vapor Moisture Extraction Method

The method for monitoring tritium in pore water includes collecting water vapor that is in equilibrium with pore water. The sample is collected by purging the sampling port or packer interval and field screening purge gas, followed by collecting samples in silica gel columns from prescribed intervals for off-site laboratory analysis. The silica gel column captures and contains water for tritium analysis. Water vapor is adsorbed onto the silica when subsurface air is pulled through the column. After a sample of subsurface water vapor has been collected, the column is removed from the system and sealed. The sealed columns are then shipped to an analytical laboratory for analysis. Both soil samples and silica-gel-column samples are analyzed for tritium by U.S. Environmental Protection Agency (EPA) Method 906.0. Field screening of subsurface vapor includes measuring the percent carbon dioxide, percent oxygen, and organic vapors.

Vapor monitoring will be conducted in accordance with the current version of SOP-06.31, Sampling Subatmospheric Air. According to this procedure, field screening will be performed before analytical 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 vapor conditions. Before each sampling cycle, vapor-sample tubing must be purged of stagnant air in the line by drawing air from the sampling interval through the line. Purging the line ensures the sample collected is representative of the subsurface air at depth; every sampling activity must include a purge cycle. Once purging and field screening are completed, water-vapor samples will be collected using silica gel columns. During each sampling event, a field-duplicate silica gel column quality assurance sample will be collected and analyzed for tritium.

3.0 REPORTING

Analytical results from soil and rock core samples are presented in Consent Order investigation reports or will be summarized in brief letter reports if samples are obtained from non–Consent Order-based work activities.

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, termination of monitoring may be recommended.

4.0 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 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 New Mexico Environment Department Hazardous Waste Bureau; DOE-Los Alamos Site Office; EPA, 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.

McGehee, E.D., and K.L.M. Garcia, December 23, 1999. "Historic Building Assessment for the Department of Energy Conveyance and Transfer Project," Vol. 1, Los Alamos National Laboratory document LA-UR-00-1003, Los Alamos, New Mexico. (McGehee and Garcia 1999, 087442)

LANL (Los Alamos National Laboratory), February 2006. "Investigation Report for Material Disposal Area U, Consolidated Unit 21-017(a)-99, at Technical Area 21," Los Alamos National Laboratory document LA-UR-05-9564, Los Alamos, New Mexico. (LANL 2006, 092589)

Appendix A

Material Disposal Area V Monitoring Plan

A-1.0 BACKGROUND

This appendix describes the activities for monitoring subsurface tritium, along with the location, depths, and frequencies of monitoring within the vadose zone beneath Consolidated Unit 21-018(a)-99, Material Disposal Area (MDA) V. 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, the data collected to date have not defined the vertical extent of tritium below the absorption beds. A vapor-monitoring well will be installed within 10 ft of borehole location 21-24524 and fitted for sampling water vapor beneath MDA V. This additional sampling will assist the U.S. Department of Energy (DOE) in characterizing the nature and extent of subsurface tritium at MDA V. In addition, the plan is developed to further evaluate the differences in sampling techniques used to collect tritium data. This monitoring plan is provided to the New Mexico Environment Department (NMED) for information in accordance with DOE policy.

A-2.0 2005–2006 DATA SUMMARY

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 (14–15 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 (379–380 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 collection of TD samples. 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 (LANL 2007, 098942, p. 22).

The concentration of tritium in subsurface pore water was determined 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 14–15 ft below ground surface) 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 decreased or relatively constant concentrations with depth. Six locations showed an increase in tritium activity with depth. Tritium activity decreased with distance away from location 21-24524 in both 2005 and 2006 samples. However, sufficient data are not available to conclusively define the vertical and lateral 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 present tritium activity in pore water in 2005 and 2006, respectively (LANL 2007, 098942).

A-3.0 PROPOSED VAPOR MONITORING

A vapor-monitoring well adjacent to (within 10 ft) of the now backfilled borehole 21-24524 will be installed to monitor tritium below MDA V (Figure A-3.0-1). The new borehole will be drilled with a combination of hollow-stem auger (HSA) and air-rotary techniques. 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 borehole log of 21-24524: Qbt 3, Qbt 2, Qbt 1v, Qbt 1g, the Tsankawi Pumice Bed, Qct, and depth 380 ft (in Qbo). After conversion to air rotary at a depth of 400 ft, two additional depths will be sampled, and monitoring ports will be installed in Qbo at approximately 100-ft intervals below 380 ft. A final sample and port will be installed approximately 10 ft into the Guaje Pumice Bed for a total of 10 ports/depths. Bedrock pore water sample and/or packer test water vapor sample test 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 values from the shallower samples collected at this borehole or a tritium value of less than 20,000 piC/L in the deepest sampling location. If deeper ports are required (into 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 multiwell completion to facilitate construction of the monitoring ports.

After the completion of auger drilling and before air-rotary drilling, a straddle packer will be used to isolate the depth intervals to 380 ft, and samples of the pore-water vapor will be collected for analysis. Because of the potential injection of air into the formations once air-rotary drilling is started, no packer tests will be performed at locations below 380 ft, except for the anticipated TD of the borehole. Based on the stratigraphy encountered in borehole 21-02523, a TD for borehole 21-24524 is estimated to be approximately 690 ft, if the deepest port is in the Guaje Pumice Bed.

After drilling and initial sampling are completed, the borehole will be equipped with multiple (a total of 10) sampling ports for collecting moisture vapor for tritium analysis. Figure A-3.0-2 provides a generalized schematic of the vapor-monitoring well design. Sampling ports will be installed at the depth of each sample obtained during drilling. The sample tubing will consist of 1/4-in. 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. Samples will be analyzed for tritium and will be collected quarterly for a minimum of 1 yr (four quarters) following construction of the vapor-monitoring well.

A-4.0 REPORTING

The data will be reported as discussed in section 3.0 of the main body of this plan. The data will be used to determine the vertical extent of tritium contamination at MDA V. Any impact on the risk screening from new tritium data will be assessed and reported.

A-5.0 REFERENCES AND MAP DATA SOURCES

A-5.1 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 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 DOE–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), 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)

A.5.2 Map Data Sources

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Dirt Road Arcs; Los Alamos National Laboratory, KSL Site Support Services, Planning, Locating, and Mapping Section; 06 January 2004; Development Edition of 05 January 2005.

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Communication Lines; Los Alamos National Laboratory, KSL Site Support Services, Planning, Locating, and Mapping Section; 08 August 2002; Development Edition of 05 January 2005.

ER Location IDs point (borehole and sample locations); Los Alamos National Laboratory, ENV Environmental Remediation and Surveillance Program; 1:2500 Scale Data; 10 November 2005.

Former Drainline; Los Alamos National Laboratory, ENV Environmental Remediation and Stewardship Program; 1:2500 Scale Data, 02 October 2006.

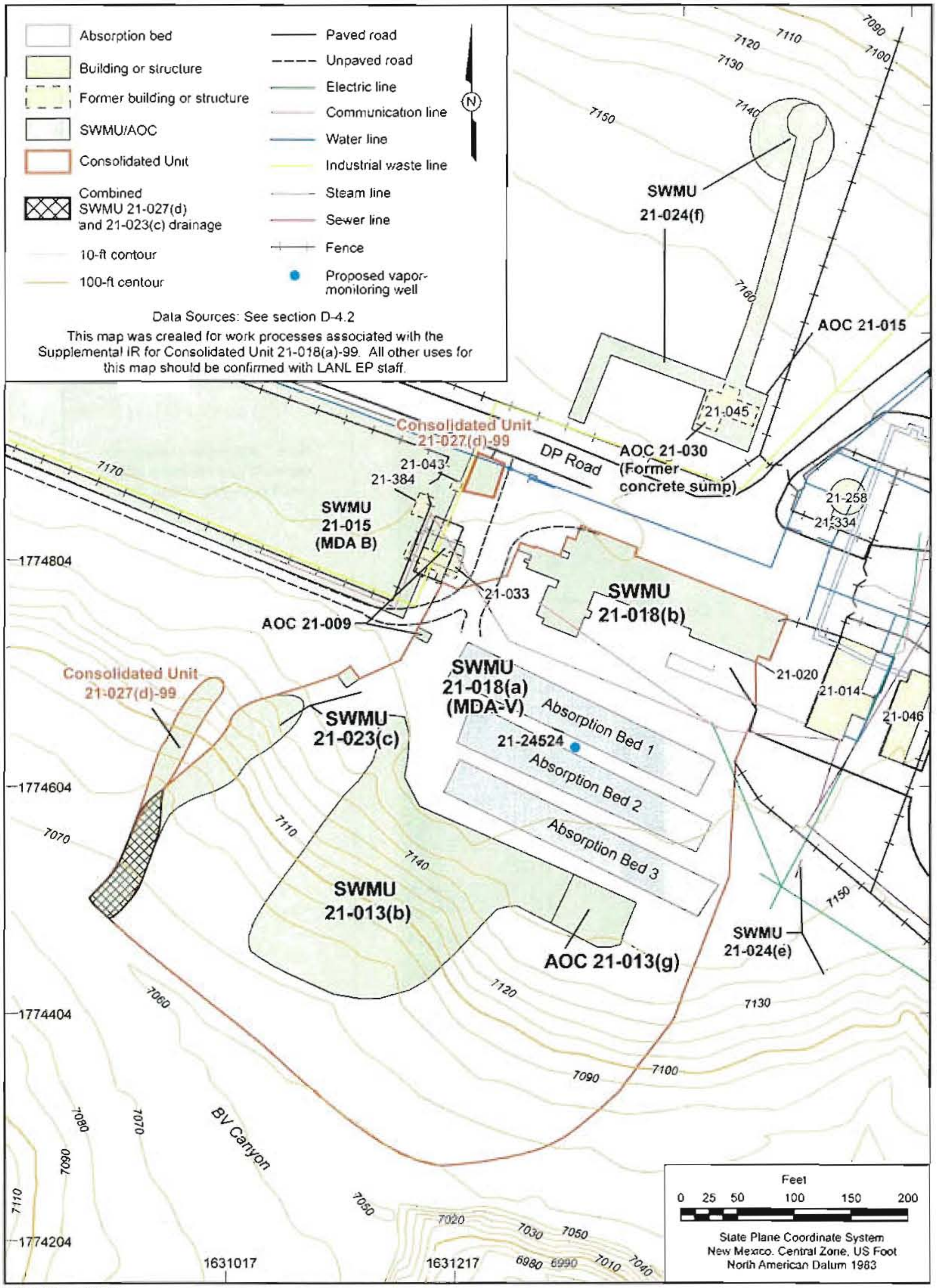

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Figure A-3.0-1 Vapor-monitoring well location

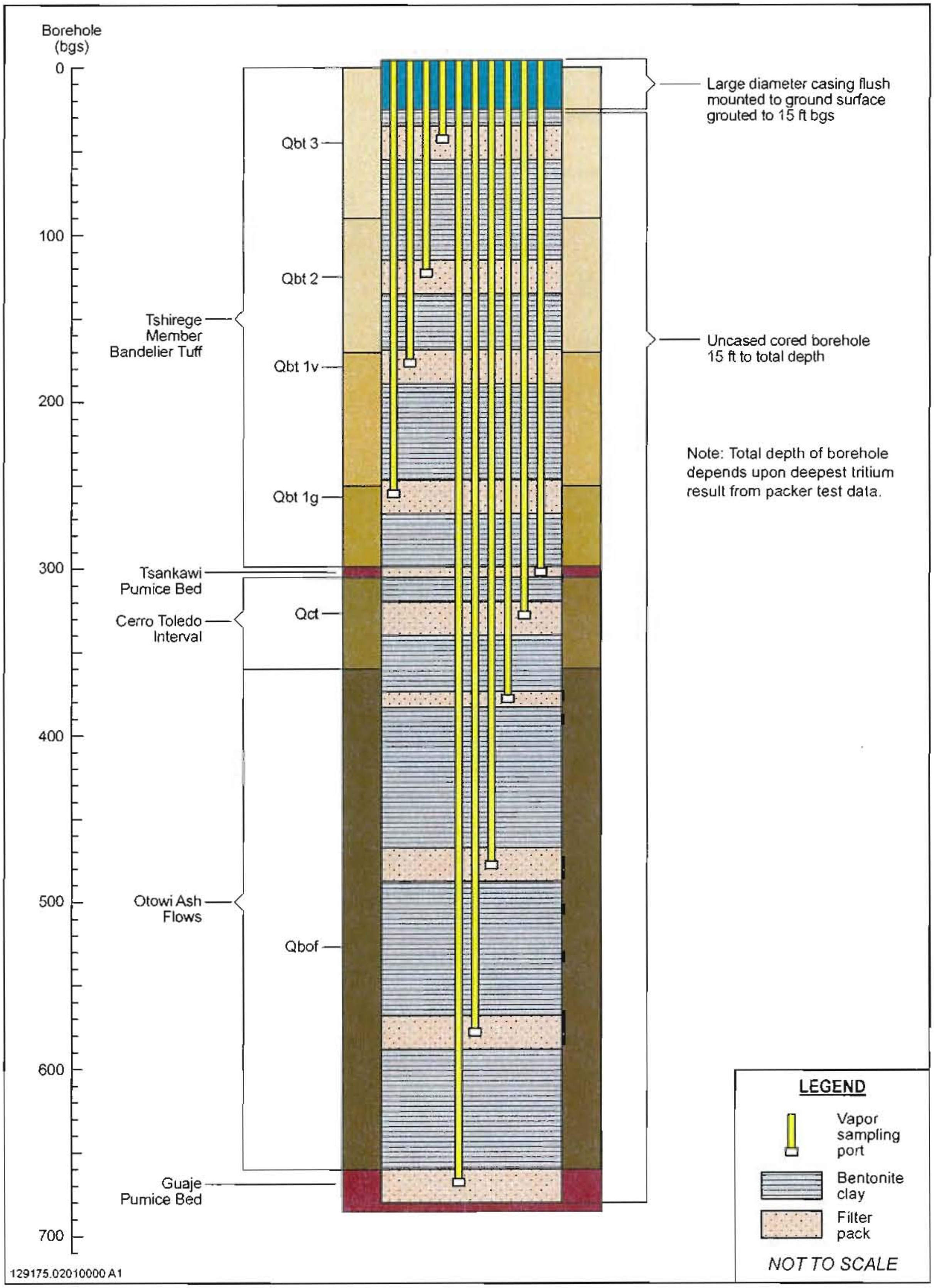

Figure A-3.0-2 Proposed vapor-monitoring well construction details, location 21-24524

Appendix B

Material Disposal Area T Monitoring Plan

B-1.0 BACKGROUND

This appendix describes the activities for monitoring subsurface tritium, along with the location, depths, and frequencies of monitoring within the vadose zone beneath Consolidated Unit 21-016(a)-99, Material Disposal Area (MDA) T. MDA T is a potential source for tritium contamination because wastewater operations discharged approximately 18,000,000 gal. of water containing tritium into four absorption beds and an outfall. A vapor-monitoring well will be installed at borehole location 21-25262 and fitted for sampling water vapor beneath MDA T. This additional sampling will assist the U.S. Department of Energy (DOE) in characterizing the nature and extent of subsurface tritium at MDA T. In addition, the plan is developed to evaluate further the differences in sampling techniques used to obtain tritium data. This monitoring plan is provided to the New Mexico Environment Department (NMED) for information in accordance with DOE policy.

B-2.0 2005–2007 DATA SUMMARY

For the 2005–2006 field investigation, 32 boreholes were drilled to depths ranging from 27 ft to 380 ft (LANL 2006, 094151, Figure 3.1-1). A total of 24 boreholes, including one within the nuclear environmental site (NES) boundary, were drilled to characterize subsurface contamination associated with releases from absorption beds, disposal shafts, the retrievable waste storage area (RWSA), building 21-257, and former building 21-035. Of the 32 boreholes, 7 were drilled to better define the location of a paleochannel beneath Consolidated Unit 21-016(a)-99.

Eight deep boreholes were drilled to at least 279 ft to characterize the vertical extent of possible contamination from the absorption beds, disposal shafts, and RWSA and to assess fractures in Qbt 2 and Qbt 3. All eight deep borings are perimeter borings around the absorption beds, disposal shafts, and the RWSA (except location 21-25374, which is sited between absorption beds 1 and 3). Groundwater was not encountered in any of these deep borings, confirming that perched groundwater or perched horizons are not present beneath Consolidated Unit 21-016(a)-99.

Of the eight deep boreholes, three boreholes at locations 21-25262 (drilled to 380 ft), 21-25263 (drilled to 354 ft), and 21-25264 (drilled to 354 ft) penetrated through the Cerro Toledo interval and reached target depths in the Otowi Member of the Bandelier Tuff. To construct a moisture profile, soil moisture samples were collected from these borings at regular intervals, with a greater sample density toward the top of the borehole. Geotechnical samples were also collected from these borings at roughly 75-ft intervals and were analyzed for chloride, bulk density, saturated hydraulic conductivity, gravimetric moisture content, and calculated total porosity.

The other five deep boreholes were drilled to the target depth of 279 ft and penetrated the Qbt 1g unit of the Tshirege Member of Bandelier Tuff. Samples were collected at appropriate target intervals, and three geotechnical samples were also collected, two at location 21-25376 and one in fill (at location 21-25375) as a surrogate for location 21-25262, where a geotechnical sample could not be collected because of radioactive contamination.

Seven borings, locations 21-25355 through 21-25360 (drilled to 40 ft) and location 21-25390 (drilled to 100 ft), were completed near and within the footprint of former building 21-035 to further refine the extent of contamination associated with this building from previous investigations. In addition, the boring located near the northwestern corner of former building 21-035 (location 21-25262, drilled to 380 ft) served multiple investigative purposes for the drilling campaign and was placed to also address the contamination extent at building 21-035. Samples were collected at appropriate target intervals.

Seven borings, five at locations 21-25380 through 21-25384 (all drilled to 100 ft), one at location 21-25388 (drilled to 100 ft), and one at location 21-25390 (drilled to 103 ft), were installed around building 21-257 for initial characterization purposes because previous investigations had not targeted this area for characterization. Access issues because of topography and the presence of underground and overhead utilities required that initial boring locations be moved slightly. Samples were collected at appropriate target intervals.

Seven boreholes, three at the eastern end and four at the western end of Consolidated Unit 21-016(a)-99, were drilled to better define the suspected location of the paleochannel identified during previous investigations. Two boreholes at the western-end locations 21-25364 and 21-25365 were drilled to 30 ft, and the borehole at the third location, 21-25366, was drilled to 27 ft. The four boreholes at the eastern end were drilled to 29 ft at locations 21-25368 and 21-25369 and to 30 ft at locations 21-25370 and 21-25371. No boreholes produced evidence of a paleochannel, and all were drilled to the target depth within Bandelier Tuff (Qbt 3). Samples were collected at appropriate target intervals, except at location 21-25364 where a TD sample was not collected at 30 ft because no evidence of paleochannel deposits was found.

Three borings, locations 21-25361 (drilled to 39 ft), 21-25362 (drilled to 39 ft), and 21-25363 (drilled to 40 ft), were drilled and sampled to characterize the diversion ditch near the northwestern end of the fenced portion of Consolidated Unit 21-016(a)-99. Samples were collected at appropriate target intervals.

Twenty-four of the 32 boreholes were plugged and abandoned in 2006 (LANL 2006, 094151, p. 29).

Three additional boreholes were drilled in 2007 and sampled at multiple depth intervals for vapor-phase VOCs and tritium (LANL 2007, 102182, Figure 3.2-1).

The concentration of tritium in subsurface pore water was determined by collecting samples of subsurface pore gas containing tritiated water vapor. Pore-gas samples were collected and analyzed for tritium in both 2005–2006 (LANL 2006, 094151, Table B-4.3-6) and 2007 (LANL 2007, 102182, Table 3.4-3). In 2005–2006, the maximum detected tritium activity (73,400 pCi/L at 152–154 ft below ground surface [bgs]) occurred at location 21-25264 north of absorption bed 4. In 2007, location 21-25264 also had the maximum detected tritium activity (9385 pCi/L) at 150.5–155.5 ft bgs.

In 2005–2006, tritium in pore gas was detected in all three boreholes during both rounds of pore gas sampling. The peak activity of 73,400 pCi/L was detected at a depth of 150 ft and decreased to 2310 pCi/L at 350 ft. As with the VOCs, the general trend of tritium in subsurface vapor is a decrease in activity at the TD of the boreholes; again, there are no clear trends of consistently decreasing activity from the top of the borehole, or from a horizon of highest activity, to the bottom of the boreholes. In addition, tritium shows inconsistent temporal trends between round 1 and round 2 analyses. Figure 6.5-4 of the MDA T investigation report (LANL 2006, 094151) presents the tritium activity versus depth for boreholes 21-25262, 21-25263, and 21-25264 for rounds 1 and 2 of pore-gas sampling.

First round quarterly pore-gas sampling in 2007 confirms low concentrations of VOCs (i.e., less than 2000 $\mu g/m^3$) and low activities of tritium (i.e., less than 10,000 pCi/L). Three additional quarters of pore gas monitoring data will be collected in accordance with the current vapor monitoring plan (LANL 2007, 098944; NMED 2007, 098946). The nature and extent of pore gas will be comprehensively evaluated and the results presented in a report following completion of planned vapor monitoring activities. Figures 3.4-7 through 3.4-10 in the Phase II investigation report present VOC concentrations and tritium activities in pore gas (LANL 2007, 102182).

B-3.0 PROPOSED VAPOR MONITORING

A vapor-monitoring well will be installed in borehole location 21-25262 to monitor tritium below MDA T (Figure B-3.0-1). The new borehole will be drilled with a combination of hollow-stem auger (HSA) and air-rotary techniques. HSAs will be used to drill to approximately 400 ft to simulate the initial drilling of borehole 21-25262. Core samples will be collected at the location where each monitoring port will be installed, which is the approximate midpoint of the six geologic units expected to be encountered based on the borehole log of 21-25262: Qbt 3, Qbt 2, Qbt 1v, Qbt 1g, Qct, and depth 375 ft (in Qbo). After conversion to air rotary at a depth of 400 ft, three additional depths will be sampled, and monitoring ports will be installed in Qbo at approximately 100-ft intervals below 380 ft. A final port will be installed and a sample collected at approximately 10 ft into the Guaje Pumice Bed for a total of nine ports/depths. Bedrock pore-water sample and/or packer test water vapor sample test 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 values from the shallower samples obtained for this borehole or a tritium value of less than 20,000 piC/L in the deepest sample location. If deeper ports are required (into 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 multiwell completion to facilitate construction of the monitoring ports.

After the completion of auger drilling and before air-rotary drilling, a straddle packer will be used to isolate the depth intervals to 380 ft, and samples of the pore-water vapor will be collected for analysis. Because of the potential injection of air into the formations once air-rotary drilling has started, no packer tests will be performed at locations below 380 ft, except for the anticipated TD of the borehole. Based on the stratigraphy encountered in borehole 21-25262, a TD for the new vapor-monitoring well is estimated to be approximately 690 ft, if the deepest port is in the Guaje Pumice Bed.

After drilling and initial sampling is completed, the borehole will be equipped with multiple (a total of 9) sampling ports for collecting moisture vapor for tritium analysis. Figure B-3.0-2 provides a generalized schematic of the vapor-monitoring well design. Sampling ports will be installed at the depth of each sample obtained during drilling. The sample tubing will consist of 1/4-in. 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. Samples will be analyzed for tritium and will be collected quarterly for a minimum of 1 yr (four quarters) following construction of the vapor-monitoring well.

B-4.0 REPORTING

The data will be reported as discussed in section 3.0 of this monitoring plan. The data will be used to determine the vertical extent of tritium contamination at MDA T. Any impact on the risk screening from new tritium data will be assessed and reported.

B-5.0 REFERENCES AND MAP DATA SOURCES

B-5.1 References

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NMED (New Mexico Environment Department), October 31, 2007. "Approval with Modifications, Subsurface Vapor-Monitoring Plan for MDA T," New Mexico Environment Department letter to D. Gregory (DOE LASO) and D. McInroy (LANL) from J.P. Bearzi (NMED HWB), Santa Fe, New Mexico. (NMED 2007, 098946)

B.5.2 Map Data Sources

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Electric Lines; Los Alamos National Laboratory, KSL Site Support Services, Planning, Locating, and Mapping Section; 06 January 2004; as published 27 April 2007.

Communication Lines; Los Alamos National Laboratory, KSL Site Support Services, Planning, Locating, and Mapping Section; 08 August 2002; as published 27 April 2007.

ER Location IDs point (borehole and sample locations); Los Alamos National Laboratory, ENV Environmental Remediation and Surveillance Program; 1:2500 Scale Data; 10 November 2005.

Former Drainline; Los Alamos National Laboratory, ENV Environmental Remediation and Stewardship Program; 1:2500 Scale Data, 02 October 2006.

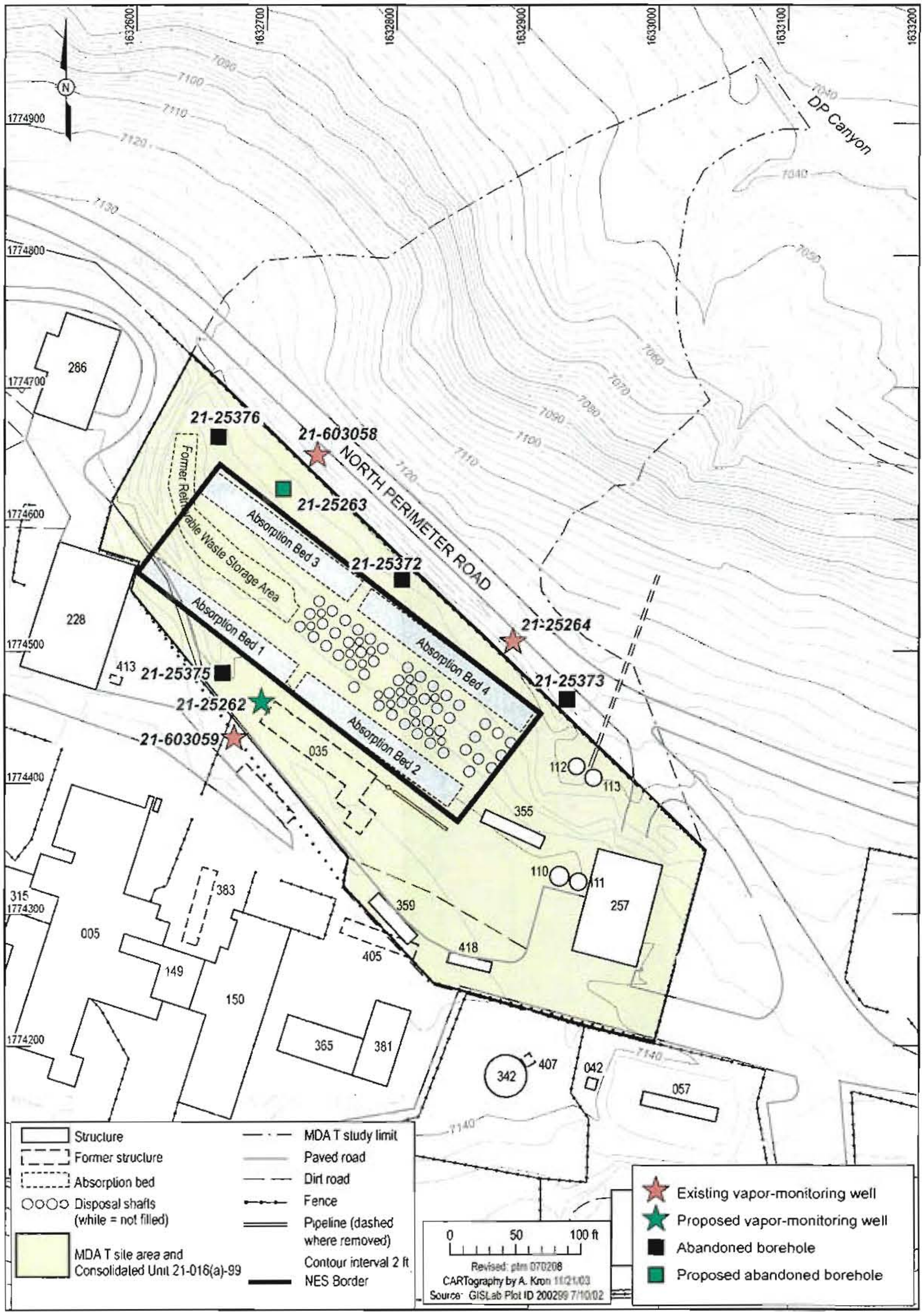

Figure B-3.0-1 Vapor-monitoring well location

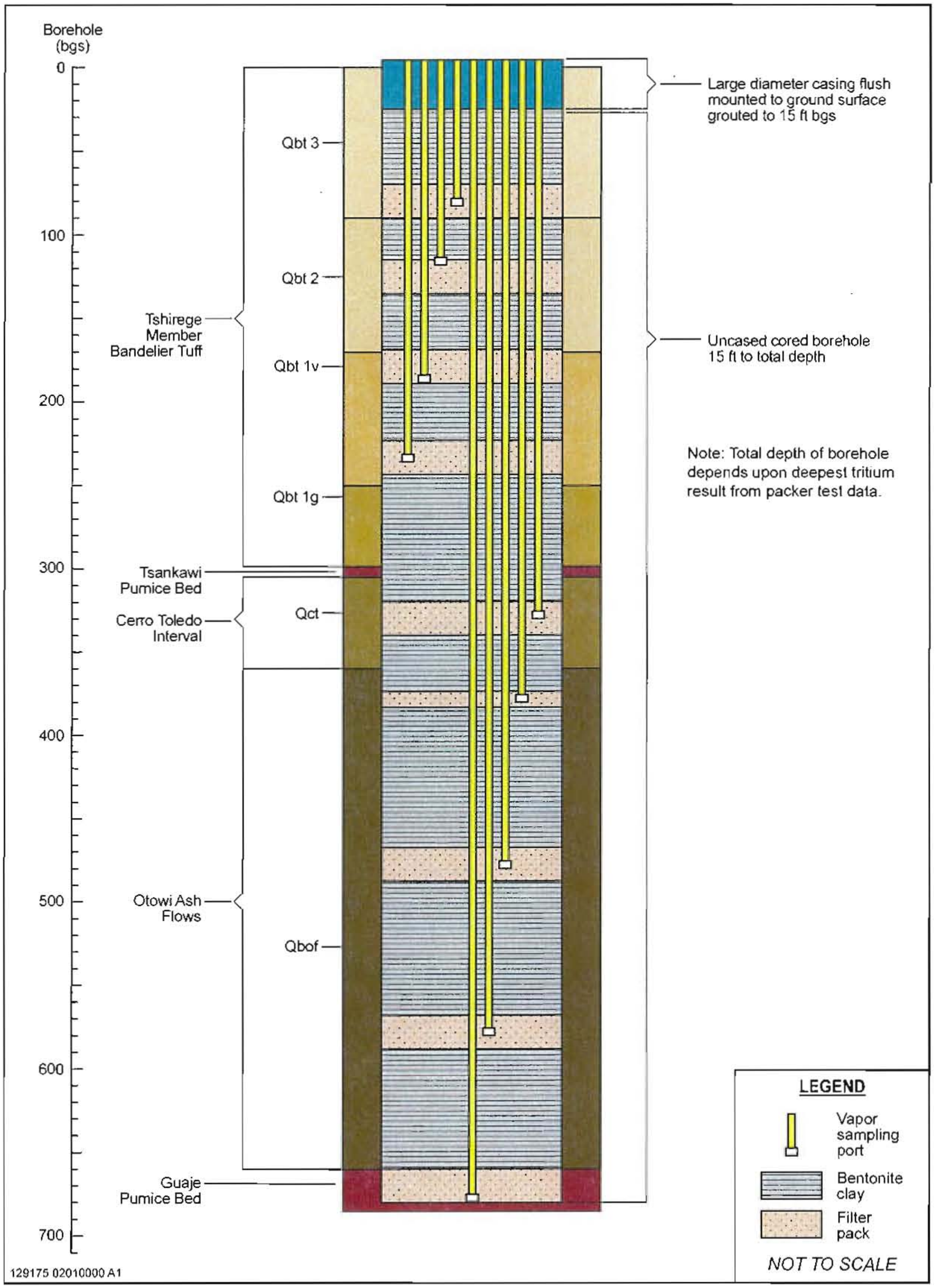

Figure B-3.0-2 Proposed vapor-monitoring well construction details, location 21-25262