Vapor-Monitoring Well Installation Work Plan for Material Disposal Area H, Solid Waste Management Unit 54-004, at Technical Area 54

Primary Purpose	This work plan describes activities needed to install a new vapor-monitoring well and new vapor-sampling systems in two existing vapor-monitoring wells at Material Disposal Area (MDA) H. MDA H is located in Technical Area 54 (TA-54) at Los Alamos National Laboratory (LANL or the Laboratory) and consists of nine subsurface disposal shafts previously used to dispose of solid-form classified wastes (Figure 1). Currently, three vapor-monitoring wells at MDA H are used to conduct quarterly vapor monitoring (Figure 1). Tritium and low concentrations of volatile organic compounds (VOCs) have been detected in pore-gas samples collected from these wells during periodic monitoring performed since 2005. The New Mexico Environment Department (NMED) is requiring the installation of a new vapor-monitoring well and reconfiguration of two of the three existing vapor-monitoring wells (54-01023 and 54-15462) to collect additional data to evaluate the lateral and vertical extent of vapor-phase contamination at MDA H (NMED 2009, 106234).
Conceptual Site Model	The conceptual site model (CSM) considers the source of contaminants, release mechanisms, and transport mechanisms to receptors. Understanding these CSM components is necessary to develop an approach to characterize the extent of contamination. The source of VOCs in pore gas at MDA H appears to be incidental VOC contamination of the wastes disposed of in the MDA H disposal shafts. MDA H was used to dispose of solid-form classified wastes, and the MDA H waste inventory shows no record of disposal of solvents at MDA H (LANL 2001, 070158). MDA H was in operation at the same time as MDA L, which was specifically intended for the disposal of liquid chemical wastes such as solvents. The only reason to dispose of bulk VOC wastes at MDA H rather than MDA L would have been if these wastes were classified, which is unlikely. To determine whether this source model is consistent with available data, the most recent pore-gas sampling results from MDA H (second quarter of fiscal year 2009) were used to estimate the mass inventory of VOCs in subsurface media at MDA H (LANL 2009, 106656). The total inventory of VOCs in subsurface pore gas, pore water, and tuff is on the order of 10 kg. This release inventory, which represents a very small fraction of the 178,000-kg inventory of waste disposed of at MDA H (LANL 2003, 076039, p. 5), is consistent with incidental contamination of solid waste as the source of the VOCs detected in pore gas at MDA H. The mechanism for release and transport of VOCs from the source is vapor diffusion. The concentrations of VOCs in pore gas near the shafts are not high enough to indicate the presence of free-phase solvents (i.e., pure liquid solvents being released from containers). VOC vapors will diffuse from areas of high concentration (i.e., near the source) to areas of low concentration (e.g., the ground surface, canyon walls, and uncontaminated pore gas at depth). Transport may also be affected by bulk movement of air through the tuff caused by changes in atmospheric pressure. This air movement could result in dilution of pore gas near the surface or near fractures and in variability of the VOC concentrations in pore gas over time. The spatial distribution of VOC contamination resulting from diffusive transport is also affected by the age of the release. Ongoing releases should exhibit highest concentrations near the source area (i.e., near the shafts), with concentrations decreasing with distance away from the shafts. Older releases may be characterized by concentrations that are higher at depth than near the source, indicating the release is not ongoing. The spatial distribution of VOC contamination should also be affected by the properties of the geologic units. Transport through the upper tuff units of the Tshirege Member of the Bandelier Tuff may be enhanced by the presence of fractures. The sedimentary deposits of the Cerro Toledo interval may enhance lateral movement rather than downward movement into the underlying unfractured Otowi Member. Thus, concentrations are expected to be lower in the Otowi Member than in the upper units. The capacity of the lower geologic units to attenuate transport of vapor-phase contaminants is important in preventing potential exposure of receptors via the groundwater pathway.

Conceptual Site Model (continued)	The CSM for tritium is similar. The source of tritium appears to be the tritium-contaminated waste or waste articles containing tritium disposed of in the MDA H shafts. This source is consistent with detection of the highest tritium activities in samples from vapor-monitoring well 54-01023, the well closest to the disposal shafts. Tritium activities in samples from the other two wells, located farther from the shafts, are approximately 3 orders of magnitude lower than those from well 54-01023. Past monitoring has consistently shown the highest tritium activities at well 54-01023 in either the sample collected near the top of the shafts or the sample collected near the base of the shafts.
Proposed Approach and Rationale	Based on the above CSM, several data needs were identified for determining the lateral and vertical extent of contamination. Monitoring-well locations are presently to the northwest, south, and southeast of MDA H (Figure 1). An additional monitoring point is needed to the north of MDA H to measure pore-gas concentrations to evaluate whether they are consistent with the CSM of diffuse transport from the shafts. Based on the CSM, vapor concentrations are expected to decrease with depth in lower geologic units, such as the Otowi Member. However, the deepest interval presently being sampled is the top of the Cerro Toledo interval. Thus, deeper monitoring ports in the Otowi Member are needed to determine vertical extent. Because there is no vapor-monitoring well north of MDA H, a new well is proposed north of shafts 4 and 9, approximately 25 to 30 ft north of the fenceline (Figure 1). This location will provide data on the lateral extent of vapor contamination to the north of MDA H. This well will extend to a total depth of 300 ft, which is approximately 35 ft into the Otowi Member, to provide data on the vertical extent of contamination in lower geologic units. Sampling ports will be installed at the bottom of the borehole, 15 ft below the Cerro Toledo interval, in the Cerro Toledo interval, 5 ft above the Cerro Toledo interval, and at five other depths above the Cerro Toledo interval corresponding to the current sampling-port depths in existing well 54-15462 (10 ft, 60 ft, 100 ft, 150 ft, and 200 ft). Sampling ports installed at these depths will allow the evaluation of concentration trends with depth in the various geologic units below MDA H. Table 1 summarizes the proposed sampling intervals and the corresponding geologic units. Borehole 54-15462 was originally drilled to 300 ft, which extended below the Cerro Toledo interval. The bottom of the borehole filled with slough before the Flexible Liner Underground Technologies (FLUTe) sampling system was installed; however, the deepest sampling port is at 254–256 ft, which is at the top of the Cerro Toledo interval. The FLUTe system will be removed from this borehole, and the hole will be redrilled to its original depth of 300 ft. Sampling screens will be installed at the bottom of the borehole, 15 ft below the Cerro Toledo interval, in the Cerro Toledo interval, 5 ft above the Cerro Toledo interval, and at five other depths above the Cerro Toledo interval corresponding to the current sampling port depths (10 ft, 60 ft, 100 ft, 150 ft, and 200 ft). Sampling ports installed at these depths will allow evaluation of concentration trends with depth in the various geologic units below MDA H. Table 1 summarizes the proposed sampling intervals and the corresponding geologic units. Borehole 54-01023 was originally drilled to 260 ft, which extended approximately 4 ft into the Cerro Toledo interval. Some sloughing into the borehole has occurred, and the deepest sampling port is now at 247–249 ft, approximately 7 ft above the Cerro Toledo interval. The FLUTe sampling system will be removed from this borehole, and the hole will be redrilled to 263 ft to allow construction of a sampling port within the Cerro Toledo interval at the same depth interval as the new borehole and borehole 54-15462. Sampling ports will be installed in the Cerro Toledo interval, 5 ft above the Cerro Toledo interval, and at five other depths above the Cerro Toledo interval corresponding to the current sampling-port depths (10 ft, 60 ft, 100 ft, 150 ft, and 200 ft). Installation of stainless-steel sampling systems in the three deep wells described above will allow samples to be collected from these wells in the same manner, using the same procedures, and at the same depth intervals in the geologic units being monitored.

Well Design	Each vapor-monitoring well will be constructed with multiple sampling ports at the depths indicated in Table 1. Sampling ports will consist of a nominal 0.5-in.-diameter, 12-in.-long stainless-steel well screen connected to sampling tubing extending to the ground surface. The sampling tubing will consist of 0.25-in.-diameter stainless steel connected with Swagelok fittings. The screens will be placed in 5-ft-thick sampling intervals filled with 10/20 silica sand. The annular space between the sampling intervals will be filled with bentonite to isolate the sampling intervals. The bentonite chips will be tremied into the borehole and hydrated as they are emplaced. The surface completion of the wells will consist of a steel casing with a locking steel cap. Schematic drawings for the new monitoring well and reconfigured wells 54-15462 and 54-01023 are shown in Figures 2, 3, and 4, respectively.
Drilling and Well Construction Methods	The new borehole will be drilled using a hollow-stem auger (HSA) drill rig. The borehole will be logged in accordance with Section IX.B.2.c of the Compliance Order on Consent, including logging by a qualified engineer or geologist in accordance with the required soil (American Society for Testing and Materials [ASTM] D2488) and rock (American Geological Institute [AGI]) classification methods. Continuous core will be collected for logging using a core barrel in accordance with Standard Operating Procedure (SOP) 06.26, "Core-Barrel Sampling for Subsurface Earth Materials" (available at http://www.lanl.gov/environment/all/qa/adep.shtml). The existing FLUTe sampling systems in wells 54-01023 and 54-15462 will be removed. Slough in boreholes 54-01023 and 54-15462 will be removed using an HSA drill rig. Borehole 54-01023 will be drilled to 3 ft below the original 260-ft depth to facilitate installation of a sampling port in the Cerro Toledo interval at the same 258- to 263-ft depth interval as the new well and well 54-15462. A core sample will be collected from the bottom of borehole 54-01023 to verify the depth of the Cerro Toledo interval. Borehole 54-15462 will be drilled to its original depth of 300 ft. Because the drill rig will be drilling into disturbed materials in borehole 54-15462, no core sampling will be performed in this borehole. Well construction will initially be done with the augers in place in the borehole. The sampling screens and tubes will be emplaced through the auger stem, and the augers will be slowly withdrawn as backfill material (sand or bentonite) is added. This approach will be used to prevent slough from entering the borehole. After six or seven sampling tubes have been installed, the augers will be completely withdrawn from the borehole to provide more room for installation of the remaining tubes. Well construction will consist of the following steps: 1. Measure and record the total depth of the borehole after drilling to the target depth. 2. 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. 3. Lower the sampling screen and enough stainless-steel tubing to reach the top of silica sand and measure and record the depth. 4. Add another 2.5 ft of 10/20 silica sand and measure and record the depth. 5. Add enough bentonite pellets to reach the next screen location and measure and record the depth. Add water periodically to hydrate the pellets as they are emplaced. 6. Label the top of each stainless-steel tube to identify each screen and the depth of the screen, and install a cap over the end of the tube. 7. Repeat steps 3 through 6 until ground surface is reached. 8. Install surface completion, including a concrete pad, steel-protective casing, and locking steel cap.

Postinstallation Vapor Sampling	The new vapor-monitoring well and reconfigured wells 54-01023 and 54-15462 will be incorporated into the ongoing quarterly vapor monitoring conducted at MDA H. Samples will be collected from all sampling ports using EP-ERSS-SOP-5074, "Sampling for Sub-Atmospheric Air" (available at http://www.lanl.gov/environment/all/qa/adep.shtml). Samples for VOC analysis will be collected in SUMMA canisters and submitted for laboratory analysis of VOCs using U.S. Environmental Protection Agency (EPA) Method TO-15. Samples for tritium analysis will be collected in silica gel cartridges and submitted for laboratory analysis of tritium using EPA Method 906.0. Monitoring results will be reported in quarterly periodic monitoring reports.
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 procedure incorporates the requirements of all applicable EPA and NMED regulations, U.S. Department of Energy orders, and Laboratory requirements. The primary waste streams include drill cuttings, contact waste, the old FLUTe sampling systems, and, potentially, decontamination water. 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. The old FLUTe systems will be containerized and characterized by direct sampling. If decontamination water is generated, it will be containerized and characterized by direct sampling of the containerized waste.
Schedule	Mobilization, drilling, and installation of the vapor-monitoring wells will be conducted in the first quarter of fiscal year (FY) 2010. Sampling will be conducted in the second quarter of FY2010 and the results reported in the "Periodic Monitoring Report for Vapor-Sampling Activities at Material Disposal Area H, Solid Waste Management Unit 54-004, at Technical Area 54, Second Quarter Fiscal Year 2010," 120 d after second quarter sampling is completed.

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

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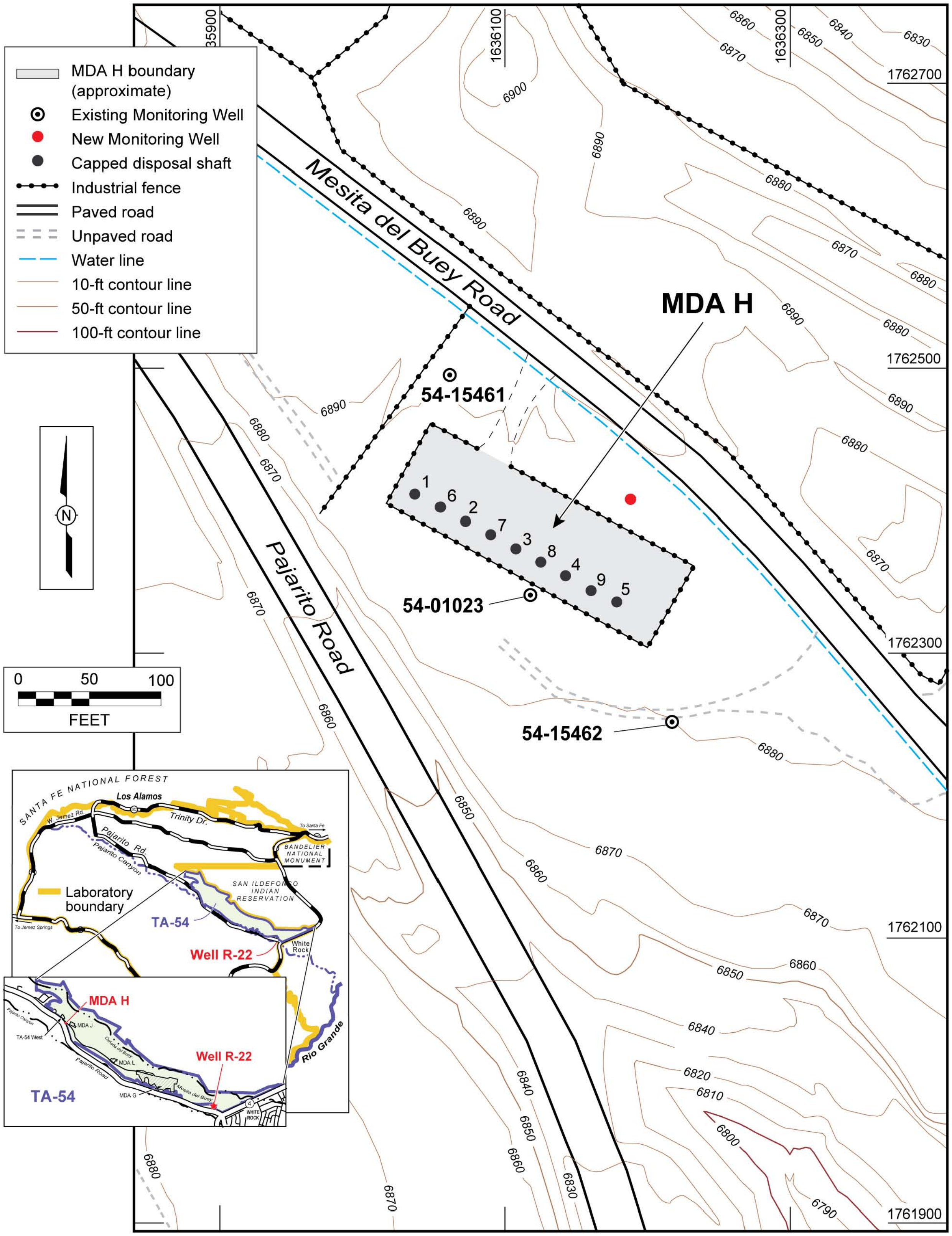
NMED (New Mexico Environment Department), June 23, 2009. "Direction to Conduct Additional Investigations at Material Disposal Area H, SWMU 54-004, at Technical Area 54 to Define the Extent of Contamination," New Mexico Environment Department letter to D. Gregory (DOE-LASO) and D. McInroy (LANL) from J.P. Bearzi (NMED-HWB), Santa Fe, New Mexico. (NMED 2009, 106234)



F2.1-3, MDA H CMS, 052003, cf; MDA H CMS Rev 1, 020105, ptm

Figure 1 Locations of disposal shafts and vapor-monitoring wells at MDA H

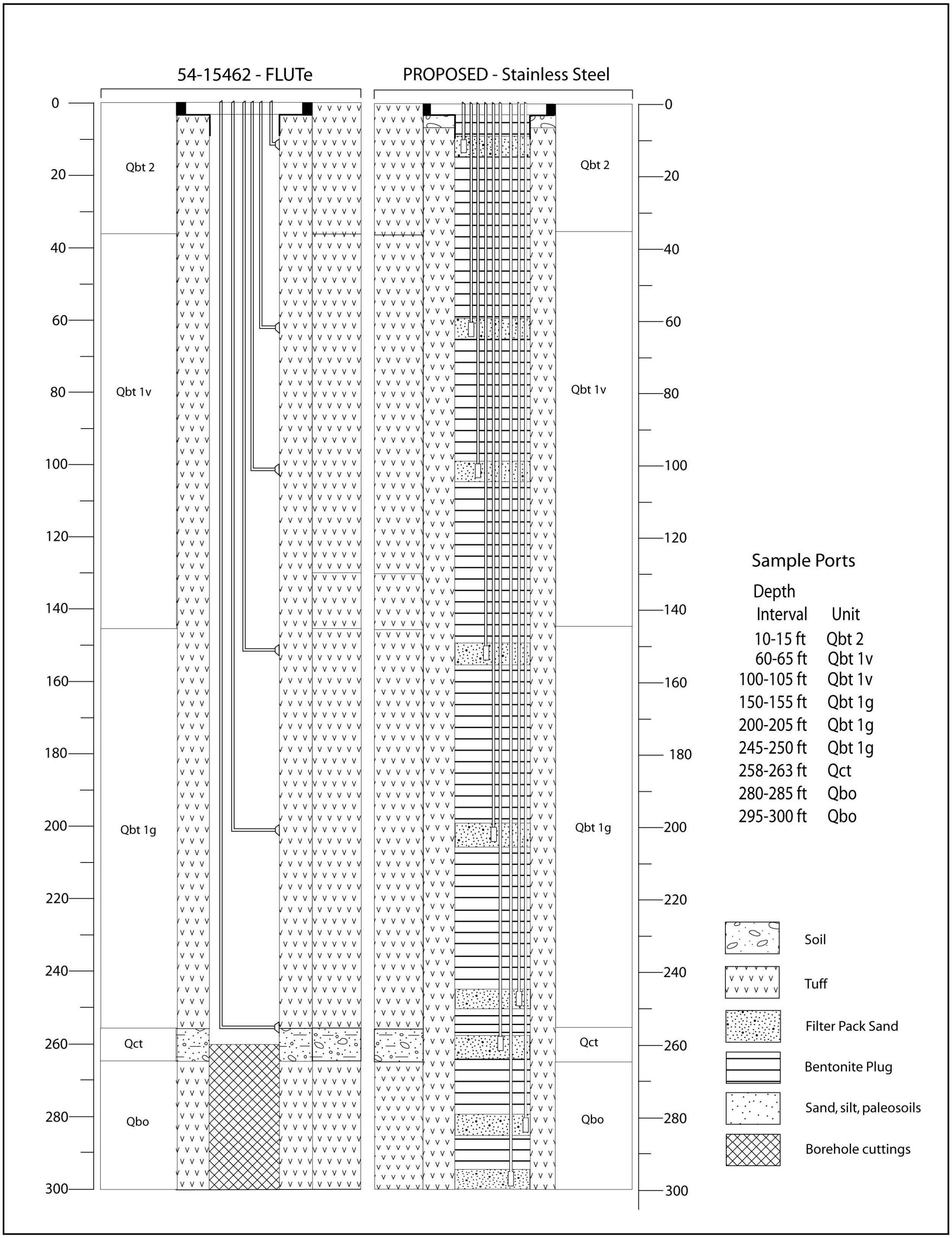


Figure 2 Proposed construction details of new vapor-monitoring well at MDA H

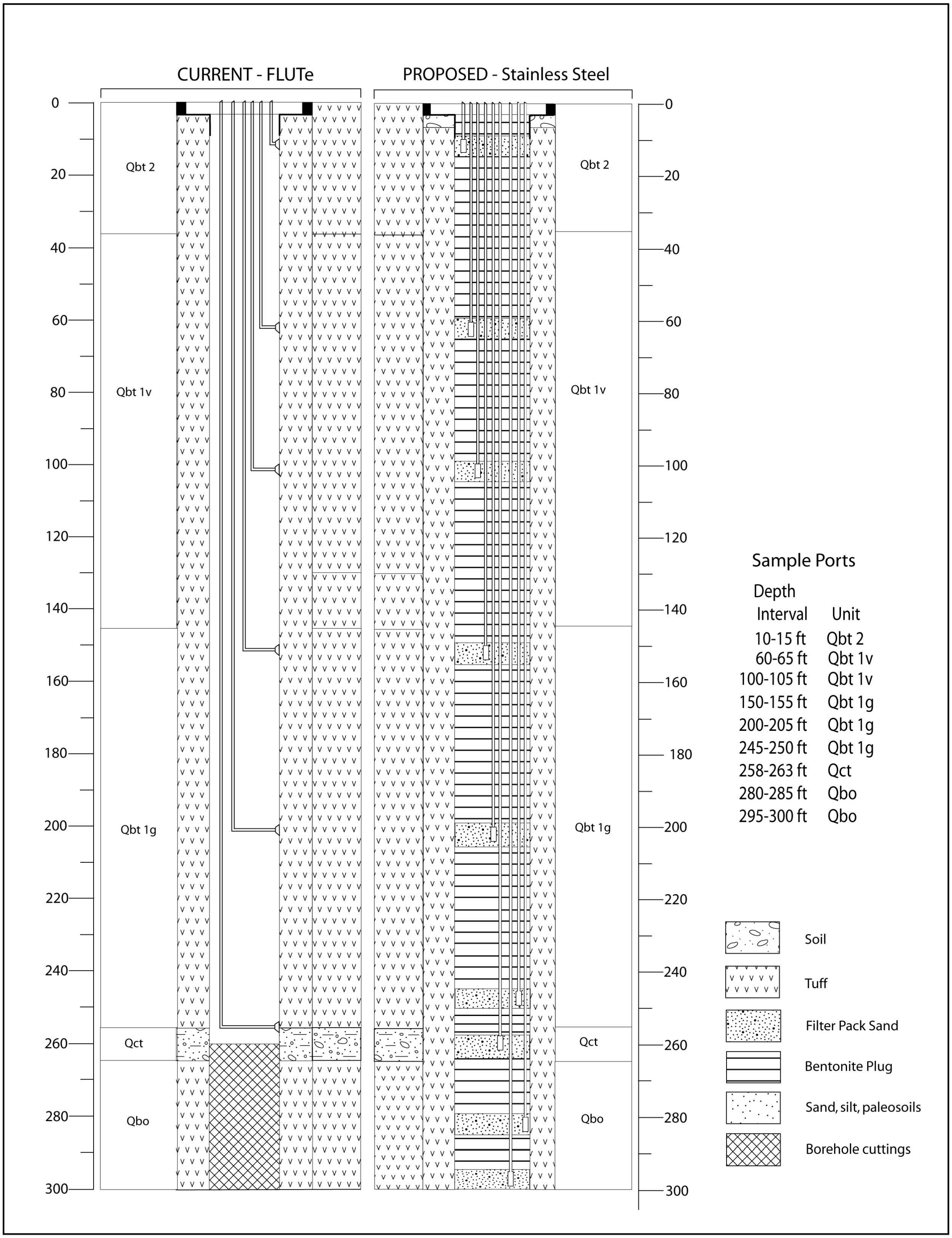


Figure 3 Proposed construction details of vapor-monitoring well 54-15462

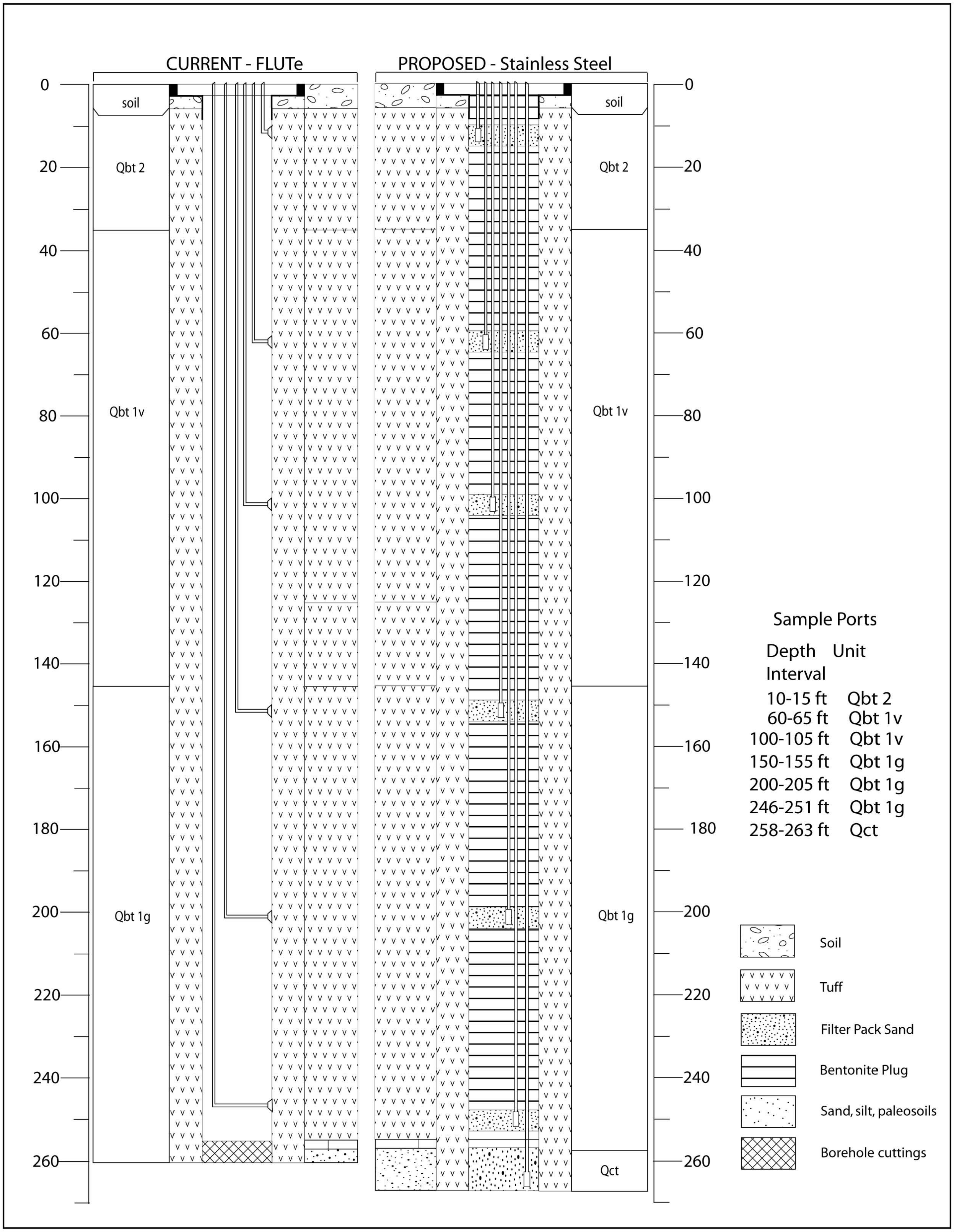


Figure 4 Proposed construction details of vapor-monitoring well 54-01023

Table 1
Proposed Sampling Intervals and Associated Geologic Units

Borehole	Sampling Interval (ft)	Geologic Unit
New borehole	10–15	Qbt 2
	60–65	Qbt 1v
	100–105	Qbt 1v
	150–155	Qbt 1g
	200–205	Qbt 1g
	245–250	Qbt 1g (5 ft above Qct)
	258–263	Qct
	280–285	Qbo (15 ft below Qct)
	295–300	Qbo (base of borehole)
54-15462	10–15	Qbt 2
	60–65	Qbt 1v
	100–105	Qbt 1v
	150–155	Qbt 1g
	200–205	Qbt 1g
	245–250	Qbt 1g (5 ft above Qct)
	258–263	Qct
	280–285	Qbo (15 ft below Qct)
	295–300	Qbo (base of borehole)
54-01023	10–15	Qbt 2
	60–65	Qbt 1v
	100–105	Qbt 1v
	150–155	Qbt 1g
	200–205	Qbt 1g
	246–251	Qbt 1g (5 ft above Qct)
	258–263	Qct

Notes: Qbt 2 = Unit 2 of the Tshirege Member of the Bandelier Tuff, Qbt 1v = unit 1v of the Tshirege Member of the Bandelier Tuff, Qbt 1g = unit 1g of the Tshirege Member of the Bandelier Tuff, Qct = Cerro Toledo interval, Qbo = Otowi Member of the Bandelier Tuff.