EVALUATION OF WATER USE IN BULK LOW-LEVEL WASTE DISPOSAL OPERATIONS AT PIT 37 IN 2011

INTRODUCTION

The U.S. Department of Energy and Los Alamos National Security, LLC (DOE/LANS, also the Permittees) recently performed an extent-of-condition review of water use in bulk low-level waste (LLW) disposal operations at Technical Area 54 (TA-54). As part of this review, it was determined that the LANS Radiation Protection Division revised the approach to worker protection for bulk LLW disposal in January 2011. The approach required the use of water spray to control dust generation when bulk waste is placed in a disposal pit and to prevent track out by removing residual material from bins and trucks. As described in the November 15, 2012, letter to the New Mexico Environment Department (NMED) Hazardous Waste Bureau and Groundwater Quality Bureau, DOE/LANS found that potable water was used for dust suppression at Pit 37 from January 2011 to May 2011. This report summarizes the results of the evaluation of potential impacts of the use of water for dust suppression and equipment decontamination at and in the vicinity of Pit 37. The objectives of this evaluation were to answer the following four questions:

- What volume of water was used in Pit 37?
- Did the use of water associated with these bulk LLW trigger the reporting requirement for a "newly discovered release" in Section V.D of the March 2005 Compliance Order on Consent (Consent Order) by either
    - ❖ causing a newly discovered release associated with disposal of a new contaminant or
    - ❖ causing a newly discovered release associated with a new release mechanism?
- Did this use of water affect any of the assumptions regarding the leaching of water-soluble contaminants and vapor-phase transport of volatile organic compounds (VOCs) underlying the remedy recommended by DOE/LANS in the Material Disposal Area G corrective measures evaluation report (MDA G CME)?

As detailed below, this evaluation determined the following:

- Approximately 352,000 gal. of water used over a 4-mo period for dust suppression and equipment decontamination was discharged to Pit 37;
- The use of water related to the disposal of these bulk LLW did not result in a newly discovered release because
    - ❖ these wastes did not contain any constituents that were not already present in the existing waste inventory and
    - ❖ the addition of the water did not create a new release mechanism;

PIT 37 DESCRIPTION

Pit 37 is one of the disposal units at Los Alamos National Laboratory (the Laboratory) that the Permittees use for the permanent disposal of low-level wastes (LLW). Pit 37 is located within Area G at TA-54, which is situated on Mesita del Buey, an east-west trending mesa bounded by Pajarito Canyon to the south and Cañada del Buey to the north. It is part of Solid Waste Management Unit (SWMU) 54-018. Figure 1 is a topographic map showing the location of Pit 37.

Disposal Unit Dimensions and Structural Description

Since 1957, about 65 acres of TA-54 have been used for radioactive waste disposal; the site has served as the primary LLW disposal site for the Laboratory since 1959. The development of disposal units has progressed generally from east to west in accordance with the pit- and shaft-construction guidelines in effect at the time of construction. The result has been the construction of 35 disposal pits and more than 200 shafts, the general layout of which is shown in Figure 1.

Pit 37 was excavated directly into the Tshirege Member of the Bandelier Tuff. Crushed tuff removed during excavation was then used to line and backfill the pit to absorb moisture. The pit, which is rectangular, is approximately 685 ft long, 85 ft wide, and 60 ft deep, including the ramp (see Figure 2).

DATES OF OPERATION

Pit 37 began accepting waste in April 1990. The disposal of LLW in Pit 37 was relatively steady from 1990 to 1997. No disposal occurred from 1998 to 2005. LLW disposal began again in 2006 and stopped temporarily again in 2007 before it resumed in 2008. This latest LLW disposal campaign continued through 2011. Three feet of crushed tuff was placed on Pit 37 at the conclusion of the TA-21 bulk waste disposal activities in 2011.

WASTE SUMMARY

The existing LLW inventory in Pit 37, before this latest waste-disposal campaign, included demolition debris, soil, and a wide range of operational wastes. Both bulk and containerized wastes were disposed of at Pit 37 in the past without the use of water for in-pit dust suppression.

The bulk LLW in Pit 37 was characterized to determine its status under the Resource Conservation and Recovery Act (RCRA) before it was transported to TA-54. The bulk LLW disposed of at Pit 37 in the time period that involved the use of water inside the pit consisted of approximately 11% debris from the demolition of aboveground structures at TA-21and 89% bulk wastes from Material Disposal Area (MDA) B.

Bulk LLW from TA-21

LLW demolition debris from TA-21 was disposed of in Pit 37 from January to May 2011. These wastes were generated during the demolition of structures at DP East, DP West, and the Tritium Systems Test Facility. The demolition of these structures was the last stage of a multistage process that included (1) utility isolation verification, (2) hazardous materials and asbestos abatement, (3) removal of remaining internal process-contaminated systems, and (4) decontamination and demobilization. The implementation of these processes ensured that the LLW demolition debris destined for disposal at Pit 37 was not a hazardous waste or subject to the Toxic Substances Control Act.

Characterization and sampling of the TA-21 demolition debris were performed in accordance with the TA-21 decommissioning and demolition waste characterization strategy form (WCSF). This waste stream included concrete, asphalt, roofing material, wood, structural steel, rebar, stairwells, and grating.

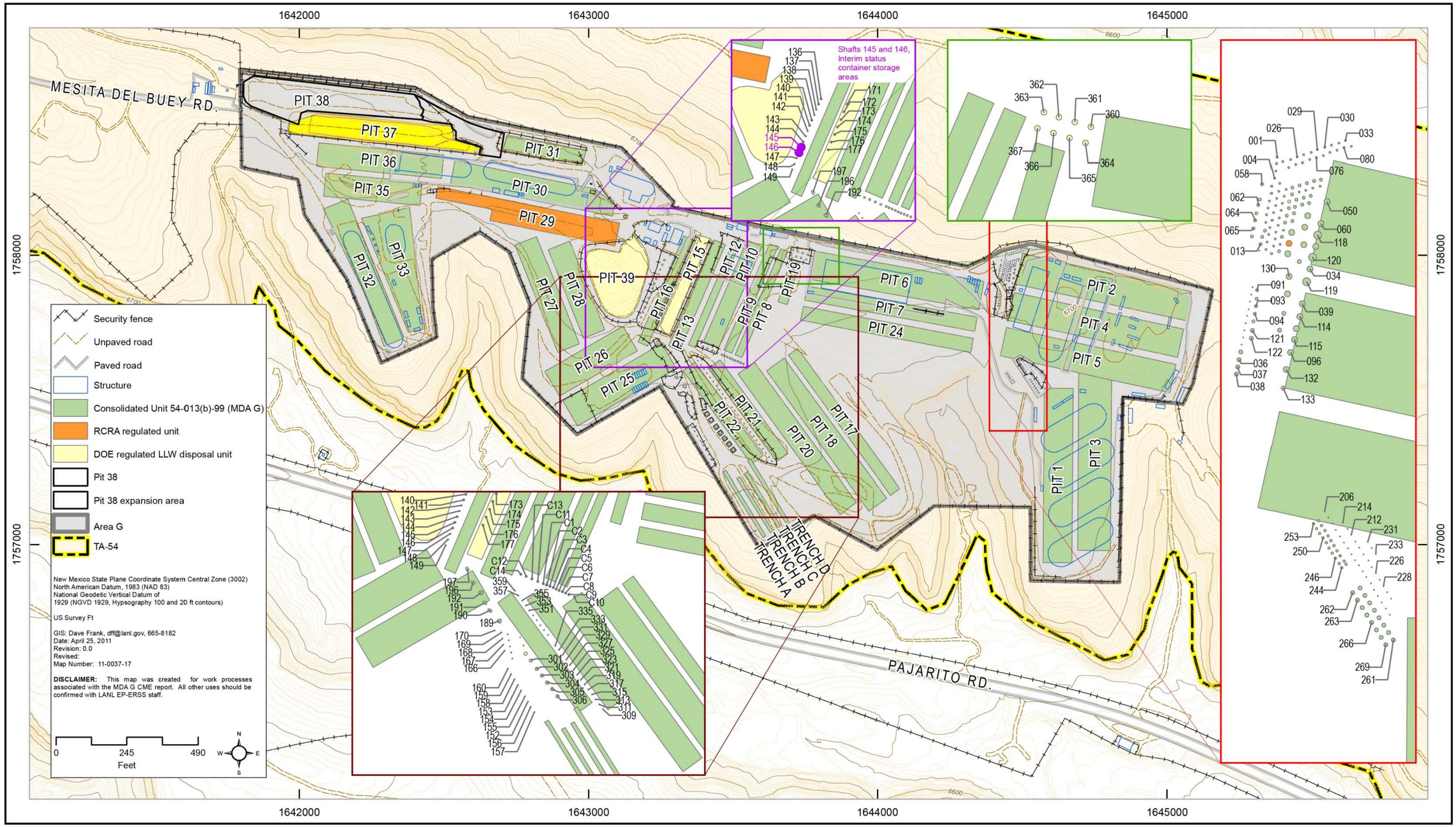


Figure 1 Area G with location of Pit 37

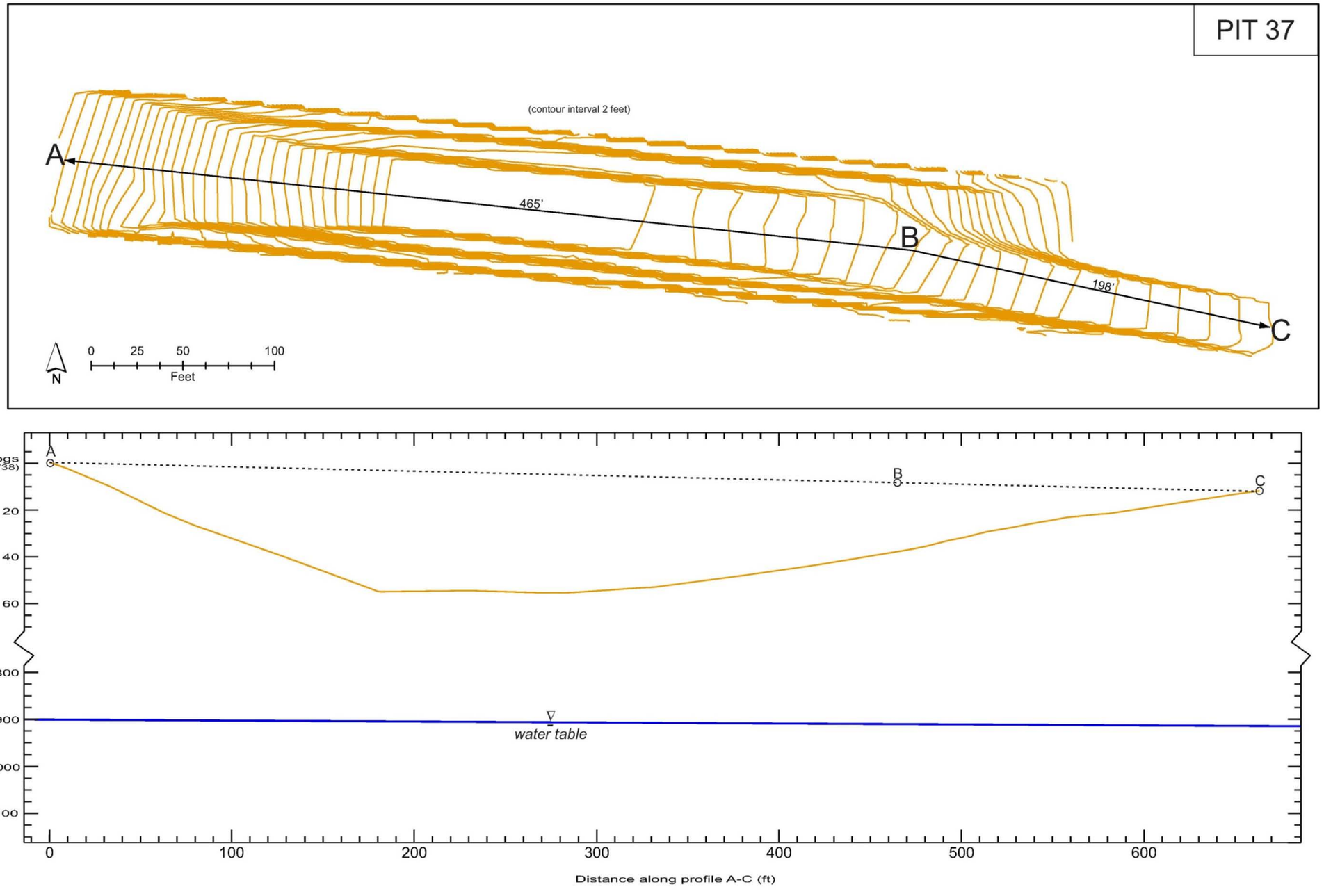


Figure 2 Pit 37 plan and cross-section

Bulk MDA B Soil/Debris

The bulk LLW from MDA B was disposed of in Pit 37 from January to May 2011. The waste in these bins consisted of soil/debris excavated during remediation activities from the historical waste disposal trenches, which contained small amounts of radionuclides. Anomalies such as sludge, discolored soil, or ash were segregated during excavation and were characterized and managed separately. None of these bins contained mixed LLW or hazardous waste.

Characterization and sampling of the MDA B soil/debris waste was performed in accordance with the MDA B waste management plan and sampling and analysis plan (SAP). DOE/LANS performed due diligence to determine if the waste was listed in Subpart D of 40 Code of Federal Regulations (CFR) 261 in accordance with the U.S. Environmental Protection Agency's Management of Remediation Waste under RCRA (EPA 530-F-98-026), Determination of When Contamination Is Caused by Listed Hazardous Waste. It was determined that because the available 60-yr-old documentation regarding the source(s) of contamination, contaminant, or waste was unavailable or inconclusive, this waste stream was not a listed waste.

Representative composite samples were collected for waste characterization in accordance with the MDA B SAP. These samples were analyzed for dioxins and furans, herbicides and pesticides, high explosives, total metals, polychlorinated biphenyls, VOCs, semivolatile organic compounds, total petroleum hydrocarbons, and diesel range organics. In the event that any constituents listed in 40 CFR 261.24, Toxicity Characteristic, were found to be elevated (i.e., close to 20 times the toxicity characteristic leaching procedure [TCLP] regulatory level), a TCLP analysis was performed to confirm that the bin did not contain a characteristically hazardous waste. The MDA B Investigation/Remediation Report, Revision 1 (LANL 2012, 215119) contains a complete description of waste characterization activities and the supporting analytical data.

DESCRIPTION OF WATER USE

The LANS Radiation Protection Division revised the approach to worker protection for bulk LLW disposal in January 2011. The revised approach requires using water spray to control dust generation when bulk waste is placed in a disposal pit and to prevent track out by removing residual material from bins and trucks. To meet this worker health and safety requirement, an 8000-gal. water wagon was parked at the center of Pit 37 throughout this bulk LLW disposal campaign. Water from the water wagon was used for the dust suppression during the disposal of the bulk LLW in the pit, decontamination of trucks and bins, and general dust suppression in the area of Pit 37.

The bulk LLW was placed in the pit, beginning on the west end and proceeding east across the entire pit. The area used for the decontamination of truck exteriors was located within the west end of the pit. Once bulk waste disposal activities ceased in Pit 37, approximately 3 ft of crushed tuff was placed over the waste.

The total estimated volume of water used between January and May 2011 is 352,000 gal. This estimate is based on the assumption that an average of 8000 gal. of water (e.g., the volume of the water truck) was applied in Pit 37 per day for 44 days.

EFFECTS OF RECENT WATER USE FOR DUST SUPPRESSION AND DECONTAMINATION IN PIT 37 ON THE MIGRATION OF CONTAMINANTS

The bulk LLW from TA-21 did not contain any hazardous constituents than were previously identified in the September 2005 MDA G investigation report (LANL 2005, 090513) as being above background values next to the base of the disposal pits, trenches, and shafts. Because these wastes did not introduce any new contaminants to Pit 37, the evaluation of the potential effects of water use for dust suppression and decontamination in Pit 37 on the migration of contaminants focused on the potential for the additional water to alter any of the assumptions used to develop the proposed preferred remedy in the 2011 MDA G corrective measures evaluation (CME) report (LANL 2011, 206324).

The MDA G CME identified two potential transport pathways to groundwater: leaching of water-soluble contaminants and vapor-phase transport of VOCs. As a result, the CME proposed two remedies to minimize these pathways. An evapotranspiration (ET) cover was recommended as a protective remedy to address uncertainty related to potential leachate production from the unlined pits and shafts at MDA G. Soil-vapor extraction (SVE) was the proposed remedy to remove VOCs within target locations with vapor concentrations that exceed screening criteria developed in the CME. This section assesses the effects of the recent water use at Pit 37 on the recommended remedies.

Leaching of Water-Soluble Constituents

The September 2005 MDA G investigation report (LANL 2005, 090513) summarizes the results of the 2005 field investigation. Thirty-nine boreholes were drilled to collect soil, rock, and pore gas samples to determine the nature and extent of any releases of contaminants from MDA G. The only organic constituents detected in soil were trace levels of several dioxin and furan congeners. Inorganic constituents were detected above background values next to the base of the disposal pits, trenches, and shafts at concentrations less than 5 times the background value.

Infiltration rates, thickness of the unsaturated zone, and geochemical properties affect the transport of soluble contaminants by leaching. The CME identified future risk associated with this pathway to be very low because infiltration rates through the mesa are low and the depth to groundwater is large (~900 to 1000 ft). Average travel times for water flowing through the unsaturated zone from the pits to the regional aquifer of several hundred years to several thousand years are predicted under disturbed (e.g., pits that remain open to precipitation, paved areas) and undisturbed conditions (natural vegetated mesa top), respectively. Contaminants will generally travel more slowly than the infiltrating groundwater. Contaminants must dissolve into water to be transported by leaching. Waste containers can limit dissolution of waste. In addition, soluble species like some inorganic chemicals (e.g., nitrate and perchlorate salts) will readily dissolve, while insoluble species (e.g., metals, polycyclic aromatic hydrocarbons) have limited solubility. Adsorption onto soils also affects transport rates, with nonsorbing species (e.g., nitrate, perchlorate, salts) transporting at a rate similar to the water and adsorbing species (e.g., metals, asphalt) transporting more slowly. Although the future risk from the transport of leachate is considered to be very low, the CME recommends an ET cover as a protective remedy to address uncertainty related to potential leachate production from the unlined pits and shafts at MDA G. An ET cover will help restore infiltration rates in disturbed zones back to levels present in native undisturbed zones.

An estimate of the added water volume (approximately 352,000 gal.) shows it is equivalent to slightly less than a year's worth of precipitation over the area of the pit (approximately 430,000 gal.). The addition of this volume of water does not result in a new release mechanism but may have temporarily increased the rate of release at Pit 37. In this case, the leaching pathway remains potentially complete, with projected

travel times to groundwater on the order of hundreds of years for uncontainerized conservative species. However, much of the LLW inventory buried in Pit 37 is in containers, and many of the contaminants have low solubility and high adsorption coefficients (e.g., metals); these contaminants will transport much more slowly than the pore water. An ET cover will decrease infiltration rates to more natural conditions and is the appropriate remedy to minimize future leaching as recommended in the CME. Therefore, no additional investigation or change in the proposed remedy is warranted with respect to leaching of water-soluble constituents from Pit 37.

Vapor-Phase Transport

Vapor-phase transport of VOCs occurs at MDA G and is considered to be a mechanism that may lead to a potentially complete pathway to groundwater in the future. Pore-gas sampling confirmed the presence of VOCs in the vadose zone beneath MDA G. The CME identified future risk associated with this pathway from VOC migration to range from very low to medium. To prevent groundwater from being impacted above a regulatory standard by the transport of VOCs through soil vapor, SVE is the proposed site remedy to remove VOCs within target locations having vapor concentrations that exceed Tier 2 screening criteria developed in the CME. Data analysis identified three comingled plume areas across MDA G: an eastern plume near Pits 1 through 5, a central plume near Pit 6, and a western plume near Pits 29 and 33.

VOCs are detected in the closest vapor-monitoring well located west of Pit 37. However, vapor concentrations are significantly lower than both the Tier 2 screening levels proposed in the CME and the more conservative Tier 1 screening levels presented in the periodic monitoring reports for vapor sampling. The area near Pit 37 was not targeted for SVE because of the low vapor concentrations. The additional water may displace the current vapor plume laterally and downward relative to its current position but would not increase vapor concentrations to above screening levels or increase the rate of release of VOCs. Vapors from any future volatilization within the pit waste would diffuse more slowly toward groundwater because of the presence of higher pore moisture. Therefore, no additional investigation or change in the proposed remedy is warranted with respect to VOCs near Pit 37.

CONCLUSIONS

The following two release mechanisms at MDA G were identified the use of water for dust suppression and equipment decontamination used at and in the vicinity of Pit 37: leaching of contaminants from MDA G disposal units caused by infiltration of precipitation and volatilization of VOCs from the wastes into the vadose zone. The addition of the 352,000 gal. of water used during bulk waste disposal did not result in a newly discovered release under Section V.D of the Consent Order for the following reasons.

- The bulk waste added to Pit 37 did not contain any contaminants not already present in wastes previously disposed of to Pit 37, and therefore, water use in Pit 37 could not have caused a new release associated with disposal of new contaminant.
- Based on the modeling performed to support the MDA G CME, the additional water use is not expected to significantly affect the migration of water-soluble contaminants or result in an increase in VOC-vapor concentrations in the vadose zone above screening levels. Therefore, no changes to the recommended remedy in the MDA G CME are proposed.
- The addition of water did not affect the volatilization of VOCs.

Therefore, no additional investigation is required under Section V.D of the Consent Order.

The potential of this water use to affect any of the assumptions regarding the leaching of contaminants or the vapor-phase transport of VOCs underlying the remedy recommended by DOE/LANS in the MDA G CME was also evaluated. While this addition of water could temporarily result in an increased rate of leaching of water-soluble contaminants, the projected travel times to groundwater will not be significantly affected. The additional water may displace the current vapor plume but would not cause any increase in vapor concentrations to above screening levels or increased rate of release of VOCs. Therefore, no additional investigation or change in the proposed remedy is warranted with respect to water soluble contaminants or VOCs near Pit 37.

REFERENCES

LANL (Los Alamos National Laboratory), September 2005. "Investigation Report for Material Disposal Area G, Consolidated Unit 54-013(b)-99, at Technical Area 54," Los Alamos National Laboratory document LA-UR-05-6398, Los Alamos, New Mexico. (LANL 2005, 090513)

LANL (Los Alamos National Laboratory), September 2011. "Corrective Measures Evaluation Report for Material Disposal Area G, Solid Waste Management Unit 54-013(b)-99, at Technical Area 54, Revision 3," Los Alamos National Laboratory document LA-UR-11-4910, Los Alamos, New Mexico. (LANL 2011, 206324)

LANL (Los Alamos National Laboratory), April 2012. "Investigation/Remediation Report for Material Disposal Area B, Solid Waste Management Unit 21-015, Revision 1," Los Alamos National Laboratory document LA-UR-12-20089, Los Alamos, New Mexico. (LANL 2012, 215119)