RCRA_00701

Environmental Protection Division
Water Quality & RCRA Group (ENV-RCRA)
P.O. Box 1663, K490
Los Alamos, New Mexico 87545
(505) 667-0666/FAX (505) 667-5224

National Nuclear Security Administration
Los Alamos Site Office, A316
3747 West Jemez Road
Los Alamos, New Mexico 87545
(505) 667-5794/FAX (505) 667-5948

Date: July 13, 2011
Refer To: ENV-RCRA-11-0122
LAUR: 11-03650

Mr. John E. Kieling
Hazardous Waste Bureau
New Mexico Environment Department
2905 Rodeo Park Drive East, Building 1
Santa Fe, NM 87505

Dear Mr. Kieling:

SUBJECT: SUBMITTAL OF CLOSURE PLAN AND REQUEST FOR ALTERNATIVE CLOSURE REQUIREMENTS, TECHNICAL AREA (TA) 54, AREA G, SHAFTS 145 AND 146 INTERIM STATUS CONTAINER STORAGE UNIT, LOS ALAMOS NATIONAL LABORATORY, EPA ID# NM0890010515

The purpose of this letter is to transmit the referenced closure plan to the New Mexico Environment Department- Hazardous Waste Bureau (NMED-HWB) for review and approval, in compliance with Section 1.4.1 of the renewed Los Alamos National Laboratory (LANL) Hazardous Waste Permit (the Permit). This letter also serves as the National Nuclear Security Administration's and Los Alamos National Security, LLC's (NNSA/LANS, collectively the Permittees') request to use alternative requirements to meet Resource Conservation and Recovery Act (RCRA) closure and post-closure care requirements for this unit, by incorporating the final closure of Storage Shafts 145 and 146 into the Technical Area 54 (TA-54), Area G corrective action process.

Closure plan. Storage Shafts 145 and 146 comprise an interim status hazardous (mixed) waste container storage unit at TA-54, Area G that is listed in Table J-1 of the Permit. For interim status units listed in Table J-1 that will not be operated, Section 1.4.1 of the Permit requires the Permittees to submit a notice of intent to close or a revised closure plan within 180 days of the effective date of the Permit. NNSA/LANS do not intend to operate this unit, and therefore request the review and approval of the enclosed closure plan.

Because of their limited use, and subsequent changes in waste management operations, Storage Shafts 145 and 146 were originally intended for "clean closure" pursuant to NMAC 4.1.600, incorporating 40 CFR Part 265, Subpart G. A previous version of this closure plan, describing clean closure of this unit, was submitted to NMED on November 8, 1999. On May 7, 2004, the NMED issued a Public Notice of its intent to approve the 1999 closure plan, along with the closure plans for four other interim status

storage units at LANL. On June 3, 2004, NMED rescinded the Public Notice and its intent to approve the 1999 closure plan for Storage Shafts 145 and 146. The revised closure plan (enclosed) is now being submitted to NMED in compliance with Section 1.4.1 of LANL's Permit.

Request for the use of Alternative Requirements. Storage Shafts 145 and 146 are co-located in close physical proximity with a solid waste management unit (SWMU) and numerous land disposal units at Area G that are subject to the Compliance Order on Consent (Consent Order), signed by the U.S. Department of Energy (DOE), the University of California, and the NMED on March 1, 2005, and revised June 18, 2008. Due to subsurface contamination from the nearby SWMU, NNSA/LANS no longer believe that it can demonstrate that the storage shafts can meet clean closure standards in 40 CFR §§265.111 through 265.115 to the NMED's satisfaction. Therefore, the Permittees' request NMED to allow the facility to use alternative requirements to meet RCRA closure and post-closure care requirements for the Shafts 145 and 146 storage unit, by incorporating the shafts' final closure into the Area G corrective action process. Further details and rationale for this alternative requirements request are given in the enclosed closure plan.

As required by Section 1.4.1 of the Permit, closure of this interim status unit will be initiated in accordance with 40 CFR § 265.113(a) no later than 270 days after the effective date of the Permit.

Section 1.4.1 of the Permit required the notice of intent to close or a revised closure plan to be submitted to the NMED-HWB within 180 days of the effective date of the Permit. Therefore, this transmittal was due no later than June 28, 2011. The Las Conchas Wildfire forced closure of LANL beginning Monday, June 27, 2011, and the Permittees requested a two-week extension for this compliance deadline from the date the Laboratory re-opened. The NMED-HWB granted this extension request on June 28, 2011. The Laboratory re-opened on July 6, 2011.

The opportunity to present this closure plan and alternative requirements request, and discuss our proposed approach with you and your staff would be appreciated. Please contact Mark Haagenstad of the Water Quality and RCRA Group (ENV-RCRA) at (505) 665-2014 if additional information would be helpful.

Sincerely,

A R Grieggs

Anthony R. Grieggs
Group Leader
Water Quality & RCRA Group
Los Alamos National Laboratory

Sincerely,

Gene E. Turner

Gene E. Turner
Environmental Permitting Manager
Environmental Projects Office
Los Alamos Site Office
National Nuclear Security Administration

ARG:GET:PS/lm

Enclosures: a/s

Cy: Steve Pullen, NMED/HWB, Santa Fe, NM, w/enc.
Gene Turner, LASO-EO, w/enc., A316
Carl A. Beard, PADOPS, w/o enc., A102
J. Chris Cantwell, ADESHQ, w/o enc., K491
Kate Lynnes, REG-DO, w/enc., M991
Kate Roberts, ET-ER, w/enc., M992
Andy Baumer, TA54CL, w/enc., J910
Mark Haagenstad, ENV-RCRA, w/enc., K490, (E-File)
Paul Schumann, ENV-RCRA, w/enc., K490, (E-File)
Bob Lechel, ENV-ES, w/enc., J593
Susan McMichael, LC-LESH, w/enc., A187
ENV-RCRA File, w/enc., K490
IRM-RMMSO, w/enc., A150

LA-UR 11-03650

July 2011

Closure Plan

Shafts 145-146 Container Storage Unit

Technical Area 54 (TA-54), Area G

Revision 1

Prepared by:

Los Alamos National Laboratory
ENV-RCRA Group
Los Alamos, New Mexico 87545

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List of Acronyms and Abbreviations

BV	background values
40 CFR	Title 40, U.S. Code of Federal Regulations
CME	corrective measures evaluation
CMI	corrective measures implementation
CMP	corrugated metal pipe
CSU	container storage unit
DOE	U.S. Department of Energy
DOT	U.S. Department of Transportation
EPA	U.S. Environmental Protection Agency
LANL	Los Alamos National Laboratory
LASO	Los Alamos Site Office
MI	multi-increment (sampling)
MLLW	mixed low-level waste
NIOSH	National Institute of Occupational Safety and Health
NMED	New Mexico Environment Department
NMEID	New Mexico Environmental Improvement Division
NNSA	National Nuclear Security Administration
QA/QC	quality assurance/quality control
PE	New Mexico-registered, independent professional engineer
PPE	personal protective equipment
RCRA	Resource Conservation and Recovery Act
RFI	RCRA Facility Investigation
RLW	Radioactive Liquid Waste Treatment Facility (LANL)
SAP	Sampling and Analysis Plan
SVE	soil vapor extraction
SW-846	*Test Methods for Evaluating Solid Waste, Physical/Chemical Methods*, EPA-SW-846, U.S. Environmental Protection Agency, Office of Solid Waste and Emergency Response, U.S. Government Printing Office, Washington, D.C. (most current version)
TA	Technical Area (LANL)

CLOSURE PLAN

TECHNICAL AREA 54, SHAFTS 145-146 CONTAINER STORAGE UNIT

1.0 INTRODUCTION

This closure plan describes the activities necessary to close Storage Shafts 145 and 146, which together comprise an interim status hazardous (mixed) waste container storage unit at Area G of Technical Area 54 (TA-54) at the Los Alamos National Laboratory (LANL or the Laboratory), hereinafter referred to as "the TA-54 storage shafts" or "the unit." The information provided in this closure plan addresses the closure requirements specified in NMAC 4.1.600, incorporating the Code of Federal Regulations (CFR) at Title 40, Part 265, Subpart G for interim status hazardous waste container storage units at LANL under the Resource Conservation and Recovery Act (RCRA) and the New Mexico Hazardous Waste Act.

A previous version of this closure plan, describing "clean closure" of this unit, was submitted to the New Mexico Environment Department (NMED or the Department) on November 8, 1999. On May 7, 2004, the NMED issued a Public Notice of its intent to approve LANL's 1999 closure plan, along with the closure plans for four other interim status storage units at LANL. However, on June 3, 2004, NMED rescinded the Public Notice and its intent to approve the 1999 closure plan for The TA-54 storage shafts.

This revised closure plan is being submitted to NMED in compliance with Section 1.4.1 of LANL's 2010 Hazardous Waste Facility Permit (Permit). Table J.1 of the Permit lists the TA-54 storage shafts as a "unit" subject to closure requirements. All waste has been removed, and initial decontamination verification activities have been performed. The National Nuclear Security Administration (NNSA) and Los Alamos National Security, LLC (collectively the "Permittees") now propose to complete closure of the unit by meeting the closure performance standards presented in Section 4.1 of this revised closure plan according to the approach described below.

Final closure of the unit will be deemed complete when the Department approves the Closure Report and certification required by 40 CFR § 265.115. Until closure is complete and has been certified in accordance with Section 8.0 of this closure plan and 40 CFR § 265.115, a copy of the approved closure plan, any approved revisions, and closure activity documentation associated with the closure will be on file with hazardous waste compliance personnel at LANL and at the NNSA Los Alamos Site Office (LASO). Prior to completing closure of the unit, this closure plan may be amended in accordance with Section 4.3 of this closure plan and 40 CFR § 265.112(c), if necessary and appropriate, to update the closure process and/or any sampling and analysis plan that may be required. An amended closure plan would then be submitted to the NMED for approval prior to completing the activities in the plan.

The TA-54 storage shafts were used temporarily to store hazardous (mixed) waste for a several month period in 1990 and 1991. Because of their limited use, and subsequent changes in LANL's waste management operations, LANL originally intended to "clean close" these storage shafts. However, these shafts are co-located in close physical proximity with numerous land disposal units and Solid Waste Management Units (SWMUs) which collectively make up Material Disposal Area (MDA) G. MDA G has documented releases that are subject to the Compliance Order on Consent (Consent Order), signed by the U.S. Department of Energy

(DOE), the University of California, and the New Mexico Environment Department (NMED) on March 1, 2005, and revised June 18, 2008. The Consent Order includes closure deadlines for completing corrective actions at TA-54 that will require close coordination with the closure activities described in this plan. As a result of releases from the SWMUs co-located and situated among the storage shafts and land disposal units, there is no definitive means to correlate specific releases at MDA G with specific sources. For these reasons, LANL is requesting the Department to approve the use of alternative requirements for these storage shafts to meet RCRA closure and post-closure standards under 40 CFR §265.110(d). This would allow complete closure of the unit by incorporating the TA-54 storage shafts' final closure into the MDA G corrective action process under the Consent Order. The details and basis for this request are more thoroughly described below.

2.0 DESCRIPTION OF UNIT TO BE CLOSED

This section includes a description and the locations of the TA-54 storage shafts. It also provides an overview of past operations and waste management practices at this unit.

2.1 Description of the Wastes Stored at the Unit

The TA-54 storage shafts were operated only for a several-month period from 1990 to 1991, for the purpose of developing and demonstrating waste storage operational protocols at Area G. The two drums used in these tests contained solid, tritium-contaminated mixed low-level waste (mixed LLW or MLLW). These were solid waste materials (rags, tools, and similar equipment) contaminated with tritium as the radioactive component, and one or more of the RCRA-regulated wastes listed in LANL's January 25, 1991 RCRA Mixed Waste Part A Permit Application. The wastes had been generated by various glovebox operations at LANL.

At that time, DOE required special packaging for mixed waste with tritium contamination in concentrations greater than 20 mCi/m3 but less than 100 Ci/m3. Therefore, the drums used in the demonstrations were asphalt-lined U.S. Department of Transportation (DOT)-approved Type 17C or 17H, 30-gal. drums with locking rings. The lids were also sealed with asphalt. No free liquids were present in the two drums.

2.2 Description of the Unit

The TA-54 storage shafts are below-grade retrievable storage structures located at TA-54, Area G, which is situated on the eastern reach of Mesita del Buey in the southeastern portion of LANL (Figure 1). Mesita del Buey is an east-west trending mesa bordered on the north by Cañada del Buey and on the south by Pajarito Canyon. These storage shafts were constructed in unit 2 (caprock) and unit 1 (subsurface) of the Tshirege Member of the Bandelier Tuff, a consolidated tuff unit. The regional aquifer is estimated to be at a depth of approximately 930 ft below ground surface, with approximately 750 ft of tuff, basalt, and sedimentary rocks separating the disposal areas from the main aquifer. The elevation at TA-54 is approximately 6,800 feet (ft). The topography of Area G is relatively flat, and it does not extend beyond the mesa top. MDA G comprises all the subsurface pits, trenches, and shafts located within the boundary of Area G. Portions of these disposal units are covered with concrete and/or asphalt to support ongoing waste-management activities on the surface. TA-54 also includes active disposal sites for low level waste and historic disposal sites for low level waste, mixed waste and hazardous waste management sites at MDAs H and L.

The TA-54 storage shafts, located between Pits 15 and 39 in the middle portion of Area G (Figure 2), were constructed in 1990 for storage and containment of containerized, solid, tritium-contaminated MLLW. The shafts are identical in construction. Each is six feet in diameter, augured to a depth of 60 ft, and lined with a corrugated metal pipe (CMP). The bottoms of the shafts were formed of approximately 9 in. of asphaltic concrete poured and leveled after the shafts were augured and lined. The annular space surrounding each CMP shaft liner was backfilled with crushed tuff to within 4 ft of the surface. The remaining annular space was filled with concrete to the surface. Each CMP protrudes above the surface, and is surrounded by an 18-in. thick concrete pad that extends out 2½ to 3 ft from the edge of the shaft. The pad is shaped to prevent infiltration of precipitation and direct runoff away from the shaft.

When in operation (1990-91), the TA-54 storage shafts had metal shaft covers and removable guard railings above surface grade. The current operational cap on each shaft consists of a metal shaft cover and a reinforced concrete collar. Figures 3 through 9 show details of the storage shafts, including surface views of the shafts, the operational caps, the CMP shaft liners, and the graded concrete collars.

2.3 Description of Storage Operations Conducted at the Unit

The TA-54 storage shafts were operated only during a several-month period from 1990 to 1991, as previously mentioned. They were used only to develop and demonstrate waste storage operational protocols.

During the 1990-91 demonstrations, one 30-gal. drum containing MLLW was suspended inside each shaft. The two drums were brought from a nearby mixed waste tritium storage shed using forklifts and drum carriers, in accordance with Area G on-site transportation procedures. Nylon ropes were attached to each drum, and each drum was then suspended in a shaft, approximately 2 to 3 ft from the top.

Each container was kept closed throughout the storage period (40 CFR §265.173). Regular weekly visual inspections of the shafts and the drums were conducted while the drums were being stored in the shafts, in accordance with 40 CFR §265.174. The drums were not opened during the inspections. No signs of leakage were observed during this demonstration. At the end of the demonstration, the drums were removed from the shafts and returned to the mixed waste tritium storage shed.

After demonstrations were completed, these shafts were never used again – whether for storage, disposal, or any other purpose. They have remained empty, and been kept physically closed and sealed. However, they continue to be inspected as ”active” shafts while awaiting completion of RCRA closure.

2.4 Other Waste Management Units at Area G

DOE initially authorized Area G in 1957 for disposal of LLW, certain radioactively contaminated infectious waste, asbestos-contaminated material, and polychlorinated biphenyls (PCBs), and for the temporary placement of transuranic (TRU) waste. The disposal areas were excavated, filled, and covered sequentially beginning with the east end of the mesa, and progressing westward over time.

Most of the remaining pits, shafts, and trenches at Area G are subject to corrective action under the Consent Order as part of MDA G, including Consolidated Unit 54-013(b)-99, which c of

SWMUs 54-013(b), 54-014(b, c, and d), 54-015(k), 54-017, 54-018, 54-019, and 54-020. These and other radioactive waste disposal units are also regulated by DOE Order 435.1.

- Thirty-one additional disposal pits were constructed and filled at Area G. Typically, after a pit was filled, it was covered with approximately three ft of consolidated crushed tuff and a nominal four inches of topsoil. Native grasses were seeded in the topsoil. Until 1996, the pits were only filled with waste to within approximately three ft of the spill point. As a result, the cap thickness over most of the pits may exceed the thickness of the 3-ft cover. Most of these pits are currently included in MDA G as part of Consolidated Unit 54-013(b)-99.
- The disposal shafts at Area G are typically three to six ft in diameter and up to 65 ft deep. There are a total of 291 shafts situated at Area G, of which 64 shafts are located in a large group immediately west of Pits 2 and 4. The shafts were lined or unlined, depending on the type of waste they contain. Typically, after a shaft was filled with waste to within three ft of the ground surface, or it was determined that a shaft would no longer receive waste, it was backfilled with crushed tuff and plugged with approximately 3 ft of concrete, slightly rounded at the surface to form a dome. These make up the rest of the shaft field that includes Shaft 124. These shafts are also included in MDA G as part of Consolidated Unit 54-013(b)-99.
- The four trenches at MDA G (identified as Trenches A, B, C, and D) vary in size from approximately 60 to 260 ft long, 13 ft wide, and 6 to 8 ft deep. They were used for retrievable placement of TRU waste. The wastes placed in the trenches were contained in 30-gallon drums inside concrete casks. Like the pits, after a trench was filled, it was covered with approximately three ft of consolidated crushed tuff and a nominal four inches of topsoil. Native grasses were seeded in the topsoil. These trenches became inactive prior to November 19, 1980, and therefore will be subject to corrective action at MDA G as part of Consolidated Unit 54-013(b)-99. The TRU wastes in Trenches A-D may be retrieved prior to closure of Area G.

Temporary structures and materials have been placed over many of the older disposal sites making up MDA G to support ongoing waste management activities. Domes, buildings, and sheds used for on-going mixed waste management activities are regulated either as operating units under the 2010 LANL Permit, or under the interim status requirements of 40 CFR Part 265. These operating units are subject to RCRA closure requirements, and will need to be closed before or during the remediation of MDA G under the corrective action program and the Consent Order.

2.5 Site Investigation Activities at Area G

For the last several decades, MDA G has been the subject of numerous site investigations and other studies, as well as ongoing monitoring of various media including air, water, biota, and pore gases. The first comprehensive investigation was conducted in 1985, pursuant to a Compliance Order from the New Mexico Environmental Improvement Division (NMEID), now the NMED. A Phase I RCRA facility investigation (RFI) was conducted at MDA G between

1993 and 1995. An additional site investigation was completed in 2007, pursuant to the Consent Order. These investigations are summarized in the approved investigation report (LANL 2005); the addendum to the investigation report (LANL 2007); and the 2010 corrective measures evaluation report (revision 2; LANL, 2010). These studies, summarized in Appendix A, have provided a comprehensive look at the potential releases of hazardous wastes and hazardous constituents from the subsurface disposal units at Area G. Together, they confirm that there have been sub-surface releases of organic and inorganic chemicals in numerous locations in the tuff beneath Area G, as follows.

- Subsurface VOC vapor plumes are spread in soil vapor in the vadose zone. The sources of VOC vapors from MDA G are thought to be the wastes disposed in the pits and shafts at the site, with VOCs being a component of the waste rather than a primary waste form. The VOC vapor plumes differ across the site in terms of the constituents and concentrations of VOCs. There appear to be three commingling plumes: an eastern plume near Pits 1 through 5, a central plume near Pit 6, and a western plume near Pits 29 and 33. Surface-flux measurements have shown releases of contaminants to the surface across the site, with the greatest fluxes measured at the eastern side of Area G. Additionally, in the most recent pore gas Periodic Monitoring Report, submitted to NMED on February 22, 2011, tritium and VOC vapors were detected in well 54-01107, which is located in the same general area as the two shafts.
- Inorganic chemicals were also detected in core samples collected beneath and adjacent to the base of disposal pits and shafts at Area G during the Phase I RFI and the 2005 site investigation.

The nature and extent of these releases has been well characterized, and includes evidence of contamination in the same general area as The TA-54 storage shafts. However, there is no definitive means (e.g., via chemical signature, etc.) to correlate specific releases from MDA G with specific sources. Thus, despite the evidence supporting clean closure presented in Section 5.1 below, LANL believes it would be impossible to demonstrate to the satisfaction of NMED the complete decontamination of the TA-54 storage shafts through sampling and analysis.

3.0 ESTIMATE OF MAXIMUM WASTE INVENTORY

The maximum inventory of waste managed in The TA-54 storage shafts consisted of one 30-gal. drum each (i.e., two 30-gal. drums in total). They were considered mixed low-level wastes because of the presence of a hazardous waste plus tritium contamination. The wastes were solid (with no liquids present).

4.0 GENERAL CLOSURE INFORMATION

This closure plan addresses the requirements in 40 CFR §§265.111 through 265.115 to complete closure of the TA-54 storage shafts. Because of LANL's previous efforts to close these shafts in 1999, the overall closure effort for these shafts consists of two major phases:

- The actions taken to date in attempting to achieve clean closure, which are reviewed in Section 5.1 of this plan. These activities included removal of wastes and associated equipment from the shafts; administrative record confirmation; sampling for detectable radioactivity; and visual examinations to confirm that hazardous waste contamination of the shafts did not occur. These previous actions were reported in the 1999 closure plan.
- The planned actions to complete closure, as discussed in Sections 5.2 through 7.0 of this plan.

4.1 Closure Performance Standard

As stated previously, LANL originally intended to "clean close" the TA-54 storage shafts in accordance with 40 CFR Part 265, Subpart G. Clean closure of the TA-54 storage shafts would have to meet the following performance standards:

a) Minimize the need for further maintenance, and
b) Control, minimize or eliminate, to the extent necessary to protect human health and the environment, post-closure escape of hazardous waste, hazardous constituents, leachate, contaminated run-off, or hazardous waste decomposition products to the ground or surface waters or to the atmosphere, and
c) Comply with the closure requirements applicable to container storage units.

LANL believed it had achieved the clean closure standards above in 1999. On that basis, LANL submitted the 1999 closure plan to NMED. However, because of the subsurface contamination discussed in Section 2.5 of this plan, LANL believes that it cannot demonstrate to NMED’s satisfaction that it has achieved the clean closure standards in (a) and (b) above. When clean closure cannot be demonstrated, 40 CFR Part 265, Subpart G allows for the final closure procedure for storage units meet the applicable closure and post-closure requirements for landfills in 40 CFR §265.310. These include removing or solidifying liquid wastes, if any, and stabilizing any remaining wastes to a bearing capacity sufficient to support a final cover. This cover (or other alternative) will:

- Provide long-term minimization of migration of liquids through the closed landfill;
- Function with minimum maintenance;
- Promote drainage and minimize erosion or abrasion of the cover;
- Accommodate settling and subsidence so that the cover's integrity is maintained; and
- Have a permeability less than or equal to the permeability of any bottom liner system or natural subsoils present.

In addition, after final closure, LANL will have to comply with all post-closure requirements contained in §§265.117 through 265.120, including maintenance and monitoring throughout the post-closure care period.

4.2 Petition for Alternative Closure Requirements

Both 40 CFR §265.110(d) and Permit Section 9.2.2.2 provide opportunities for LANL to petition the Department for alternative closure requirements. The remaining sections of this closure plan represent LANL's petition to the Department for alternative closure requirements for the TA-54 storage shafts (145 and 146). The justification for this petition is based on the criteria in 40 CFR §265.110(d) and Permit Section 9.2.2.2, as follows.

- Documented releases from SWMUs at Area G have occurred that are co-located and in close proximity to land disposal units and the TA-54 storage shafts (145 and 146). Due to the resulting subsurface contamination, LANL believes that it will be unable to correlate specific releases at MDA G to specific sources, and thus it cannot demonstrate attainment of the clean closure standards for the TA-54 storage shafts to the NMED's satisfaction.
- The alternative requirements under the Consent Order will protect human health and satisfy the closure performance standards of §§ 264.111(a) and (b). The remedy for MDA G, when it is approved by NMED under the Consent Order, must comply with the closure performance standards at 40 CFR §264.111. Although LANL anticipates recommending an evapotranspiration (ET) cover remedy for MDA G, as presented in the November 2010 MDA G Corrective Measures Evaluation (CME) report (currently under revision), NMED shall select the final remedy for MDA G. Therefore, all remaining actions to complete closure of the TA-54 storage shafts in compliance with 40 CFR §264.111 will be incorporated into the NMED-selected remedy, and the details of implementation will be specified in the subsequent MDA G Corrective Measures Implementation (CMI) plan.

For these reasons, LANL proposes to complete closure of this unit as a landfill by incorporating the remaining closure activities for the shafts into the overall corrective action process for TA-54 under the Consent Order. Following submittal of this closure plan, LANL will give notice by e-mail to persons on the e-mail notification list that it has petitioned the Department for alternative closure requirements for the TA-54 storage shafts.

4.3 Closure Schedule

This closure schedule is intended to provide for integration of the remaining closure activities for the TA-54 storage shafts into the plan and schedule for completion of MDA G corrective actions under the Consent Order. The closure activities performed to date will be described in Section 5.1. This section proposes a conceptual 0+ schedule for the remaining closure activities for the TA-54 storage shafts.

The Consent Order currently requires completion of remediation at MDA G by December 2015. The RCRA unit described in this closure plan, and the other RCRA units co-located with MDA G, need to be closed prior to or during the remediation activities at MDA G. Therefore, completion of closure for the TA-54 storage shafts is currently anticipated to occur in 2015.

LANL plans to initiate the RCRA closure process for the TA-54 storage shafts in accordance with 40 CFR §265.112(d). In the event that closure activities cannot begin within 90 days after approval of this closure plan, LANL will notify the Secretary of the NMED in accordance with the extension requirements in 40 CFR §265.113(a).

The conceptual schedule in Table 1 below reflects the required coordination of closure activities with the corrective action process for MDA G in the Consent Order, assuming NMED will select LANL's preferred remedy for MDA G (LANL's preferred remedy will be proposed to NMED in the MDA G Corrective Measures Evaluation (CME) Report). If not, this plan and schedule will need to be revised and integrated into the remedy that is selected by NMED.

Per the Consent Order, a schedule for implementation of LANL's preferred remedy will be proposed in the MDA G CME Report. It will address planning, design, and construction of an ET cover; operation of an SVE system; and installation and testing of long-term monitoring systems. However, this proposed schedule will be revised in LANL's CMI plan to reflect NMED's selected remedy. It will identify the duration of corrective action operations, the frequency of monitoring and sampling activities, and the dates for submitting inspection and monitoring reports to the NMED, including any status reports and preliminary data.

Closure of the TA-54 storage shafts will be deemed complete when closure has been certified by an independent, professional engineer licensed in the State of New Mexico, and closure certification has been submitted to and approved by NMED as part of the Remedy Completion Report required by the Consent Order.

Table 1
Schedule for Closure of Shafts 145-146 at TA-54

TA 54 Storage Shafts Closure Activity	MDA G Corrective Measures (CMI) Activity	Approximate time frame
PRE-CLOSURE ACTIVITIES		**1999**
• Final receipt of waste		
• Remove waste		
• Remove equipment		
• Perform verification surveys		
• Perform visual verification sampling		
• Submit clean closure plan		
Submit revised (landfill) closure plan/ petition for alternative closure requirements (*this plan)*		**June 2011** (180 days after permit effective)
NMED review/approval		
		August 2011
Notify NMED of intent to close	Submit revised MDA G CME Report	
Initiate Shafts 145 and 146 RCRA storage unit closure process		**September 2011** (270 days after permit effective)
	NMED review/approval	
	Submit MDA G CMI Plan and schedule	Within 90 days after NMED selects remedy *(NOTE: all subsequent dates depend on the date of NMED approval of the CMI Plan, and are subject to revision based on the approved CMI schedule)*
Conduct records review and structural assessment	NMED review/approval	
	Complete detailed CMI design	
	Site mobilization and readiness reviews	
	PREPARE SITE FOR ET COVER	
	• Complete clean closures of the Area G RCRA surface storage units	
	• Prepare MDA G RCRA land disposal units for closure in place (i.e., prepare units to provide structural support to MDA G sub-base and ET cover)	
	• Remove, decontaminate, and dispose of other (non-RCRA-unit) remaining equipment and structures	
	• Site grading	
	• Sub-base preparation	
Decontamination and Removal of Structures and Related Equipment (Shafts 145 and 146 operational caps)		
Backfill empty shafts with clean crushed tuff to provide structural support to MDA G sub-base and ET cover		
	PLACE ET COVER	
	• Sub-base placement	
	• Topsoil placement	
	• Gravel (Drainage Collection) Layer placement	
	• Erosion / Freeze Protection Layer placement (cover soil, topsoil)	24 mos. after CMI plan approval
	Finalize stormwater controls	
	Install/ test soil vapor extraction (SVE) system	
	Install/ test monitoring systems	
	Seed and establish vegetative cover	36 mos. after CMI plan approval
	Perform verification sampling and analysis	
Manage closure-generated wastes	Manage CMI-generated wastes	
Certify closure	**Certify CMI completion**	**December 2015**
Prepare closure certification	Prepare Remedy Completion Report (will contain Shafts 145 and 146 closure certification)	
Complete/ submit closure certification	Submit Remedy Completion Report (will contain Shafts 145 and 146 closure certification)	
NMED review/approval	NMED review/approval	
Initiate RCRA post-closure activities	**Initiate long-term maintenance and surveillance activities**	

4.4 Closure Plan; Amendment of Plan

As discussed above, under alternative closure requirements, this closure plan assumes NMED will select LANL's preferred remedy for MDA G; if not, this plan will be revised to reflect integration with the remedy selected by NMED. Likewise, since the specific schedule for completion of closure depends on the approved CMI schedule, this closure schedule will be revised and resubmitted for NMED approval following NMED's approval of the schedule in the CMI plan.

In the event that closure of the unit cannot proceed according to the approved schedule, the Permittees will notify the Department in accordance with 40 CFR §265.113(b). In addition, the demonstrations in 40 CFR §265.113(a)(1) and (b)(1) will be made in accordance with 40 CFR §265.113(c).

5.0 CLOSURE PROCEDURES

This section describes the steps already taken (i.e., pre-closure activities), as well as remaining actions proposed by LANL, to ensure that the TA-54 storage shafts will be closed in accordance with 40 CFR Part 265, Subpart G. The 1999 closure effort found no evidence of leaks from the drums during the storage demonstration, and reviews suggested that contamination of the shafts from waste management activities is unlikely.

Remaining activities to complete closure of this unit are presented in Section 5.2 and subsequent sections of this plan.

5.1 Pre-Closure Activities

LANL's previous efforts to clean-close these shafts, as reported in its November 1999 closure plan, were as follows.

1. Removal and disposal of waste and related equipment.
    - Pursuant to 40 CFR §265.112(e), hazardous waste may be removed in accordance with an approved closure plan at any time before or after notification of closure. The two waste containers used in the demonstration were removed in 1991 immediately after the completion of the demonstration. No RCRA-regulated or non-RCRA-regulated waste has been stored in either shaft since that time.
    - Pursuant to 40 CFR §265.112(e), equipment may be decontaminated or dismantled in accordance with an approved closure plan at any time before or after notification of closure. The drum handling equipment (i.e., ropes) used in the demonstration was also removed from the storage shafts in 1991.
2. Evidence of No Contamination - Design

The design of the storage shafts prevented contamination to the shafts and the surrounding areas.

- Their overall design diverts runoff away from the shafts.
- The shaft covers prevented storm water seepage into the shafts, precluding migration of tritium or hazardous constituents out of the drums (See Section 2.2).

3. Evidence of No Contamination - Operation

The waste management procedures followed during the storage demonstration also prevented contamination to the shafts and the surrounding areas, as follows:

- The drums did not contain any liquid waste.
- The drums were stored for a short period of time.
- The waste drum lids were closed and sealed with asphalt.
- The drums were not opened while in the vicinity of the storage shafts.
- The drums were suspended using nylon ropes, and did not come in contact with the sides of the storage shafts.
- The RCRA permit contingency plan was never implemented during the units' active life.

4. Evidence of No Contamination – Inspections and Sampling

- The storage shafts were inspected weekly during the units' active life.
- The inspection records reported no signs of leaks or waste releases.
- When the two drums were removed from the shafts (at the end of the storage demonstration), visual inspection confirmed there had been no leaks or waste releases.
- The TA-54 storage shafts have been regularly surveyed for radiological contamination. All surveys have confirmed that that no radioactivity was released and no radiological contamination is present in or around either storage shaft. Based on the concept of co-detection (discussed in Appendix B), LANL believes that since there was no radiological contamination found in or around either storage shaft, then likewise, hazardous waste constituents from the previously stored containers did not contaminate the storage shafts.
- Following the 1999 radiological surveys, a video camera was used to scan the interior of the shafts. It was confirmed that the shafts' walls and bottoms are in good condition and no debris is present. A videotape copy was provided to NMED in 1999 with the November 1999 closure plan.

The administrative record demonstrated that the storage shafts did not become contaminated; the radiological surveys confirmed that no radiological contamination is present in either storage shaft; and video examination confirmed that no debris is present. Thus, as presented in the 1999 closure plan, LANL believed that the storage shafts could be clean-closed without the need for further RCRA maintenance.

However, since LANL believes that it will be unable to demonstrate attainment of the clean closure standards for the TA-54 storage shafts to NMED's satisfaction, LANL proposes to complete closure of this unit as presented in the following sections.

5.2 Records Review and Structural Assessment

As part of the CMI design, the TA-54 storage shafts' operating and inspection records will be reviewed for any previous finding(s) or action(s) that might influence the closure activities, and a structural assessment of the unit's physical condition will be conducted. This will be done to assemble the information necessary for preparing the shafts to support the Area G final ET cover.

5.3 CMI Design, Readiness Reviews, Mobilization

As discussed in Section 4.1 of this closure plan, closure of this unit as a landfill will require the use of a final cover, unless an alternative corrective measure for MDA G is approved by NMED.

Any cover installed as part of a corrective action must meet the corrective action objectives and cleanup goals of the Consent Order. If LANL's preferred remedy is selected, the following measures would be taken to establish an ET cover, although final design details are subject to change as additional information becomes available through the CMI design process and the Consent Order. These might include the potential for the development of a large integrated cover for Area G, or a cover whose depth varies across the site based upon design considerations for each covered RCRA unit being incorporated into the overall MDA G remedy.

The results of the records review and structural assessment for the shafts will be incorporated into the final detailed design, which must be prepared following NMED's selection of the corrective measure and approval of a CMI plan to implement it. Upon NMED approval, site mobilization activities and readiness reviews will commence.

5.4 Preparation of MDA G for the ET Cover

Initial steps to prepare MDA G will include completing clean closures of the Area G RCRA surface storage units and preparing the Area G RCRA land disposal units for closure in place (i.e., preparing the units to provide structural support to the MDA G sub-base and ET cover). In addition, during this phase, LANL will remove, decontaminate, and dispose of other (non-RCRA-unit) remaining equipment and surface structures at Area G.

LANL's preferred remedy requires a sub-base layer to provide water storage, minimize infiltration, and support the upper layers of the ET cover. The sub-base layer would consist of several feet of clean crushed tuff with amendments, placed over the prepared site surface as well as all storage or disposal units that will be closed in place (including The TA-54 storage shafts). The total depth of this layer may be adjusted on a site specific basis depending upon the depth of the existing cover over the waste layers in the disposal units. The sub-base layer will be applied in lifts and compacted.

Site grading will be performed to prepare the surface for placement of this sub-base layer. During this phase, sub-base preparation will include the following closure activities for The TA-54 storage shafts.

5.4.1 Decontamination and Removal of Structures and Related Equipment

In accordance with 40 CFR § 265.112(b)(4), the unit's operating covers will be removed and managed according to Section 7.0 of this closure plan. Based on the structural assessment and records review, further decontamination of structures and related equipment is not anticipated to be necessary. All removed items will be considered solid and potentially hazardous waste when removed, and will be disposed of in accordance with Section 7.0.

5.4.2 Backfilling Shafts 145 and 146

The Shaft 145 and 146 structures (CMP liners and bottoms) are expected to be left in place at completion of unit closure. Backfilling the empty shafts with clean crushed tuff will allow them to act as structural supports to the MDA G sub-base and ET cover. Specific details of this support will be determined during the corrective measure design process.

5.5 Placement of the ET Cover

Topsoil will be placed to a depth of between 6 and 8 inches, and a gravel layer may be placed over the topsoil to a total combined depth of approximately 1.5 feet. Additional layers of material may be added for drainage or biotic barriers, if determined appropriate for the site conditions or as decided upon during the corrective action design review process. These may include a gravel (drainage collection) layer and/or an erosion/ freeze protection layer (consisting of cover soil or topsoil).

5.6 Activities to Complete the ET Cover

The surface of the cover will be seeded with a native mix, including grasses and forbs. Fertilizer will be used on the seeded area to eliminate deficiencies in topsoil, and the seeded area will be stabilized. A temporary watering system will be provided and maintained until adequate vegetative growth has been established (possibly requiring up to 12 months).

A soil vapor extraction (SVE) system will be installed and tested during this phase. Storm water run-on and runoff controls will be installed as part of the cover. The controls will be designed to reduce storm water run-on to the cover, and convey storm water runoff away from the cover and towards the storm water monitoring station(s) operating at Area G.

Finally, verification sampling and analysis will be conducted during this phase of the CMI, to confirm that both the MDA G corrective measure objectives and the closure performance standards for the RCRA units (including the TA-54 storage shafts) have been achieved. Verification sampling will be conducted in accordance with the approved CMI Plan and the long-term monitoring and maintenance plan (which will be based on the approved CMI Plan).

5.7 Closure Waste Management

Wastes generated during the closure may include any asphalt or fill removed from the site surface; shaft liners and underlying and surrounding contaminated soil (if removed); waste material removed from in or around the shafts (if any); sampling wastes; and contaminated equipment or PPE used during the closure. A list of potential wastes and disposition options is included in Table 3 of this closure plan.

5.8 Decontamination Waste Management

Reusable protective clothing, tools, and equipment used during decontamination activities will be cleaned with a wash water solution. After any decontamination wash down process needed for the closing unit, used wash water will be collected, transferred to containers, sampled, and analyzed for the hazardous constituents likely to be present. Results of this analysis will determine if the used wash water should be managed as hazardous or non-hazardous wastewater.

Residue, disposable equipment, waste cleaning solutions, and any reusable equipment that cannot be decontaminated will be containerized and managed as waste in accordance with Section 7.0. The wastewater, PPE, and any other waste generated as a result of closure will be managed as indicated in Table 3 of this closure plan.

6.0 SAMPLING AND ANALYSIS PLAN (SAP)

SAP requirements will be identified in the long-term monitoring and maintenance plan that will be prepared as part of the MDA G CMI. It will identify the specific monitoring, sampling, and analyses to be performed in order to verify that all corrective action requirements for MDA G in the Consent Order have been met. This plan will incorporate additional sampling and analyses needed (if any) in order to verify that all 40 CFR Part 265 Subpart G closure requirements for the TA-54 storage shafts have been met during the CMI. The long-term monitoring and maintenance plan will also describe the quality assurance/ quality control methods to be used to demonstrate achievement of the closure performance standards given in Section 4.1 of this closure plan.

7.0 WASTE MANAGEMENT

By removing any hazardous waste, or equipment and materials contaminated with hazardous waste constituents during closure, LANL may generate hazardous or mixed waste. LANL will control, handle, characterize, and dispose of all wastes generated during closure activities in accordance with this Section (7.0), 40 CFR § 265.114, LANL waste management procedures, and Consent Order requirements. These wastes may include, but are not limited to:

1. debris;
2. contaminated equipment, structures, and materials;
3. containerized sampling waste;
4. decontamination wash water; and
5. decontamination waste.

The different types of wastes that may be generated during closure and their disposition options are summarized in Table 3 of this closure plan.

8.0 CLOSURE CERTIFICATION REPORT

LANL will submit a closure certification to document closure of the unit in compliance with its closure plan. LANL will report all activities conducted during closure including, but not limited to the results of all investigations; closure-related waste management; decontamination; decontamination verification and sampling activities; and results of all chemical analyses and other characterization activities.

As part of the Remedy Completion Report for the MDA G CMI, LANL will include a separate closure certification for the TA-54 storage shafts. The TA-54 storage shafts closure certification will be signed by LANL and by an independent professional engineer registered in the State of New Mexico (*see* 40 CFR § 265.115).

The MDA G Remedy Completion Report will be written to include the following RCRA closure information specific to the TA-54 storage shafts:

1. a copy of the certification pursuant to 40 CFR § 265.115;
2. any variance, and the reason for the variance, from the RCRA closure activities in the approved CMI Plan;
3. documentation of the records review and structural assessment conducted;
4. a summary of any closure-related sampling results, showing:

a. sample identification;
b. sampling location;
c. data reported;
d. detection limit for each analyte;
e. a measure of analytical precision (*e.g.*, uncertainty, range, variance);
f. identification of analytical procedure;
g. identification of analytical laboratory;

5. a QA/QC statement on analytical data validation and decontamination verification;
6. the location of the file of supporting documentation, including:
   a. field logbooks;
   b. laboratory sample analysis reports;
   c. QA/QC documentation; and
   d. chain-of-custody forms;
7. storage or disposal location of hazardous waste resulting from closure activities;
8. a copy of any unit-specific Human Health and Ecological Risk Assessment, if one is conducted pursuant to Section 11.5 of the Permit; and
9. a certification statement attesting to the accuracy of the report.

Since LANL will leave waste in place as part of the MDA G selected remedy, LANL will submit to NMED a survey plat as required by 40 CFR § 265.116 in conjunction with the closure certification in the MDA G Remedy Completion Report.

9.0 GENERAL POST-CLOSURE INFORMATION

Because Area G RCRA units closed with waste in place are subject to the requirements of 40 CFR Part 265, Subpart G, the long-term monitoring and maintenance plan prepared as part of the MDA G CMI must address these requirements for the TA 54 storage shafts, as appropriate .

9.1 Post-Closure Performance Standard

Post-closure of the TA 54 storage shafts will meet the following performance standards (if LANL's proposed remedy is selected):

- Provide long term minimization of migration of liquids through the closed MDA;
- Function with minimum maintenance;
- Promote drainage and minimize erosion or abrasion of the cover;
- Accommodate settling and subsidence so that the cover's integrity is maintained; and
- Have a permeability less than or equal to the permeability of any bottom liner system or natural subsoils present unless an alternative with equivalent performance to this condition is determined to be appropriate for the final remediation option chosen for the project.

Following remedy completion for MDA G, the measures by which LANL will confirm its attainment of applicable 40 CFR §265.310(b) requirements (if any) for the TA 54 storage shafts are presented in Section 10 of this closure plan.

9.2 Post-Closure Care Requirements

For any LANL units subject to 40 CFR §265.117(a)(1), post-closure care will begin upon completion of the selected remedy, as part of long-term monitoring and maintenance of the remedy, and will continue for 30 years. The Secretary of the NMED may shorten the post-closure care period at any time during the post-closure period if all disposal units at the facility have been closed, and it is determined that a reduced period is sufficient to protect human health and the environment, in accordance with 40 CFR §265.117(a)(2)(i). Alternatively, the Secretary of the NMED may extend the post-closure care period if it is determined that the extended period is necessary to protect human health and the environment, in accordance with 40 CFR §265.117(a)(2)(ii).

For any LANL units subject to 40 CFR §265.117(a)(1)(i) and (ii), post-closure care must include maintenance, monitoring, and reporting as appropriate, in accordance with the requirements of 40 CFR Part 264, Subpart F and 40 CFR §265.310. Rather than submitting a separate post-closure care plan, the long-term monitoring and maintenance plan prepared as part of the MDA G CMI will address these requirements for the TA 54 storage shafts, if applicable.

9.3 Amendment of the Post-Closure Care Plan

For any LANL units subject to 40 CFR §265.118(d)(1) and (d)(2), LANL may submit a written notification of or request a permit modification to authorize a change in an approved post-closure plan at any time during the active life of the facility or during the post-closure care period whenever:

- There are changes in operating plans or facility design that affect the approved post-closure plan
- There is a change in the expected year of final closure, if applicable
- Events occur during the active life of the facility, including partial and final closures, that affect the approved post-closure plan
- LANL requests the Secretary of the NMED to apply alternative requirements (e.g., if corrective action necessitates changes to the closure configuration or the post-closure care requirements) under 40 CFR §264.90(f) and/or §264.110(c).

In this case, since the MDA G long-term monitoring and maintenance plan will include any post-closure concerns specific to the TA 54 storage shafts, any changes that would otherwise trigger a post-closure care plan amendment will be addressed as changes to the MDA G long-term monitoring and maintenance plan. Such changes would be made under the Consent Order review and approval process until the Consent Order is completed, at which time any remaining deliverables and compliance responsibilities would be moved under the Permit.

9.4 Post-Closure Cost Estimate, Financial Assurance, and Liability Requirements

In accordance with 40 CFR §265.140(c), as a federal facility, LANL is exempt from the requirements of 40 CFR Part 265, Subpart H to provide a cost estimate, financial assurance mechanisms, and liability insurance for post-closure actions.

9.5 Post-Closure Certification Report

The MDA G long-term monitoring and maintenance plan will provide that, within 60 days after completion of any post-closure care period applicable to the TA-54 storage shafts, LANL will submit to the Secretary of the NMED, by registered mail, a certification that post-closure care for the TA-54 storage shafts was performed in accordance with the post-closure requirements in the approved long-term monitoring and maintenance plan. The certification must be signed by the appropriate DOE and LANL officials and by an independent, registered professional engineer licensed in the State of New Mexico. Documentation supporting the engineer's certification will be furnished to the Secretary of the NMED upon request, and a copy of the certification and supporting documentation will be maintained by NNSA/LASO. The supporting documentation may include, for example, the following:

- Any significant variance from the approved activities and the reason for the variance
- A summary of all sampling results
- A quality assurance/quality control statement on analytical data validation
- The location of the file of supporting documentation
- Storage or disposal locations of any hazardous or mixed waste resulting from post-closure activities.

9.6 Security

Because of the ongoing nature of waste management operations at TA-54, security and administrative controls for Area G will be under the care of the DOE or another authorized federal agency during the Area G long-term monitoring and maintenance period. The security fence at TA-54 will be maintained during that period to prohibit public access into Area G.

9.7 Survey Plat and Post-Closure Certification Requirements

As stated in Section 8, a survey plat prepared in accordance with 40 CFR §265.116 will be filed with the appropriate authorities along with the certification of closure for The TA-54 storage shafts. Along with the plat, LANL will submit to the County of Los Alamos and other authorized agencies and to the Secretary of the NMED a record of the type, location, and quantity of hazardous wastes disposed of within the unit. For hazardous wastes disposed of before January 12, 1981, if any, LANL will identify the type, location, and quantity of the hazardous wastes to the best of their knowledge and in accordance with any records that have been kept.

For any LANL units subject to 40 CFR §265.117 through §265.120, post-closure notices must be filed with appropriate authorities within 60 days of certification of closure of the first such RCRA unit at LANL, and within 60 days of certification of closure of the last such RCRA unit. To meet that requirement, DOE will file a "Land Use Restriction Notice" or equivalent document with the County of Los Alamos and other authorized agencies.

The "Land Use Restriction Notice" will indicate that the land has been used to manage hazardous wastes and that its use is restricted under 40 CFR Part 265, Subpart G regulations. It will also indicate that the survey plat and record of the type, location, and quantity of hazardous wastes disposed of have been filed with the Secretary of the NMED, the County of Los Alamos, and other authorized agencies. LANL will also submit a certification to NMED, signed by

NNSA and LANL, that they have recorded the notation required in 40 CFR §265.119(b)(1), including a copy of the document in which the notation was placed.

Within 60 days after completion of the post-closure care period for the TA-54 storage shafts established in the Area G long-term monitoring and maintenance plan, LANL will submit to the Secretary of the NMED, via certified mail, a certification of completion of post-closure care in accordance with the requirements of 40 CFR §265.120. Certification of completion of post-closure care is described in Section 10.5.

10.0 POST-CLOSURE MONITORING AND MAINTENANCE

For any LANL units subject to 40 CFR § 265.118(c), the post-closure activities to be conducted during the MDA G CMI will be an integral part of the MDA G corrective action process under the Consent Order. The post-closure activities to address RCRA requirements described below will be included in the Area G long-term monitoring and maintenance plan.

Representative post-closure activities for the TA-54 storage shafts would include monitoring activities consistent with 40 CFR Part 264, Subpart F and 40 CFR §265.310, as appropriate. They would also include maintenance activities consistent with 40 CFR §265.118(c)(2). Specific details of these activities, and the frequencies at which they will be performed for post- closure, will be specified in the Area G long-term monitoring and maintenance plan.

10.1 Monitoring and Frequency

Monitoring of the vadose zone and groundwater will be conducted as appropriate according to in the approved Area G long-term monitoring and maintenance plan, and any characterization and monitoring will be performed under the Consent Order and/or LANL's Groundwater Protection Program.

10.1.1 Vadose Zone

Pore-gas monitoring to determine trends in VOC concentrations will be proposed in the long-term monitoring and maintenance plan. Final long-term monitoring requirements will be determined as part of the Corrective Measures Implementation process based on the remedy selected for MDA G.

10.1.2 Regional Groundwater

40 CFR Part 264, Subpart F groundwater monitoring requirements will be met through the conditions of the Consent Order. The monitoring requirements in the Interim Facility-Wide Groundwater Monitoring Plan (Interim Plan) may be supplemented as necessary in the Area G long-term monitoring and maintenance plan. Upon completion of the Canyon Watershed and Technical Area Investigations required by the Consent Order, the Interim Plan will be replaced by approved watershed-specific long-term groundwater monitoring plans.

The four regional monitoring wells located near MDA G and/or any additional wells that may be installed pursuant to Consent Order investigations will be monitored at a frequency described in the most current annual update of the Interim Plan, in order to support performance evaluations of the disposal facilities at TA-54. The monitoring suite is also described in each annual update.

It generally includes determination of water levels, and chemical analysis of metals and organic compounds.

10.2 Maintenance and Frequency

For any LANL units subject to 40 CFR §264.118(b)(2), the maintenance activities to be proposed in the Area G long-term monitoring and maintenance plan will include inspections at prescribed frequencies and resulting maintenance actions that are consistent with 40 CFR §265.310. Planned maintenance will also maintain the functionality of MDA G monitoring systems, consistent with 40 CFR Part 264, Subpart F and 40 CFR §265.310 requirements.

10.2.1 Integrity of Cover

Should NMED approve an ET cover as part of the final remedy for MDA G, the effectiveness of the cover will be monitored through regular inspections and also through collection of moisture content data from beneath the cover. Specific moisture monitoring requirements will be developed as part of the final cover design.

The ET cover will be maintained during the TA-54 storage shafts post-closure period in order to preserve its integrity and effectiveness, consistent with 40 CFR §265.310(b)(1). Inspections of the cover will be conducted on the schedule in the approved Area G long-term monitoring and maintenance plan. The ET cover will be maintained to prevent run-on and runoff from eroding or otherwise damaging it, and repairs will be made, if necessary, to correct the effects of settling, subsidence, erosion, or other events, consistent with this plan and 40 CFR § 265.310(b)(5).

10.2.2 Monitoring Equipment

The Area G long-term monitoring and maintenance plan will specify that prior to each borehole sampling event, the protective surface casing of each selected borehole will be inspected to ensure that it has not been damaged. Sampling equipment will also be inspected and tested, as necessary, prior to each sampling event. Over time, as the monitoring systems that contain the sampling membranes (e.g., socks) or other equipment within a borehole require replacement, maintenance will be performed as needed. Any moisture monitoring equipment in the cover will be inspected regularly and replaced as necessary.

The groundwater monitoring system, discussed in Section 10.1.2, will also be maintained to ensure maximum operating conditions, consistent with 40 CFR §265.310(b)(3) and the approved Area G long-term monitoring and maintenance plan. Maintenance will be performed on an as-needed basis when the necessity is indicated as a result of inspections.

10.3 Reporting

Post-closure care activities for the TA-54 storage shafts will be reported under the Area G long-term monitoring and maintenance plan. Monitoring results will be reported as provided in the long-term monitoring and maintenance plan and in accordance with Section XI.D, “Periodic Monitoring Report,” of the Consent Order.

10.4 Post-Closure Use of Property

For any LANL units subject to 40 CFR §265.117(c), post-closure uses of property on or in which hazardous waste remains after partial or final closure may not disturb the integrity of the final cover or any other components of the containment system, if present. In addition, any post-closure use of property that disturbs the function of the monitoring systems will not be allowed, unless the Secretary of the NMED finds that the disturbance is necessary to the proposed use of the property and will not increase the potential hazard to human health or the environment, or that the disturbance is necessary to reduce a threat to human health or the environment.

10.5 Post-Closure Care Period Contact

For any LANL units subject to 40 CFR §265.118(c)(3), the name, address, and phone number for contact during the post-closure care period is:

U.S. Department of Energy
National Nuclear Security Administration
Office of Los Alamos Site Operations
528 35th Street
Los Alamos, New Mexico 87544
505-667-5105

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Table 2

Hazardous Waste Constituents of Potential Concern for Shafts 145-146 at TA-54*

Category	EPA Hazardous Waste Numbers	Specific Constituents
Toxic Metals	D004, D005, D006, D007, D008, D009, D010, D011	Arsenic, Barium, Cadmium, Chromium, Lead, Mercury, Selenium, Silver
Semi-volatile Organic Compounds	D030, D036, F004	2,4-Dinitrotoluene, Nitrobenzene
Volatile Organic Compounds	F002, F003, F004, F005	Acetone, Ethanol, Benzene, MEK, Methylene Chloride, Toluene, MIBK, Xylene, Ethyl Acetate, Methanol**
Other constituents of concern		to be determined*

**To be confirmed and updated based on the unit records review (Section 5.2 of this plan).*
***MEK= methyl ethyl ketone; MIBK = 4-methyl-2-pentanone*

Table 3
Potential Waste Materials, Waste Types, and Disposal Options

Potential Waste Materials	Possible Waste Types	Disposal Options
Decontamination waste (such as personal protective equipment (PPE))	Low-level solid waste Non-regulated solid waste	LANL Area G LLW disposal pit, or Subtitle D landfill, as appropriate
	Hazardous waste Mixed low-level waste	The PPE will be treated to meet Land Disposal Restriction (LDR) treatment standards, if necessary, and disposed in a Subtitle C or D landfill, as appropriate.
Decontamination wash water	Low-level liquid waste Non-regulated liquid waste	LANL Radioactive Liquid Waste Treatment Facility (RLW) or sanitary waste collection system, as appropriate.
	Hazardous waste Mixed low-level waste	Waste will be treated to meet LDR treatment standards, if necessary, and disposed in a Subtitle C or D landfill, as appropriate.
Debris	Low-level solid waste Non-regulated solid waste	LANL Area G LLW disposal pit, or Subtitle D landfill, as appropriate
	Hazardous waste Mixed low-level waste	Waste will be treated to meet LDR treatment standards, if necessary, and disposed in a Subtitle C or D landfill, as appropriate.
Contaminated equipment and materials	Low-level solid waste Non-regulated solid waste	LANL Area G LLW disposal pit, or Subtitle D landfill, as appropriate
	Hazardous waste Mixed low-level waste	Waste will be treated to meet LDR treatment standards, if necessary, and disposed in a Subtitle C or D landfill, as appropriate.
Discarded sampling and decontamination equipment	Low-level solid waste Non-regulated solid waste	LANL Area G LLW disposal pit, or Subtitle D landfill, as appropriate
	Hazardous waste Mixed low-level waste	Waste will be treated to meet LDR treatment standards, if necessary, and disposed in a Subtitle C or D landfill, as appropriate.

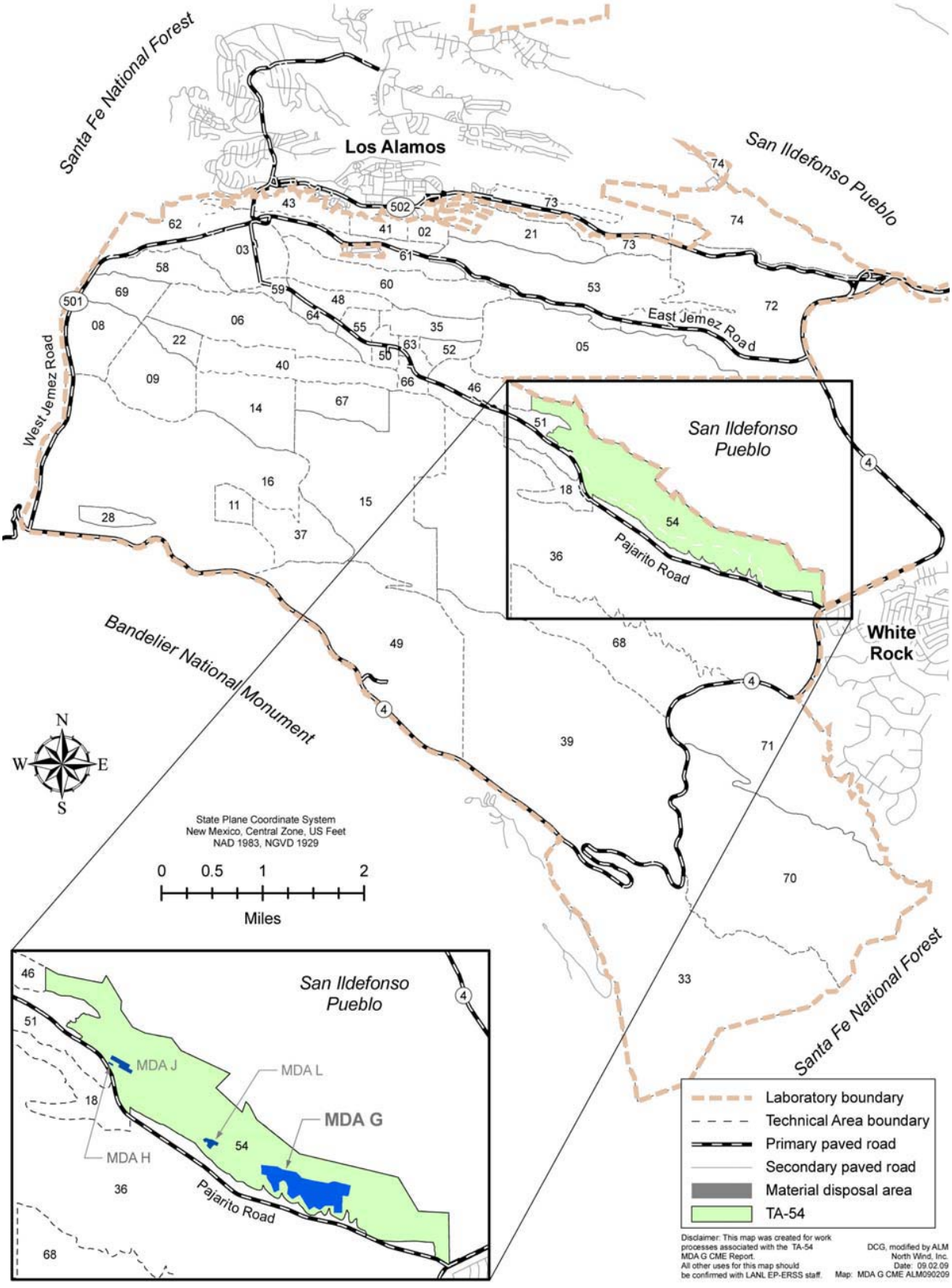

Figure 1 Location of TA-54, Area G in Relation to Other Laboratory TAs

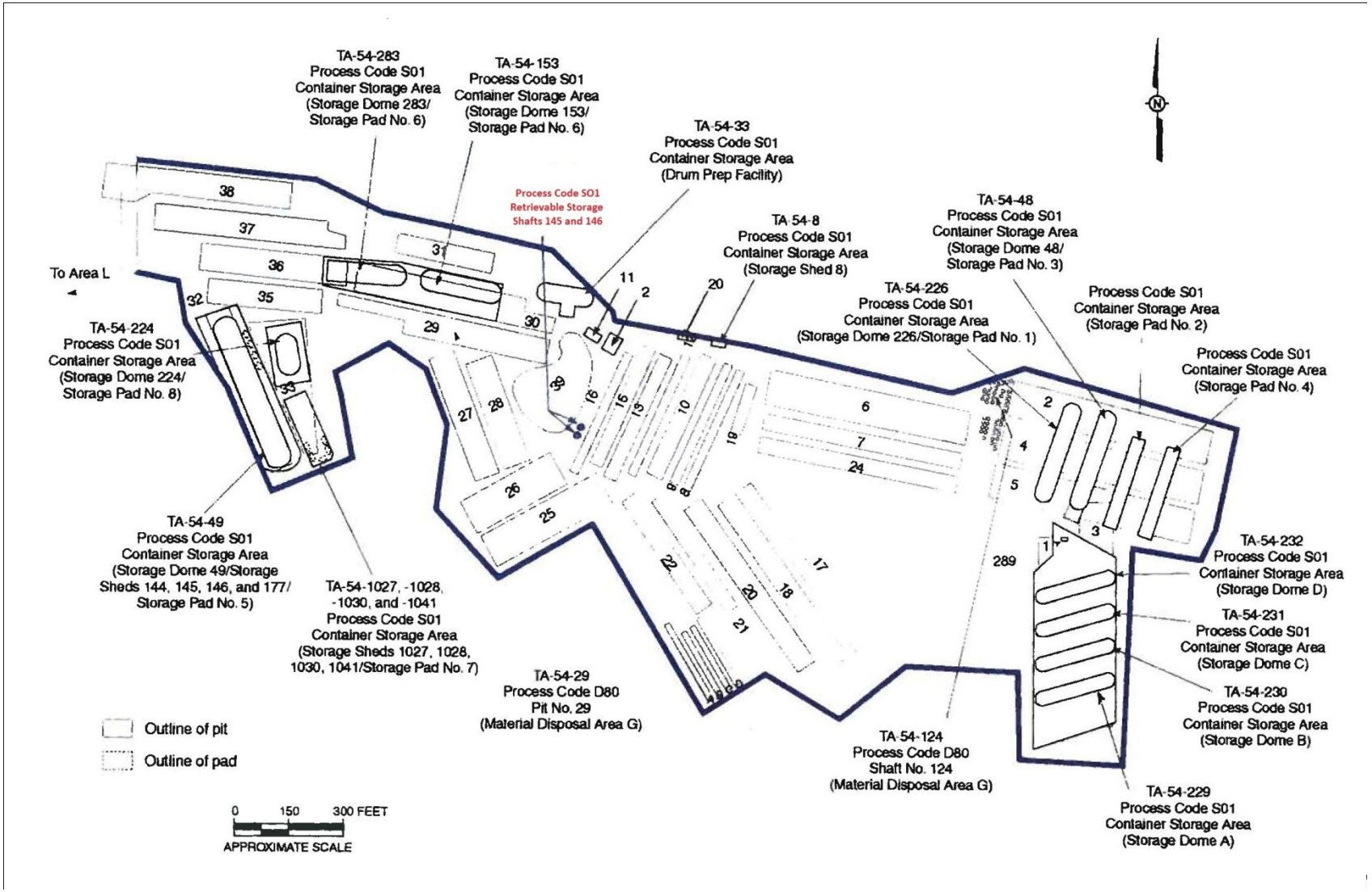

Figure 2. Location and Layout of Shafts 145-146 at TA-54, Area G

Figure 3. Storage Shafts 145 and 146

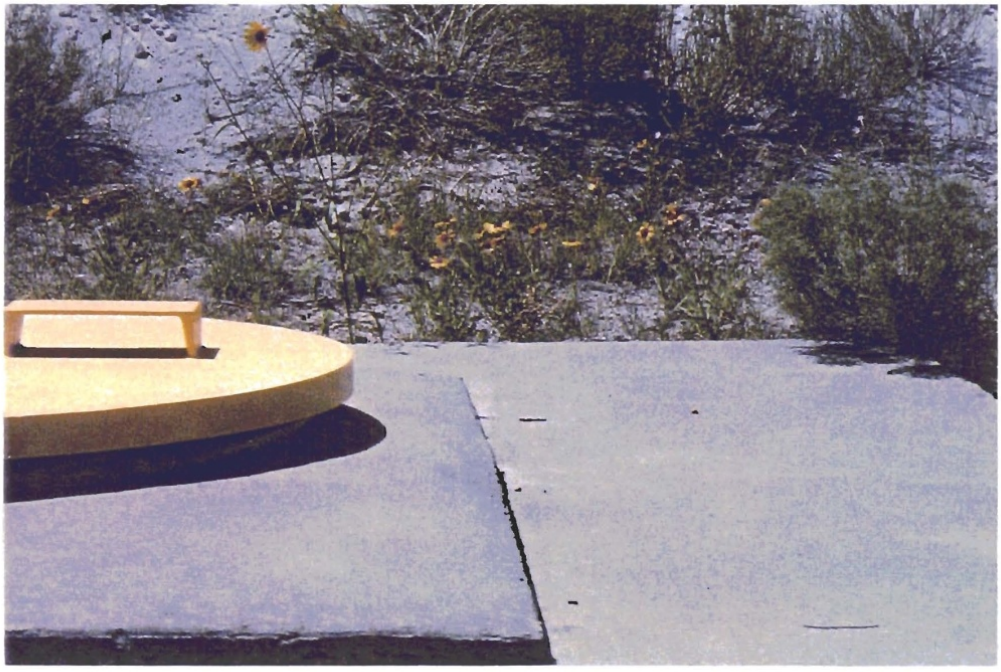

Figure 4. Graded Concrete Collar, Storage Shaft 145

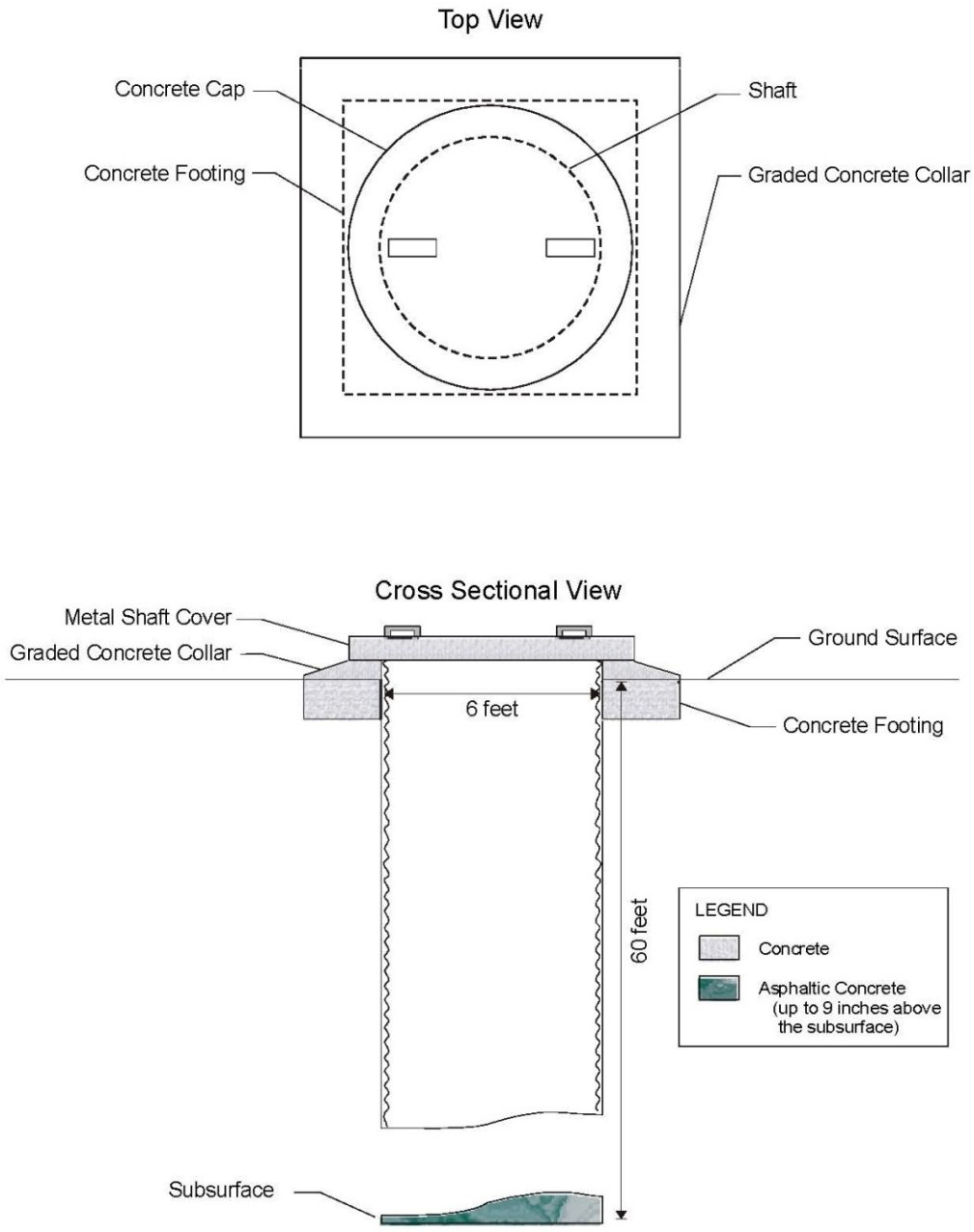

Figure 5. Illustration B Shaft and Cap

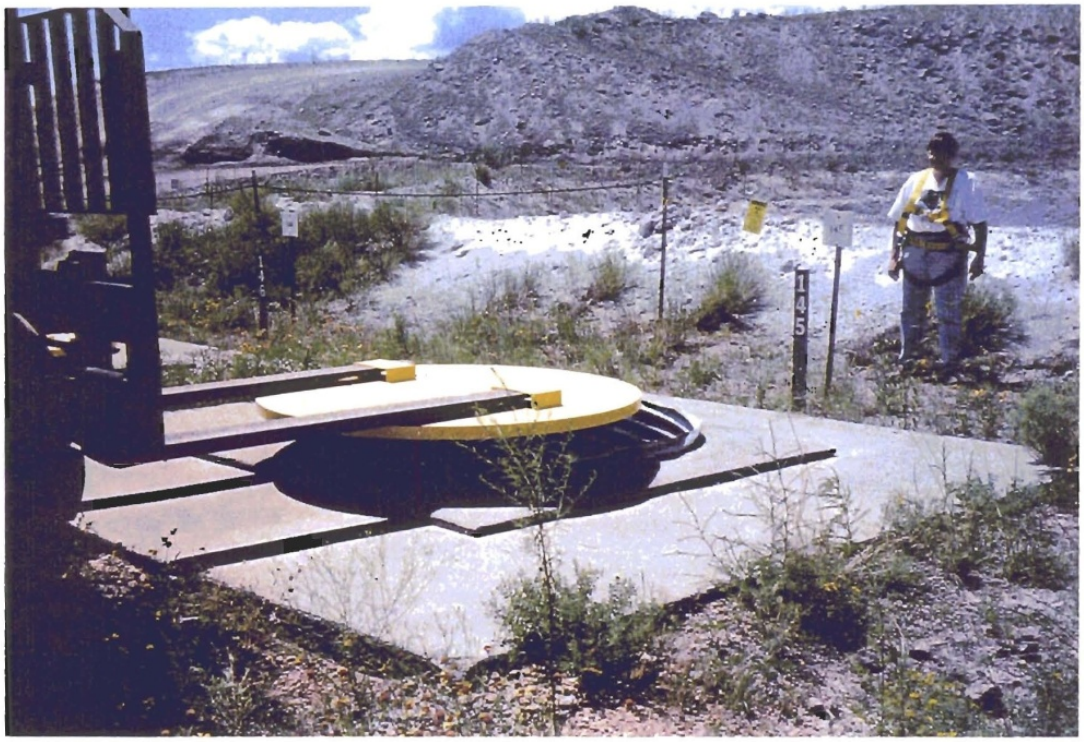

Figure 6. Operational Cap Removed for Inspection, Storage Shaft 145

Figure 7. Visual Exam of Galvanized Steel Conduit, Storage Shaft 145

Figure 8. Surface View with Operational Cap Removed, Storage Shaft 145

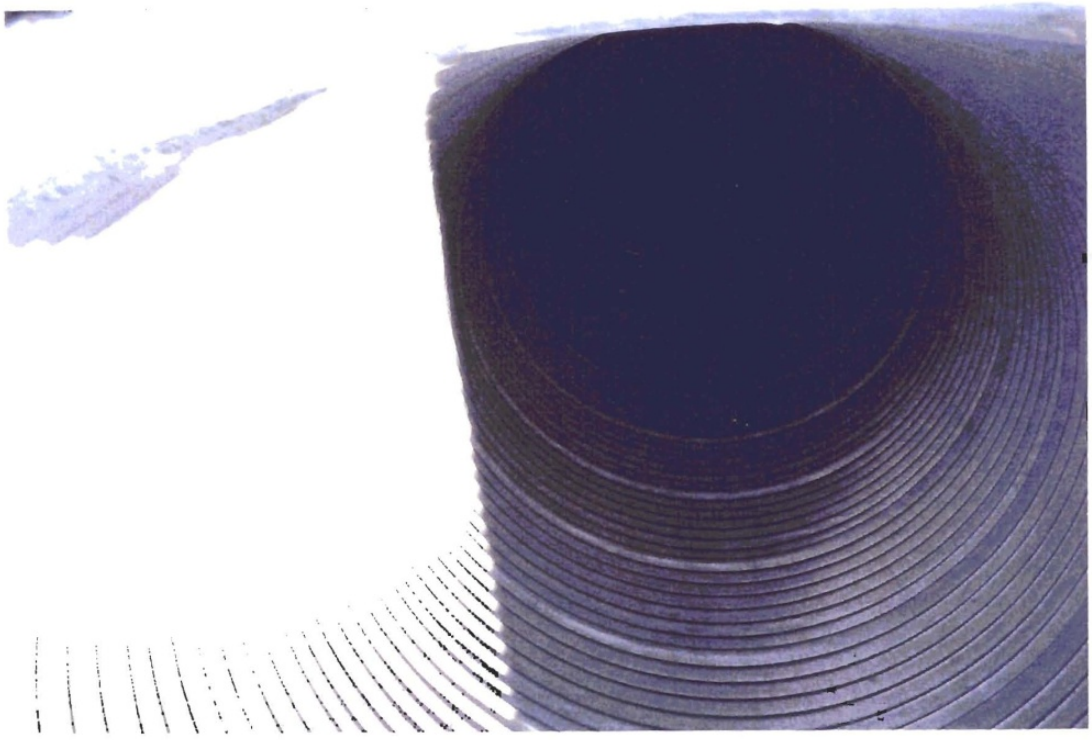

Figure 9. Internal View – Galvanized Steel Conduit, Storage Shaft 145

CERTIFICATION

I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations.

7/13/11

Dennis L. Hjeresen **Date Signed**

Division Director
Environment Protection Division
Los Alamos National Laboratory
Operator

7/18/11

Gene E. Turner **Date Signed**

Environmental Permitting Manager
Environmental Projects Office
Los Alamos Site Office
National Nuclear Security Administration
U.S. Department of Energy
Owner/Operator

APPENDIX A

Summary of Previous Investigations at Area G

APPENDIX A SUMMARY OF PREVIOUS INVESTIGATIONS AT AREA G

For the last several decades, MDA G has been the subject of numerous site investigations and other studies, as well as ongoing monitoring of various media including air, water, biota, and pore gases. The first comprehensive investigation was conducted in 1985 pursuant to a Compliance Order from the New Mexico Environmental Improvement Division (NMEID), now the NMED. A Phase I RCRA facility investigation (RFI) was conducted at MDA G between 1993 and 1995. A Consent Order site investigation was completed in 2007. These investigations are summarized in the following appendix, and in the approved 2005 investigation report and the 2007 addendum to the investigation report. Together, these studies have provided a comprehensive look at the potential releases of hazardous wastes and hazardous constituents from the subsurface disposal units at Area G. The key findings from these studies are summarized below.

The 2007 investigation report addendum reported that the hazardous constituents in the subsurface of MDA G pose no potential unacceptable present-day risk or dose to human health or the environment.

A.1 1985 Physical Investigations

In 1985, the Laboratory received a Compliance Order from NMEID that addressed numerous waste management issues at the Laboratory. An investigation in and around MDA G was performed and focused on six tasks outlined in the 1985 Compliance Order. The results and outcomes of these six tasks were described in a 1987 hydrogeologic assessment of TA-54, Areas G and L (produced by IT Corporation).

A.2 Phase I RFI

In 1993, 1994, and 1995, ambient-air, channel-sediment, surface-flux, and subsurface-core samples were collected at MDA G during a Phase I RFI. In addition, pore-gas samples have been collected since 1985. The results of these previous investigations are summarized in the historical investigation report in the approved 2004 work plan for MDA G. The key findings from these studies are summarized below.

- In channel sediments, cadmium, tritium, plutonium-238, plutonium-239, and americium-241 were detected above background values (BVs). These results indicated that migration of contaminants from Area G via surface flow and sediment transport may have occurred.
- In ambient-air samples, elevated levels of tritium, plutonium-238, plutonium-239, and americium-241 were detected during routine monitoring in 2002. These results showed potential transport of contaminants via air dispersion and wind.
- Surface-flux measurements for vapors were taken at several locations across the mesa top and sides at Area G. Vapor fluxes for tritium and several volatile organic compounds (VOCs) were observed (e.g. 1,1,1-trichloroethane [TCA], trichloroethene [TCE], tetrachloroethene [PCE], and Freon). These results indicated diffusion of subsurface vapors releasing to the atmosphere.
- A total of 125 borehole soil and tuff samples were collected in 19 boreholes over depths of approximately 38.5 ft to 150 ft bgs. Forty-three constituents of potential concern (COPCs), including metals, radionuclides, PCBs, semivolatile organic compounds (SVOCs), and VOCs, were identified from these samples because either detections or detection limits exceeded BVs or

the constituents were detected but had no BVs. Metals had very low frequencies of detection above BVs, suggesting limited mobility in the subsurface. Most radionuclides had very low frequencies of detection (2 or fewer), suggesting limited mobility in the subsurface. Tritium was detected above BV in most samples; Americium-241 and uranium-235 had multiple detections. Detections of PCBs, SVOCs, and VOCs were also infrequent and sporadic. The interpretation of these data indicates limited mobility by liquid-phase transport away from the disposal units.

- Pore-gas monitoring data for MDA G indicate that VOCs and tritium are present in pore gas. Trichloroethane was the dominant VOC detected. Pore-gas data indicate that VOCs and tritium had been released into the tuff beneath the disposal units.

A.3 Summary of Consent Order Investigations

Two investigations were conducted under the Consent Order at MDA G: a 2005 site investigation and a 2007 supplemental investigation.

A.3.1 2005 Site Investigation

Field investigations conducted in 2005 at MDA G under the Consent Order were reported in the 2005 MDA G investigation report. 39 boreholes were drilled in accordance with the approved 2004 MDA G work plan. 37 of the boreholes were drilled and sampled to characterize underlying stratigraphy; 2 of the 39 boreholes were drilled to determine whether perched water was present. Core samples in and adjacent to fractures were collected and analyzed for target analytes. In addition, a risk assessment concluded that surface and subsurface contamination did not pose an unacceptable risk to human health and the environment based on current site use.

The soil and rock sample results indicated a number of inorganic and organic chemicals were detected at trace levels beneath the former disposal units, and were consistent with the results obtained during the Phase I RFI. All inorganic chemicals detected above BVs during the 2005 study were generally less than five times the BV. In addition, all inorganic chemicals detected at levels greater than BVs were in samples from intervals containing clay-filled fractures and were at levels less than the soil BV, which was considered to be a more representative metric for comparison. The interpretation of these results suggests little if any migration of metals and other inorganic chemicals from the disposal units. The only organic chemicals detected in core samples were trace levels of several dioxin and furan congeners.

Pore-gas sampling was also conducted under the 2005 investigation. After drilling activities concluded, pore-gas samples were collected at the depth of the nearest adjacent disposal unit and at total depth (TD). Results confirmed the presence of chlorinated VOCs in the vadose zone beneath MDA G. The dominant subsurface vapor contaminant was TCA. Tritium was also detected in pore gas. The highest tritium concentrations were detected in samples from the eastern and south-central portions of MDA G.

Naturally occurring and anthropogenic radionuclides were confirmed at levels above BVs in soil and rock samples collected beneath MDA G. The anthropogenic radionuclides detected sporadically across the site included americium-241, plutonium-238, plutonium-239, and strontium-90.

Subsurface samples collected to a depth of 700 ft (210 m) beneath the MDA G subsurface units did not identify perched water zones.

A.3.2 2007 Supplemental Site Investigation

Field investigations at MDA G conducted in 2007 under the Consent Order were reported in the addendum to the MDA G investigation report. Four boreholes were extended to define the vertical extent of VOC pore-gas contamination. Validated analytical results collected during pore-gas monitoring of these boreholes confirm the presence of VOCs and tritium in vapor samples. The additional data supported the risk assessment presented in the 2005 investigation report (stating that that the site did not pose a potential unacceptable risk to human health or the environment).

The vertical distribution of VOC and tritium concentrations indicated no current threat of groundwater contamination, but the fiscal year 2007 (FY2007) periodic monitoring report recommended future pore-gas monitoring. The pore-gas sampling data supported the adequacy of the existing subsurface vapor-monitoring network to track contaminants in pore gas.

A.4 Summary of SVE Pilot Studies

NMED requested that LANL conduct pilot tests to determine the effectiveness of SVE to remove VOCs from the vadose zone. Two active in-situ SVE pilot studies were conducted at MDA G to evaluate the effectiveness of SVE technology for remediating the subsurface VOC vapor plumes and to provide design, operational, and cost information for the CME. The first study was conducted during the summer of 2008; the second study was conducted in the spring of 2010.

The 2008 SVE pilot study was conducted adjacent to the disposal shaft field located west of Building 54-0412 and included a shallow active extraction test, a deep active extraction test, and a passive monitoring period. Results of the 2008 SVE pilot study determined that active SVE is a viable technology for removing vapor-phase VOCs from the subsurface at MDA G. Approximately 278 lb (126 kg) of VOCs was removed from the Tshirege Member during the 30-day active shallow-extraction phase of the pilot study, with TCA making up approximately 75% of the recovered VOC mass. Using data collected from the pilot study, a two-dimensional numerical analysis estimated the radii of influence to be approximately 150 ft (45 m) for the shallow-extraction interval and approximately 50 ft (15 m) for the deep-extraction interval.

At the direction of NMED, a supplemental SVE pilot study was conducted at MDA G at the same location used for the 2008 study. The objectives of the supplemental pilot study were (1) to determine the capabilities and optimal design for a full-scale active SVE system at MDA G, and (2) to further demonstrate that active SVE has the potential to be an effective part of the remediation plan for hazardous constituents at MDA G. The 2010 SVE pilot test was designed to target the permeable zones identified in the Tshirege Member of the Bandelier Tuff, the contacts between the stratigraphic units, and any permeable layers in the geologic column. It was also designed to assess whether major stratigraphic units, such as the Cerro Toledo unit and Otowi Member, would act as either a barrier to contaminant migration or an effective extraction interval.

The results of the 2010 SVE pilot test further demonstrated that active SVE has the potential to be an effective remedial technology for removing VOCs from the subsurface at MDA G. Tests indicated a radius of influence large enough for SVE to be implementable and cost-effective at MDA G, depending on the target cleanup levels.

A.5 Status of Pore-Gas Monitoring

Pore-gas monitoring activities have been conducted at MDA G since 1985 to characterize VOC and tritium concentrations present in the vadose zone beneath MDA G. Quarterly pore-gas monitoring began in 1990 after EPA issued Module VIII of the LANL Permit, which included requirements for quarterly pore-gas sampling at MDA G. The Consent Order further required pore-gas monitoring during the site investigations, as well as submittal of a long-term pore-gas monitoring plan. Currently, pore-gas monitoring activities are implemented annually in accordance with the revised long-term vapor-monitoring plan, provided as part of the MDA G CME Plan, and a subsequent table of revised pore-gas monitoring locations approved by NMED.

Pore-gas monitoring activities at MDA G currently include field screening of 121 completed sampling ports in 20 pore-gas monitoring boreholes and 1 open borehole. VOC and tritium samples are collected from 41 sampling ports within each of the 20 completed boreholes and from the open borehole. Pore-gas data before 1996 were not subject to the current quality assurance / quality control procedures. Data collected from 1997 to the present have been subjected to rigorous QA/QC procedures.

Results of long-term pore-gas monitoring activities at MDA G have shown that VOCs are the primary RCRA-regulated vapor-phase constituents in the subsurface at MDA G. The nature and extent of the VOCs are discussed in the referenced reports.

A.6 Summary of Canyons Investigations

Sediment, surface water, and groundwater data are collected as part of the canyons investigations. These data are very useful for helping to determine whether SWMUs (particularly those with outfall/mesa slope aspects) have contamination or release histories that manifest in the canyon floors, and whether they are at levels that represent potentially unacceptable human-health risk or adverse ecological effects. The data collected from sediment investigation reaches up-canyon and down-canyon from Area G indicate no potential impacts from Area G in canyon-bottom sediments. Biota investigations for the segment of Pajarito Canyon adjacent to Area G also indicate no adverse affects.

Based on their spatial distribution, MDA G is a potential source for several contaminants in Cañada del Buey sediment, including low levels of radionuclides, inorganic chemicals, and PCBs. However, contaminants released from MDA G have had little to no off-site impact, and MDA G is not a recognizable source of contaminants for White Rock or the Rio Grande.

A.7 Status of Groundwater Monitoring

Groundwater monitoring at TA-54, currently conducted in accordance with the 2010 Interim Facility-Wide Groundwater Monitoring Plan, provides the basis for accurately describing groundwater conditions beneath MDA G. The monitoring well network at MDA G includes that are part of the overall effort to further characterize the groundwater conditions. The groundwater monitoring network for TA-54 includes both perched-intermediate and regional wells, and new wells drilled in 2010.

Data from the groundwater monitoring network around TA-54 show sporadic detections of a variety of contaminants including, most notably, several VOCs. The temporal and spatial nature of the occurrences do not, however, clearly indicate the presence of a discernible plume or a source related to MDA G or other sources at TA-54.

APPENDIX B

CO-DETECTION

APPENDIX B CO-DETECTION

The concept of co-detection is predicated on the commingling of hazardous and radioactive waste within a single container, resulting in the distribution of both types of contamination within the waste. Co-detection refers to the detection of hazardous waste from waste containers based on detection of radioactivity.

If radioactive contamination is found, a leak or release of hazardous constituents is assumed to have occurred; conversely, the absence of radioactive contamination is proof of the absence of hazardous constituents resulting from a leak or release from a container holding the mixed waste. This assumption that the hazardous and radioactive contaminants are released together (i.e., co-release) is appropriate because no reasonable release mechanism has been postulated that would separate the different types of contamination (i.e., would result in the preferential release of either type of contaminant).

At Los Alamos National Laboratory, TA-54, Area G, the co-detection concept is used to conservatively manage mixed waste. Containers are visually inspected on a regular basis to ensure container integrity. In addition, radiological surveys are conducted periodically to verify that leaks or spills from containers have not occurred. In the event that a spill or leak is discovered, a radiological survey is performed to identify the extent of the spill or leak, and the area is then decontaminated to remove not only the radioactivity, but to clean up any hazardous constituents in the waste that are also assumed to have been released. The concept of co-detection is also used in managing mixed waste at the TA-55 Vault Storage area. If radiological surveys reveal radiological contamination, hazardous waste contamination is assumed. Because radiation detection equipment is more sensitive than chemical detection methods, even small releases from a container can be detected.

During the periodic monitoring of the containers while they were stored in Storage Shafts 145 and 146, no radioactivity releases were detected. In addition, radiological surveys of the empty storage shafts, performed in January 1999, indicated that no radioactivity remained in the shafts following removal of the containers. Based on the concept of co-detection, hazardous waste constituents were not released from the previously stored containers.

Los Alamos
NATIONAL LABORATORY
EST. 1943

COPY

Environmental Protection Division
Water Quality & RCRA Group (ENV-RCRA)
P.O. Box 1663, K490
Los Alamos, New Mexico 87545
(505) 667-0666/FAX (505) 667-5224

National Nuclear Security Administration
Los Alamos Site Office, A316
3747 West Jemez Road
Los Alamos, New Mexico 87545
(505) 667-5794/FAX (505) 667-5948

RECEIVED
JUL 2011

Date: July 13, 2011
Refer To: ENV-RCRA-11-0122
LAUR: 11-03650

Mr. John E. Kieling
Hazardous Waste Bureau
New Mexico Environment Department
2905 Rodeo Park Drive East, Building 1
Santa Fe, NM 87505

Dear Mr. Kieling:

SUBJECT: SUBMITTAL OF CLOSURE PLAN AND REQUEST FOR ALTERNATIVE CLOSURE REQUIREMENTS, TECHNICAL AREA (TA) 54, AREA G, SHAFTS 145 AND 146 INTERIM STATUS CONTAINER STORAGE UNIT, LOS [illegible] NM0890010515

SENDER: COMPLETE THIS SECTION

- Complete items 1, 2, and 3. Also complete item 4 if Restricted Delivery is desired.
- Print your name and address on the reverse so that we can return the card to you.
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1. Article Addressed to:

Mr. John E. Kieling
Hazardous Waste Bureau
New Mexico Environment Department
2905 Rodeo Park Drive East, Building 1
Santa Fe, NM 87505

11-0122

2. Article Number (Transfer from service label) Hand-deliver

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A. Signature X [signature] ☐ Agent ☐ Addressee

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PS Form 3811, February 2004 Domestic Return Receipt 102595-02-M-1540

to the New Mexico Environment
nd approval, in compliance with
JL) Hazardous Waste Permit (the
dministration's and Los Alamos
tees') request to use alternative
RA) closure and post-closure care
rage Shafts 145 and 146 into the

status hazardous (mixed) waste
he Permit. For interim status units
Permit requires the Permittees to
0 days of the effective date of the
e request the review and approval

gement operations, Storage Shafts 145 and 146 were originally intended for "clean closure" pursuant to NMAC 4.1.600, incorporating 40 CFR Part 265, Subpart G. A previous version of this closure plan, describing clean closure of this unit, was submitted to NMED on November 8, 1999. On May 7, 2004, the NMED issued a Public Notice of its intent to approve the 1999 closure plan, along with the closure plans for four other interim status