
LA-UR-06-1984
March 2007

Closure/Post-Closure Plan for the Technical Area 54 Area G Landfill (Pit 29 and Shaft 124)

Revision 1.0

Prepared by:

*Los Alamos National Laboratory
Los Alamos, New Mexico 87545*

Los Alamos National Laboratory
Closure/Post-Closure Plan for the
Technical Area 54 Area G Landfill
(Pit 29 and Shaft 124)

Revision 1.0
LA-UR-07-1984

Facility ID No.:	NM0890010515
Facility Name:	Los Alamos National Laboratory
Facility Address:	Los Alamos National Laboratory P.O. Box 1663 Los Alamos, New Mexico 87545
Legal Owner:	U.S. Department of Energy
Legal Operators:	U.S. Department of Energy Los Alamos Site Office 528 35th Street Los Alamos, New Mexico 87544 Los Alamos National Security, LLC. 4200 West Jemez Road, Suite 4000 Los Alamos, New Mexico 87544
Contact Person:	Gene E. Turner Environmental Permitting Manager Los Alamos Site Office National Nuclear Security Administration U.S. Department of Energy Owner/Operator
Date:	March 2007

TABLE OF CONTENTS

1	INTRODUCTION	1
2	GENERAL CLOSURE INFORMATION	2
2.1	Closure Performance Standard	2
2.2	Partial and Final Closure Activities	3
3	DESCRIPTION OF UNITS TO BE CLOSED	3
3.1	TA-54 Description	3
3.2	Area G Description	4
3.2.1	Pit 29	4
3.2.2	Shaft 124	5
3.2.3	Other Waste Management Units at Area G	6
3.3	Site Investigation Activities at Area G	7
4	CLOSURE SCHEDULE	8
5	CLOSURE PROCEDURES	8
5.1	Records	9
5.2	Pre-Closure and Structural Assessment	9
5.3	New Mexico Environment Department Closure Assessment	9
5.4	Security	9
5.5	Safety Precautions	10
5.6	Closure In Place	10
5.6.1	Relationship with Consent Order	11
5.7	General Decontamination Procedures	12
5.7.1	Equipment Used During Closure	13
5.7.2	Verification of Decontamination	13
5.7.3	Decontamination Waste Management	14
6	SAMPLE MANAGEMENT PROCEDURES	14
6.1	Sample Documentation	14
6.1.1	Chain-of-Custody	14
6.1.2	Sample Labels and Custody Seals	15
6.1.3	Sample Logbook	15
6.2	Sample Handling, Preservation, and Storage	16
6.3	Packaging and Transportation of Samples	16
6.4	Sample Collection Procedures	16
6.4.1	Liquid Sampling	17
6.4.2	Solids (Wipe) Sampling	17
6.4.3	Soil Sampling	17
6.4.4	Cleaning of Sampling Equipment	17
7	ANALYSIS REQUIREMENTS	18
7.1	Analytical Laboratory Requirements	18
7.2	Quality Assurance/Quality Control	18
7.2.1	Field Quality Control	19
7.2.2	Analytical Laboratory QC Samples	19
7.3	Data Reduction, Verification, Validation, and Reporting	19
7.4	Data Reporting Requirements	19

8	AMENDMENT OF THE CLOSURE PLAN	19
9	CLOSURE COST ESTIMATE, FINANCIAL ASSURANCE, AND LIABILITY REQUIREMENTS....	20
10	CLOSURE CERTIFICATION REPORT	20
11	GENERAL POST-CLOSURE INFORMATION.....	21
11.1	Post-Closure Performance Standard	21
11.2	Post-Closure Care Requirements	21
11.3	Amendment of the Post-Closure Plan.....	22
11.4	Post-Closure Cost Estimate, Financial Assurance, and Liability Requirements	23
11.5	Post-Closure Certification Report.....	23
11.6	Security	23
11.7	Survey Plat and Post-Closure Requirements	23
12	POST-CLOSURE INFORMATION	24
12.1	Monitoring and Frequency.....	25
12.1.1	Vadose Zone	25
12.1.2	Regional Aquifer Groundwater.....	26
12.2	Maintenance and Frequency	27
12.2.1	Integrity of Cap/Cover	27
12.2.2	Monitoring Equipment.....	28
12.3	Reporting.....	29
12.4	Post-Closure Use of Property.....	29
12.5	Post-Closure Care Period Contact Office	29
13	REFERENCES.....	30

LIST OF TABLES

<u>TABLE NO.</u>	<u>TITLE</u>
1	Dates of Use, Dimensions, Capacities, and Contents of Pit 29 and Shaft 124 at Technical Area 54 Area G Landfill
2	Schedule for Closure Activities at Technical Area 54 Area G Landfill
3	Analysis Requirements for Decontamination at Technical Area 54 Area G Landfill
4	Recommended Sample Containers, Preservation Techniques, and Holding Times
5	Recommended Quality Control Sample Types, Applicable Analysis, Frequency, and Acceptance Criteria
6	Potential Waste Materials, Waste Types, and Disposal Options
7	MDA G Subsurface Vapor Monitoring Locations

LIST OF FIGURES

<u>FIGURE NO.</u>	<u>TITLE</u>
1	Location Map of Los Alamos National Laboratory (LANL) Technical Areas (TA)
2	Technical Area (TA) 54, Site Location Map
3	Technical Area (TA) 54, Area G
4	Area of Proposed Cover, Technical Area TA-54, Area G
5	Example of an Evapotranspiration Cover
6	Existing and Proposed Vapor Monitoring Locations at MDA G
7	R-Wells Located Near TA-54

LIST OF ACRONYMS AND ABBREVIATIONS

20.4.1 NMAC	New Mexico Administrative Code, Title 20, Chapter 4, Part 1
CFR	Code of Federal Regulations
CME	Corrective Measures Evaluation
DOE	U.S. Department of Energy
EPA	U.S. Environmental Protection Agency
ft	feet
HWB	Hazardous Waste Bureau
in.	inch(es)
LANL	Los Alamos National Laboratory
NIOSH	National Institute of Occupational Safety and Health
NMED	New Mexico Environment Department
PPE	personal protective equipment
P&T	Packaging and Transportation
QA	quality assurance
QC	quality control
RCRA	Resource Conservation and Recovery Act
SW-846	Test Methods for Evaluating Solid Waste, Physical/Chemical Methods
TA	Technical Area
TCA	1,1,1 trichloroethane
TCE	Trichloroethene

LOS ALAMOS NATIONAL LABORATORY TECHNICAL AREA 54 AREA G LANDFILL CLOSURE AND POST-CLOSURE PLAN

1 INTRODUCTION

This plan describes the activities necessary to achieve closure and post-closure of the two hazardous waste disposal units at Los Alamos National Laboratory (LANL) Technical Area (TA) 54, Area G. The units are subject to closure under Resource Conservation and Recovery Act (RCRA) and New Mexico Hazardous Waste Act regulations because they received hazardous waste after November 19, 1980. The information provided in this plan is submitted to address the applicable closure and post-closure requirements specified in the New Mexico Administrative Code, Title 20, Chapter 4, Part 1, (20.4.1 NMAC), incorporating the Code of Federal Regulations, Title 40 (40 CFR) Part 265, Subparts F and G, (all 20.4.1 NMAC regulatory references in this closure plan refer to the October 1, 2003 revisions); and 20.4.1 NMAC incorporating 40 CFR §265.310. The Area G units are also “regulated units,” as defined in 20.4.1 NMAC, incorporating 40 CFR §264.90(a)(2) and are subject to the requirements referenced therein.

The Area G land disposal units are located below grade and within the boundaries of the TA-54 Area G waste storage facility. The units include Pit 29 and Disposal Shaft 124. The phrase “Area G Landfill” is also used as a general term throughout this plan to denote these combined waste management units.

Pit 29 and Shaft 124 are expected to be closed in place without removing the waste. These units are co-located with other land disposal units that comprise Solid Waste Management Units (SWMU) to be remediated under the LANL corrective action program subject to the LANL 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. The Consent Order includes closure deadlines for completing corrective actions at TA-54 that will require coordination between corrective action and the closure activities described in this plan. The closure and post-closure activities for Pit 29 and Shaft 124 may potentially be included with corrective actions through alternative requirements to meet closure and post-closure care requirements, as allowed by 20.4.1 NMAC incorporating 40 CFR §265.110(d).

Closure of Pit 29 and Shaft 124 will ensure that the wastes and/or waste residues that remain in place are stabilized and will likely involve the use of an engineered cover followed by post-closure care activities. The cover will be designed and constructed to minimize the need for further maintenance and be

protective of human health. Post-closure care will include monitoring, maintenance, and reporting requirements for the cover. These activities will occur in coordination with remediation efforts of the LANL corrective action program and the Consent Order.

2 GENERAL CLOSURE INFORMATION

This section includes a discussion of the performance standards for closure of the Area L Landfill units and the relationship of this closure with closure of the remainder of the waste management units in the general LANL facility.

2.1 Closure Performance Standard

The Area G landfill will be closed to meet the following performance standards as required by 20.4.1 NMAC incorporating 40 CFR §265.111:

- Minimize the need for further maintenance
- Control, minimize, or eliminate, to the extent necessary to protect human health and the environment, the post-closure escape of hazardous waste, hazardous constituents, leachate, contaminated runoff, or hazardous waste decomposition products to the ground or surface waters or atmosphere
- Comply with the applicable closure and post-closure requirements of 20.4.1 NMAC incorporating 40 CFR Part 265, Subpart G and 20.4.1 NMAC incorporating 40 CFR §265.310.

To meet the above closure performance standards, the final closure procedure chosen for Pit 29 and Shaft 124 will be designed and implemented to meet the closure requirements for landfills. These include:

- Remove or decontaminate all waste residues, contaminated containment system components, contaminated subsoils, and structures and equipment contaminated with waste and leachate, and manage them as hazardous waste, as necessary,

or

- Close the impoundment as a landfill by removing or solidifying liquid wastes,
- Stabilize remaining wastes to a bearing capacity sufficient to support a final cover.

Closure standards for any units closing as landfills include the use of a cover or other alternative that will:

- Minimize long-term migration of liquids through the closed unit
- 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 that is less than or equal to the permeability of the natural subsoils present.

2.2 Partial and Final Closure Activities

This closure plan has been written for partial closure rather than final closure of the entire LANL facility. Partial closure will consist of closing an individual hazardous or mixed waste management unit while leaving the other active RCRA-regulated units at LANL in service. Partial closure of each unit (hereinafter referred to simply as "closure") 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 the NMED.

Final closure of the LANL facility will occur when all the remaining hazardous or mixed waste management units at LANL have been closed. Final closure will consist of assembling documentation on the closure status of each unit, including all previous partial closures as well as permitted or interim status land-based units that have been or are being addressed via coordination with corrective action projects. Final closure will be deemed complete when the information has been submitted to the NMED and approved.

3 DESCRIPTION OF UNITS TO BE CLOSED

This section provides a general description of TA-54 and Area G. It also presents a more detailed description of Pit 29 and Shaft 124 and includes a discussion of the wastes contained in and the maximum capacities of the units.

3.1 TA-54 Description

LANL is located in Los Alamos County, an incorporated county, in north-central New Mexico, approximately 60 miles north of Albuquerque and 25 miles northwest of Santa Fe. LANL is divided into separate TAs (see Figure 1). TA-54 is located on top of Mesita del Buey, an east-west trending mesa that is bordered on the north by Cañada del Buey and on the south by Pajarito Canyon. The elevation at TA-54 is approximately 6,800 feet (ft). TA-54 is used primarily for waste management. It includes four waste disposal areas (one each at Areas G, H, J, and L, see Figure 2), storage areas for hazardous and mixed (hazardous with a radioactive component) waste, and supporting structures or offices. Further information regarding the TA-54 facility, including hydrogeologic conditions, is available in Section 2.0 of the latest revision of the Los Alamos National Laboratory Technical Area 54 Part B Permit Renewal Application and the Los Alamos National Laboratory General Part B Permit Renewal Application. Further characterization of the Area G site is also ongoing under the Consent Order investigation activities.

3.2 Area G Description

Area G is an approximately 63-acre site in the eastern portion of TA-54 (Figure 1). It is surrounded by an 8-ft-high chain-link security fence with razor wire at the top. Access to Area G is controlled by security gates and entrance to the area is restricted to authorized and/or escorted personnel. In 1957, Area G was developed as a radioactive waste landfill upon approval by the U.S. Atomic Energy Commission and the recommendation of the U.S. Geological Survey. This waste disposal site was selected due to the favorable hydrogeological characteristics, and is the only currently operating site for solid radioactive waste disposal at LANL. Land disposal of RCRA hazardous waste occurred at Pit 29 and Shaft 124 in the mid-1980s. Disposal of hazardous waste no longer occurs at LANL. Area G is also presently used for radioactive and mixed waste storage in surface structures - asphalt pads with fabric covered domes, buildings, and sheds. Surface storage will cease at the current location prior to closure in 2015.

Area G is located on the eastern end of the Mesita del Buey. The mesa varies in width from 500 to 1000 feet across the site. Near Area G, Cañada del Buey and Pajarito Canyon are roughly 100 ft below the mesa rim. Precipitation runoff is primarily from sheet flow to the north of Area G into minor drainages of Canada del Buey and south into Pajarito Canyon. As a result of waste management activities, the natural drainage pattern is locally disturbed. Erosion controls at Area G divert water away from the Area G Landfill units; these include drainage channels, riprap-lined channels, berms, silt fences, and culverts. Storm water flows at a number of points along the perimeter of Area G.

Subsurface disposal units at Area G consist of pits, trenches, and shafts. Most of these disposal units are solid waste management units (SWMUs) subject to the corrective action requirements of the Consent Order. In addition, these radioactive waste disposal units are also subject to DOE Order 435.1, "Radioactive Waste Management." The disposal units were excavated, filled and covered sequentially generally from the east end of the mesa progressing westward. The units are constructed in unit 2 (caprock) and unit 1 (subsurface) of the Tshirege Member of the Bandelier Tuff, a consolidated tuff unit throughout the region. The regional aquifer is estimated to be at an average depth of approximately 900 feet below ground surface at Area G, based on data from wells at the Laboratory and the predictions of the hydrogeologic conceptual model for the Pajarito Plateau (LANL, 1998).

3.2.1 Pit 29

Excavation began at Area G in 1957, and disposal of radioactive waste began in Pit 1 in 1959. Pit 29 is located in the west-central portion of Area G (Figure 3). Pit 29 received hazardous waste after November 19, 1980, subjecting it to regulation under RCRA as an active disposal pit. This pit received non-liquid waste from 1984 to 1986 and is subject to RCRA closure standards addressed in this plan.

Pit 29 is approximately 600 ft long and 30 ft deep. At its eastern end, it is approximately 70 to 75 ft wide; at its western end, it is approximately 40 ft wide. The pit has a total capacity of approximately 45,795 cubic yards (yd³), and contains a waste volume of 9,784 yd³ not including fill (LANL, 1990). The contents include laboratory waste, glove boxes, plywood boxes, contaminated soil, and decontamination and decommissioning waste (LANL, 1990). The pit may also contain empty waste acid, pesticide, and herbicide containers (LANL, 1985), as well as asbestos and polychlorinated biphenyls-contaminated waste (LANL, 1992). A retrievable transuranic (TRU) radioactive waste storage unit is located above Pit 29. This unit contains a layer of TRU waste in cement-filled sections of corrugated pipe that was placed within a mound of fill material above Pit 29 for temporary storage. This TRU waste will be removed prior to final closure of Pit 29.

Tuff removed during excavation of the pit was crushed and used to line the bottom of the pit. Waste handling equipment was used to place waste in the pit by lifts, and crushed tuff was placed within each lift to fill void spaces. A layer of crushed tuff was also used to separate lifts of waste. When the pit was filled to within approximately 3 ft of the spill point (the lowest point along the surface perimeter of the pit), it was covered with approximately 3 ft of crushed tuff and 4 inches of topsoil. Native grasses were seeded in the topsoil. An access road at Area G currently traverses the surface above the pit. As a result, the covering thickness over some areas of the pit may exceed the original 3-ft cover.

3.2.2 Shaft 124

The shafts at Area G are used for disposal of wastes that require segregation, special packaging, or special handling. Disposal of radioactive waste began in Shaft 1 in 1966. Only Shaft 124 received hazardous waste after November 19, 1980. Hence, it is subject to RCRA closure standards and is addressed in this plan.

Shaft 124 is located in the northeast portion of Area G (Figure 3). This unlined shaft was used from 1984 to 1987. Shaft 124 is 6 ft in diameter. The disposal shafts in this section of Area G are typically 65 ft deep (LANL, 1992). With this depth, Shaft 124 has a total capacity of approximately 1,753 cubic ft (ft³). It is estimated that this shaft contains a total waste volume of approximately 378 ft³ not including fill (LANL, 1992). The shaft was used for disposal of solid radioactive wastes but included approximately one ft³ of hazardous wastes made up of organic liquids and vials (LANL, 1990). When it was determined that Shaft 124 would no longer receive waste, it was backfilled with crushed tuff and the shaft was plugged with approximately 3 ft of concrete, which was slightly rounded at the surface to form a dome. A brass marker was placed for identification.

3.2.3 Other Waste Management Units at Area G

Most of the remaining pits and shafts at Area G are subject to corrective action under the Consent Order as part of Consolidated Unit 54-013(b)-99, which is comprised of SWMUs 54-013(b), 54-014(b, c, and d), 54-015(k), 54-017, 54-018, 54-019, and 54-020. In addition, these and other radioactive waste disposal units are regulated by DOE Order 435.1. There are thirty one additional disposal pits constructed and filled at Area G (Figure 3). 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 Consolidated Unit 54-013(b)-99 which is described as Material Disposal Area (MDA) G in this and related documents.

The disposal shafts at Area G are typically three to six ft in diameter and up to 65 ft deep. Shafts are 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. 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. These make up the rest of the shaft field that includes Shaft 124. These shafts are part of Consolidated Unit 54-013(b)-99.

The four trenches at Area G vary in size from approximately 60 to 260 ft long, 13 ft wide, and 6 to 8 ft deep. The trenches (identified as Trenches A, B, C, and D) were used for retrievable placement of transuranic (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. The trenches became inactive prior to November 19, 1980, and are therefore subject to corrective action under the LANL Consent Order for any releases of hazardous constituents as part of Consolidated Unit 54-013(b)-99. The TRU wastes in Trenches A-D are scheduled to be retrieved prior to closure of Area G.

Temporary structures and materials have been placed over many of the older disposal sites at MDA G to support ongoing waste management activities. Domes, buildings, and sheds are used for on-going mixed waste management activities and are regulated as operating units under either the 1989 LANL hazardous waste facility permit or by interim status subject to 20.4.1 NMAC incorporating 40 CFR Subpart 265. These operating units are subject to closure under the provisions of interim status or the LANL Hazardous Waste Facility Permit and need to be closed prior to the further remediation of the site under the corrective action program and the Consent Order.

3.3 Site Investigation Activities at Area G

LANL has performed pore-gas monitoring and other environmental investigations at Area G for 22 years under several characterization programs. In 1985, LANL received a compliance order from the New Mexico Environmental Improvement Division addressing waste management practices. The order required site investigation activities at Area G including quarterly pore-gas monitoring. Pore-gas monitoring has also been performed under the ER Program's Phase 1 RCRA Facility Investigation (RFI), and for field investigations through 2005. The results of these investigations indicate that there have been sub-surface releases of several organic and inorganic chemicals in the tuff beneath Area G.

In the early 1990s, Phase 1 RFI activities were undertaken at Area G including sampling of ambient air, channel sediments, and subsurface core in addition to pore-gas sampling. A total of twenty boreholes were drilled during the Phase 1 RFI between 1993 and 1995. 113 sediment samples were collected from drainages leading from Area G and background samples taken at other areas of Mesita del Buey. The results of the investigation indicated that VOCs were detected in subsurface pore gas although the vertical extent of contamination was not defined. The VOCs consist primarily of 1,1,1 trichloroethane (TCA) and trichloroethene (TCE). Concentrations of certain metals (arsenic, antimony, cadmium, cyanide, molybdenum, selenium, silver, thallium, and vanadium) in tuff beneath disposal units were detected. Channel sediments contained elevated levels (compared to baseline fallout levels) of methoxychlor and some radioisotopes. Ambient air sampling indicated that VOCs and tritium were being released into the atmosphere from the subsurface.

A site investigation was completed in 2005 in response to the requirements of the Consent Order. Results of the investigation (LANL, 2005) confirmed the presence of a number of organic and inorganic chemicals with radionuclides and were consistent with the results obtained during the Phase 1 RFI. The primary organic chemicals detected included chlorinated VOCs and trace levels of several dioxin/furan congeners. Inorganic chemicals detected above background levels did not show any discernable trends and, as such, the extent of contaminant releases is believed to be defined.

The data obtained from all three projects indicate that the highest VOC concentrations are beneath the eastern portion of the site in the vicinity of the shaft field west of Pits 2 and 4 (including Shaft 124). The results indicate that TCA is the dominant component and that the concentrations seem relatively stable over time.

In July, 2006, NMED required that LANL develop an additional four boreholes to confirm the vertical extent of VOCs in subsurface pore gas. An updated Investigation Report containing that data will be submitted to NMED by May 2007.

4 CLOSURE SCHEDULE

The TA-54 Area G Landfill will close on a schedule that supports the schedule for completion of corrective actions under the Consent Order. The Consent Order currently requires completion of remediation at MDA G by 2015. The RCRA waste disposal units described in this closure plan need to be closed prior to or during the remediation activities implemented to meet that deadline. The completion of closure for these units is therefore currently anticipated by 2015. Final closure activity for the entire LANL facility is estimated not to occur before the year 2100. The closure schedule given in Table 2 of this closure plan reflects this coordination of activities with the corrective action process for the Consent Order (see Section 5.6.1).

Written notification will be provided to the NMED 60 days before the start of closure activities for the Area G Landfill. However, pursuant to 20.4.1 NMAC incorporating 40 CFR §265.112(e), removing hazardous waste and decontaminating or dismantling equipment in accordance with an approved closure plan may be conducted at any time before or after notification of closure. Closure activities will begin in accordance with 20.4.1 NMAC incorporating 40 CFR §265.112(d). Because closure of the Area L Landfill units must be preceded by closure of the Area L surface storage units, the start of closure of the landfill units will be tied to the schedule for closure of the storage units. Treatment, removal, or disposal of hazardous waste will begin in accordance with the approved closure plan, as required by 20.4.1 NMAC incorporating 40 CFR §265.113(a), within 90 days after approval of the closure plan. In the event that closure activities cannot begin within 90 days, LANL will notify the Secretary of the NMED in accordance with the extension requirements in 20.4.1 NMAC, §265.113(a) [10-1-03].

In the event that closure of the Area G Landfill cannot proceed according to schedule, LANL will notify the Secretary of the NMED in accordance with 20.4.1 NMAC incorporating 40 CFR §265.113(b). In addition, the demonstrations in 20.4.1 NMAC incorporating 40 CFR §265.113(a)(1) and (b)(1), will be made in accordance with 20.4.1 NMAC incorporating 40 CFR §265.113(c).

5 CLOSURE PROCEDURES

Closure activities at the TA-54 Area G Landfill may include closure of Pit 29 and Shaft 124 in place as landfills; proper management and disposition of any hazardous waste residues, contaminated equipment, and contaminated structures associated with the closure of the landfill; and verification that the closure performance standards have been achieved. The following sections describe the closure procedures applicable to the Area G Landfill closure activities.

As discussed in Section 5.6.1, closure activities will be coordinated with activities associated with remediation of the disposal units at Area G regulated under the Consent Order. At the time of development of this closure plan, the LANL Corrective Action Program has submitted a Corrective

Measures Evaluation (CME) Plan (May, 2006) to the NMED that describes the technical approach to be used to develop the CME Report for the SWMUs at Area G. The CME Report is scheduled for submittal to the NMED by August, 2007. The CME Report will identify and evaluate corrective measure alternatives that address potential unacceptable future risks and recommend one or more alternatives for implementation. The CME Report will recommend a final remedy for MDA G; however, NMED will select the final remedy.

5.1 Records

Until closure is complete and has been certified in accordance with 20.4.1 NMAC incorporating 40 CFR §265.115, a copy of the approved closure plan, any approved revisions, and closure activity documentation will be on file at the LANL Environmental Protection Division-Water Quality and RCRA Group and at the DOE Los Alamos Site Office.

5.2 Pre-Closure and Structural Assessment

Before starting closure activities, the operating records for Pit 29 and Shaft 124 will be reviewed to determine any previous finding(s) or action(s) that may influence closure activities or potential sampling locations. This review will determine the necessity for additional sampling; identify specific hazardous waste constituents of concern; determine potential sampling locations by identifying any events or chronic conditions in the operating record that would indicate the type and location of released constituents; and differentiate any equipment or other materials that will undergo decontamination from those to be recycled, reused, or managed as waste. In addition, background samples or data derived from studies developed under the LANL Corrective Action Program or other programs will be reviewed to determine levels or concentration thresholds applicable for the purposes of closure. Any hazards associated with the work necessary for closure activities will be identified, their effect on procedures assessed, and controls developed before the closure activities begin.

5.3 New Mexico Environment Department Closure Assessment

LANL will notify the NMED Hazardous Waste Bureau (HWB) prior to the pre-closure and structural assessment of Pit 29 and Shaft 124 to provide an opportunity to participate in the unit's physical condition review. LANL may also arrange for other on-site reviews of closure activities at reasonable times upon request by NMED representatives. Upon submittal of the closure certification report described in Section 10 of this closure plan, LANL will arrange an on-site closure review with representatives of the HWB or equivalent NMED representatives to assess the completion of the closure activities.

5.4 Security

Because of the ongoing nature of operations at TA-54, site security at Area G will be maintained by the DOE for as long as necessary to prohibit public access. The security fence at TA-54 will be maintained to prevent public access. Further information regarding security provisions at TA-54 is available in Section

G.1.2, "Security and Access Control," in the "Los Alamos National Laboratory Technical Area 54 Part B Permit Renewal Application, " Revision 3.0 (LANL, 2003b).

5.5 Safety Precautions

In accordance with LANL safety procedures, job hazards associated with closure activities will be identified, controls developed, and workers briefed before closure activities are conducted. Personnel involved in closure activities will wear appropriate personal protective equipment (PPE) specified by LANL industrial hygiene and health physics procedures and will follow good hygiene practices to protect themselves from exposure to hazardous waste. The level of PPE required will depend upon the physical hazards present and the levels of radiological and/or chemical contamination detected, if any. Contaminated PPE will be decontaminated or managed in accordance with appropriate waste management regulations.

All workers involved in closure activities will be required to have appropriate training as required by site-specific work procedures. Workers who will manage hazardous waste or hazardous waste constituents during closure activities will follow the training requirements in the LANL RCRA Training Plan of the LANL Hazardous Waste Facility Permit.

5.6 Closure In Place

As discussed in Section 2.1 of this closure plan, closure as a landfill requires the use of a final cover for the units unless an alternative measure is approved. This will be coordinated with the remediation options and activities conducted under the Consent Order. LANL proposes that if the closure option for a cover is chosen, the closure will include installation of an evapotranspiration (ET) cover over the regulated units rather than a traditional RCRA cover.

Because of the generally arid environment of the site, MDA G is considered a prime candidate for a site specific RCRA alternative cover (e.g., ET cover). ET cover systems use one or more vegetated soil layers to retain water until it is either transpired through vegetation or evaporated from the soil surface and can be appropriate for use in arid and semi-arid areas. A schematic of an ET cover is presented in Figure 5. The vegetated ET cover proposed was developed based upon early research into this concept at a test site near TA-54. The cover will be designed to capture sufficient moisture to prevent the percolation of liquids into and through the waste material below. By their nature, ET covers may not have a permeability less than or equal to that of the natural surrounding materials but their function is designed to achieve the same performance. The cover will function with minimum maintenance, promote drainage, and minimize erosion or abrasion of the cover in accordance with 20.4.1 NMAC incorporating 40 CFR §265.310(a). In addition, the cover will provide run-on and runoff control, pursuant to 20.4.1 NMAC

incorporating 40 CFR §265.112(b)(5). Any cover installed as part of a corrective action must meet the corrective action objectives and clean up goals of the Consent Order. These include assuring long-term protection of human health and the environment, achieving a lifetime excess cancer risk of 10^{-5} or less, and a hazard index for non-carcinogenic contaminants of 1 or less.

The following measures will be taken to establish the ET cover although final design details are subject to change as additional information becomes available through the corrective action design process and the Consent Order. These 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 unit.

As currently planned, a nominal 3 ft of clean crushed tuff will be placed over the disposal units in the Area G Landfill (for preliminary conceptual design boundary, see Figure 4). 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 layer will be applied in lifts and compacted. Additional layers of material may be added to the cover for drainage or biotic barriers as determined appropriate for the site conditions and decided upon during the corrective action design review process. Topsoil will be placed to a depth of between 6 and 8 inches and a gravel layer may be placed over the topsoil. The surface of the cover will be seeded with a native mix, including grasses and forbes. 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. 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. Controls will also be designed to convey storm water run-off away from the area and towards the storm water monitoring station(s) operating at Area G. The backfill will help to stabilize the wastes in the pit and the cover will provide long-term minimization of precipitation infiltration.

5.6.1 Relationship with Consent Order

The LANL Consent Order requires corrective action program activities for SWMUs and Areas of Concern at Area G based upon the release of contaminants from past waste disposal activities. The Consent Order further requires that a CME Report for MDA G be submitted to the NMED by August 2007. The purposes of the CME Report are to identify and evaluate corrective measure alternatives that address potential unacceptable future risks and to recommend one or more of these alternatives for implementation. The procedures described in this closure plan may be impacted by the final corrective action alternative chosen for remediation of MDA G. This corrective action decision process may affect the technical requirements for closure of Pit 29 and Shaft 124 although the administrative process for closure will be retained under the requirements of 20.4.1 NMAC incorporating 40 CFR Part 265, Subpart G, or, potentially, in the LANL Hazardous Waste Facility Permit.

The CME Plan for MDA G (LANL, 2006a), describes the integrated closure approach for Area G. This includes both the possibility that all the affected units will be subject to the same chosen alternatives or that the closure activities would need to be integrated between closure and corrective action if the units are not closed to the same alternative. The CME options to be considered for the corrective action units include 1) monitoring, 2) maintenance of existing covers and monitoring, 3) engineered containment (covers), 4) waste stabilization, 5) partial or complete waste excavation, 6) contaminant extraction from media, or 7) some combination of these options.

The procedures in this closure plan for the disposal units in the Area G Landfill generally represent those considered most likely based upon the information obtained to this point and that meet the requirements of 20.4.1 NMAC incorporating 40 CFR 265.310 without further alternative development. As described above, these fit within Alternative 3 or potentially Alternative 7.

Any corrective action decision that involves different alternatives for final action at MDA G may represent a significant difference in the closure procedures for Pit 29 and Shaft 124 discussed in this closure plan. As described above, the final technical details for characterization and corrective action at MDA G are subject to review and approval through the Consent Order process, which has not been completed at this point. Therefore, future changes to this closure plan may become necessary in order to maintain the coordination of the closure and corrective action plans for these units. If the incorporation of necessary changes becomes difficult in terms of the schedules required for technical review or for the Consent Order deadlines including timeframes needed for review and approval by the NMED, LANL may propose using the option of alternative closure or post-closure requirements under an enforceable document as contained by 20.4.1 NMAC incorporating 40 CFR §265.110(d) to coordinate these closure activities with the corrective action program. This option would be allowable if the appropriate conditions for the option are determined to be met. These include the use of the Consent Order as an enforceable document, the proximity of units regulated by corrective action, the presence of a release, and the likelihood that both regulated disposal units and SWMUs have contributed to the release. If this option is utilized, all outstanding closure or post-closure care requirements will revert to the appropriate permit document upon termination of the Consent Order.

5.7 General Decontamination Procedures

To the extent necessary, any contaminated equipment present at closure will be decontaminated. Discarded materials and equipment that cannot or will not be decontaminated will be managed as waste or otherwise managed in compliance with applicable regulations. The necessity for decontamination will be reviewed as part of the pre-closure assessment for these units.

If decontamination is necessary, all sampling during closure to determine decontamination will be conducted in accordance with quality assurance (QA)/quality control (QC) procedures defined by the latest revision of "Test Methods for Evaluating Solid Waste, Physical/Chemical Methods" (SW-846) (EPA, 1986) or other approved methods. Monitoring for contamination will occur throughout closure activities, as appropriate.

5.7.1 Equipment Used During Closure

Reusable protective clothing, tools, and equipment used during decontamination activities will be cleaned with a wash water solution or dry decontamination methods. Residue, disposable equipment, and reusable equipment that cannot be decontaminated will be containerized and managed as waste in accordance with LANL waste management procedures, depending on the regulated constituents present.

5.7.2 Verification of Decontamination

LANL proposes analysis of water and/or wipe samples for equipment decontamination verification for closure at the Area G Landfill. Wipe samples may be used where the surfaces of the equipment, the analytical constituents, and any analytical constraints are appropriate. In cases where wipe sampling is not appropriate or feasible, verification will be confirmed by sampling and analyzing the collected verification solutions. Decontamination verification will use the following methods:

- When liquid sampling, the verification solution will be limited to an amount that is sufficient to wipe down the surface to be verified and collect the required number of samples. This will minimize dilution of hazardous constituents present at the location.
- For wipe sampling, guidance from the analytical laboratory must be obtained prior to wipe verification sampling to confirm that the solution chosen for each analysis is appropriate for the analysis to be conducted.
- Decontamination will be verified by comparing the discrete analytical results for liquid sampling to a baseline result (blank) obtained from the verification solution prior to its use for the verification wipe down. Comparison of wipe sample analytical results to an unused wipe media sample (blank) will be used to determine the presence or absence of contamination.
- If the result is at or below that of the blank, decontamination is verified for the discrete area sampled.
- If the result is above the blank, decontamination and verification will be repeated for the discrete sampling location or decontamination will be verified as described below.

These proposed methods minimize dilution and establish criteria by which successful decontamination is verified. Analytical procedures will conform to the procedures found in Section 7.

If analysis of the decontamination verification water or wipes indicates that hazardous constituents are present, decontamination and sampling will continue until the equipment has been decontaminated or the decision is made to manage the equipment as contaminated waste.

5.7.3 Decontamination Waste Management

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. The wastewater, PPE, and any other waste generated as a result of closure will be managed as indicated in Table 7.

6 **SAMPLE MANAGEMENT PROCEDURES**

The following information presents general sample management and sampling equipment cleaning procedures shared in common for closure of the waste management units described in this closure plan. In the event that discrepancies exist or develop between these procedures and those instituted for corrective action program activities under the Consent Order, sample management procedures will be revised to meet the conditions of the Consent Order (Section IX.B).

Samples will be collected and transported using documented chain-of-custody and sample management procedures to ensure the integrity of the sample and provide an accurate and defensible written record of the possession and handling of a sample from the time of collection through laboratory analysis. Sample collection equipment will include coolers, EPA-certified clean containers, preservatives, labels, chain-of-custody forms, and custody seals. The following provides a description of sample documentation; sample handling, preservation, and storage; and sample packaging and transportation requirements that will be followed during the sampling activities associated with the closure.

6.1 Sample Documentation

Sampling personnel will complete and maintain records to document sampling and analysis activities. Sample documentation will include sample identification numbers, chain-of-custody forms, analyses requested, sample logbooks detailing sample collection activities, and shipping forms (if necessary).

6.1.1 Chain-of-Custody

Chain-of-custody forms will be maintained by sampling personnel until the samples are relinquished to the analytical laboratory. One chain-of-custody form may be used to document all of the samples

collected from a single sampling event. The sample collector will be responsible for the integrity of the samples collected until properly transferred to another person.

The EPA considers a sample to be in a person's custody if it is:

- In a person's physical possession,
- In view of the person in possession, or
- Secured by that person in a restricted access area to prevent tampering.

The sample collector will document all pertinent sample collection data. Individuals relinquishing or receiving custody of the samples will sign, date, and note the time on the analysis request/chain-of-custody form. A chain-of-custody form must accompany all samples from collection through laboratory analysis. The completed original chain-of-custody form will be returned by the analytical laboratory and will become a part of the permanent record documenting the sampling effort.

6.1.2 Sample Labels and Custody Seals

A sample label will be affixed to each sample container. The sample label will include the following information:

- A unique sample identification number;
- Name of the sample collector;
- Date and time of collection;
- Type of preservatives used, if any; and
- Location from which the sample was collected.

A custody seal will be placed on each sample container to detect unauthorized tampering with the samples. These labels must be initialed, dated, and affixed by the sample collector in such a manner that the seal must be broken to open the container.

6.1.3 Sample Logbook

All pertinent information on the sampling effort must be recorded in a bound logbook. Information must be recorded in ink and any cross-outs must be made with a single line and the change initialed and dated by the author. The sample logbook will include the following information:

- The sample location,

- Suspected composition,
- Sample identification number,
- Volume/mass of sample taken,
- Purpose of sampling,
- Description of sample point and sampling methodology,
- Date and time of collection,
- Name of the sample collector,
- Sample destination and how it will be transported,
- Observations, and
- Signatures of personnel responsible for the observations.

6.2 Sample Handling, Preservation, and Storage

Samples will be collected and containerized in appropriate pre-cleaned sample containers. Table 4 presents the requirements specified in SW-846 (EPA, 1986) for sample containers, preservation techniques, and holding times. Samples that require cooling to 4 degrees Celsius will be placed in a cooler with ice or ice gel or in a refrigerator immediately upon collection.

6.3 Packaging and Transportation of Samples

All packaging and transportation activities will meet safety expectations, QA requirements, DOE Orders, and relevant local, state, and federal laws (including 10 CFR and 49 CFR). Appropriate LANL documents establish these requirements for packaging design, testing, acquisition, acceptance, use, maintenance, and decommissioning and for on-site, intra-site, and off-site shipment preparation and transportation of general commodities, hazardous materials, substances, waste, and defense program materials.

Off-site transportation of samples will occur via private, contract, or common motor carrier; air carrier; or freight. All off-site transportation will be processed through the LANL Packaging and Transportation (P&T) Organization, unless the shipper is specifically authorized through formal documentation by the P&T Organization to independently tender shipments to common motor or air carriers.

6.4 Sample Collection Procedures

Samples will be collected in accordance with the most recent and appropriate LANL sampling plan incorporating guidance from the EPA (EPA, 2002) and DOE (DOE, 1995), or other approved procedures. In the event of discrepancies between these procedures and those instituted for corrective action under the Consent Order, sample collection procedures will be revised to meet the conditions of the Consent Order (Section IX.B).

6.4.1 Liquid Sampling

For decontamination sampling, each discrete sample location will be wiped down with clean water. A mop, cloth, and/or other absorbent material will be submerged into the container and squeezed out prior to wiping down the discrete surface to be verified. Excess solution will collect in a bermed area if necessary. To minimize dilution of the samples, the wipe down solution will be limited to a quantity sufficient to collect the appropriate number of samples. Liquid sampling will be conducted using glass or plastic tubes, a composite liquid waste sampler, a bacon bomb, a bailer, or by pouring liquid into sample containers.

6.4.2 Solids (Wipe) Sampling

In some cases, equipment may need to be decontaminated prior to removal from the site and is not amenable to liquid wash down due to its size or composition. This equipment may include items such as monitoring equipment. In such cases, surface wipe samples may be used to determine whether hazardous waste constituents are present.

Surface wipe samples will be taken in accordance with the National Institute of Occupational Safety and Health (NIOSH) *Manual of Analytical Methods*, Method 9100 (NIOSH, 1994), or other approved methodology. The appropriate use of wipe sample methods will consider the type of surface being sampled, the type of contaminant, the solution used, and the desired contaminant concentration detection limits. The NIOSH method includes wiping a 100 square centimeter area at each discrete location with a gauze wipe wetted with a liquid solution appropriate for the desired analysis (e.g., deionized water for lead). The solution used depends on the analysis; therefore, the analytical laboratory will be consulted prior to sampling activities to ensure that the correct solution is employed for each analysis and that wipe sampling is a proper technique for the specific analysis.

6.4.3 Soil Sampling

Any necessary surface or shallow subsurface soil samples will be collected using stainless steel scoops or hand augers. Samples for VOC analysis will be collected using disposable En Core[®] samplers or equivalent. Surface soil samples will be collected at any sample location in accordance with the most recent and appropriate LANL sampling plan, incorporating SW-846 or other approved methods.

6.4.4 Cleaning of Sampling Equipment

Reusable sampling equipment will be cleaned and rinsed prior to use. Sampling equipment rinsate blanks will be collected and analyzed only if reusable sampling equipment is used. Reusable decontamination equipment, including protective clothing and tools, used during closure activities will be scraped as necessary to remove residue and cleaned with a wash water solution or dry decontamination

procedures. Sampling equipment will be cleaned prior to each use with a wash solution, rinsed several times with tap water, and air-dried or wiped dry to prevent cross contamination of samples. A disposable sampler is considered clean if still in a factory-sealed wrapper. Residue, disposable decontamination equipment, and reusable decontamination equipment that cannot be decontaminated will be containerized and managed appropriately at an approved on-site facility.

7 ANALYSIS REQUIREMENTS

The following information presents general analysis procedures shared in common for closure of the waste management units described in this closure plan. In the event that discrepancies exist or develop between these procedures and those instituted for corrective action program activities under the Consent Order, analytical procedures will be revised to meet the conditions of the Consent Order (Section IX.C).

7.1 Analytical Laboratory Requirements

The analytical laboratory will perform the detailed qualitative and quantitative chemical analyses specified in this closure plan. The qualifications for the analytical laboratory will include:

- A documented comprehensive QA and QC program,
- Technical analytical expertise,
- A document control/records management plan, and
- The capability to perform data reduction, validation, and reporting.

The selection of the analytical testing methods identified in Table 3 was based on the following considerations:

- The physical form of the waste,
- Constituents of interest,
- Required detection limits (e.g., regulatory thresholds), and
- Information requirements (e.g., waste classification).

7.2 Quality Assurance/Quality Control

Field sampling procedures and laboratory analyses will be evaluated through the use of QA/QC samples to assess the overall quality of the data produced. QC samples used to evaluate precision, accuracy, and potential sample contamination associated with the sampling/analysis process are described in the following sections, along with information on calculations necessary to evaluate the QC results. . These QA/QC samples will be collected in accordance with the most recent and appropriate LANL sampling plan incorporating guidance from the EPA (EPA, 2002) and DOE (DOE, 1995), or other approved procedures. Analysis will be conducted in accordance with procedures given in SW-846 (EPA, 1986), or other approved procedures or methods.

7.2.1 Field Quality Control

The field QC samples that may be collected include trip blanks, field blanks, field duplicates, and equipment rinsate blanks. Table 5 summarizes QC sample types, applicable analyses, frequency, and acceptance criteria. QC samples will be given a unique sample identification number and submitted to the analytical laboratory as blind samples. QC samples will be identified on the applicable forms so that the results can be applied to the associated sample.

7.2.2 Analytical Laboratory QC Samples

QA/QC considerations are an integral part of analytical laboratory operations. Laboratory QA ensures that analytical methods generate data that are technically sound, statistically valid, and that can be documented. Individual QC procedures measure the degree to which these QA objectives are met.

7.3 Data Reduction, Verification, Validation, and Reporting

Analytical data generated by the activities described in this closure plan will be verified and validated. Data reduction involves the conversion of raw data to reportable units; transfer of data between recording media; and computation of summary statistics, standard errors, confidence intervals, and statistical tests.

7.4 Data Reporting Requirements

Analytical results will include all pertinent information about the condition and appearance of the sample-as-received. Analytical reports will include:

- A summary of analytical results for each sample;
- Results from QC samples such as blanks, spikes, and calibrations;
- Reference to standard methods or a detailed description of analytical procedures; and
- Raw data printouts for comparison with summaries.

The laboratory will describe off-normal sample preparations that occur during the analysis in sufficient detail so that the data user can understand how the sample was analyzed.

8 AMENDMENT OF THE CLOSURE PLAN

In accordance with 20.4.1 NMAC incorporating 40 CFR §265.112(c), LANL will submit a written change in the approved closure plan whenever:

- There are changes in operating plans or facility design that affect the closure plan, or
- There is a change in the expected date of closure, or
- Unexpected events occur during closure that require modification of the approved closure plan.

LANL will submit a written request for a permit modification with a copy of the amended closure plan at least 60 days prior to the proposed change in unit design or operation or no later than 60 days after an occurrence of an unexpected event that affects the closure plan. If the unexpected event occurs during closure, the permit modification will be requested within 30 days of the occurrence. The Secretary of the NMED may request a modification of the closure plan under the conditions presented in the bulleted items above. LANL will submit the modified plan in accordance with the request within 60 days of notification, or within 30 days of notification if a change in facility condition occurs during the closure process.

9 CLOSURE COST ESTIMATE, FINANCIAL ASSURANCE, AND LIABILITY REQUIREMENTS

In accordance with 20.4.1 NMAC incorporating 40 CFR §265.140(c), LANL, as a federal facility, is exempt from the requirements of 20.4.1 NMAC incorporating 40 CFR Part 265, Subpart H, to provide a cost estimate, financial assurance mechanisms, and liability insurance for closure actions.

10 CLOSURE CERTIFICATION REPORT

Upon completion of the closure activities at the Area G Landfill, a closure certification report will be prepared and submitted to the Secretary of the NMED. The report will document the closure and contain the following:

- A copy of the certification described in Section 2.2 of this closure plan.
- Any significant variance from the approved activities and the reason for the variance.
- A description of cover construction activities including as-built details and engineering QA sampling results.
- A description of any additional design or closure process activities added to the project through the Consent Order.
- A summary of all sampling results, showing:
 - Sample identification
 - Sampling location
 - Datum reported
 - Detection limit for each datum
 - A measure of analytical precision (e.g., uncertainty, range, variance)
 - Identification of analytical procedure
 - Identification of analytical laboratory.
- A QA/QC statement on analytical data validation and decontamination verification.
- The location of the file of supporting documentation, including:
 - Field logbooks
 - Laboratory sample analysis reports

- QA/QC documentation
- Chain-of-custody forms.

- Storage or disposal location of regulated hazardous waste resulting from closure activities.
- A certification of accuracy of the report.

11 GENERAL POST-CLOSURE INFORMATION

Area G units closed as regulated unit landfills will be subject to the requirements of 20.4.1 NMAC incorporating 40 CFR Part 265, Subpart G; and 20.4.1 NMAC incorporating 40 CFR §265.310, as applicable.

11.1 Post-Closure Performance Standard

Post-closure of the Area G Landfill will meet the following performance standards:

- 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 unless an alternative with equivalent performance to this condition is determined to be appropriate for the final remediation option chosen for the project.

After closure, the measures by which LANL will meet the applicable 20.4.1 NMAC incorporating 40 CFR §265.310(b) requirements (or equivalents thereof) are presented in Section 12 of this plan.

11.2 Post-Closure Care Requirements

In accordance with 20.4.1 NMAC incorporating 40 CFR §265.117(a)(1), post-closure care for the Area G Landfill will begin after completion of closure of the unit 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 are closed and it is determined that the reduced period is sufficient to protect human health and the environment, in accordance with 20.4.1 NMAC incorporating 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 20.4.1 NMAC incorporating 40 CFR §265.117(a)(2)(ii).

As required by 20.4.1 NMAC incorporating 40 CFR §265.117(a)(1)(i and ii), post-closure care of the Area G landfill will include maintenance, monitoring, and reporting as appropriate and in accordance with the

requirements of 20.4.1 NMAC incorporating 40 CFR Part 264, Subpart F and 20.4.1 NMAC incorporating 40 CFR §265.310, as described in Section 12.

11.3 Amendment of the Post-Closure Plan

In accordance with 20.4.1 NMAC incorporating 40 CFR §265.118(d)(1), LANL may submit a written notification of or request for a permit modification to authorize a change in the approved post-closure plan at any time during the active life of the facility or during the post-closure care period. In accordance with 20.4.1 NMAC incorporating 40 CFR §265.118(d)(2), LANL will submit a written notification of or request for a permit modification to authorize a change in the approved post-closure plan 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 which occur during the active life of the facility, including partial and final closures, 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) to a regulated unit under 20.4.1 NMAC incorporating 40 CFR §264.90(f) and/or §264.110(c).

The written notification or request will include a copy of the amended post-closure plan for review or approval by the NMED, in accordance with 20.4.1 NMAC incorporating 40 CFR §265.118(d). LANL will submit a written request for an amendment at least 60 days prior to the proposed change in unit design or operation, or no later than 60 days after an occurrence of an unexpected event that affects the post-closure plan in accordance with 20.4.1 NMAC incorporating 40 CFR §265.112(d)(3).

The Secretary of the NMED may request modifications to the plan under the conditions presented in the bulleted items above. LANL will submit the modified plan no later than 60 days after the Secretary's request. Any modifications requested by the Secretary will be approved, disapproved, or modified in accordance with the procedures in 20.4.1 NMAC incorporating 40 CFR §265.112(d)(4).

In accordance with 20.4.1 NMAC incorporating 40 CFR §265.119(c), LANL or a subsequent owner or operator may request a modification to the approved post-closure plan to authorize the removal of hazardous wastes and hazardous waste residues or contaminated soils. If approval to conduct such removal activities is granted, the owner or operator may request that the Secretary of the NMED approve the removal of the post-closure notice filed with the County of Los Alamos, other authorized agencies, or

the Secretary of the NMED. Alternatively, the owner or operator may provide an additional post-closure notice indicating the removal of the hazardous waste, with approval from the Secretary of the NMED.

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

In accordance with 20.4.1 NMAC incorporating 40 CFR §265.140(c), LANL, as a federal facility, is exempt from the requirements of 20.4.1 NMAC incorporating 40 CFR Part 265, Subpart H to provide a cost estimate, financial assurance mechanisms, and liability insurance for post-closure actions.

11.5 Post-Closure Certification Report

Within 60 days after completion of the established post-closure care period for the Area L landfill, LANL will submit to the Secretary of the NMED, by registered mail, a certification that the post-closure care period for the unit was performed in accordance with the approved post-closure plan. The certification will 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. A copy of the certification and supporting documentation will be maintained by DOE/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 location of hazardous waste resulting from post-closure activities.

11.6 Security

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

11.7 Survey Plat and Post-Closure Requirements

As stated in Section 1.10, a survey plat prepared in accordance with 20.4.1 NMAC incorporating 40 CFR §265.116 will be filed with the appropriate authorities at certification of closure. No later than 60 days

after certification of closure of the Area G landfill, 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, 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.

Post-closure care pursuant to 20.4.1 NMAC incorporating 40 CFR §265.117 through §265.120 will begin after closure of a disposal unit. Post-closure notices will be filed with appropriate authorities within 60 days of certification of closure of the first disposal unit and within 60 days of certification of closure of the last disposal unit, as described in 20.4.1 NMAC incorporating 40 CFR §265.119. 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 20.4.1 NMAC, incorporating 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 County of Los Alamos and other authorized agencies and with the Secretary of the NMED. LANL will also submit a certification, signed by DOE and LANL, that they have recorded the notation specified in 20.4.1 NMAC incorporating 40 CFR §265.119(b)(1), including a copy of the document in which the notation has been placed, to the Secretary of the NMED.

Within 60 days after completion of the established post-closure care period for the unit, 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 20.4.1 NMAC incorporating 40 CFR §265.120. Certification of completion of post-closure care is described in Section 11.5.

12 POST-CLOSURE INFORMATION

Pursuant to 20.4.1 NMAC incorporating 40 CFR § 265.118(c), the post-closure portion of this plan identifies the activities that will be conducted after closure of the Area G Landfill and the frequency of these activities. In some cases, these activities must be coordinated with the LANL corrective action process under the Consent Order. These post-closure activities are described below and include activities that are planned as well as those that may be conducted as a result of the corrective action process.

This section describes these activities, which include monitoring activities and the frequencies at which they will be performed to be consistent with 20.4.1 NMAC incorporating 40 CFR Part 264, Subpart F, as appropriate, and 20.4.1 NMAC incorporating 40 CFR §265.310 during the post-closure care period, in

accordance with 20.4.1 NMAC incorporating 40 CFR §265.118(c)(1). The activities also include maintenance activities and the frequencies at which they will be performed, as required in 20.4.1 NMAC incorporating 40 CFR §265.118(c)(2).

12.1 Monitoring and Frequency

The monitoring activities and the frequencies at which they will be performed, pursuant to 20.4.1 NMAC incorporating 40 CFR §265.118(b)(1), are described to the extent known in the following sections. Monitoring of the vadose zone and groundwater will be conducted as appropriate according to currently existing schedules, pending potential modifications as determined by the characterization and monitoring process under the Consent Order and/or implementation of LANL's Groundwater Protection Program. The frequency of monitoring for each medium is also discussed.

12.1.1 Vadose Zone

The following information describes proposed subsurface vapor monitoring activities and the frequencies at which they will be conducted within the vadose zone beneath Area G. The information is taken from the 2005 "MDA G Investigation Report" submitted to the NMED under the requirements of the Consent Order. As described in Section 3.3 of this closure plan, routine monitoring of subsurface pore-gas has been on-going at Area G from 1992 to the present. Results from this monitoring indicate that TCA is the dominant contaminant present as a vapor beneath Area G. Maximum concentrations are closely associated with the location of the earliest Area G disposal in the eastern area. The detectable VOC concentrations extend to at least 153 ft below ground surface (LANL, 2005, IR). The highest concentrations of VOCs occurred near Pits 1-5 and the adjacent shaft fields including the area of Shaft 124. Lower concentrations of TCA, TCE, and PCE have been detected in boreholes in the central and western portions of Area G, relatively near Pit 29.

Pore gas monitoring requirements to determine trends in VOC concentrations will be recommended in the CME Plan. It is proposed that the pore-gas monitoring locations listed by borehole number in Table 7 (as located in Figure 6) be used to monitor within and adjacent to areas of maximum VOC concentrations. The planned port depths for these boreholes will include ports at the base depth of the nearest adjacent disposal unit and every 25 ft along the length of the borehole to the total depth.

The boreholes listed will be monitored annually for two years by field measurement of percent carbon dioxide, percent oxygen, static subsurface pressure, and organic vapors using the methods appropriate for Consent Order pore-gas monitoring (Section IX.B.2.g). These data will be compared to the historic record to evaluate spatial extent and trends of the dominant VOCs released from Area G.

Vapor samples will be collected annually for one year using SUMMA canisters and silica gel columns from the port nearest the lowest base elevation of the adjacent disposal unit and at the total depth of the boreholes listed in Table 7 with two exceptions; location 54-25105 will be sampled across the open portion using a straddle packer, and location 54-22116 will be sampled from the two ports containing the highest level of TCA, as measured by B&K analyzer. Annual subsurface vapor monitoring will include collection of a minimum of 32 vapor samples from subsurface monitoring locations at Area G. Additionally two duplicates, two equipment blanks, and one performance evaluation sample will be collected during each event using SUMMA canisters. One duplicate sample will be collected during each event using a silica gel column. During the second year, vapor samples will be collected semi-annually.

This annual monitoring will continue until a final remedy for Area G is selected under the Consent Order. Final long-term monitoring requirements will be determined as part of the Corrective Measures Implementation (CMI) process based on the remedy selected for MDA G.

Pore-gas monitoring data will be reported annually until the CMI. Monitoring data will be reported in a periodic monitoring report according to the requirements of the Consent Order, Section XI.D. This report may include recommendations for future monitoring and remedial actions based on data results and trends observed.

12.1.2 Regional Aquifer Groundwater

Pit 29 and Shaft 124 are subject to groundwater monitoring requirements under 20.4.1 NMAC incorporating 40 CFR 264 Subpart F. Under Section IV.A.1 of the Consent Order, "Background," these groundwater monitoring requirements will be met through implementation of the groundwater monitoring requirements of the Consent Order. As these coincide with the location and the types of the regulated disposal units contained in this closure plan, LANL proposes that the groundwater monitoring requirements for these units will be met through implementation of the conditions of the Consent Order. In the event that the Consent Order expires before final implementation of these requirements for these regulated units, the conditions will continue under this post-closure plan as necessary to meet the post-closure requirements.

The Interim Facility-Wide Groundwater Monitoring Plan (Interim Plan) (LANL, 2006c) is the current document under the Consent Order addressing the monitoring requirements. 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 Interim Plan lists four aquifer monitoring wells in the vicinity of TA-54 that will monitor any potential releases from TA-54 to meet the regulatory requirements.

The Interim Plan divides groundwater monitoring schemes by watersheds. Area G is bordered by Cañada del Buey on the north and Pajarito Canyon on the south. Cañada del Buey is a tributary of Mortandad Canyon. Both the Mortandad and Pajarito Canyon watersheds are included as separate study areas in the Interim Plan. Of the four wells near TA-54, well R-21 is in the Mortandad watershed and wells R-20, R-22, and R-32 are in the Pajarito watershed (Figure 7). Well R-22 was completed in March 2001 and Well R-32 was completed in August 2002. Wells R-20 and R-21 were completed in early 2003.

Each newly installed well is incorporated into the Interim Plan and LANL's Groundwater Protection Program. The monitoring data are managed in a database that is available to LANL and external stakeholders. Under the Groundwater Protection Program, all water sampling, water-level measurements, and other testing will be implemented consistent with laws, regulations, and DOE orders.

The four regional monitoring wells described above and/or any additional wells installed pursuant to Consent Order investigations will be monitored at a frequency described in each annual update of the Interim Plan to support performance evaluation of the disposal facilities at TA-54. The monitoring suite is also described in each annual update and generally includes determination of water levels and chemical analysis for metals and organic compounds.

12.2 Maintenance and Frequency

Pursuant to 20.4.1 NMAC incorporating 40 CFR §264.118(b)(2), the planned maintenance activities and the frequencies at which they will be performed are discussed in the following sections. Planned maintenance will include inspections at prescribed frequencies and potential resulting maintenance activities consistent with 20.4.1 NMAC incorporating 40 CFR §265.310. The planned maintenance will also ensure the function of the monitoring equipment consistent with 20.4.1 NMAC incorporating 40 CFR Part 264, Subpart F and 20.4.1 NMAC incorporating 40 CFR §265.310.

12.2.1 Integrity of Cap/Cover

The cover at the Area G regulated unit will be maintained during post-closure to preserve its integrity and effectiveness in accordance with 20.4.1 NMAC incorporating 40 CFR §265.310(b)(1). Inspections of the cover will be conducted on a schedule to be defined by the Consent Order and repairs will be made, if necessary, to correct the effects of settling, subsidence, erosion, or other events. Inspection results and subsequent repairs will be noted in the facility record. In addition to inspections, the effectiveness of the ET cover will also be monitored through collection of moisture content data from beneath the cover. The specific moisture monitoring requirements will be developed as part of the final cover design. The final selected corrective measure will be maintained to prevent run-on and runoff from eroding or otherwise damaging the selected measure, consistent with 20.4.1 NMAC incorporating 40 CFR § 265.310(b)(5).

12.2.2 Monitoring Equipment

As discussed in Section 12.1.1, LANL will continue to conduct vadose zone monitoring at MDA G and may modify the existing vadose zone monitoring program based on the design process under the Consent Order. Continued vadose zone monitoring will allow early detection of potential contaminant transport toward the regional aquifer. The continued vadose zone monitoring will be conducted to meet 20.4.1 NMAC incorporating 40 CFR §265.310(b)(2) requirements. Prior to each sampling event, the protective surface casing of each selected borehole will be inspected to ensure that it has not been damaged. The locking mechanisms at each borehole will be checked to verify that they have not been compromised. Vapor ports will also be inspected to ensure that they are not obstructed and have not degraded or lost their plugs. In addition, vapor port depth tags will be inspected for legibility, as will the identification number on the inside of the borehole. Sampling equipment will also be inspected and tested, as necessary, prior to each sampling event. Over time, the monitoring systems that contain the sampling membranes (e.g., socks) or other equipment within a borehole may require replacement. If the borehole is in an area where vehicle traffic might pose a hazard, the guard or bumper posts will be inspected to ensure their integrity is maintained. Maintenance will be performed on an as-needed basis when the necessity is indicated as a result of inspections. Any moisture monitoring equipment in the cover will be inspected regularly and replaced as necessary.

The groundwater monitoring system, discussed in Section 12.1.2, will also be maintained to ensure maximum operating conditions, consistent with 20.4.1 NMAC incorporating 40 CFR §265.310(b)(3). Prior to each sampling event, the protective steel casing and locking mechanism(s) will be inspected to ensure that they have not been compromised. The well identification number on the inside and/or outside of the cover will also be inspected for legibility. In addition, the brass monument on the concrete protective pad, placed around the well casing to ensure long-term structural integrity of the well, will be inspected to verify that the location identification number remains clearly imprinted on the monument. If the well is in an area where vehicle traffic might pose a hazard, the guard or bumper posts will be inspected to ensure their integrity is maintained. Maintenance will be performed on an as-needed basis when the necessity is indicated as a result of inspections.

Surveyed benchmarks used in accordance with 20.4.1 NMAC incorporating 40 CFR §265.309 will be protected and maintained throughout the post-closure period, pursuant to 20.4.1 NMAC incorporating 40 CFR §265.310(b)(5). If a benchmark is in an area where vehicle traffic might pose a hazard, guard or bumper posts will be installed to provide protection. The condition of the surveyed benchmarks will be inspected for legibility and to identify any potential maintenance needs. Maintenance will be performed on an as-needed basis when the necessity is indicated as a result of inspections.

12.3 Reporting

Post-closure care will also include reporting consistent with 20.4.1 NMAC incorporating 40 CFR Part 264, Subpart F and 20.4.1 NMAC incorporating 40 CFR §265.310, as appropriate. As described in Section 12.1.2 of this closure plan, Section IV.A.1 “Background” of the Consent Order includes a provision that implementation of the groundwater monitoring requirements of the Consent Order will fulfill the requirements of 20.4.1 NMAC incorporating 40 CFR Part 264, Subpart F.

The Interim Facility-Wide Groundwater Monitoring Plan is the current document under the Consent Order addressing reporting requirements for schedule and format of reports. Reporting of monitoring data for the post-closure activities described in this closure plan will be in accordance with Section 1.8, “Sampling Frequency and Schedule” of the monitoring plan and Section IV.A and Section XI.D “Periodic Monitoring Report” of the Consent Order. At the time of development of this closure plan, these include the condition that data from watershed sampling will be reported to NMED within 120 days after the last location has been sampled in each watershed. The required contents and format of periodic monitoring reports for groundwater, vapor, and remediation system monitoring are also described. These reporting provisions are subject to modification in compliance with the provisions of Section III.J.1 of the Consent Order. In the event that such modifications create conflicts with this post-closure plan, LANL will request permit amendments as necessary. In the event of such conflicts, the requirements of the Consent Order will take precedence over the requirements of the post-closure plan.

12.4 Post-Closure Use of Property

In accordance with 20.4.1 NMAC incorporating 40 CFR §265.117(c), post-closure use of property on or in which hazardous waste remains after partial or final closure will not be allowed to disturb the integrity of the final cover or any other components of the containment system, if present. In addition, post-closure use of property will not be allowed to disturb the function of the monitoring systems 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 it is necessary to reduce a threat to human health or the environment.

12.5 Post-Closure Care Period Contact Office

As required by 20.4.1 NMAC incorporating 40 CFR §265.118(c)(3), the name, address, and phone number of the office to contact about the Area L landfill 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

13 **REFERENCES**

DOE, 1995. "DOE Methods for Evaluating Environmental and Waste Management Samples," DOE/EM-0089T, Rev. 2. Prepared for the U.S. Department of Energy by Pacific Northwest Laboratory, Richland, Washington.

EPA, 1986 and all approved updates. "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.

EPA, 2002. "RCRA Waste Sampling Draft Technical Guidance Planning, Implementation, and Assessment," EPA530-D-02-002, August 2002, Office of Solid Waste, U.S. Environmental Protection Agency, Washington, D.C.

LANL, 1988. "Post-Closure Permit Application (Supplemental Information)," September 1988, Los Alamos National Laboratory, Los Alamos, New Mexico.

LANL, 1998. "Hydrogeologic Workplan," May 1998, Los Alamos National Laboratory, Los Alamos, New Mexico.

LANL, 1999. "Screening Level Ecological Risk Assessment Methods," LA-UR-99-1406, Los Alamos National Laboratory, Los Alamos, New Mexico.

LANL, 2003a, "Los Alamos National Laboratory General Part B Permit Renewal Application," Revision 2.0, LA-UR-03-5923, Los Alamos National Laboratory, Los Alamos, New Mexico.

LANL, 2003b, "Los Alamos National Laboratory Technical Area 54 Part B Permit Renewal Application," Revision 3.0, LA-UR-03-3579, Los Alamos National Laboratory, Los Alamos, New Mexico.

LANL 2003c, "Investigation Work Plan for Material Disposal Area G, at Technical Area 54," September 2003, LA-UR-03-6491, Los Alamos National Laboratory, Los Alamos, New Mexico.

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

LANL, 2006a, "Corrective Measures Evaluation Plan for Material Disposal Area G at Technical Area 54," May 2006, LA-UR-06-1709, Los Alamos National Laboratory, Los Alamos, New Mexico

LANL, 2006b, "Los Alamos National Laboratory General Part A Permit Application," Revision 5.0, April, 2006 LA-UR-06-2553, Los Alamos National Laboratory, Los Alamos, New Mexico.

LANL, 2006c, "Interim Facility-Wide Groundwater Monitoring Plan," Revision 1, April, 2006 LA-UR-06-2888, Los Alamos National Laboratory, Los Alamos, New Mexico

NIOSH, 1994. The National Institute for Occupational Health and Safety (NIOSH) *Manual of Analytical Methods*, Method 9100, 4th ed. Issue 1. 1994.

NMED, 2005. "Compliance Order on Consent between NMED, the U.S. Department of Energy, and the Regents of the University of California," March 1, 2005, Santa Fe, New Mexico

NMED, 2006. "Technical Background Document for Development of Soil Screening Levels," Rev. 4.0, June 2006, New Mexico Environment Department, Santa Fe, New Mexico.

NMED, 2006. Letter from James Bearzi, Chief, Hazardous Waste Bureau, NMED to Mat Johansen, Groundwater Project Manager, Los Alamos Site Office, U.S. Department of Energy and David McInroy, Remediation Services Deputy Project Director, LANL. "Notice of Disapproval for the Investigation Report for Material Disposal Area G, Consolidated Unit 54-013(b)-99 at Technical Area 54," July 26, 2006. Santa Fe, New Mexico

NMED, 2006. Letter from James Bearzi, Chief, Hazardous Waste Bureau, NMED to David Gregory, Federal Project Director, Los Alamos Site Office, U.S. Department of Energy and David McInroy, Remediation Services Deputy Project Director, LANL. "Notice of Approval for the Work Plan for Supplemental Sampling at Material Disposal Area G, Consolidated Unit 54-013(b)-99 at Technical Area 54," November 13, 2006. Santa Fe, New Mexico

Table 1
Dates of Use, Dimensions, Capacities, and Contents of Pit 29 and Shaft 124
at Technical Area 54 Area G Landfill

Unit	Dates of Use	Length	Width	Depth	Capacity	Amount of Hazardous Waste	Waste Contents and Waste Categories
Pit 29	1983-1986	600 ft	40-75 ft	30 ft	45,795 yds ³	9,784 yds ³	General debris, soils, equipment and compactible/noncompactible waste
Shaft 124	1984-1991	6 ft diameter	NA	65 ft	1,753 ft ³	1 ft ³	Organic Liquids

Table 2
Schedule for Closure Activities at
Technical Area 54 Area G Landfill

Deliverable ^a	Date
Corrective Measures Evaluation Report	August 5, 2007
Remedy Completion Report	December 6, 2015

^a From Section XII, "Compliance Schedule Tables," Compliance Order on Consent between NMED, the U.S. Department of Energy, and the Regents of the University of California," March 1, 2005, Santa Fe, New Mexico

Table 3
Analysis Requirements for Pit 29 and Shaft 124
At Technical Area 54 Area G Landfill

Analyte	EPA SW-846 Analytical Method ^a	Test Methods/ Instrumentation	Target Detection Limit ^b	Rationale
Metal Analysis				
Arsenic	1311, 7060A ^c , 7061A	FLAA, GFAA	10 µg/L	Determine the total and TCLP metal concentration in the samples.
	6010B	ICP-AES	35 µg/L	
	6020	ICP-MS	0.1 µg/L	
Barium	1311, 7080A ^d , 7081 ^c	FLAA, GFAA	200 µg/L	
	6010B	ICP-AES	1 µg/L	
	6020	ICP-MS	0.1 µg/L	
Cadmium	1311, 7130 ^d , 7131A ^c	FLAA, GFAA	2 µg/L	
	6010B	ICP-AES	3 µg/L	
	6020	ICP-MS	0.1 µg/L	
Chromium	1311, 7190 ^d , 7191 ^c	FLAA, GFAA	10 µg/L	
	6010B	ICP-AES	5 µg/L	
	6020	ICP-MS	0.1 µg/L	
Lead	1311, 7420 ^d , 7421 ^c	FLAA, GFAA	5 µg/L	
	6010B	ICP-AES	28 µg/L	
	6020	ICP-MS	0.1 µg/L	
Mercury	1311, 7470A, 7471A ^e	CVAA	0.2 µg/L	
	6010B	ICP-AES	20 µg/L	
Selenium	1311, 7740 ^c , 7741A	FLAA, GFAA	5 µg/L	
	6010B	ICP-AES	50 µg/L	
Silver	1311, 7760A ^d , 7761 ^c	FLAA, GFAA	10 µg/L	
Nickel	7520 ^c , 7521 ^d	FLAA, GFAA	40 µg/L	Determine total metal concentration in samples
	6010B	ICP-AES	10 µg/L	
	6020	ICP-MS	0.2 µg/L	
Hexavalent Chromium	7196A	C	0.5mg/L	Determine total metal concentration in samples
Organic Analysis				
Target compound list VOCs	8260B	GC/MS	10 µg/L	Determine the VOCs concentration

				in the samples.
Target compound list SVOCs	8270D ^c	GC/MS	10 µg/L	Determine the SVOCs concentration in the samples.
<i>Inorganic Analysis</i>				
Cyanide	9010C, 9014	C	20 µg/L	Determine total cyanide concentration in the samples.

^a U.S. Environmental Protection Agency (EPA), 1986 and all approved updates, "Test Methods for Evaluating Solid Waste, Physical/Chemical Methods," SW-846.

^b Detection limits listed for metals are for clean water. Detection limits for organics are expressed as practical quantitation limits. Actual detection limits may be higher depending on sample composition and matrix type.

^c Method being integrated into Method 7010, per the May 1998 SW-846 Draft Update IVA.

^d Method being integrated into Method 7000B, per the May 1998 SW-846 Draft Update IVA.

^e Method being revised to 7471B per the May 1998 SW-846 Draft Update IVA.

C = Colorimetric

CVAA = Cold-vapor atomic absorption spectroscopy

FLAA = Flame atomic absorption spectroscopy

GC/FID = Gas chromatography/flame ionization detector

GC/MS = Gas chromatography/mass spectrometry

GFAA = Graphite furnace atomic absorption spectroscopy

ICP/AES = Inductively coupled plasma – atomic emission spectrometry

ICP/MS = Inductively coupled plasma – mass spectrometry

mg/L = milligrams per liter

SVOC = semi volatile organic compounds

TCLP = Toxicity Characteristic Leaching Procedure

ug/L = micrograms per liter.

VOC = volatile organic compounds

Table 4

Recommended Sample Containers^a, Preservation Techniques, and Holding Times^b

Analyte Class and Sample Type	Container Type and Materials	Preservation	Holding Time
Metals			
TCLP Metals: Arsenic, Barium, Cadmium, Chromium, Lead, Selenium, Silver	Aqueous Media: 500-mL Wide-Mouth Polyethylene or Glass with Teflon Liner	Aqueous Media: HNO ₃ to pH <2 Cool to 4°C	180 Days
	Solid Media: 125-mL Glass	Solid Media: Cool to 4°C	
TCLP/Total Mercury	Aqueous Media: 500-mL Wide-Mouth Polyethylene or Glass with Teflon Liner	Aqueous Media: HNO ₃ to pH <2 Cool to 4 °C	28 Days
	Solid Media: 125-mL Glass	Solid Media: Cool to 4°C	
Volatile Organic Compounds			
Target Compound Volatile Organic Compounds	Aqueous Media: Two 40 mL Amber Glass Vials with Teflon-Lined Septa	Aqueous Media: HCl to pH<2 Cool to 4 °C	14 days
	Solid Media: 125-mL Glass jar with Teflon-Lined Septa or Two 40 mL Amber Glass Vials with Teflon-Lined Septa	Solid Media: Cool to 4°C Add 5 mLs Methanol or Other Water Miscible Organic Solvent to 40-mL Glass Vials	
Semi-Volatile Organic Compounds			
Target Compound Semi-volatile Organic Compounds	Aqueous Media: Four 1-L Amber Glass with Teflon-Lined Lid	Aqueous Media: Cool to 4 °C	Seven days from field collection to preparative extraction. 40 days from preparative extraction to determinative analysis.
	Solid Media: 250-mL Glass	Solid Media: Cool to 4°C	

^a Smaller sample containers may be required due to health and safety concerns associated with potential radiation exposure, transportation requirements, and waste management considerations.

^b Information obtained from "Test Methods for Evaluating Solid Waste, Physical/Chemical Methods," SW-846, U.S. Environmental Protection Agency, 1986 and all approved updates.

°C = degrees Celsius

HNO₃ = nitric acid

HCl = hydrochloric acid

L = Liter

mL = milliliter

TCLP = Toxicity Characteristic Leaching Procedure

Table 5

Recommended Quality Control Sample Types, Applicable Analyses, Frequency, and Acceptance Criteria

QC Sample Type	Applicable Analysis^a	Frequency	Acceptance Criteria
Trip Blank	VOC	One set per shipping cooler containing samples to be analyzed for VOCs	Not Applicable
Field Blank	VOC/SVOC, metals,	One sample daily per analysis	Not Applicable
Field Duplicate	Chemical	One for each sampling sequence	Relative percent difference less than or equal to 20 percent
Equipment Rinsate Blank ^b	VOC/SVOC, metals,	One sample daily	Not Applicable

^a For VOC and SVOC analysis, if blank shows detectable levels of any common laboratory contaminant (e.g., methylene chloride, acetone, 2-butanone, toluene, and/or any phthalate ester), sample must exhibit that contaminant at a level 10 times the quantitation limit to be considered detectable. For all other contaminants, sample must exhibit the contaminant at a level 5 times the quantitation level to be considered detectable.

^b Collected only if reusable sampling equipment used.

QC = quality control

VOC = volatile organic compound

SVOC = semi-volatile organic compound

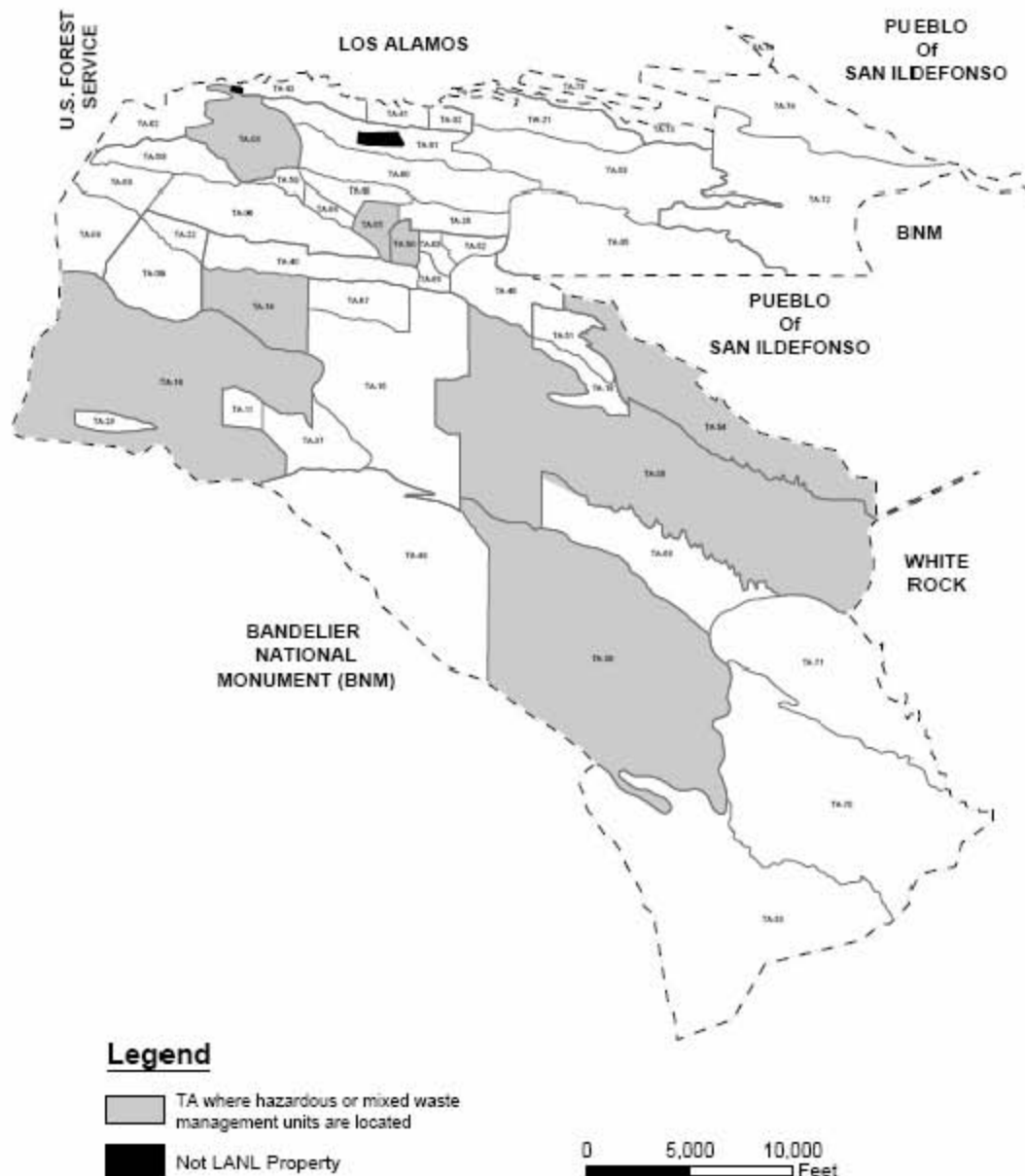
Table 6
Potential Waste Materials, Waste Types, and Disposal Options

Potential Waste Materials	Waste Types	Disposal Options
Personal protective equipment (PPE)	Non-regulated solid waste	Subtitle D landfill
	Hazardous 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	Non-regulated liquid waste	Sanitary sewer
	Hazardous liquid waste	Waste will be treated to meet LDR treatment standards, if necessary, and disposed in a Subtitle C or D landfill, as appropriate.
Verification water	Non-regulated liquid waste	Sanitary sewer
	Hazardous liquid waste	Waste will be treated to meet LDR treatment standards, if necessary, and disposed in a Subtitle C or D landfill, as appropriate.
Discarded waste management equipment	Non-regulated solid waste	Subtitle D landfill
	Hazardous waste	Waste will be treated to meet LDR treatment standards, if necessary, and disposed in a Subtitle C or D landfill, as appropriate.
Sampling equipment	Non-regulated solid waste	Subtitle D landfill
	Hazardous waste	Waste will be treated to meet LDR treatment standards, if necessary, and disposed in a Subtitle C or D landfill, as appropriate.

Table 7

MDA G Subsurface Vapor Monitoring Locations

Location ID	Depth of Screened Ports (ft)
54-24382	28, 50, 75, 108
54-24388	26, 50, 75, 100, 130
54-24390	15, 31, 50, 75, 100, 125, 159
54-24393	25, 51, 75, 100, 125, 164
54-25105	485-701
54-01107	20, 44.5, 56.5, 74, 91, 100
54-01110	20, 48, 60, 70, 85, 90
54-01111	20, 39.5, 50, 70, 78, 100, 139
54-01115	7.9, 26.5, 40.8, 53, 63.6, 68.9
54-01117	20, 31.5, 55, 73, 82, 85
54-01121	20, 26, 61.5, 70, 76, 98, 121
54-01126	7.5, 17.5, 28.5, 35, 42.5, 49.5
54-01128	7.5, 15, 20, 30, 39
54-02009	37, 62, 92
54-02010	30, 53, 95
54-02032	20, 60, 100, 130, 156
54-02033	20, 60, 100, 160, 200, 220, 260, 277
54-22116	28, 46, 64, 82, 100, 118, 136, 154, 172, 190, 208, 226, 244, 262, 280



Created by ERSS GIS TEAM, Map Number 06-0106 September 12, 2006
State Plane Coordinate System New Mexico Central Zone North American Datum 1983 (NAD83)
This map was created for work processes associated with the Environmental Remediation Support Services. All other uses for this map should be confirmed with LANL EP-ERSS staff.
Boundary of Department of Energy Property Around the Los Alamos National Laboratory, Los Alamos National Laboratory, GDMO Site Planning & Project Initiation, Infrastructure Planning Office, 10 February 2006
Boundary of Department of Energy Property In and Around the Los Alamos National Laboratory, Los Alamos National Laboratory, GDMO Site Planning & Project Initiation, 01 February 2003 as captured 07 September 2004.

Figure 1: Location Map of Los Alamos National Laboratory (LANL) Technical Areas (TA)

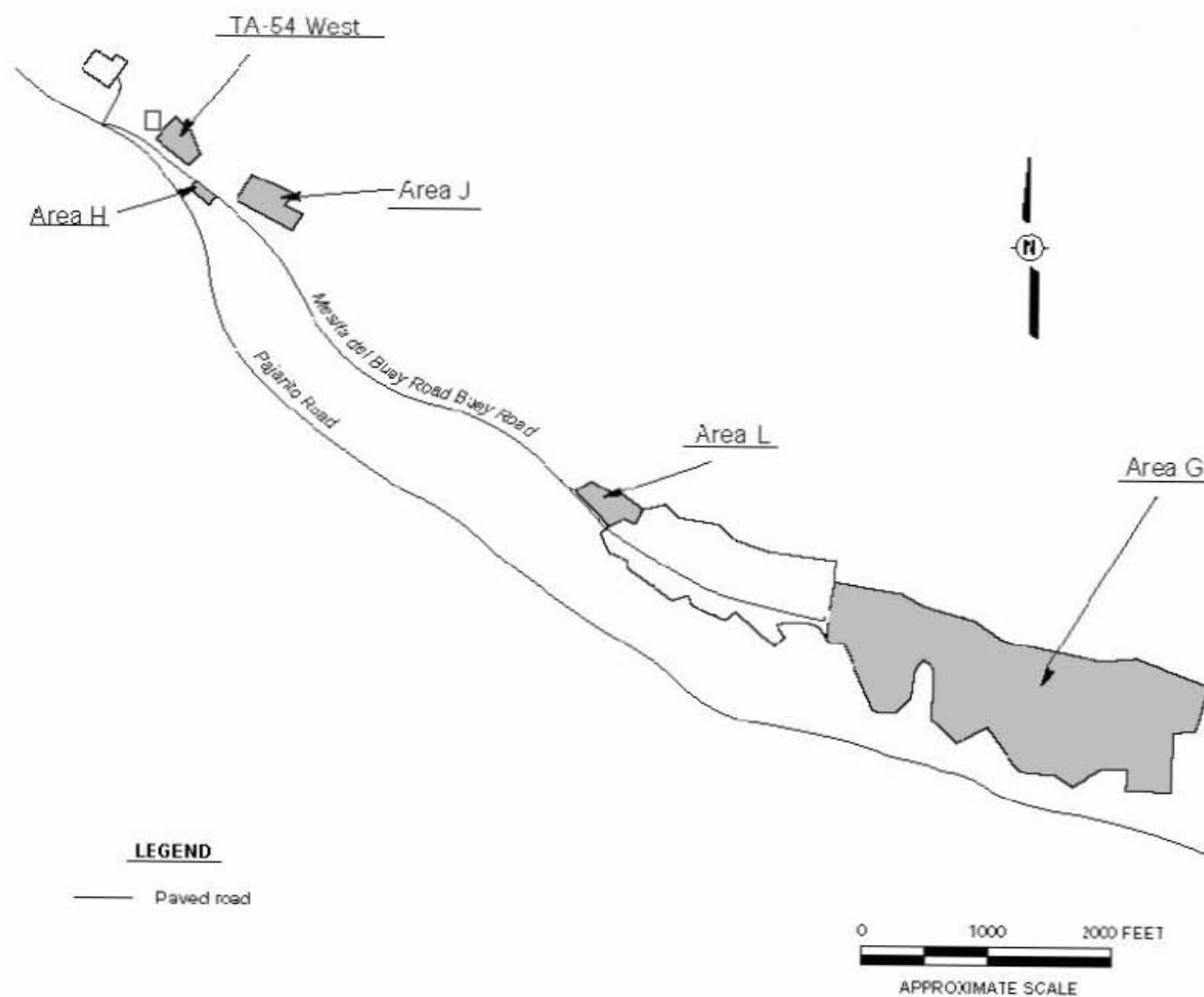


Figure 2: Technical Area (TA) 54, Site Location Map

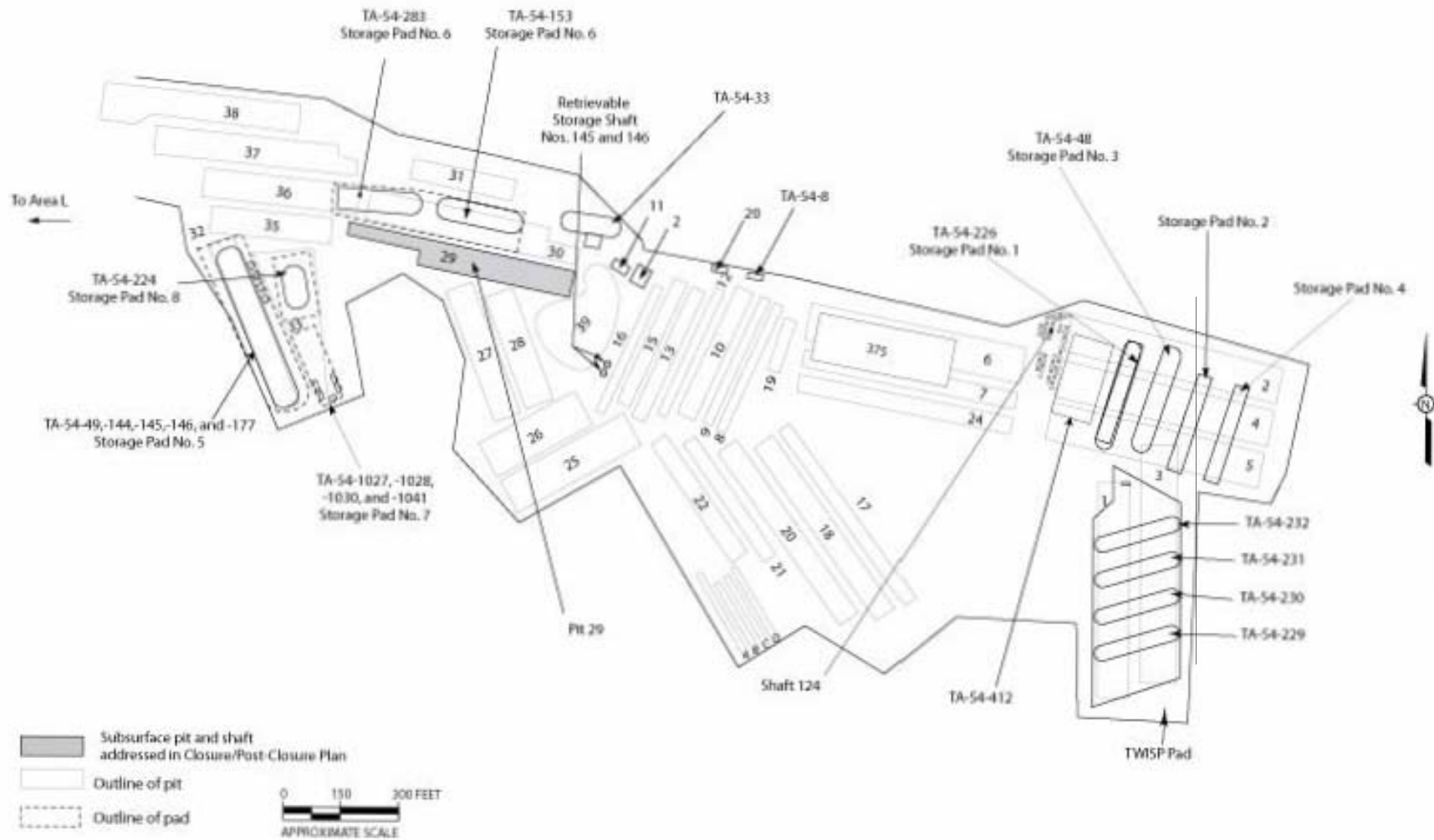
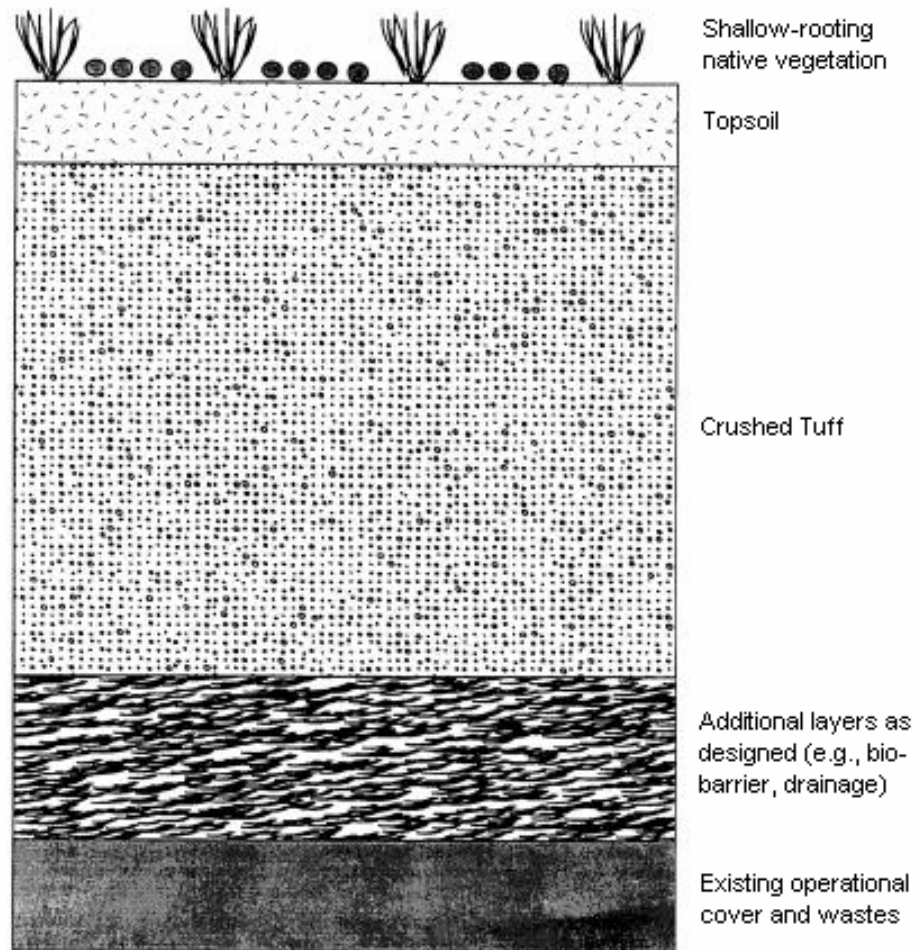


Figure 3: Technical Area (TA) 54, Area G



Figure 4: Area of Proposed Cover, Technical Area TA-54, Area G



Not to Scale

Figure 5: Example of An Evapotranspiration Cover

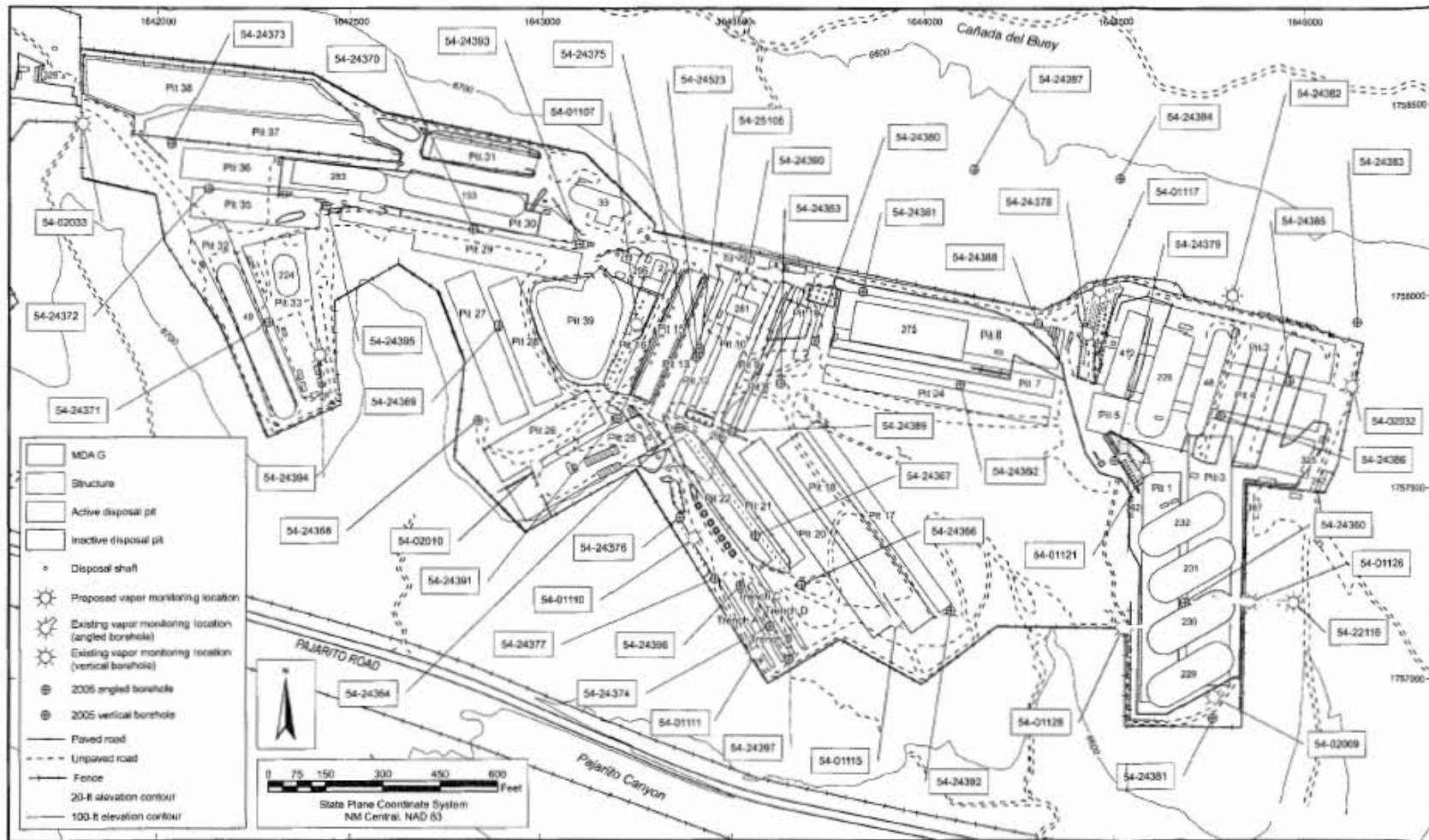


Figure 6: Existing and Proposed Vapor Monitoring Locations at MDA G

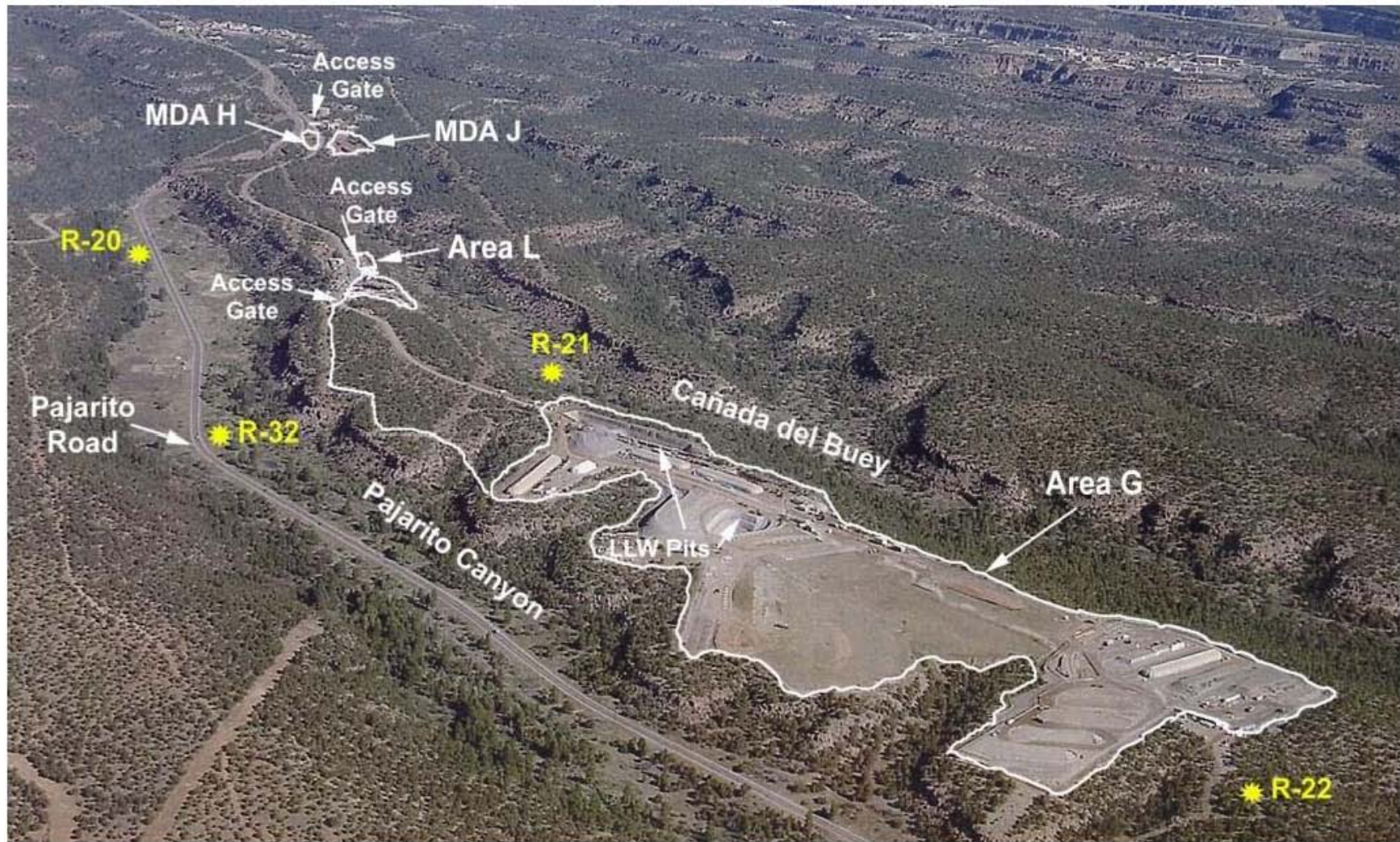


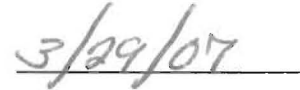
Figure 7: R-Wells Located Near TA-54

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.



Richard S. Watkins
Associate Director
Environment, Safety, Health, & Quality
Los Alamos National Laboratory
Operator



Date Signed



Daniel E. Glenn
Acting Manager, Los Alamos Site Office
National Nuclear Security Administration
U.S. Department of Energy
Owner/Operator



Date Signed