



National Nuclear Security Administration
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DEC 21 2009

CERTIFIED MAIL-RETURN RECEIPT REQUESTED

James Bearzi, Chief
Hazardous Waste Bureau
New Mexico Environment Department
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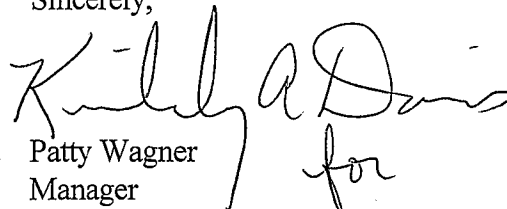


Dear Mr. Bearzi:

On behalf of the U. S. Department of Energy/National Nuclear Security Administration (DOE/NNSA), and Sandia Corporation (Sandia), DOE/NNSA is submitting the "Mixed Waste Landfill (MWL) Quarterly Progress Report Evapotranspirative (ET) Cover Construction Project, August–October 2009." This quarterly project report addresses all quarterly reporting requirements required by the New Mexico Environment Department (NMED) Final Order In the Matter of Request for a Class 3 Permit Modification for Corrective Measures for the MWL (Final Order) (NMED May 2005) and the NMED conditional approval of the MWL Corrective Measures Implementation Plan (Bearzi December 2008), both requiring the Progress Reports to be submitted to NMED on a quarterly basis during implementation of the remedy. MWL ET Cover construction activities for the period of August through October 2009 are presented in this second quarterly progress report consistent with requirements in the Compliance Order on Consent (NMED April 2004), Section VII.D.5.

Should you have any questions regarding this project quarterly report please contact me at (505) 845-6036, or Joe Estrada of my staff at (505) 845-5326.

Sincerely,


Patty Wagner
Manager

Enclosure (1)

cc w/enclosure:

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CERTIFICATION STATEMENT FOR APPROVAL AND FINAL RELEASE OF DOCUMENTS

Document title: **Mixed Waste Landfill Quarterly Progress Report
Evapotranspirative Cover Construction Project,
August - October 2009.**

Document author: **Mike Mitchell, Department 06765**

I certify under penalty of law that this document and all attachments were prepared under my direction or supervision according to a system designed to ensure 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 or imprisonment for knowing violations.

Signature: 

Marianne Wack, Director

Nuclear Energy & Global Security Technologies
Center 6700

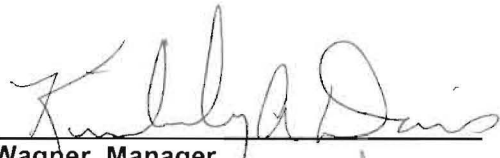
Sandia National Laboratories/New Mexico

Albuquerque, New Mexico 87185

Operator

12/14/09
Date

and

Signature: 

Ms. Patty Wagner, Manager

U.S. Department of Energy

National Nuclear Security Administration

Sandia Site Office

Owner and Co-Operator

12/21/09
Date

Sandia National Laboratories, New Mexico (SNL/NM)
Environmental Restoration Project

**MIXED WASTE LANDFILL
QUARTERLY PROGRESS REPORT
EVAPOTRANSPIRATIVE COVER CONSTRUCTION
PROJECT
AUGUST – OCTOBER 2009**

DECEMBER 2009



United States Department of Energy
Sandia Site Office

**MIXED WASTE LANDFILL
QUARTERLY PROGRESS REPORT
EVAPOTRANSPIRATIVE COVER CONSTRUCTION
PROJECT
AUGUST – OCTOBER 2009**

Sandia National Laboratories/New Mexico
Environmental Restoration Project
Department 6765
Albuquerque, New Mexico 87185

December 2009

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ABBREVIATIONS AND ACRONYMS

ASTM	American Society of Testing Materials
CMIP	Corrective Measures Implementation Plan
CQA	Construction Quality Assurance
CY	Cubic Yards
DOE	U.S. Department of Energy
EDi	Environmental Dimensions, Inc.
ET	Evapotranspirative
KAFB	Kirtland Air Force Base
MWL	Mixed Waste Landfill
NMED	New Mexico Environment Department
QA	Quality Assurance
QC	Quality Control
Sandia	Sandia Corporation
SNL/NM	Sandia National Laboratories/New Mexico
TA	Technical Area

1.0 Introduction

Sandia National Laboratories/New Mexico (SNL/NM) is located within the boundaries of Kirtland Air Force Base (KAFB), immediately south of the city of Albuquerque in Bernalillo County, New Mexico. KAFB occupies 52,233 acres. SNL/NM research and administration facilities are divided into five technical areas (TAs), designated 1 through 5, and several additional test areas, occupying 2,842 acres. TA-1, TA-2, and TA-4 are separate research facilities in the northwestern portion of KAFB. TA-3 and TA-5 are contiguous research facilities forming a 4.5-square-mile, rectangular area in the southwestern portion of KAFB. TA-3 alone occupies 2,000 acres. The Mixed Waste Landfill (MWL) is a 2.6-acre, fenced waste disposal area located in north-central TA-3 at SNL/NM (Figure 1).

1.1 Background

The MWL Corrective Measures Implementation Plan (CMIP) (SNL/NM November 2005) incorporates the remedy selected by the New Mexico Environment Department (NMED) and details the deployment of the MWL Alternative Evapotranspirative (ET) Cover (Chapter 2), the regulatory basis (Chapter 3), MWL characteristics (Chapter 4), the technical basis for the cover (Chapter 5), the MWL ET Cover design (Chapter 6), and cover performance monitoring (Chapter 7). Appendices include construction specifications (Appendix A), and the construction quality assurance plan (Appendix B).

After receiving conditional approval of the CMIP from the NMED (Bearzi December 2008), the MWL ET Cover Construction contracting process was initiated and completed in March 2009. The Environmental Dimensions, Inc. (EDi) Team was selected to construct the ET Cover and the URS Corporation was selected to perform independent third party Construction Quality Assurance (CQA) under a separate contract. NMED was notified of the start of ET Cover construction field work on April 10, 2009 (Davis April 2009). The EDi Team mobilized to the field to begin initial site activities on May 11, 2009 after completing an updated Health and Safety Plan that was approved by Sandia.

1.2 Purpose and Scope

Progress reports for ET Cover construction activities are required by the NMED Final Order In the Matter of Request for a Class 3 Permit Modification for Corrective Measures for the Mixed Waste Landfill (Final Order) (NMED May 2005) during implementation of the remedy. The Conditional Approval for the MWL CMIP (Bearzi December 2008) required the Progress Reports to be submitted to the Department on a quarterly basis during implementation of the

remedy. The Compliance Order on Consent (NMED April 2004), Section VII.D.5 specifies that progress reports shall, at a minimum, include the following information.

1. A description of the work completed during the reporting period;
2. A summary of all problems, potential problems, or delays encountered during the reporting period;
3. A description of all actions taken to eliminate or mitigate problems, potential problems, or delays;
4. A discussion of the work projected for the next reporting period, including all sampling events; and
5. Copies of the results of all monitoring, including sampling and analysis, and other data generated during the reporting period; and
6. Copies of all waste disposal records generated during the reporting period.

MWL ET Cover construction activities for the period May through July 2009 are presented in the first quarterly progress report that was submitted to the NMED in September 2009 (SNL/NM September 2009). This first progress report presented ET Cover construction activities from initial mobilization to the site (May 2009) to construction of the Native Soil Layer (completed in late July 2009). All laboratory and field testing results associated with ET Cover construction were included in this first quarterly progress report, with the exception of Topsoil Layer field testing that was performed early September 2009. All waste disposition documentation associated with the MWL ET Cover construction occurred in the previous reporting period and was addressed in the first quarterly progress report.

This second quarterly progress report documents the final ET Cover construction activities completed from August 3 – September 3, 2009, including installation of the Topsoil Layer and re-vegetation. Two soil vapor monitoring wells were installed through the Topsoil Layer prior to seeding and mulching activities to minimize the impact to re-vegetation efforts (i.e., minimize damage to plants). These soil vapor monitoring wells are required by NMED (Bearzi December 2008, referred to as soil-vapor sampling points) but are not part of cover construction as defined by the CMIP, and will be documented in a separate report that will be submitted to the NMED for approval.

A CMI Report documenting ET Cover construction will be prepared and submitted to the NMED within 180 days of ET Cover completion as required by the Final Order. The CMI Report will present detailed cover construction documentation, all field and laboratory testing results, CQA

documentation, a photographic log of construction activities, and final as-built drawings. Sandia Corporation (Sandia) and the U.S. Department of Energy (DOE) anticipate submitting this report in early calendar year 2010.

1.3 Construction Activity Summary

MWL ET Cover construction was completed on September 3, 2009. Table 1 provides a summary of construction activities completed this reporting period (August – October 2009) as well as the activities completed during the previous reporting period. More detailed information for ET Cover construction activities completed this reporting period is provided in Section 2.0. A photographic log covering all ET Cover construction activities will be included in the CMI Report.

There were no significant schedule delays or problems encountered during the reporting period, and the ET Cover construction work was completed ahead of the overall schedule approved by the NMED (Bearzi December 2008). Preliminary soil and rock volume estimates for each layer of the ET Cover (compacted, in-place volumes) are summarized in Table 2 and have been updated from the May-July Quarterly Progress Report. Final volume and thickness information will be provided in the MWL CMI Report. Figure 2 shows the ET Cover in profile view and presents the as-designed (minimum specifications) and as-constructed (average) cover layer thicknesses.

NMED personnel visited the MWL ET Cover construction site on August 6, 2009 to oversee the installation of the two soil vapor monitoring wells. This was the only NMED site visit during the reporting period. There was one NMED visit and one NMED inspection during the previous reporting period.

1.4 Report Structure

The 2009 ET Cover construction work completed this reporting period includes installation of the Topsoil Layer, re-vegetation, supplemental watering, and project demobilization. In addition, preparation of the MWL CMI Report and MWL Alternative Cover CQA Report was ongoing throughout the reporting period. These activities are presented in Section 2.0. The construction schedule and remaining work are presented in Section 3.0, and a reference list is provided in Section 4.0.

2.0 MWL ET Cover Completion Activities

Activities completed during this reporting period include Topsoil Layer installation, soil vapor monitoring well installation, seeding and mulching, administrative security fence installation, and supplemental watering. Installation of the two soil vapor monitoring wells will be documented in a separate installation report.

2.1 Topsoil Layer

The Topsoil Layer is the final cover layer and the layer that will directly support the establishment of native plants. It is also the layer that will initially hold all surface moisture that falls on the cover surface as precipitation. As specified in the CMIP, the Topsoil Layer is to be minimally compacted (i.e., compacted only as a result of the installation process, not by use of standard compaction equipment such as a vibratory roller) and have a minimum thickness of 8 inches.

Construction of the Topsoil Layer was conducted from August 3 through August 12, 2009. Topsoil material consisted of topsoil (upper 6 inches of the in situ Borrow Pit Area soil) and native soil (soil excavated below 6 inches) excavated from the Borrow Pit, screened to 2-inch minus, then admixed with 3/8-inch crushed gravel (25 percent by volume). A total of approximately 7,300 cubic yards (cy) (loose) of topsoil material with 25 percent by volume, 3/8-inch crushed gravel was hauled from the Borrow Pit in 20 cy dump trucks and unloaded directly onto the landfill surface. The material was spread with a John Deere (JD) 670 motor grader in a single, approximately 12-inch loose lift. The 2 percent east-to-west surface design slope established on the Native Soil Layer surface was maintained on the Topsoil Layer surface during final construction, and the side slopes were established at a 6 (horizontal) to 1 (vertical) or flatter angle.

Due to the larger footprint of the as-constructed ET Cover (versus the 2005 CMIP design), the toe of the cover slope on the west side encroached on the MWL groundwater monitoring well pads. Soil drainage diversions immediately east of the three monitoring well locations were constructed to create a localized east-west ridge (i.e., localize high point) parallel to the slope angle. These small ridges or high points divert water to the north and south of the monitoring well pads, protecting them from surface run-off. These features represent a minor design change that was approved by the CQA Engineer as part of the Topsoil Layer.

Visual inspection of the topsoil fill containing 25 percent by volume 3/8 inch crushed gravel was conducted throughout the installation process by the CQA Inspector to verify the topsoil fill conformed to the CMIP specifications. No organic matter, rubble, trash, rocks, or deleterious material greater than 2 inches in dimension was identified.

Following QC and QA verification surveying that confirmed proper layer thickness and slope angles, the Topsoil Layer surface was ripped to loosen the soil and then tilled to break up larger soil clumps in preparation for seeding. The initial ripping was accomplished using scarifier shanks on the JD670 motor grader. Additional surface preparations were conducted as part of the re-vegetation activity discussed in Section 5.6.

2.1.1 Field Testing

Gradation (American Society for Testing and Materials [ASTM] C136) and Classification (ASTM D2487 and D4318) soil testing was performed on the Topsoil Layer fill material at a frequency of 1 sample per 500 cy (loose) as specified in the CMIP. Gradation and Classification results for all samples were included in the previous quarterly progress report (SNL/NM September 2009) and verified the topsoil fill material met the CMIP specifications.

Four soil samples were also collected from the topsoil material for Standard Proctor (ASTM 698) testing to support in-place density and moisture testing of the Topsoil Layer after installation. The Standard Proctor and in-place density and moisture tests were not required by the CMIP. The Standard Proctor results for all samples were included in the previous quarterly progress report (SNL/NM September 2009). The Topsoil Layer in-place density and moisture test results are provided in Table 3.

Four grid block locations on the ET Cover surface were tested at two depths per location, for a total of eight in-place density and moisture tests ranging in depth from 4 to 10 inches. Field testing grid blocks are shown in Figure 3. Percent of maximum dry density achieved (i.e., compaction) ranged from 75 percent (at a 4 inch testing depth) to 96 percent (at an 8-inch testing depth), and the moisture content ranged from 3.7 to 5.4 percent of optimum moisture content.

2.1.2 Verification

The thickness, surface slope, and side slopes of the Topsoil Layer were verified through both the quality control (QC) survey and the quality assurance (QA) survey using the established 50-foot

spaced verification grid shown in Figure 3. Hubs and whiskers were used instead of grade stakes for the Topsoil Layer (blue top approach).

The 2 percent east-to-west surface design slope and 6 to 1 side slopes were verified by both the QC and QA surveys. The average thickness of the Topsoil Layer after placement was 1.02 feet, and the thickness at each grid point exceeded the minimum CMIP specification of 8 inches. The final QC and QA survey data, including the thickness and slopes (surface design and side slopes), were approved by the CQA Engineer on August 12, 2009.

2.2 Re-vegetation

Activities related to re-vegetation were initiated on August 13, 2009, with the installation of an above-ground sprinkler irrigation system that covered the entire landfill surface. All re-vegetation activities except for supplemental watering were completed by September 3, 2009. Tilling, seeding and crimping operations were conducted using a Kubota M7040 agricultural tractor. The tiller was towed by the tractor to till the soil on the cover, slopes, and surrounding area, which broke up the larger soil clumps present after the surface was ripped using scarifier shanks on the JD670 motor grader. Tilling on side slopes was conducted perpendicular to the slope direction to prevent or minimize surface erosion. After tilling, personnel walked the site to break up clumps near irrigation piping that the tiller did not reach.

Seeding operations began on August 25, 2009. Based on recommendations from the SNL/NM Staff Biologist that were approved by the CQA Engineer, the following modifications were implemented to the Reclamation Seeding and Mulching Specification of the CMIP (Section 02930):

- Uniform seeding rate of 80 pounds of seed mix per acre (4 times the original rate);
- No fertilizer added due to timing of seeding; and
- Supplemental watering to assist seed germination and root development.

The seed drill equipment set at the maximum output rate was capable of applying 20 pounds of seed mix per acre. At this rate, the seed drill equipment would have required a minimum of 4 passes to achieve the 80 pounds per acre requirement. This approach would have resulted in an unacceptable amount of compaction to the topsoil, so the decision was made and approved by the CQA Engineer to spread half of the seed by hand. The remaining seed was installed using 2 passes with the seed drill equipment. Following placement of seed, straw was blown over the site at the rate of 2 tons per acre and crimped in.

2.3 Administrative Security Fence

As seeding and mulching activities were being completed, the three strand barbed wire administrative security fence was installed around the cover as specified in the CMIP (Specification 02445). One access gate was placed at the north end. Due to the slightly larger footprint of the as-constructed cover, the fence is positioned on the 6 to 1 side slope on the west side of the ET Cover, just east of three groundwater monitoring wells located on this side of the MWL.

2.4 Supplemental Watering

Supplemental watering of the seeded Topsoil Layer is not addressed in the CMIP and is not considered part of the alternative cover construction scope. The NMED was verbally notified of the supplemental watering schedule and approach on August 13, 2009, and a notification letter was submitted in September 2009 (Wagner September 2009).

On September 3, 2009 seeding and mulching activities were completed and supplemental watering began using the above-ground irrigation system. Watering continued through October 20, 2009 to facilitate the establishment of a native plant community. Consistent with the NMED conditional approval of the CMIP (Bearzi December 2008) and the Sandia/DOE notification letter, detailed supplemental watering information will be included in the revised Long-Term Monitoring and Maintenance Plan.

2.5 Technical Issues and Resolution

The main technical issue associated with the Topsoil Layer is the larger cover footprint, which is the result of the cover being thicker than the minimum thickness specifications in the CMIP.

This is graphically summarized in Figure 2, which shows the average thickness of the as-constructed cover is 1.2 feet greater than the minimum thickness in the CMIP. The thicker as-constructed ET Cover is the result of each cover layer being constructed with at thickness exceeding the minimum specification. Although this required more biointrusion rock and soil fill material than estimated in the CMIP, the final result was achievable within the estimated project budget and schedule. The as-designed versus as-constructed soil and rock volumes for each cover layer are provided in Table 2 along with a brief summary of the main reasons additional materials were needed. In summary, the increase in soil and rock material volumes resulted in a thicker, larger, more protective ET Cover that was achieved within budget and schedule.

3.0 Construction Schedule and Remaining Work

The ET Cover construction was completed ahead of the overall construction timeline schedule originally proposed in the December 15, 2006 Notice of Deficiency Comment Response on the MWL CMIP (SNL/NM December 2006) and approved as condition 1.f. in the NMED CMIP conditional approval (Bearzi December 2008). ET Cover activities that will be completed during the next reporting period include demobilization of the temporary irrigation system and the field office trailer.

Preparation of the MWL CMI Report and the Alternative Cover CQA Report started this reporting period and will be completed within or shortly after the next quarterly reporting period (November through January). The Cover CQA Report will be a stand-alone appendix to the CMI Report and will address all CMI Report cover construction documentation requirements.

4.0 References

Bearzi, J.P. (New Mexico Environment Department), December 2008. Letter to K. Davis (U.S. Department of Energy) and F. Nimick (Sandia Corporation), "Conditional Approval, Mixed Waste Landfill Corrective Measures Implementation Plan, November 2005, Sandia National Laboratories NM5890110518, SNL-05-025." December 22, 2008.

Davis, K. (U.S. Department of Energy), April 2009. Letter to J. Bearzi (New Mexico Environment Department), notifying the New Mexico Environment Department of the start of Mixed Waste Landfill Evapotranspirative Cover construction field work. April 10, 2009.

New Mexico Environment Department (NMED), May 2005. "Final Order, State of New Mexico Before the Secretary of the Environment in the Matter of Request for a Class 3 Permit Modification for Corrective Measures for the Mixed Waste Landfill, Sandia National Laboratories, Bernalillo County, New Mexico," EPA ID #5890110518," New Mexico Environment Department, May 26, 2004.

New Mexico Environment Department (NMED) April 2004, "Compliance Order on Consent Pursuant to the New Mexico Hazardous Waste Act 74-4-10: Sandia National Laboratories Consent Order," New Mexico Environment Department, April 24, 2004.

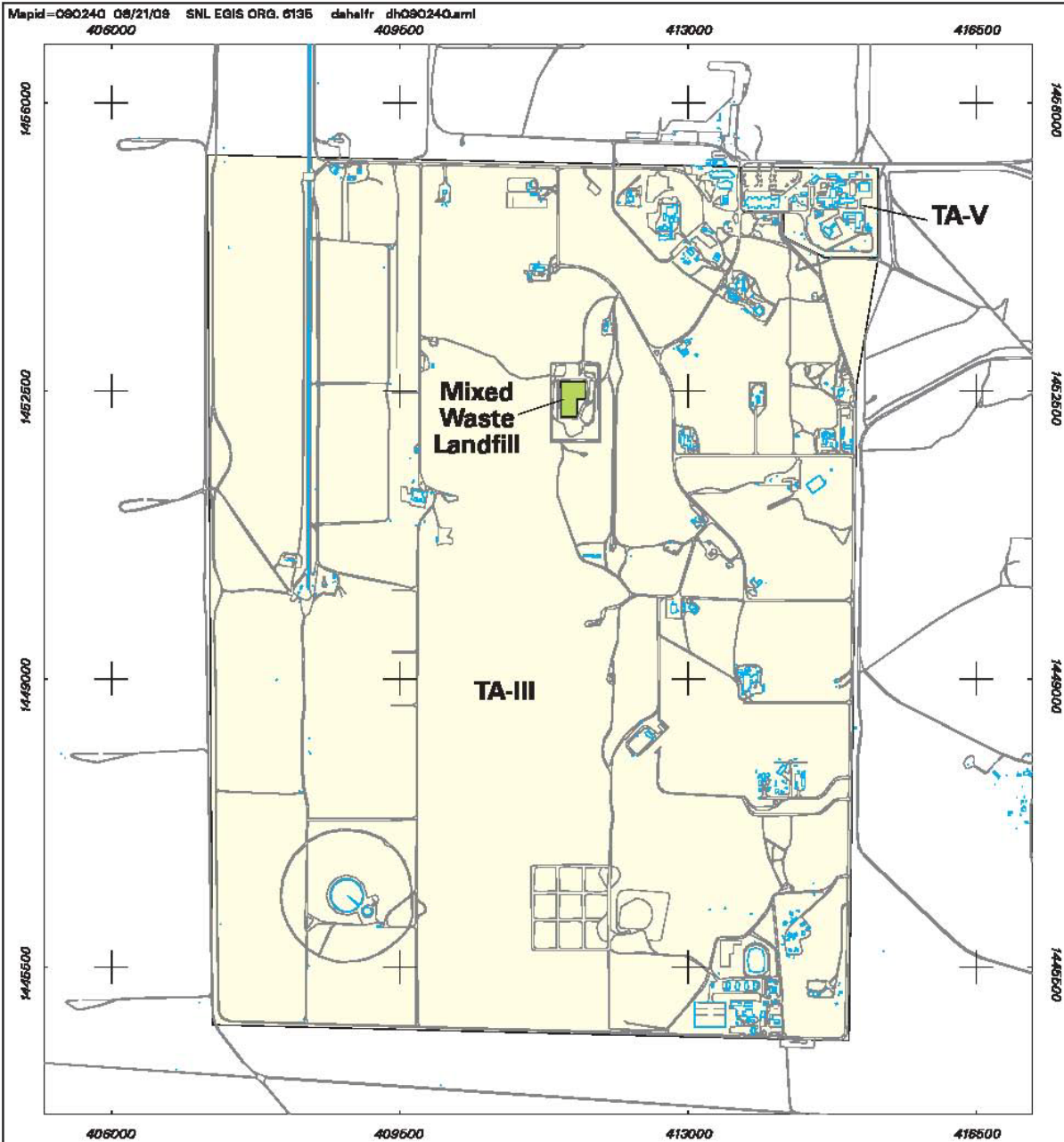
Sandia National Laboratories/New Mexico (SNL/NM), September 2009. "Mixed Waste Landfill Quarterly Progress Report Evapotranspirative Cover Construction Project, August – October 2009," Environmental Restoration Project, Sandia National Laboratories, Albuquerque, New Mexico, November 2005.

Sandia National Laboratories/New Mexico (SNL/NM), December 21 2006, "DOE/Sandia Responses to NMED's 'Notice of Disapproval: Mixed Waste Landfill Corrective Measures Implementation Work Plan, November 2005' – Comment Set 1," prepared for US DOE by Sandia National Laboratories Environmental Restoration Project, Albuquerque, New Mexico.

Sandia National Laboratories/New Mexico (SNL/NM), November 2005. "Mixed Waste Landfill Corrective Measures Implementation Plan," Environmental Restoration Project, Sandia National Laboratories, Albuquerque, New Mexico, November 2005.

Wagner, Patty (U.S. Department of Energy), September 4, 2009. Letter to J. Bearzi (New Mexico Environment Department), notifying the New Mexico Environment Department of the start of Mixed Waste Landfill Evapotranspirative Cover supplemental watering. September 4, 2009.

FIGURES



Legend





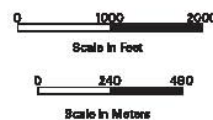
-  Building / Structure
-  Paved and Unpaved Road
-  SNL Technical Area III & V
-  Mixed Waste Landfill

Figure 1
Location of Technical
Areas III & V and the
Mixed Waste Landfill



Sandia National Laboratories, New Mexico
Environmental Geographic Information System

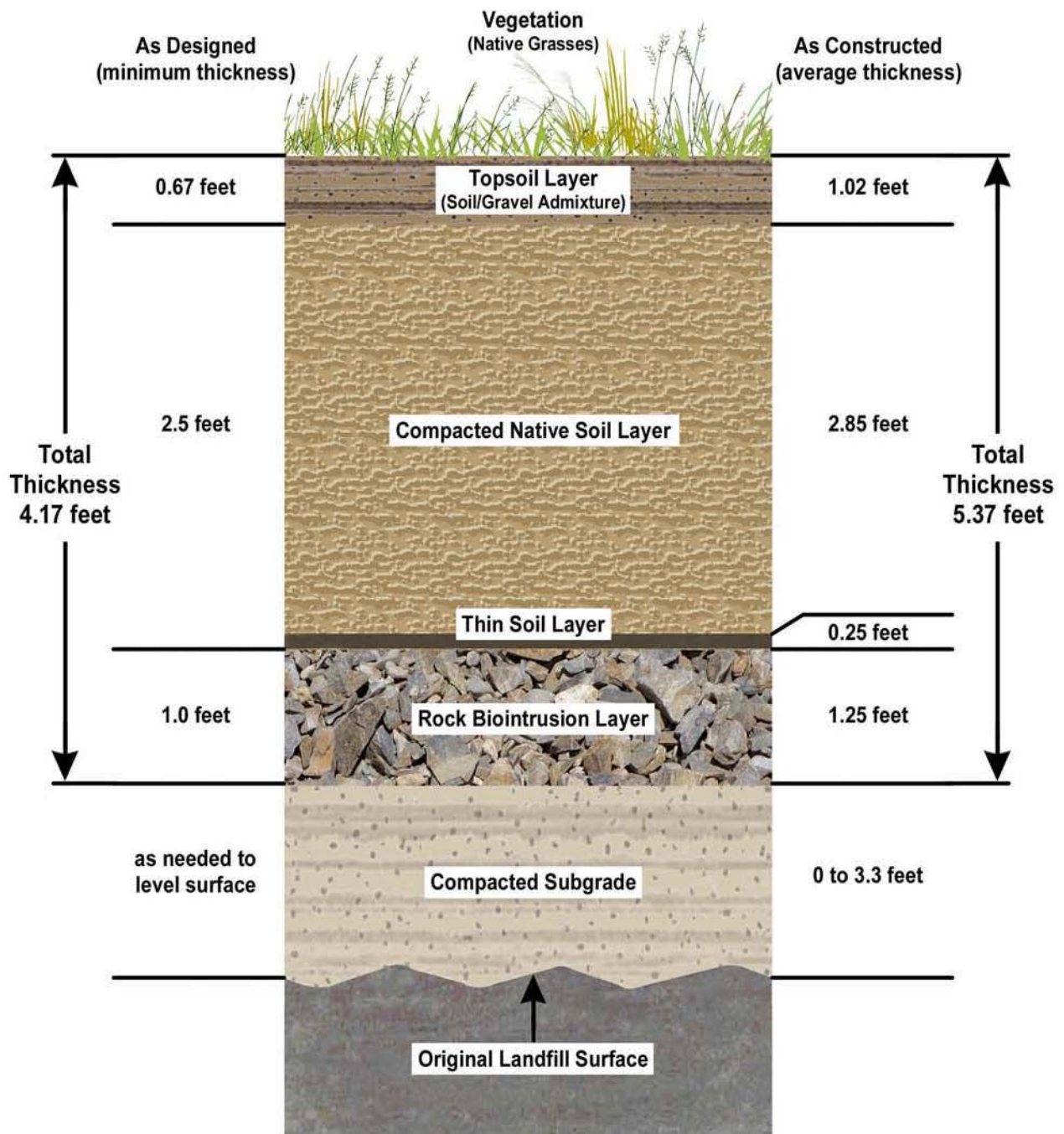


Figure 2
Schematic Diagram of the Mixed Waste Landfill Alternative Evapotranspirative Cover

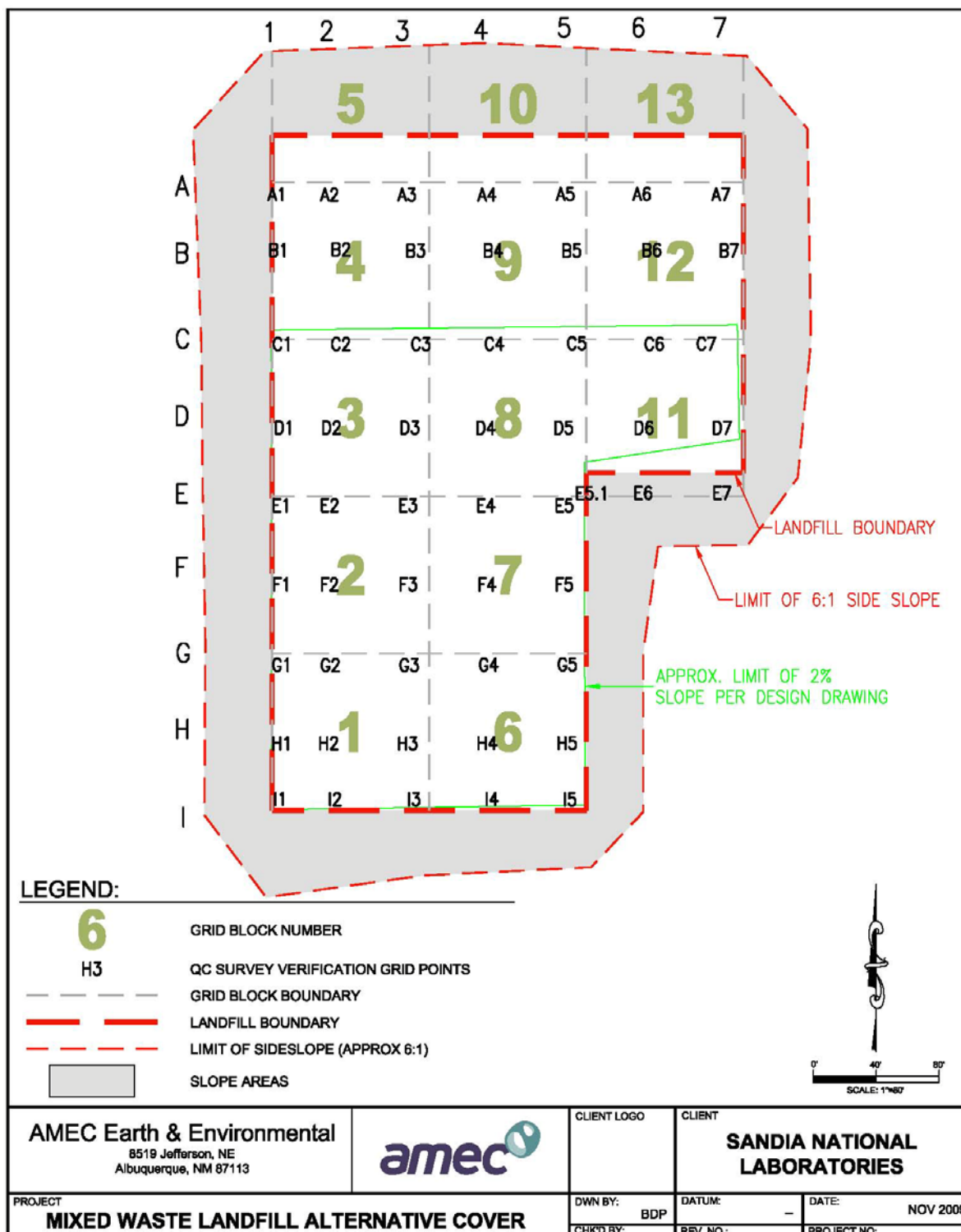


Figure 3

TABLES

Table 1 Mixed Waste Landfill Evapotranspirative Cover Construction Summary

Activity	Start	Finish	Description
Work Completed August through October 2009			
Soil Vapor Monitoring Wells	August 5, 2009	August 7, 2009	Two soil vapor monitoring wells were installed through the ET Cover to an approximate depth of 35 feet below the original ground surface.
Topsoil Layer	August 3, 2009	August 12, 2009	Placed topsoil on cover and side slopes, verification survey for thickness and slopes, and ripped/scarified surface.
Seeding and Supplemental Watering	August 13, 2009	September 3, 2009	Set up and test supplemental watering system. Disk and drill seeded entire cover surface and disturbed areas. Approximately ½ the seed hand-broadcasted to minimize compaction caused by multiple passes with the tractor.
Supplemental Watering	September 3, 2009	October 20, 2009	System will be operated for up to 3 months (pending weather) to help establish native vegetation.
Administrative Fence	August 31, 2009	September 2, 2009	Perimeter fence was installed according to the specifications in the CMIP.
Revegetation of the Borrow Pit	To Be Determined	To Be Determined	The MWL Borrow Pit Area will be seeded and reclaimed in the 2010 growing season if it is not transferred to Sandia Facilities for continued use.
Work Completed May through July 2009			
Mobilization and Training	May 11, 2009	May 18, 2009	Resources, equipment, and office trailer mobilized to site and personnel training completed. Installed new perimeter boundary, silt fence, and drive-off pad. Removed administrative fence.
Subgrade Layer	May 20, 2009	May 22, 2009	Cleared vegetation, watered and compacted surface, performed field testing and verification survey.
Biointrusion Layer	May 26, 2009	June 16, 2009	Construction method tests conducted on May 26. Hauled and placed rock to create >1 foot thick layer, then placed soil layer on top to fill voids and create a thin soil layer above the rock (~3-inch thickness). New rock material hauled directly to site from vendor June 8-12. Verification surveys for thickness of rock layer and overlying soil layer.
MW4 Extension	May 27, 2009	May 27, 2009	Well casing and protective outer steel casing raised to accommodate surface elevation increase associated with construction of the ET Cover.
Native Soil Layer	June 15, 2009	July 31, 2009	Placed and compacted soil in lifts for cover surface and slopes. Wedge lifts used to establish 2% east-to-west slope. Verification surveys for thickness and slopes.
Borrow Pit Area Activities	June 12, 2009	July 24, 2009	Excavated and screened (2-minus) additional soil fill material, including SWPPP berm soil excavated and hauled to the Borrow Pit from the MWL site. Pug Mill operations set up and calibrated to blend top soil and 3/8-inch crush gravel.

Table 2 Preliminary Soil and Rock Volume Estimates Comparing CMIP Estimates to As-Constructed Estimates

MWL ET Cover Layer	Volume Estimates Reflect Placed, Compacted Cubic Yards (cy)		Explanation
	CMIP Volume	As-Constructed Volume	
Subgrade	6,500	7,700	The MWL existing surface required more elevation increase than anticipated in the CMIP design.
Biointrusion Layer	4,900	5,800	The average thickness of the installed Biointrusion Layer is 0.25 feet greater than the CMIP design. Estimate does not account for volume of rock penetrating down into the Subgrade due to installation method.
Biointrusion Layer - Void filling and overlying 3-inch thick soil layer	Not Estimated	3,100	Volume estimate based on truck load tallies and represents a loose un-compacted estimate. Volume cannot be accurately estimated due to some soil moving down into rock void space.
Native Soil	13,200	17,300	The average thickness of the constructed Native Soil Layer is approximately 2.85 feet (versus 2.5 feet minimum in the CMIP) due to wedge lifts required to correct the <2% slope in the Subgrade and Biointrusion Layer. The north end elevation of the Subgrade Layer appears to be greater than predicted in the 2005 design, creating a larger cover footprint (i.e., 6 to 1 slopes are larger as a result).
Topsoil	3,900	5,400	The average thickness of the Topsoil Layer is approximately 0.33 feet greater than the CMIP design.
Total	28,500	36,200	7,700 cy difference (27% increase from original estimate). 36,200 cy total does not include the 3,100 cy for the void filling and thin soil layer above the Biointrusion Layer.

- 1) The CMIP estimates were based on minimum thickness specifications for each cover layer. The greater cover layer thicknesses resulted in a larger cover footprint, increasing the volume of soil material needed for the side slopes.
- 2) The increase in soil and rock material volumes results in a thicker, larger, more protective Evapotranspirative Cover.

Table 3
Topsoil Layer In-Place Density and Moisture Content Field Results

Test Number	Date of Field Test	Description	Location	Standard Proctor Maximum Density (lb/ft ³) ¹	Standard Proctor Optimum Moisture Content (%)	Percent of Maximum Density Required	Percent Compaction Achieved	Moisture Content Achieved	Meets Density Spec? ⁴	Meets Moisture Spec? ⁴	Testing Laboratory ²
EDi NS Top Soil ³	9/03/2009	Topsoil	Grid Block 12 4" depth	118.9	9.6	NA ³	89	4.7	NA ⁴	NA ⁴	AMEC
EDi NS Top Soil ³	9/03/2009	Topsoil	Grid Block 12 10" depth	118.9	9.6	NA ³	94	4.9	NA ⁴	NA ⁴	AMEC
EDi NS Top Soil ³	9/03/2009	Topsoil	Grid Block 8 4" depth	118.9	9.6	NA ³	75	3.9	NA ⁴	NA ⁴	AMEC
EDi NS Top Soil ³	9/03/2009	Topsoil	Grid Block 8 6" depth	118.9	9.6	NA ³	82	3.9	NA ⁴	NA ⁴	AMEC
EDi NS Top Soil ³	9/03/2009	Topsoil	Grid Block 2 4" depth	118.9	9.6	NA ³	89	3.8	NA ⁴	NA ⁴	AMEC
EDi NS Top Soil ³	9/03/2009	Topsoil	Grid Block 2 8" depth	118.9	9.6	NA ³	96	3.7	NA ⁴	NA ⁴	AMEC
EDi NS Top Soil ³	9/03/2009	Topsoil	Grid Block 5 4" depth	118.9	9.6	NA ³	88	5.4	NA ⁴	NA ⁴	AMEC
EDi NS Top Soil ³	9/03/2009	Topsoil	Grid Block 5 8" depth	118.9	9.6	NA ³	94	3.8	NA ⁴	NA ⁴	AMEC

¹lb/ft³ = pounds per cubic foot

²AMEC = AMEC Earth and Environmental, Albuquerque, NM

³N/A = not applicable; Maximum Density and Moisture Content specifications and tests do not apply to the topsoil layer.

⁴ Topsoil Layer density and moisture testing was performed but not required. These test locations were not surveyed.