Sandia National Laboratories/New Mexico Environmental Restoration Project

MIXED WASTE LANDFILL CORRECTIVE MEASURES IMPLEMENTATION REPORT

JANUARY 2010

United States Department of Energy
Sandia Site Office

Sandia is a multiprogram laboratory managed and operated by Sandia Corporation, a wholly-owned subsidiary of Lockheed Martin Corporation, for the United States Department of Energy's National Nuclear Security Administration under contract DE-AC04-94AL85000.

EXECUTIVE SUMMARY

Sandia National Laboratories/New Mexico (SNL/NM) is located within the boundaries of Kirtland Air Force Base, immediately south of the city of Albuquerque in Bernalillo County, New Mexico. Sandia Corporation (Sandia), a wholly owned subsidiary of Lockheed Martin Corporation, manages and operates SNL/NM for the U.S. Department of Energy (DOE). Sandia performs research and development in support of various energy, weapons, and national security programs. It also performs work for the U.S. Department of Defense, the U.S. Nuclear Regulatory Commission, and other government agencies.

The Mixed Waste Landfill (MWL) is located 4 miles south of SNL/NM central facilities and 5 miles southeast of the Albuquerque International Sunport. The MWL is a fenced, 2.6-acre Solid Waste Management Unit in the north-central portion of Technical Area 3 that was a disposal area for low-level radioactive and minor amounts of mixed waste from March 1959 through December 1988. Approximately 100,000 cubic feet of low-level radioactive and mixed waste containing approximately 6,300 curies of activity (in 1988) were disposed of in the MWL. The New Mexico Environment Department (NMED) is authorized by the U.S. Environmental Protection Agency to implement and enforce the corrective action requirements for the MWL.

In this MWL Corrective Measures Implementation (CMI) Report, the DOE and Sandia demonstrate that the deployment of the MWL alternative evapotranspirative (ET) cover (hereafter referred to as the ET Cover) was performed in accordance with the requirements, specifications, and design drawings presented in the MWL Corrective Measures Implementation Plan (CMIP) (SNL/NM November 2005). The MWL ET Cover was deployed from October 2006 through September 2009 and consists of four main layers: compacted subgrade, biointrusion barrier, compacted native soil, and topsoil. The Subgrade varies in thickness from 0 to 3.3 feet, and the combined average thickness of the overlying ET Cover layers (Biointrusion, Native Soil, and Topsoil Layers) is 5.37 feet. The overall footprint of the ET Cover is 4.1 acres including side slopes. The ET Cover was constructed with approximately 33,000 cubic yards of soil fill and 6,800 cubic yards of rock (in-place, compacted volumes) that meet CMIP specifications based upon 113 laboratory tests (Standard Proctor, Gradation, Classification, and Saturated Hydraulic Conductivity), 271 field tests (in-place density and moisture), and visual inspections. All MWL ET Cover construction activities were observed, inspected, and documented by an independent third-party Construction Quality Assurance (CQA) contractor.

This MWL CMI Report meets the requirements stipulated in the 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); the CMIP (SNL/NM November 2005); the SNL/NM Resource Conservation and Recovery Act Permit (as modified for the MWL after the Final Order); the Compliance Order on Consent (NMED April 2004); and the NMED conditional approval for the MWL CMIP (Bearzi December 2008). The MWL Alternative Cover CQA Report (Appendix A of this CMI Report) is certified by a New Mexico-registered Professional Engineer and provides all construction quality control and CQA data and documentation required to verify that the MWL ET Cover meets NMED requirements and the specifications of the CMIP.

On May 26, 2005, the Secretary of the NMED selected a vegetative soil cover with a biointrusion barrier (i.e., the ET cover) as the remedy for the MWL. The remedy selection was documented in the NMED Final Order for the MWL (NMED May 2005) that also required submittal within 180 days of a CMIP incorporating the selected remedy. The MWL CMIP

(SNL/NM November 2005) was submitted to the NMED in November 2005 and outlines the deployment of the MWL ET Cover (Chapter 2.0), the regulatory basis (Chapter 3.0), MWL characteristics (Chapter 4.0), the technical basis for the cover (Chapter 5.0), the MWL alternative cover design (Chapter 6.0), and cover performance monitoring (Chapter 7.0). Appendices include Construction Specifications (Appendix A), a CQA Plan (Appendix B), and other supporting documentation. The MWL CMIP was conditionally approved by the NMED in December 2008 (Bearzi December 2008), and all conditions related to construction of the MWL ET Cover were addressed and incorporated into the CMIP through replacement pages (Davis February 2009).

Deployment of the MWL alternative ET Cover was conducted in two main phases. During the first phase in 2006, MWL Borrow Pit and Subgrade construction activities were conducted in preparation for ET Cover construction. Soil fill material was excavated, screened to 2-inch minus, and stockpiled at the MWL Borrow Pit from June through July 2006. Following the NMED approval in September 2006, Subgrade construction was performed from October through December 2006, and protective measures installed on the completed Subgrade surface in April 2007. After NMED conditional approval of the CMIP in December 2008 (Bearzi December 2008), the MWL ET Cover was constructed during the second phase, which took place from May through September 2009.

The MWL Alternative Cover CQA Report (Appendix A) is the comprehensive report that documents all aspects of MWL ET Cover deployment and addresses all CMI Report data and documentation requirements. All ET Cover materials and layers were approved by the CQA Engineer as specified in the CQA Plan in Appendix B of the CMIP (SNL/NM November 2005) prior to starting construction of the next layer. All design changes were identified; documented; resolved in consultation between the Sandia Project Staff, the Construction Team, and the CQA Team; and approved by the CQA Engineer. The design changes were implemented and resulted in a thicker, more conservative and protective MWL ET Cover.

Longer-term aspects of site revegetation, monitoring and maintenance, and institutional controls will be addressed in a revised MWL Long-Term Monitoring and Maintenance Plan that will be prepared and submitted to the NMED within 180 days of approval of this MWL CMI Report.

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A Mixed Waste Landfill Alternative Cover Construction Quality Assurance Report, January 2010

Volume 1 – Main Text and Tabbed Sections
Volume 2 – Attachments (provided electronically on a CD at the end of the report)

Separately bound hard copies of Volume 2 are available in the NMED Hazardous Waste Bureau document library (Santa Fe, New Mexico); the DOE/Sandia document repository (Public Reading Room, Zimmerman Library at the University of New Mexico, Albuquerque, New Mexico); and the SNL/NM Customer Funded Records Center (formerly known as the ES&H and Security Records Center).

ACRONYMS AND ABBREVIATIONS

CMI	Corrective Measures Implementation
CMIP	Corrective Measures Implementation Plan
CMS	Corrective Measures Study
CQA	Construction Quality Assurance
CQC	Construction Quality Control
cy	cubic yard(s)
DOE	U.S. Department of Energy
EPA	U.S. Environmental Protection Agency
ES&H	Environment, Safety, and Health
ET	Evapotranspirative
KAFB	Kirtland Air Force Base
LTMMP	Long-Term Monitoring and Maintenance Plan
MKM	MKM Engineers, Inc.
MWL	Mixed Waste Landfill
NMED	New Mexico Environment Department
NOD	Notice of Disapproval
RCRA	Resource Conservation and Recovery Act
Sandia	Sandia Corporation
SNL/NM	Sandia National Laboratories/New Mexico
SWMU	Solid Waste Management Unit
TA	Technical Area
URS	URS Group, Inc.

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 (Figure 1-1). SNL/NM includes five Technical Areas (TAs), designated 1 through 5, occupying approximately 2,842 acres. Additional SNL/NM remote test areas total approximately 12,200 acres located on KAFB and adjacent land withdrawn from the U.S. Forest Service. 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 (Figure 1-2). TA-3 alone occupies 2,000 acres. The Mixed Waste Landfill (MWL) is a 2.6-acre, fenced Solid Waste Management Unit (SWMU) located in north-central TA-3 at SNL/NM (Figure 1-2).

Sandia Corporation (Sandia), a wholly owned subsidiary of Lockheed Martin Corporation, has a Management and Operating Contract with the U.S. Department of Energy (DOE) for SNL/NM. SNL/NM is owned by the DOE. Sandia performs research and development in support of various energy and weapons programs. It also performs work for the U.S. Department of Defense, the U.S. Nuclear Regulatory Commission, and other government agencies.

In this MWL Corrective Measures Implementation (CMI) Report, the DOE and Sandia demonstrate that the deployment of the MWL alternative Evapotranspirative (ET) Cover (hereafter referred to as the ET Cover) was performed in accordance with the requirements, specifications, and design drawings presented in the MWL Corrective Measure Implementation Plan (CMIP) (SNL/NM November 2005). The MWL CMIP was conditionally approved by the New Mexico Environment Department (NMED) in December 2008 (Bearzi December 2008), and all NMED conditions related to construction of the MWL ET Cover were addressed and incorporated into the CMIP through replacement pages (Davis February 2009).

The MWL ET Cover was deployed from October 2006 through September 2009 and consists of four main layers: compacted subgrade, biointrusion barrier, compacted native soil, and topsoil. The Subgrade varies in thickness from 0 to 3.3 feet, and the combined average thickness of the overlying ET Cover layers (Biointrusion, Native Soil, and Topsoil Layers) is 5.37 feet. The overall footprint of the ET Cover is 4.1 acres including side slopes. The ET Cover was constructed with approximately 33,000 cubic yards (cy) of soil fill and 6,800 cy of rock (in-place, compacted volumes) that meet CMIP specifications (SNL/NM November 2005) based upon 113 laboratory tests (Standard Proctor, Gradation, Classification, and Saturated Hydraulic Conductivity), 271 field tests (in-place density and moisture), and visual inspections. All MWL ET Cover construction activities were observed, inspected, and documented by an independent third-party Construction Quality Assurance (CQA) contractor.

The MWL Alternative Cover CQA Report is a stand-alone document prepared by the CQA contractor responsible for independent third-party oversight of MWL ET Cover deployment, and is incorporated as Appendix A of this CMI Report. The MWL Alternative Cover CQA Report contains all construction quality control (CQC) and CQA data and documentation required to provide a comprehensive, integrated report for the deployment of the MWL ET Cover. This stand-alone report verifies that the MWL ET Cover was installed in a manner that meets the CMIP specifications and requirements (SNL/NM November 2005) and is certified by a New Mexico-registered Professional Engineer.

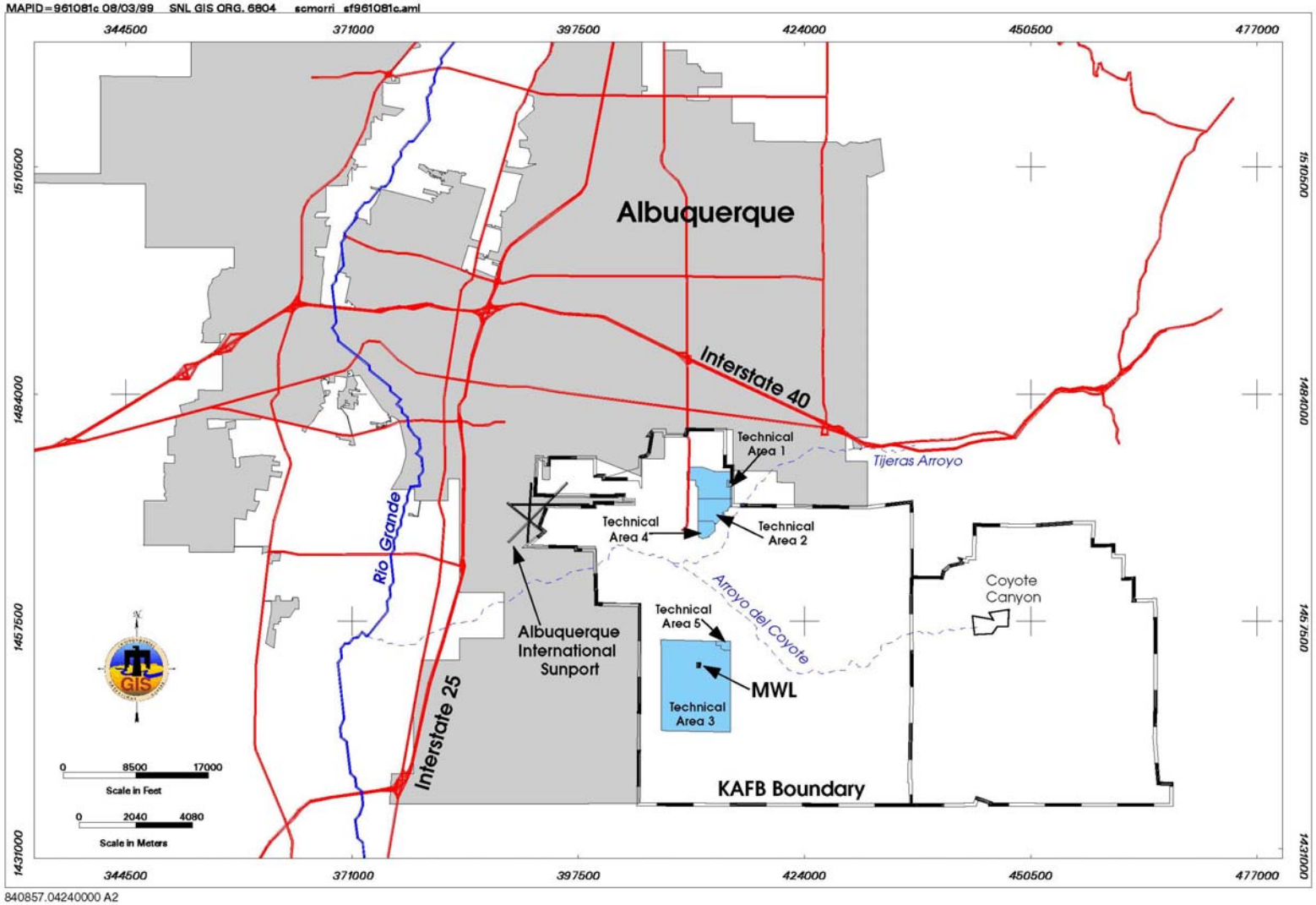

Figure 1-1
Location of Kirtland Air Force Base and Sandia National Laboratories, New Mexico

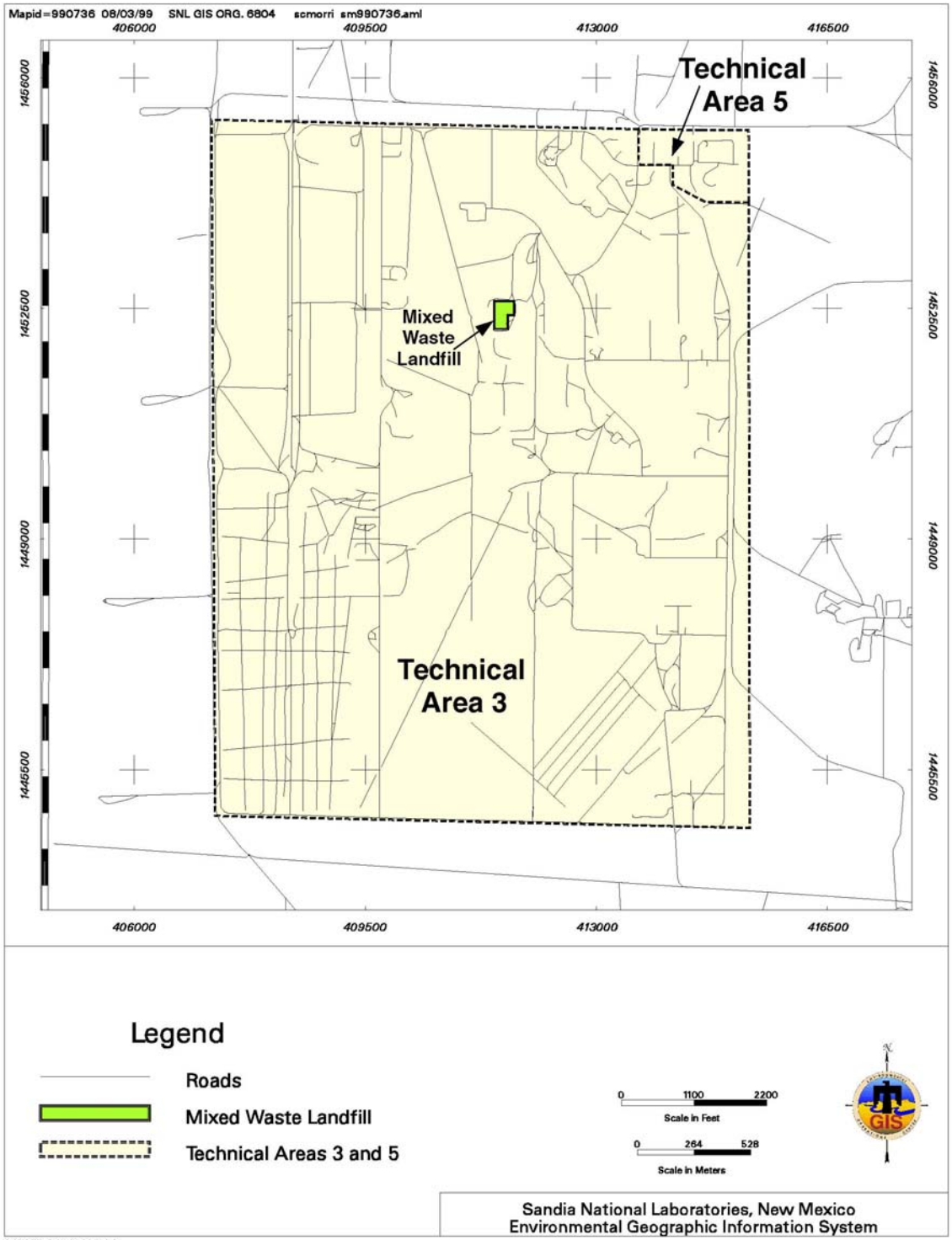

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Figure 1-2
Location of Technical Areas 3 and 5 and the Mixed Waste Landfill

In this CMI Report, regulatory background information and a summary of ET Cover deployment are presented in Sections 1.2 and 1.3, respectively. All CMI Report data and documentation requirements defined in the NMED Final Order for the MWL (NMED May 2005); the CMIP (SNL/NM November 2005); the SNL/NM Resource Conservation and Recovery Act Permit (RCRA) Permit (as modified for the MWL after the Final Order); the Compliance Order on Consent (NMED April 2004); and the NMED conditional approval of the MWL CMIP (Bearzi December 2008) are presented in Chapter 2.0 (Sections 2.1 and 2.2). In addition, Sections 2.1 and 2.2 provide cross-walk information indicating where these requirements are addressed in the MWL Alternative Cover CQA Report (Appendix A). Section 2.3 briefly summarizes NMED oversight and DOE/Sandia quarterly progress reporting during ET Cover deployment, and a summary of the cover deployment safety program is provided in Section 2.4. Chapters 3.0 and 4.0 provide conclusions and references cited, respectively.

The MWL is located 4 miles south of SNL/NM central facilities and 5 miles southeast of Albuquerque International Sunport (Figure 1-1). The MWL is a fenced, 2.6-acre SWMU in the north-central portion of TA-3 that was a disposal area for low-level radioactive and minor amounts of mixed waste generated by SNL/NM research facilities from March 1959 through December 1988. Approximately 100,000 cubic feet of low-level radioactive and mixed waste containing approximately 6,300 curies of activity (in 1988) were disposed of in the MWL.

The MWL consists of two distinct disposal areas. The classified area occupies 0.6 acres and the unclassified area occupies 2.0 acres (Figure 1-3). Low-level radioactive and minor amounts of mixed waste were disposed of in each of these areas. Classified wastes were buried in unlined, cylindrical pits in the classified area. Unclassified wastes were buried in shallow, unlined trenches in the unclassified area. The MWL is designated as an Underground Radioactive Materials Area under DOE requirements and a Hazardous and Solid Waste Amendments SWMU subject to NMED corrective action regulations as delegated by the U.S. Environmental Protection Agency (EPA). The NMED is authorized by the EPA to implement and enforce the corrective action requirements for the MWL.

1.1 Purpose and Scope

The purpose of this MWL CMI Report is to provide the required data and documentation to demonstrate that the deployment of the MWL ET Cover was performed in accordance with the construction and design specifications detailed in the MWL CMIP (SNL/NM November 2005). The scope includes all required CQC and CQA documentation to provide a comprehensive, integrated report for the deployment of the MWL ET Cover. This CMI Report presents background information, regulatory requirements, and conclusions; the required CQC and CQA data and documentation are provided in the stand-alone MWL Alternative Cover CQA Report incorporated as Appendix A. Chapter 2.0 presents more specific information regarding data and documentation requirements and how these are addressed in the MWL Alternative Cover CQA Report (Appendix A).

1.2 Regulatory Background

On October 11, 2001, the NMED directed the DOE and Sandia to conduct a Corrective Measures Study (CMS) for the MWL. The MWL CMS Report was submitted to the NMED on

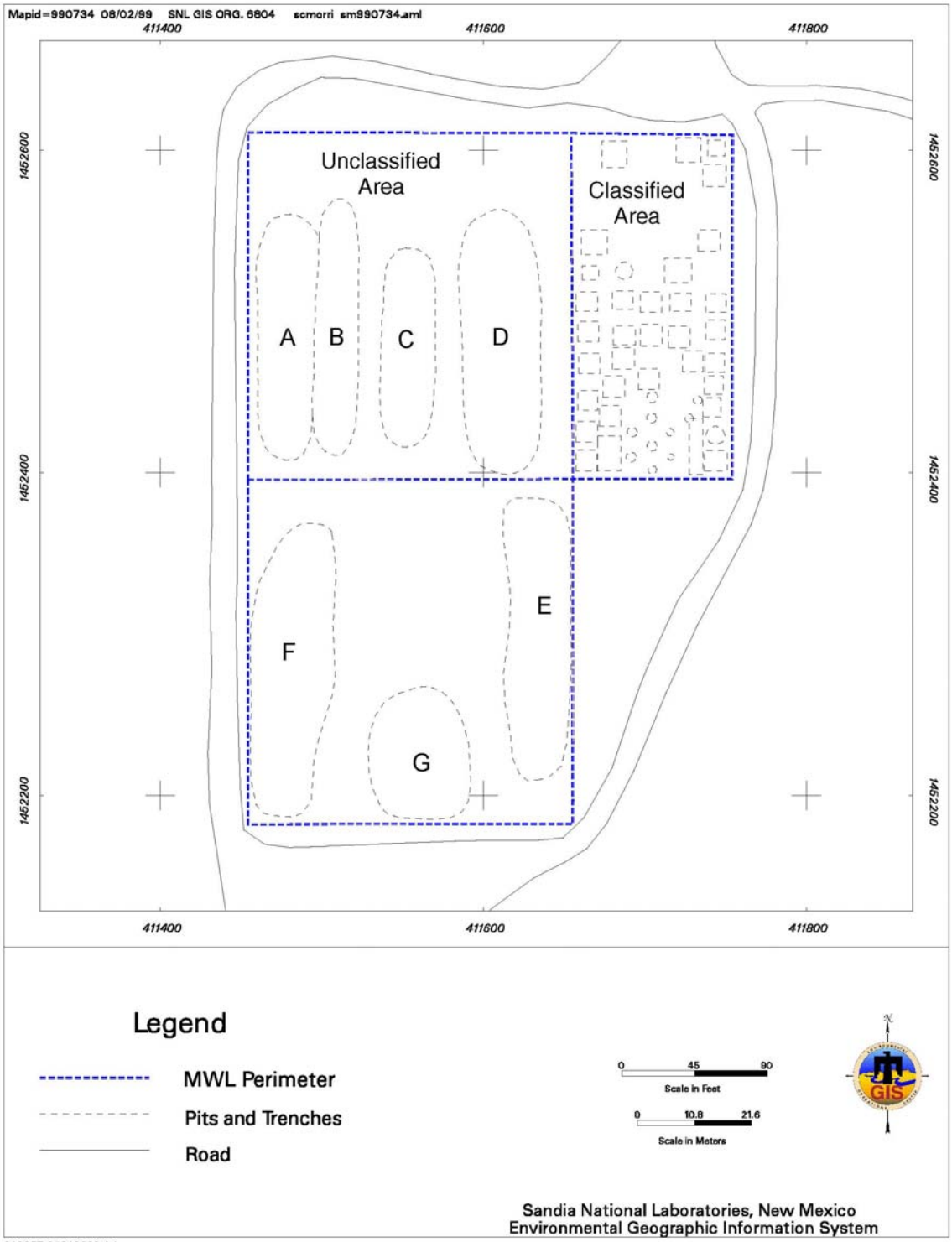

Figure 1-3
Map of the Mixed Waste Landfill

May 21, 2003, for technical review and comment (SNL/NM May 2003). The purpose of the CMS was to identify, develop, and evaluate corrective measures alternatives and recommend the corrective measure(s) to be taken at the MWL. Based upon detailed evaluation and risk assessment using guidance provided by the EPA and NMED, the DOE and Sandia recommended that an alternative vegetative soil cover (i.e., ET Cover) be deployed as the preferred corrective measure for the MWL.

The NMED held a public comment period on the MWL CMS from August 11 to December 9, 2004. A public hearing was held for the MWL CMS from December 2 to December 3 and December 8 to December 9, 2004. On May 26, 2005, the Secretary of the NMED selected a vegetative soil cover with a biointrusion barrier as the remedy for the MWL. The selection was based upon the administrative record, including the Hearing Officer's report, and was documented in 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). The Secretary requested that a CMIP incorporating the selected remedy be developed within 180 days following the selection of the remedy. The draft permit modification issued by the NMED in the matter prior to the hearing was revised by the NMED in accordance with the Secretary's final decision.

The MWL CMIP (SNL/NM November 2005) was submitted to the NMED in November 2005 and incorporates the remedy selected by the NMED. The CMIP outlines the deployment of the ET Cover (Chapter 2.0), the regulatory basis (Chapter 3.0), MWL characteristics (Chapter 4.0), the technical basis for the cover (Chapter 5.0), the MWL alternative cover design (Chapter 6.0), and cover performance monitoring (Chapter 7.0). Appendices include Construction Specifications (Appendix A), a CQA Plan (Appendix B), identification and qualifications of key persons implementing the remedy (Appendix C), a health and safety plan (Appendix D), and a comprehensive fate and transport model with triggers for monitoring (Appendix E).

In September 2006, approval to proceed with MWL security fence removal and Subgrade construction was received from the NMED (Bearzi September 2006). The NMED issued the first of two Notices of Disapproval (NODs) on the CMIP in November 2006 (Bearzi November 2006). Sandia responded to the first NOD in two parts (Wagner December 2006 and January 2007). The majority of the second NOD comments (Bearzi October 2008) were holdover issues from the first NOD. The response to the second NOD (Davis November 2008) resolved these remaining comments, and the CMIP was conditionally approved by the NMED (Bearzi December 2008). Comments related to construction of the ET Cover were incorporated into the CMIP through replacement pages that were submitted to the NMED (Davis February 2009). The MWL ET Cover construction began in May 2009 after the NMED was notified of the start of ET Cover construction fieldwork on April 10, 2009 (Davis April 2009).

1.3 Mixed Waste Landfill Evapotranspirative Cover Deployment Summary

Deployment of the MWL ET Cover was conducted during two main construction phases consisting of the 2006 Subgrade Construction and the 2009 ET Cover Construction. The MWL Alternative Cover CQA Report (Appendix A) documents both phases of ET Cover deployment.

In preparation for the ET Cover Construction phase, rock needed to construct the Biointrusion Layer was selected and delivered to the Bulk Waste Staging Area in TA-3. Approximately 6,000 cy of crushed, angular rock were delivered from October 4 through November 14, 2005. From June 14 through July 17, 2006, Storm Water Pollution Prevention Plan surface water and site controls were implemented at the MWL Borrow Pit in TA-3, and soil fill material needed for construction of the Subgrade and ET Cover layers was excavated, screened to 2-inch minus, and stockpiled following the specifications provided in the CMIP (SNL/NM November 2005). Screened soil fill was hauled and stockpiled at the MWL for the Subgrade Construction phase from July 31 through November 5, 2006.

After receiving NMED approval (Bearzi September 2006), the Subgrade Construction phase began on October 2, 2006, and was completed on April 11, 2007. This phase involved preparation of the existing MWL surface, construction of the Subgrade, and installation of protective measures on the completed Subgrade surface. Subgrade construction was performed from October 2 through December 21, 2006, and measures to protect the completed Subgrade surface while awaiting final NMED approval of the CMIP (SNL/NM November 2005) were completed on April 11, 2007 (i.e., installation of erosion control straw mats). The ET Cover Construction phase was performed from May 20 to September 3, 2009, and involved the construction of the ET Cover layers (Biointrusion, Native Soil, and Topsoil Layers), revegetation of the Topsoil Layer, and installation of the final administrative security fence around the perimeter of the MWL. Third-party CQA services were provided by MKM Engineers, Inc. (MKM) during the 2006 Subgrade Construction phase (under subcontract to URS Group, Inc. [URS]), and by URS during the 2009 ET Cover Construction phase.

The completed ET Cover is shown schematically in Figure 1-4. The Subgrade varies in thickness from 0 to 3.3 feet and is the base layer that established the broad, central crown and 2-percent east-to-west surface design slope. The combined average thickness of the overlying ET Cover layers (Biointrusion, Native Soil, and Topsoil Layers) is 5.37 feet, which is 1.2 feet thicker than the minimum specifications provided in the CMIP (SNL/NM November 2005). The ET Cover overlies the 2.6-acre disposal area, with an overall footprint of 4.1 acres including side slopes. The Subgrade and ET Cover layers were constructed with approximately 33,000 cy of soil fill and 6,800 cy of rock (in-place, compacted volumes) that meet CMIP specifications based upon 113 laboratory tests (Standard Proctor, Gradation, Classification, and Saturated Hydraulic Conductivity), 271 field tests (in-place density and moisture), and visual inspections. The approximate in-place compacted soil and rock volumes for each component of the ET Cover are as follows:

- Subgrade (soil) – 7,700 cy
- Biointrusion Layer (rock) – 6,800 cy
- Biointrusion Layer void space and thin overlying soil layer (soil) – 2,600 cy
- Native Soil Layer (soil) – 17,300 cy
- Topsoil Layer (soil) – 5,400 cy

All MWL ET Cover construction activities were observed, inspected, and documented by an independent third-party CQA contractor.

A Subgrade CQA Report was prepared as a draft in 2007 by MKM and included certification by the CQA Engineer that the Subgrade Construction conformed to the CMIP construction and design specifications (SNL/NM November 2005). This draft report was completed in August 2007 (MKM August 2007) and updated in 2009 and 2010 to incorporate the ET Cover

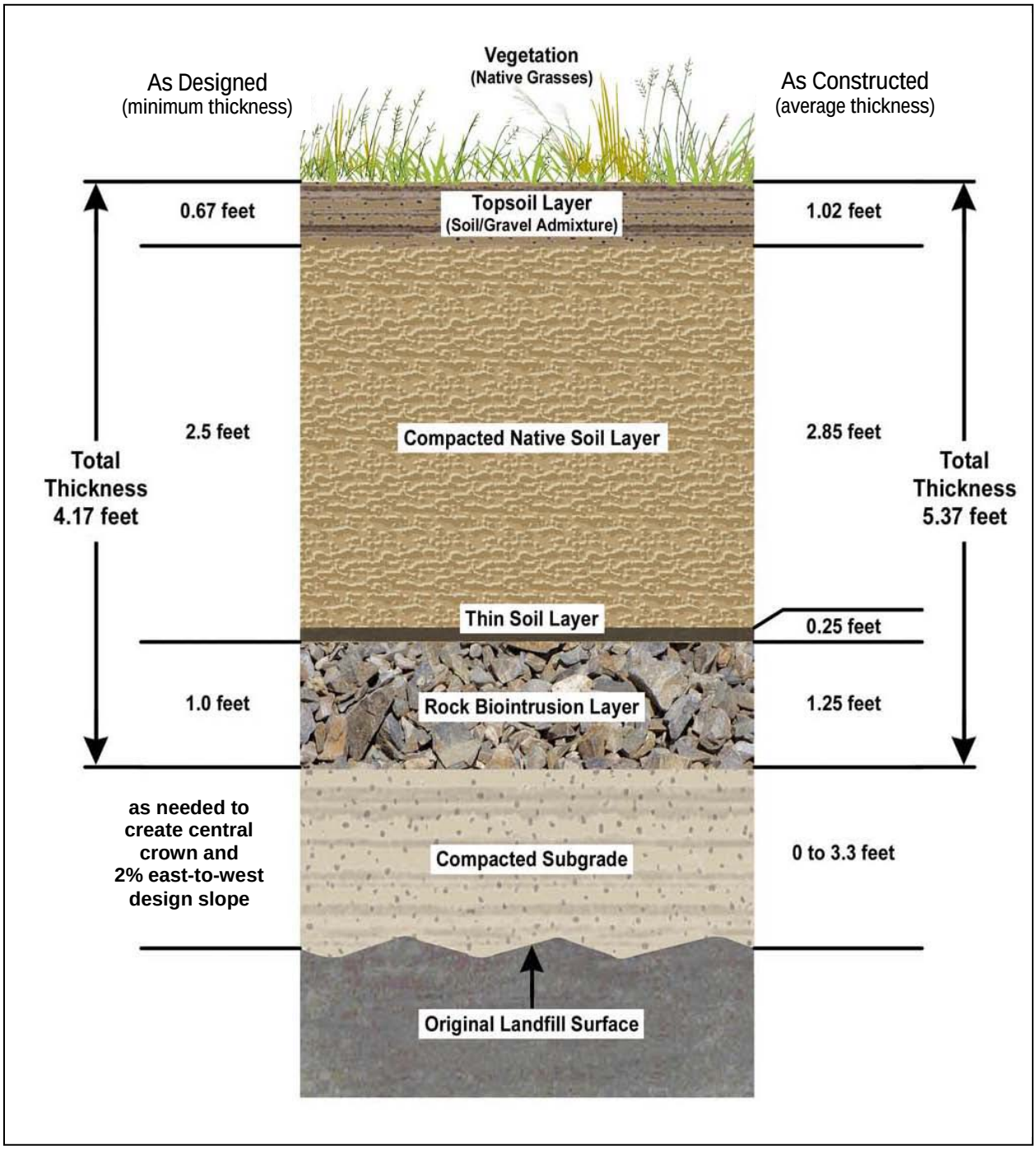

Figure 1-4
Schematic Diagram of the Mixed Waste Landfill Alternative Evapotranspirative Cover

Construction phase CQA and CQC information. The resulting MWL Alternative Cover CQA Report (Appendix A) integrates NMED requirements, including a detailed summary of the construction activities, laboratory and field testing results, land surveying results, as-built drawings, quality assurance verification survey plates, a photographic record of the construction activities, and other CQA documentation (i.e., meetings, daily reports, inspection forms, and data and cover layer approvals).

For both the 2006 and 2009 construction phases, a representative of the CQA Team was at the construction site each workday to inspect and oversee construction activities, laboratory and field testing, and land surveying. The CQA inspections and oversight are documented in daily reports, inspection checklists/forms, and approval forms provided in the MWL Alternative Cover CQA Report (Appendix A). All ET Cover layers were approved by the CQA Engineer as stipulated by the CQA Plan in Appendix B of the CMIP (SNL/NM November 2005) prior to starting construction of the next layer. All design changes were identified, documented, and resolved in consultation between the Sandia Project Staff, the Construction Team, and the CQA Team. Overall, the design changes resulted in a thicker, more protective ET Cover.

2.0 ALTERNATIVE COVER DOCUMENTATION

All required MWL ET cover deployment data and documentation are provided in the MWL Alternative Cover CQA Report (Appendix A). Section 2.1 presents an overview of MWL CMI Report data and documentation requirements as defined in various regulatory source documents. More specific information on data and documentation requirements as detailed in the CMIP (SNL/NM November 2005), and how CQC and CQA data are delineated for each phase of ET Cover construction (2006 Subgrade and 2009 ET Cover Construction), is presented in Section 2.2. The location of required CQC and CQA data and documentation in the MWL Alternative Cover CQA Report (Appendix A) is provided in the cross-walk tables presented in Sections 2.1 and 2.2. Section 2.3 provides information on regulatory oversight and quarterly reporting. Section 2.4 briefly summarizes the ET Cover deployment health and safety program.

2.1 Requirements Cross-Walk

The NMED Final Order for the MWL (NMED May 2005) required the submittal of this MWL CMI Report within 180 days after completion of the MWL ET Cover. Data and documentation requirements for this MWL CMI Report are defined in the NMED-approved CMIP (SNL/NM November 2005); the SNL/NM RCRA Permit (as modified for the MWL after the Final Order); the NMED conditional approval of the MWL CMIP (Bearzi December 2008); and the Compliance Order on Consent (NMED April 2004). Table 2-1 lists the requirements for the MWL CMI Report as compiled from these source documents and provides the location where the related information can be found in the MWL Alternative Cover CQA Report (Appendix A).

The MWL CMI Report requirements are divided into two broad categories: data and documentation. Data requirements include both CQC (data collected to verify ET Cover construction meets CMIP construction and design specifications) and CQA (data collected to verify the CQC data, if required). Both data and documentation requirements are more specifically defined in the NMED-approved CMIP (SNL/NM November 2005) and in Section 2.2, which also provides cross-walk tables mapping the locations where each requirement is addressed in the MWL Alternative Cover CQA Report (Appendix A).

2.2 Data and Documentation Requirements

As part of the MWL Subgrade Construction and ET Cover deployment, CQC data were collected to verify that construction and design specifications provided in the CMIP (SNL/NM November 2005) were met. CQA documentation was collected to establish and verify construction methods and processes, as well as CQC and CQA data collection procedures and field and laboratory testing methods. All data and documentation requirements are defined in the Construction Specifications in Appendix A and CQA Plan in Appendix B of the CMIP (SNL/NM November 2005).

During the 2006 Subgrade Construction phase, the CQA Team was responsible for all CQC data and CQA documentation requirements. CQA Team personnel either performed or coordinated all CQC laboratory sampling and testing, field testing, and land surveying. They also provided oversight and documentation of all construction activities and prepared a Draft

Table 2-1
MWL CMI Report Requirements Cross-Walk Table

Requirement	Comment/Location in CQA Report Appendix A
CMIP Appendix B, Construction Quality Assurance Plan (SNL/NM November 2005)	
Quality control data generated by the construction contractor	Described in Sections 2.4, 2.5, 2.7, and 4.3–4.5; data presented in Tables 5–10, 12, 13, and Attachment 7
Quality assurance data generated by the CQA contractor	Described in Sections 2.5, 2.6, 2.7, and 4.1–4.5; see below for information regarding specific CQA documentation and data
Daily summary reports	Section 4.1 and Attachment 3
Inspection checklists	Section 4.2 and Attachments 4–6
Nonconformance and corrective action reports	There were no nonconformances – all design changes are documented in Chapter 7.0 and Table 14
Field test results (in-place density and moisture tests)	Section 4.3.2 and Table 11 and Attachment 7
Laboratory test results (Standard Proctor, Gradation, Classification, and Saturated Hydraulic Conductivity)	Section 4.3.1 and Tables 4–8, and Attachment 7 (CQC data collected and/or overseen by CQA Contractor)
Photographs and photograph logbook	Section 4.5; Photographic logs included in tabbed section at end of report
As-built drawings	Section 4.4; As-built drawings included in tabbed section at end of report
Internal CQA memoranda or reports with data interpretation or analysis	Chapter 3.0; Quality Resolution Meeting minutes in Attachment 1; data submittals and Cover Layer Approval Forms in Attachment 2
Design changes	Chapter 7.0, Table 14
SNL/NM Part B Permit, Section V, Corrective Measures for the Mixed Waste Landfill	
A summary of the work completed	Chapter 5.0
A statement signed by a registered professional engineer, that the remedy has been completed in full satisfaction of the specifications in the CMIP	Chapter 9.0
As-built drawings and specifications signed and stamped by a registered professional engineer	As-built drawings included in tabbed sections at end of report
Copies of the results of all monitoring, including sampling and analysis, and other data generated during the remedy implementation, if not already submitted in a progress report	Chapter 4.0, Tables 4–12, and Attachment 7
A certification, signed by a responsible Permittee official stating: "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 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"	Included as part of formal submittal package to NMED
SNL/NM Compliance Order On Consent, Section VII (NMED April 2004)	
Items 1, 2, 3, 4, and 6 are identical to requirements of the Part B Permit presented above.	
5. Copies of all waste disposal records, if not already submitted in a progress report	The only waste disposal records associated with cover construction were presented in the MWL Quarterly Progress Report, May–July, 2009 (SNL/NM September 2009)

CMI Corrective Measures Implementation
CMIP Corrective Measures Implementation Plan
CQA Construction Quality Assurance
MWL Mixed Waste Landfill
NMED New Mexico Environment Department
SNL/NM Sandia National Laboratories/New Mexico

CQA Subgrade Report (MKM August 2007) according to the requirements of the CQA Plan presented in Appendix B of the CMIP (SNL/NM November 2005) to document the effort.

For the 2009 ET Cover Construction phase, the Construction Team was responsible for all required CQC laboratory sampling and field testing, as well as land surveying. Independent CQA field testing and surveying were performed under the direction of the CQA Team to verify CQC results. CQA field testing was performed at approximately 50 percent of the locations tested by the Construction Team. Independent CQA surveys were conducted on the surface of each ET Cover layer (Biointrusion, Native Soil, and Topsoil Layers). CQA Team personnel also conducted oversight of all construction activities, including CQC laboratory sampling, field testing, and surveying, and were responsible for all project documentation, including preparation of the MWL Alternative Cover CQA Report (Appendix A). Detailed information for data and documentation requirements are provided in the following sections.

2.2.1 Data Requirements

Data requirements defined in the CMIP include laboratory testing, field testing, and surveying results. Laboratory and field testing were performed to verify that the materials used met specifications and that the existing surface (pre-Subgrade Construction MWL site surface), Subgrade, and ET Cover layers met the construction and design specifications (i.e., compaction, thickness, and slope) provided in the CMIP (SNL/NM November 2005). Laboratory testing included Standard Proctor, Gradation, Classification, and Saturated Hydraulic Conductivity analyses of fill material soil samples. Field testing consisted of in-place density and moisture testing of the fill material after installation and compaction. The frequency and methods for laboratory and field testing are addressed in the CMIP Construction Specifications, Appendix A, Specification 02200 (*Earthwork)*, Table 3.1 (SNL/NM November 2005). Land surveys were performed to guide and control the construction process and to verify that the Subgrade and ET Cover layers met CMIP design specifications (i.e., thickness and slope specifications). Surveying specifications are addressed in the CMIP Construction Specifications, Appendix A, Specification 02210 (*Grades, Lines, and Levels)* and in the CMIP design drawings (SNL/NM November 2005).

Table 2-2 lists the data requirements and provides specific information regarding where these are addressed in the MWL Alternative Cover CQA Report (Appendix A). Both CQC and CQA data are delineated in the center columns, which provide references to sections of the report, tables, tabbed sections at the end of the report, and attachments that specifically address each data requirement. Additional information is provided in the comment column on the far right-hand side of the table.

2.2.2 Documentation Requirements

Documentation requirements defined in the CMIP include daily reports of construction activities; equipment used; materials receiving, construction, and testing/inspection checklists/forms; backup laboratory documentation for laboratory and field testing; as-built drawings; and photographic records (SNL/NM November 2005). In addition, for the 2009 ET Cover Construction phase, all laboratory and field testing CQC data were approved by the CQA Engineer through a formal submittal process, and each ET Cover layer was approved through Quality Resolution Meetings documented on Cover Layer Approval Forms (documentation was

Table 2-2
MWL CMI Report Requirements – Data Requirements Summary and Cross-Walk

Data Requirement	Location in the MWL Alternative Cover CQA Report (Appendix A)		Comments
	CQA Data	CQC Data	
Laboratory Testing Data Standard Proctor (ASTM D698)	NA	Described in Section 4.3.1 Results in Tables 4–5	For 2006 Subgrade Construction phase, all CQC laboratory testing was performed by the CQA Team. For 2009 ET Cover Construction phase, all laboratory testing was performed by the Construction Team, with oversight by the CQA Team.
Laboratory Testing Data Gradation (ASTM C136) and Classification (ASTM D2487 and D4318)	NA	Described in Section 4.3.1 Results in Table 4 (4th column), Tables 6–7, and Attachment 7	For 2006 Subgrade Construction phase, all CQC laboratory testing was performed by the CQA Team. For 2009 ET Cover Construction phase, all laboratory testing was performed by the Construction Team with oversight by the CQA Team.
Laboratory Testing Data Saturated Hydraulic Conductivity (ASTM D5856-95 [2007])	NA	Described in Section 4.3.1 Results in Table 8	Saturated Hydraulic Conductivity testing was only required for the Native Soil Layer. CQC testing was performed by the Construction Team with oversight by the CQA Team.
Field Testing Data In-place density and moisture (ASTM D2922 and D3017)	CQA field testing for 2009 Subgrade surface and Native Soil Layer only Described in Section 4.3.2 Results in Table 11	Described in Section 4.3.2 Results in Tables 9–10	For 2006 Subgrade Construction phase, all CQC field testing was performed by the CQA Team. For 2009 ET Cover Construction phase, field testing was performed by the Construction Team and the CQA Team. CQA testing was performed at approximately 50% of the locations tested by the Construction Team.
Land Survey Data	Described in Sections 2.5 and 4.4 Only 2009 CQA verification surveys considered CQA data – results in QA Verification Plates in tabbed section at end of report	Described in Sections 2.5 and 4.4 2006 results in Subgrade As-Built Drawing 2009 results in Table 12 and 2009 As-Built Drawings All As-Built Drawings in tabbed section at end of report	For 2006 Subgrade Construction phase, all surveying was for CQC, performed by CQA Team, and documented in the 2006 Subgrade As-Built Drawing. For 2009 ET Cover Construction phase, the Construction Team performed CQC surveying and the CQA Team performed CQA verification surveys on the surface of each cover layer to confirm and support the CQC surveys. CQA surveys are documented in QA Verification Plates in tabbed section at end of report.

ASTM American Society for Testing and Materials (ASTM International)
CMI Corrective Measures Implementation
CQA Construction Quality Assurance
CQC Construction Quality Control
ET Evapotranspirative
MWL Mixed Waste Landfill
NA Not applicable
QA Quality assurance

prepared for both the Quality Resolution Meetings and the Cover Layer Approval, the latter on project-specific approval forms).

Table 2-3 lists the documentation requirements and provides specific information regarding where they are addressed in the MWL Alternative Cover CQA Report (Appendix A). Documentation for CQC and CQA are delineated in the center columns, which provide references to sections of the report, tables, tabbed sections at the end of the report, and attachments that specifically address each documentation requirement. Additional information is provided in the comment column on the far right-hand side of the table.

2.3 Regulatory Oversight Quarterly Reporting

NMED personnel visited the MWL ET Cover construction site on three occasions during ET Cover deployment in 2009. On June 26, 2009, NMED representatives visited the site and received a briefing on cover activities completed to date. On July 8, 2009, William Moats and Bill McDonald of the NMED conducted a site inspection of both the ET Cover and the MWL Borrow Pit Area operations. During this NMED inspection, a review of laboratory and field-testing data was conducted, as well as a complete walk-down of ongoing site activities at the MWL (Native Soil Layer installation) and Borrow Pit (soil excavation, screening, stockpiling, loading, hauling, and Pug Mill operations to blend topsoil fill with 3/8-inch gravel). On August 6, 2009, NMED personnel also visited the MWL ET Cover construction site to oversee the installation of the two soil-vapor monitoring wells.

In accordance with the SNL/NM RCRA Permit and Compliance Order on Consent requirements, quarterly progress reports were submitted to the NMED during the construction period (e.g., SNL/NM September 2009). Periodic updates, including photographs of construction activities, were also provided to the NMED during the construction period.

2.4 Cover Deployment Health and Safety Program

The MWL ET Cover was constructed without a single loss-time injury or accident resulting in property damage. There were two minor incidents during June 2009 that involved small amounts of spilled diesel fuel or hydraulic oil. In both cases the spill occurred on the site perimeter (i.e., no spills occurred on the ET Cover or side slopes) and involved very small quantities of material (less than 1 quart of diesel fuel and 2 to 3 gallons of hydraulic oil). Site personnel immediately recognized the problem, took corrective action to stop the spill, and then cleaned up the affected area. All contaminated soil related to the spills was placed into two 55-gallon drums for disposal (one drum for each spill). One plastic bag of absorbent materials was also generated as part of the hydraulic oil spill on June 30, 2009. All resulting waste was New Mexico Special Waste and disposed of through the SNL/NM Hazardous Waste Management Facility. For each minor incident, Incident Reports were completed, and final waste disposition documentation was provided to the NMED as required in the MWL Cover Construction Quarterly Progress Report, May–July 2009 (SNL/NM September 2009).

Table 2-3
MWL CMI Report Requirements – Documentation Requirements Summary and Cross-Walk

Documentation Requirement	Location in the MWL Alternative Cover CQA Report (Appendix A)		Comments
	CQA Data	CQC Data	
Daily reports of construction activities	Described in Section 4.1 Reports in Attachment 3	NA	Daily Reports were the responsibility of the CQA Team. For 2009 ET Cover Construction phase, daily reports were completed by the Construction Team but not included in the CQA Report.
Documentation of equipment used	Described in Chapter 5.0, Table 13, and Daily Reports See comments for additional information	NA	Documentation of equipment used for the 2006 Subgrade Construction phase is documented in Daily Reports (Attachment 3) and Section 5.2.1. For 2009 ET Cover Construction phase, equipment used is documented in Daily Reports and Table 13, and described in Sections 5.2.2, 5.3.2, 5.3.3, 5.4, 5.5, and 5.6.
Inspection checklists/forms[1]	Described in Section 4.2 Forms in Attachments 4-6	NA	Receiving, Construction, and Testing Inspection Forms and related documentation were completed by the CQA Team.
Supporting documentation for laboratory and field testing[1]	Described in Section 4.3 Supporting documentation in Attachment 7	Described in Section 4.3 Supporting documentation in Attachment 7	Supporting documentation for all 2006 Subgrade and 2009 ET Cover laboratory and field testing is included in Attachment 7 and represents CQA documentation. See Table 2-2 for additional information on CQA and CQC laboratory and field testing.
As-Built Drawings	Described in Sections 2.5 and 4.4	Described in Section 2.5 and 4.4 Results in Table 12 and 2006 Subgrade As-Built Drawing and 2009 As-Built Drawings in tabbed section at end of report	For 2006 Subgrade Construction phase, all surveying was for CQC and documented in the 2006 Subgrade As-Built Drawing. For 2009 ET Cover Construction phase, the Construction Team performed all required field control and final surveying and prepared the final as-built drawings. The 2009 as-built drawings are complete, final drawings documenting the MWL ET Cover. See Table 2-2, "Land Survey Data," for more information.
Photographic records	Described in Section 4.5	NA	Photographic Logs for both 2006 and 2009 phases included in a tabbed section at end of the CQA Report.
CQA Engineer Approval of all Cover Layers, Design Changes, and Final Construction	Described in Sections 3.4, Chapters 7 and 9, and Tables 3 and 14	NA	Table 3 documents approval of all Cover Layers. Chapter 7.0 and Table 14 document all design changes. Attachment 2 provides approval documentation. MWL ET Cover construction is certified by a New Mexico-registered Professional Engineer in Chapter 9.0.

[1] All construction materials and the completed Subgrade and ET Cover Layers were approved by the CQA Engineer as documented in Section 3.4, Chapter 7.0, and Table 3; with supporting documentation in Attachments 1, 2, and 7.

CMI Corrective Measures Implementation
CQA Construction Quality Assurance
CQC Construction Quality Control
ET Evaporatranspirative
MWL Mixed Waste Landfill
NA Not applicable

3.0 CONCLUSIONS

This CMI Report for the MWL meets all requirements stipulated in the NMED Final Order for the MWL (NMED May 2005); the CMIP (SNL/NM November 2005); the SNL/NM RCRA Permit (as modified for the MWL after the Final Order); the Compliance Order on Consent (NMED April 2004); and the NMED conditional approval for the MWL CMIP (Bearzi December 2008). All required CQC and CQA data and documentation have been included in the MWL Alternative Cover CQA Report, incorporated as Appendix A of this CMI Report, to provide a comprehensive, integrated report for the deployment of the MWL ET Cover. The information contained in the MWL Alternative Cover CQA Report is certified by a New Mexico-registered Professional Engineer and verifies that the MWL existing surface, Subgrade, and ET Cover layers (Biointrusion, Native Soil, and Topsoil Layers) were prepared and installed in a manner that meets the CMIP construction and design specifications.

Longer-term aspects of site revegetation, monitoring, maintenance, and institutional controls will be addressed in a revised MWL Long-Term Monitoring and Maintenance Plan (LTMMP) that will be prepared and submitted to the NMED within 180 days of approval of this CMI Report. The MWL LTMMP that the DOE and Sandia submitted to the NMED in September 2007 (SNL/NM September 2007) will be revised to incorporate changes requested by the NMED as part of the CMIP NOD process (Bearzi November 2006 and October 2008).

4.0 REFERENCES

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