

Sandia National Laboratories

Albuquerque, New Mexico

August 2011

DOE/Sandia Responses to NMED's "Notice of Disapproval: Mixed Waste Landfill Corrective Measures Implementation Report, January 2010"

INTRODUCTION

This document responds to the comments received in a letter from the New Mexico Environment Department (NMED) to the U.S. Department of Energy (DOE) and Sandia Corporation (Sandia) dated May 20, 2011 regarding the Mixed Waste Landfill (MWL) Corrective Measures Implementation Report for Sandia National Laboratories (SNL). The letter is entitled "Notice of Disapproval: Mixed Waste Landfill Corrective Measures Implementation Report, January 2010, Sandia National Laboratories", EPA ID NM5890110518, HWB-SNL-10-005.

The Corrective Measures Implementation (CMI) Report provides documentation that demonstrates the MWL evapotranspirative cover (i.e., ET Cover) was constructed in accordance with the specifications and requirements of the CMI Plan (SNL/NM November 2005). The CMI Report includes the stand alone MWL Alternative Cover Construction Quality Assurance (CQA) Report as Appendix A that was prepared by the CQA contractors responsible for independent third-party oversight of MWL ET Cover deployment. The Appendix A CQA Report is the comprehensive two-volume report that documents all aspects of MWL ET Cover deployment in accordance with CMI Plan requirements. Volume 1 of the CQA Report is included in the same binder as the CMI Report, along with as-built drawings, CQA verification survey plates, photographic logs, and a compact disc (CD) containing the CQA Report Volume 2 supporting attachments in electronic format. Volume 2 of the CQA Report is a separately bound volume; due to the size and nature of the information hard copies were only provided for the NMED and DOE/Sandia document repositories.

Sandia National Laboratories is a multi-program laboratory managed and operated by Sandia Corporation, a wholly owned subsidiary of Lockheed Martin Corporation, for the U.S. Department of Energy's National Nuclear Security Administration under Contract DE-AC04-94AL85000.

This DOE/Sandia response package consists of the following components:

- Comment Response document (provided in comb-bound format), which includes:
 - Restatement of each of the eight NMED comments in boldface followed by the corresponding DOE/Sandia response in normal font.
 - Cross-reference table (Table 1) that tracks revisions made in the MWL CMI Report (main text and Appendix A CQA Report) relative to each NMED comment.
 - Attachment 1 that includes revised pages of the MWL CMI Report (main text and Appendix A CQA Report) in redline-strikeout format.
- Attachment 2 (provided in three-ring binder), which includes replacement covers, spines, and pages to revise existing hard copies of the MWL CMI Report (main text and Appendix A CQA Report):
 - Replacement cover sheets and spine inserts for the two original January 2010 MWL CMI Report binders.
 - Replacement insert for the MWL CMI Report, in its entirety.
 - Replacement insert for the MWL CQA Report, Volume 1, main text only.
 - Replacement Table 8 for the MWL CQA Report, Volume 1 (single replacement page for the tabbed “Table” section in Volume 1).
 - Four replacement drawings for the MWL CQA Report, Volume 1 (for the tabbed “As-Built Drawings” section, 2009 Alternative Cover, in Volume 1).
 - Replacement Figure 2-5, of Attachment 8, for the MWL CQA Report, Volume 2 (Note: this is the only replacement page for Volume 2 of the CQA Report).
 - Replacement CD for the disc titled, “Mixed Waste Landfill Corrective Measures Implementation Report, January 2010, Appendix A, Volume 2 – Attachments.” The “Revision 1” replacement CD goes in the plastic sleeve located in the tabbed “Appendix A, Volume 2” section at the back of the original binder.
- A CD (provided in jewel case) with the revised MWL CMI Report (entire report, including Appendix A CQA Report Volumes 1 and 2) and this Notice of Disapproval (NOD) comment response document.

The revised MWL CMI Report retains the original January 2010 submittal date but is distinguished as “Revision 1” on the cover and title pages. All revised pages have “Revision 1” in the header or footer.

The revised 2009 ET Cover as-built drawings are provided to document the locations of two access gates in the perimeter security fence at the northern and southern ends of the MWL. The construction specifications for the northern access gate were shown, but the location within the perimeter fence was inadvertently left off the original drawings. DOE/Sandia requested NMED approval to install an additional access gate at the southern end of the site on April 21, 2011 to facilitate ET Cover maintenance, and NMED approved this request via email on April 28, 2011. Construction details for both gates and their location within the perimeter fence are provided on the revised as-built drawings for the 2009 ET Cover. There were no changes to the as-built drawing provided for the 2006 Subgrade.

Comments and Responses for the Mixed Waste Landfill Corrective Measures Implementation Report

1. Construction Quality Assurance (CQA) During Subgrade Layer Construction

The Corrective Measures Implementation (CMI) Report, Section 2.2, second paragraph, first sentence states: "During the 2006 Subgrade Construction phase, the CQA [Construction Quality Assurance] Team was responsible for all CQC [Construction Quality Control] data and CQA documentation requirements." Similarly, the first paragraph of Section 2.6 of Appendix A of the CQA Report states: "The CQA personnel roles and responsibilities were generally the same for both the 2006 and 2009 construction phases. However, some differences between the two construction phases reflect a more robust CQC and CQA program for the 2009 ET (Evapotranspiration) Cover Construction phase (i.e., construction of the Biointrusion, Native Soil, and Topsoil Layers)." The subsequent paragraph states "During the 2006 Subgrade Construction phase, the CQA Team was responsible for all CQC laboratory testing (i.e., Standard Proctor, Gradation, and Classification soil data), field testing (i.e., in-place density and moisture testing), as well as associated oversight of the testing laboratory."

The "more robust" quality assurance/quality control (QA/QC) implementation during the 2009 construction phase was actually more in accordance with the CMI Plan (CMIP) than the 2006 Subgrade Layer construction because the project requirements for independent QA testing of the Subgrade Layer were evidently not done in 2006. For example, Paragraph 3.3.4 (6) of Section 02200 Earthwork specification (Corrective Measures Implementation Plan [CMIP], Appendix A) indicates that "the Contractor shall perform field-testing of the compacted fill" and "the Contractor shall submit test results to the CQA Engineer and Operator for approval ... " Section 3.4.1 of this Specification states: "the Contractor shall be responsible for the performance of all pre-acceptance and quality control testing." However, the fourth bullet of Section 2.6.2 of the CQA Plan (Appendix B of the CMIP) states that "CQA testing will be conducted at a frequency of at least 5 percent (%) of that done by the Construction Contractor," which refers to testing by CQA Inspection personnel. Similarly, Section 5.1.2.3 of the CQA Plan states that "testing shall be performed at a minimum frequency of 5% of that done by the Construction Contractor" for the Subgrade Layer.

Similar language is also presented in the third paragraph of Section 4.0 of the CQA Report, where it is stated "In general, CQC and CQA data and documentation can be collected by either the Construction Team or the CQA Team or a combination of both." According to the CMIP Specifications and CQA Plan, this statement is not correct.

With regards to this issue, NMED notes reference to a different CQA Plan (May 2006) for the Subgrade Layer construction, but contends that a different CQA Plan should not diminish the project requirements of 5% CQA field testing for Subgrade Layer compaction and moisture content tests. Neither NMED conditional approval for the CMIP (December 2008), nor subsequent submittals (i.e., the CMIP replacement pages; Davis, February 2009) recognized a different CQA plan for the Subgrade Layer construction. However, NMED notes the efforts of the 2009 Contractor and CQA staff to re-condition, re-compact, and re-

test (as well as re-survey) the upper surface of the Subgrade Layer during the subsequent 2009 construction phase.

Therefore, the fact that the Permittees did not conduct QC testing of the Subgrade Layer by the Contractor, and 5% independent QA testing by CQA personnel, should be documented as a nonconformance. As part of the resolution of this comment (i.e., documentation of the nonconformance), revise as appropriate the CMI Report and the CQA Report (Appendix A of the CMI Report).

Response: The MWL CMI Report and CQA Report (Appendix A, Volume 1) have been revised to address documentation of the 2006 Subgrade in-place density and moisture field-testing program as a nonconformance, which is defined as a deviation from the CMIP specifications. In general, CQC versus CQA field tests were not clearly distinguished, and the CQA Team directed/Performed all field testing. However, the number of field tests conducted exceeded the CMIP requirements. This is further clarified below.

As documented in the CMI Report (CQA Report, Appendix A, Volume 1, Section 2.0), the construction team for the 2006 Subgrade construction phase was comprised of on-site SNL/NM contractors (i.e., Shaw/GRAM, Inc.); this phase of work was not subcontracted to an outside construction company. For this reason, the decision was made to consolidate all Subgrade CQC and CQA field and laboratory testing under the direction of the CQA contractor, MKM Engineers, Inc., who functioned as a third party oversight contractor responsible for documenting and certifying all phases of Subgrade construction. The CQA Plan (SNL/NM May 2006) prepared by the CQA Team prior to Subgrade construction included the same testing requirements as the CMIP CQA Plan (Appendix B of CMIP) and was not the reason for the deviation from CMIP specifications.

The actual in-place density and moisture testing performed during Subgrade construction exceeded the CMIP specifications of 5 CQC tests per acre per lift plus at least 5% additional confirmatory CQA tests. Based upon the aerial extent of the twelve Subgrade lifts, only 48 CQC and 3 CQA field tests were required according to CMIP requirements (total of 51 tests). However, a total of 71 field tests were performed.

In the judgment of the CQA Engineers, there was no quality impact to the Subgrade of the MWL ET Cover, and therefore, no corrective action plan was required. The fact that the CQA Team performed/directed all CQC and CQA field testing represents a technically sound approach that was more conservative than required by the CMIP. The field testing performed exceeded the CMIP requirements by 20 tests. In addition, the thirteen 2009 re-testing results for the upper lift verified the Subgrade met CMIP density and moisture specifications approximately 3 years after Subgrade Layer completion.

Associated revisions to the CMI and CQA Reports are tracked in Table 1 and documented in redline-strikeout format in Attachment 1. Attachment 2 of this comment response document provides replacement pages, and revised text has been incorporated into the electronic version of the CMI Report (January 2010, Revision 1) provided on a CD.

2. Hydraulic Conductivity Testing

CQA Report, Section 4.3.1, Saturated Hydraulic Conductivity (ASTM Method D5856-95 [2007]): NMED agrees in general with the technical validity of the testing approach for hydraulic conductivity, and concurs that the results meet the performance specification of 4.6×10^{-4} centimeters per second (cm/s) or less. However, the sampling and testing approach do not appear to conform to the project Specifications, and a design change (Table 14) was not provided. It is evident that the Specifications in the CMIP intended for collection of *in situ* samples from the cover for hydraulic conductivity testing, rather than remolded samples (as was performed). Specifically, Paragraph 3.3.6(6) of the Section 02200 Earthwork specification states (regarding the Native Soil Layer):

Samples shall be obtained by means of a thin-walled sample tube or equivalent sampling device in a manner that minimizes disturbance to the lift and in the direction perpendicular to the plane of compaction. Samples shall be sealed and carefully stored to prevent drying during storage and transport. Hydraulic conductivity testing shall be performed in the laboratory according to ASTM specifications for rigid wall testing.

Clearly the intent of the Specification was not to use remolded samples, although there is some lack of clarity because the ASTM method was not specified, and because the term "rigid wall" was used in the Specifications.

See also the June 16, 2009, Quality Resolution Meeting minutes discussion of ASTM D-5084 flexible wall sample (undisturbed) vs. ASTM D-5856 rigid wall (remolded sample) hydraulic conductivity testing. Furthermore, it is not clear what test methods were used for the hydraulic conductivity results that were reported. Re-evaluate the hydraulic conductivity requirements and testing performed, and provide documentation of this matter as a nonconformance. Revise as appropriate the CMI Report and the CQA Report.

Response: The saturated hydraulic conductivity test method used (ASTM D5856-95) is stated in the CQA Report (Appendix A, Volume 1 of the CMI Report) in Section 4.3.1 *Laboratory Testing*, on page 39 and in footnote 2 of Table 8 *Mixed Waste Landfill 2009 ET Cover Construction, Saturated Hydraulic Conductivity CQC Laboratory Results*.

The ambiguity of the CMIP specifications with regards to saturated hydraulic conductivity testing was noted by the 2009 ET Cover construction project team and discussed during the referenced June 16, 2009 Quality Resolution Meeting. A considerable effort was made by the Construction Team, in coordination with SNL/NM project personnel and the CQA Team, researching saturated hydraulic conductivity testing options and the advantages and disadvantages associated with the two most appropriate ASTM methods. Based upon the physical properties of the native soil fill material and in the judgment of the CQA Engineer, ASTM D5084 flexible wall sample (undisturbed) and ASTM D5856-95 rigid wall (remolded sample) are both appropriate testing methods. After discussion that included input from the testing laboratory personnel at AMEC Earth and Environmental, Inc., all parties were in agreement that the ASTM D5856-95 rigid wall method was the best choice. The ASTM D5856-95 rigid wall method had two main advantages over the ASTM D5084 flexible wall method: 1) samples could be collected without compromising the integrity of the installed Native Soil Layer lift (i.e., without punching holes in the lift surface), and 2) compaction of the sample in the

laboratory could be controlled to accurately simulate compaction achieved in the field, especially considering the consistency of the native soil fill material. Although collection of an in situ, undisturbed sample in the field is a technically sound approach, the collection process is subject to variables that often result in some disturbance to the sampled material, which can affect the quality of the results.

The CMI Report has been revised to address this issue as a nonconformance. In the judgment of the CQA Engineer and project team, it was not possible to perform saturated hydraulic conductivity testing without some deviation from CMIP specifications. The method used was appropriate for the Native Soil Layer fill material and the results met the CMIP performance specification of 4.6×10^{-4} cm/s or less as noted in the NMED comment.

Associated revisions to the CMI and CQA Reports are tracked in Table 1 and documented in redline-strikeout format in Attachment 1. Attachment 2 of this comment response document provides replacement pages, and the revised text is incorporated into the electronic version of the CMI Report (January 2010, Revision 1) provided on a CD.

3. Equipment List.

CQA Report, Section 5.2.1, 2nd paragraph and bullet list: Provide a more detailed equipment list for the 2006 Subgrade Layer work. Note the detail provided in Table 13 for the 2009 construction phase; make and model number of the 2006 earthwork equipment (or other indication of size) should be provided at a minimum. As an example illustrating this need, CQA Report, Table 14, first line, states that a smaller roller was used for landfill surface compaction than specified: however, there are no details of the actual equipment used in 2006.

Response: The CQA Report (Appendix A of the CMI Report), Section 5.2.1, has been revised to provide the requested information. Associated revisions to the CQA Report are tracked in Table 1 and documented in redline-strikeout format in Attachment 1. Attachment 2 of this comment response document provides replacement pages, and the revised text has been incorporated into the electronic version of the CMI Report (January 2010, Revision 1) provided on a CD.

4. Stockpiled Volume of Native Soil

CQA Report, Section 5.4, second paragraph, third sentence reads as follows: "Soil fill stockpiled at the Borrow Pit in 2006 based on CMIP estimates was not sufficient to complete construction of the Native Soil and Topsoil Layers." NMED suggests changing this sentence to read: "The quantity of soil fill stockpiled at the Borrow Pit.... " to prevent potential confusion regarding the sufficiency of quality of the stockpiled material, which was adequate for soil fill.

Response: The CQA Report (Appendix A of the CMI Report) has been revised to make the suggested clarification. The associated revision to the CQA Report is tracked in Table 1 and documented in redline-strikeout format in Attachment 1. Attachment 2 of this comment response document provides the replacement page, and the revised text has been incorporated into the electronic version of the CMI Report (January 2010, Revision 1) provided on a CD.

5. Engineering Certification

CQA Report, Section 9: It seems odd that the certification of the subgrade is dated August 31, 2007, but also states that their original MKM Engineers, Inc. CQA Report "has been incorporated into this report," which appears to refer to the current 2010 CQA Report. NMED notes also that the 2009 CQA Engineer certified both the Subgrade Layer and the overlying ET Cover, which is appropriate given the re-testing of the Subgrade surface and oversight of the ET Cover construction.

Provide clarification of the engineering certification. It may be more appropriate to include a copy of the original CQA Engineer subgrade certification, without modifying it to conform to the format of the current report.

Response: The MWL ET Cover was deployed in two separate construction phases, the 2006 Subgrade and the 2009 ET Cover Construction phases, as described in the CMI Report (Section 1.3, page 1-3) and the CQA Report (Section 1.1 [page 21], Section 1.3 [pages 22-23], and Section 5.0 [page 47]). Section 1.3 of the CQA Report provides a detailed description of how the 2006 Subgrade construction was documented and certified in the Draft MWL Alternative Cover Subgrade CQA Report (MKM, August 2007), which was subsequently revised to incorporate the 2009 ET Cover construction activities and certification. The Draft Subgrade CQA Report was prepared and certified in 2007 because it was not known when NMED approval to proceed with ET Cover construction would be received, and when that approval was received, if the same CQA Engineer would be available.

As a result of the delay, a new construction team and CQA Team performed the 2009 ET Cover construction work. It was always the intent of DOE/Sandia to submit one final report to NMED (i.e., CMI Report) documenting installation of the ET Cover that included the required CQA Report certified by the CQA Engineer. In order to accomplish this, the 2007 Draft Subgrade CQA Report was updated to incorporate the 2009 ET Cover Construction activities. During preparation of the 2009 CMI and CQA Reports, Dr. Kelly Peil (certifying engineer for 2006 Subgrade) was consulted and the approach to revise the 2007 Draft Subgrade CQA Report and modify his 2007 certification statement was discussed. Dr. Peil concurred with the approach and, for completeness, DOE/Sandia retained his certification for the 2006 Subgrade effort.

Based upon this information, it is the position of DOE/Sandia that the 2007 certification presented in Chapter 9 of the CQA Report is appropriate. However, as requested in this NMED comment, DOE/Sandia are replacing the modified 2007 certification statement with the original, and adding an explanatory note at the bottom of the page to address the incorporation of the referenced "CQA subgrade preparation draft report" into the January 2010 CQA Report as described in Section 1.3, page 23.

Dr. Peil and the 2009 CQA Certifying Engineer, Mr. Donald T. Lopez, have reviewed this NOD comment response document and the associated revisions to the CMI and CQA Reports. Chapter 9 of the revised CQA Report (January 2010, Revision 1) includes an updated certification statement from Mr. Lopez as the CQA Certifying Engineer for the MWL ET Cover. The statement addresses the revisions made to the January 2010 report in response to NMED NOD comments dated May 20, 2011.

The associated revisions to the CQA Report are tracked in Table 1 and documented in redline-strikeout format in Attachment 1. As revised in Attachment 1, Dr. Peil's certification statement on page 75 of 79 reflects the original wording of the August 31, 2007 certification statement. Attachment 2 of this comment response document provides replacement pages for the revised certification statement, which have been incorporated into the electronic version of the CMI Report (January 2010, Revision 1) provided on a CD.

6. Hydraulic Conductivity Table

CQA Report, Table 8, 4th column: NMED suggest changing the title of the 4th column to "Sample" Compaction (to avoid confusion with in-place cover compaction) to better describe that the hydraulic conductivity tests were apparently performed on samples that were remolded in the laboratory. With the current column heading one might make the erroneous assumption that 90% compaction was not achieved at all test locations on the cover. Also, regarding Footnote 1, change "Minimum" to "Maximum" with regards to the specified comparison criteria for hydraulic conductivity results.

Response: The CQA Report (Appendix A of the CMI Report), Table 8 has been revised to make the suggested changes. The associated revision to the CQA Report is tracked in Table 1 and documented in redline-strikeout format in Attachment 1. Attachment 2 of this comment response document provides the replacement page, and the revised table is incorporated into the electronic version of the CMI Report (January 2010, Revision 1) provided on a CD.

7. Disposition of Grubbed Vegetation

Volume 2 of the CQA Report, Attachment 1, Record of Meeting for June 5, 2006: item 9 indicated "grubbed vegetation may contain tritium, and will be mulched and stored for placement with topsoil at a later time". Indicate whether the grubbed vegetation that was removed from the MWL surface in 2006 was tested. Indicate also if this vegetation contained tritium and the disposition of this material. Note the October 2, 2006 Record of Meeting, Item 2 which indicates "shredded brush will be stored for future reuse in covered containers." However, the material is not mentioned in the February 12, 2007 minutes which indicated the project would be mothballed and stabilized due to approval delays. The following statement is made in the CQA Report (Section 5.1, second paragraph, third sentence), but no backup was provided in the attachments: "The vegetation removed from the existing MWL surface and the perimeter area was shredded and containerized for future disposition. The material was sampled for radiological contamination and approved for reuse." Provide additional clarification and supporting documentation in the CMI Report concerning the management and disposition of the grubbed vegetation.

Response: Between October 5 and 16, 2006, one grab sample of a soil-vegetation mixture and one pinch sample of soil only were collected from each of the four piles of grubbed vegetation stockpiled at the MWL. The four sample pairs (8 total samples) were analyzed for gamma spectroscopy, tritium, gross alpha and gross beta. All sample results were reviewed and were below background activities, including the tritium results. The soil and vegetation were subsequently segregated and the vegetation was shredded and containerized in roll off containers (as shown in the 10/23/06 photograph in the CQA Report, Volume 1 Photographic Log). The original intent was to use this shredded vegetation to increase the organic content of the topsoil

material. However, due to the delay in NMED approval to proceed with ET Cover installation, the shredded vegetation was eventually disposed of at the Kirtland Air Force Base (KAFB) Landfill to allow the roll off containers to be used at other SNL locations. Segregated soil material was used to maintain the surface-water soil berm surrounding the MWL site. The October 2006 soil-vegetation grab sample radiological analytical results are maintained in the SNL Customer Funded Record Center.

The CQA Report (Appendix A of the CMI Report), Section 5.1, second paragraph, third sentence has been revised to clarify the disposition of the grubbed vegetation at the KAFB Landfill. This revision is tracked in Table 1 and documented in redline-strikeout format in Attachment 1. Attachment 2 of this comment response document provides the replacement page, and the revised text is incorporated into the electronic version of the CMI Report (January 2010, Revision 1) provided on a CD.

8. Monitoring Well Extension

CQA Report, Attachment 8, Figure 2-5, center of figure: "PVC Slip Coupling w/ Stainless Steel Screens" should read "PVC Slip Coupling w/Stainless Steel Screws".

Also in Attachment 8, Section 3, first bullet provides justification of the "double anchored" well resulting from not demolishing the original well pad. The Permittees should carefully monitor and observe the upper 10 feet of the interior casing during future sample events to monitor whether this arrangement causes damage to the well casing from potential settlement of underlying waste.

Response: The error in Figure 2-5 of Attachment 8 in the CQA Report (Appendix A of the CMI Report, Volume 2), has been corrected. The associated revision to the CQA Report is tracked in Table 1 and documented in redline-strikeout format in Attachment 1. Attachment 2 of this comment response document provides the replacement page, and the revised figure is incorporated into the electronic version of the CMI Report (January 2010, Revision 1) provided on both CDs.

In addition, DOE/Sandia will inspect the upper 10 feet of the interior casing during future sampling events to monitor whether this arrangement causes damage to the well casing from potential settlement of underlying waste.

Table 1
Mixed Waste Landfill Corrective Measures Implementation Report
Revisions Made in Accordance with the New Mexico Environment Department
Notice of Disapproval Comments Dated May 20, 2011

NOD Comment #	CMI Report Page Revisions	CQA Report, Volume 1 Page Revisions	CQA Report, Volume 2 Page Revisions
--	Cover and title pages, page i ¹	Appendix A cover page, report cover and title pages (pages 1 and 3), page 15 ¹	No Change
1	ii, 1-9, 2-6	Pages 7, 16, 20, 41, 69 and 73	No Change
2	ii, 1-9, 2-6	Pages 7, 16, 20, 69, 70 and 73	No Change
3	No Change	Page 51	No Change
4	No Change	Page 59	No Change
5	No Change	Pages 75 and 76	No Change
6	No Change	Tables-Page 15 of 33	No Change
7	No Change	Page 49	No Change
8	No Change	No Change	Attachment 8, Page 2-8
NA	No Change	Tabbed section in back of report labeled “As-Built Drawings”, Figure No. 1 – 4 depicting the 2009 As-Built Drawings ²	No Change

Note: Revised CMI and CQA Report pages referenced above are provided in redline-strikeout format in Attachment 1 to document the changes made in response to NMED NOD comments #1 through 8.

¹ Changes made to the cover and title pages to include “Revision 1” following “January 2010.” A brief note has been added to the beginning of the Executive Summaries to explain revision of the January 2010 document in response to the NMED NOD.

² Revised as-built drawings for the 2009 ET Cover are provided as part of this NOD Response to document the location of two access gates in the perimeter security fence at the northern and southern ends of the MWL not previously shown on the original drawings. These changes are not related to a specific NMED NOD comment and they are not provided in redline-strikeout format in Attachment 1.

CMI	Corrective Measures Implementation
CQA	Construction Quality Assurance
NA	Not applicable
NMED	New Mexico Environment Department
NOD	Notice of Disapproval

Attachment 1

Revisions to the MWL CMI Report in Redline-Strikeout Format

This Attachment Includes Revised Pages From:

- CMI Report, Main Text
- CMI Report, Appendix A - CQA Report, Volume 1, Main Text
- CMI Report, Appendix A, CQA Report, Volume 2, Attachments

Revised Pages in Redline-Strikeout Format
MWL CMI Report Main Text



**Sandia
National
Laboratories**

Sandia National Laboratories/New Mexico Environmental Restoration Project

MIXED WASTE LANDFILL CORRECTIVE MEASURES IMPLEMENTATION REPORT

JANUARY 2010
Revision 1



United States Department of Energy
Sandia Site Office

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

EXECUTIVE SUMMARY

This document represents a revision to the January 2010 Mixed Waste Landfill Corrective Measures Implementation Report in response to the New Mexico Environment Department Notice of Disapproval dated May 20, 2011.

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 nonconformances and 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.

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 nonconformances and 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 and there were no adverse impacts to ET Cover quality as a result of the nonconformances and design changes.

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 nonconformances and 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

Revised Pages in Redline-Strikeout Format
MWL CMI Report, Appendix A - CQA Report, Volume 1
Main Text and Table Section

APPENDIX A

**Mixed Waste Landfill Alternative Cover
Construction Quality Assurance Report**
January 2010
Revision 1

Volume 1
Main Text and Tabbed Sections

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

Mixed Waste Landfill

Alternative Cover Construction

Quality Assurance Report

Submitted to



Sandia National Laboratories

P.O. Box 5800

Albuquerque, NM 87185



January 2010

Revision 1

Submitted by



URS Group, Inc.

One Park Square

6501 Americas Parkway NE, Suite 900

Albuquerque, NM 87110

**MIXED WASTE LANDFILL
ALTERNATIVE COVER
CONSTRUCTION QUALITY ASSURANCE REPORT**

JANUARY 2010
Revision 1

6.0	Monitoring Well (MWL-MW4) Extension	67
7.0	Cover Layer Approvals, <u>Nonconformances</u> , and Design Changes.....	69
8.0	Conclusions.....	73
9.0	Engineering Certification.....	75
10.0	References.....	77

Executive Summary

This document represents a revision to the January 2010 Mixed Waste Landfill Alternative Cover Construction Quality Assurance Report in response to the New Mexico Environment Department Notice of Disapproval dated May 20, 2011.

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. SNL/NM is owned by the U.S. Department of Energy (DOE) and managed and operated by Sandia Corporation (Sandia), a wholly owned subsidiary of Lockheed Martin Corporation. Sandia performs research and development in support of various energy, weapons, and national security programs. Sandia 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) at SNL/NM is designated as an Underground Radioactive Materials Area under DOE requirements and a Hazardous and Solid Waste Amendments Solid Waste Management Unit subject to New Mexico Environment Department (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. The MWL is located within the boundaries of KAFB on federal land controlled by the DOE. The MWL consists of two distinct disposal areas; the classified area in the northeast portion occupies 0.6 acres and the unclassified area occupies 2.0 acres. Approximately 100,000 cubic feet of low-level radioactive and mixed waste containing approximately 6,300 curies of activity (at the time of disposal) were disposed of in the MWL from March 1959 through December 1988.

The MWL alternative evapotranspirative (ET) cover (hereafter referred to as the 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 (Figure ES-1). 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 the specifications provided in the MWL Corrective Measures Implementation Plan (CMIP) (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.

This MWL Alternative Cover CQA Report documents the implementation of the MWL CMIP (SNL/NM, November 2005) that was conditionally approved by the NMED (Bearzi, December 2008) and addresses all requirements for the MWL Corrective Measures Implementation Report as 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 (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). The CMIP contains the Construction Specifications (Appendix A) and CQA Plan (Appendix B) that define the construction, design, and quality assurance requirements for construction of the MWL Alternative Cover (i.e., MWL ET Cover).

Deployment of the MWL ET Cover was conducted in two main construction phases, the 2006 Subgrade Construction and 2009 ET Cover Construction. The 2006 Subgrade Construction phase began on October 2, 2006, following the NMED approval received in September 2006 (Bearzi, September 2006), and was completed on April 11, 2007. This phase involved MWL Borrow Pit activities to generate soil fill material for cover construction, preparation of the existing disposal area surface, construction of the Subgrade, and installation of erosion control measures to protect the Subgrade surface while awaiting final NMED approval of the CMIP. The 2009 ET Cover Construction phase was performed from May 20 through September 3, 2009, and involved preparation of the Subgrade surface, construction of the ET Cover layers (Biointrusion, Native Soil, and Topsoil Layers) and site drainage features, installation of the administrative security fence, and site revegetation activities. Minor variances in construction and/or design specifications that did not adversely affect the quality of the cover were documented as nonconformances or design changes and approved by the CQA Engineer. Overall, the final MWL ET Cover as constructed provides a thicker, more protective ET Cover relative to the CMIP minimum design specifications. The completed ET Cover is shown schematically in Figure ES-1.

Third-party CQA services were provided by MKM Engineers, Inc. during the 2006 Subgrade Construction phase (under subcontract to URS Group, Inc. [URS]), and by URS during the 2009 ET Cover Construction phase. This report and the attachments provide the construction quality control and CQA data and documentation required to verify that the MWL ET Cover meets the construction and design specifications of the NMED-approved CMIP (SNL/NM, November

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

Deployment of the MWL ET Cover is detailed in this MWL Alternative Cover CQA Report (Volumes 1 and 2), which incorporates all construction quality control (CQC) and CQA data and documentation requirements for the MWL Corrective Measures Implementation (CMI) Report as 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 (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).

Volume 1 includes the main text (Chapters 1.0 through 10.0) and tabbed sections located at the end of this report. Chapter 1.0 provides background information and the purpose and scope of this report. Chapter 2.0 presents the roles and responsibilities of the organizations, contractor teams, and key personnel. Chapter 3.0 presents project communications, the construction approval process, and related CQA documentation. The CQC and CQA programs that were implemented to test, control, and verify construction of the ET Cover according to the specifications and design drawings in the CMIP are presented in Chapter 4.0, along with the associated CQC and CQA data. Chapter 5.0 provides a detailed summary of the 2006 Subgrade and 2009 ET Cover Construction earthwork. Chapter 6.0 discusses the extension of groundwater monitoring well MWL-MW4 and the installation of two required soil-vapor monitoring wells; these tasks were completed in 2009 during installation of the ET Cover. Chapter 7.0 summarizes nonconformances and design changes (i.e., minor variances in construction and/or design specifications that do not affect the quality of the cover) to the CMIP specifications and design drawings. Chapters 8.0 and 9.0 provide the conclusions and CQA Engineering Certification of ET Cover construction, respectively. Report references are provided in Chapter 10.0. Tabbed sections at the end of Volume 1 include all tables, figures, as-built drawings, quality assurance (QA) verification survey plates, and photographic logs. Volume 2 contains Attachments 1 through 8 that include supporting CQC and CQA documentation. Volume 2 is provided in electronic format (PDF files) on a compact disc (CD) at the end of this report. Separately bound hard copies of the attachments in 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 [Environment, Safety, and Health] and Security Records Center).

density and moisture readings were obtained to verify compaction of not less than 90 percent of the maximum dry density. After discussions with the SCR and Sandia Oversight, Construction Team, and CQA Team personnel, this approach was approved by the CQA Engineer for verification of a stable surface, rather than counting the number of passes over an area using a roller with a ballasted weight of 25 tons, as stipulated in Section 02200 in Appendix A of the CMIP (SNL/NM, November 2005). Due to moisture being added to the surface rather than mixed into the soil prior to placement, the optimum moisture content goal of +/- 2 percent could not be attained using either compaction method. However, the field-testing results provided a more quantitative method and verified adequate compaction of the existing surface.

The spatial extent of most Subgrade Construction phase lifts was highly variable due to the uneven existing surface, so many of the lifts were significantly smaller than 1 acre. Therefore, the number of tests per lift was generally less than five. The field test locations were selected to be representative of each lift and were surveyed, recorded on an inspection checklist, and plotted on maps. The actual in-place density and moisture testing performed during Subgrade construction exceeded CMIP specifications of 5 CQC tests per acre per lift plus at least 5% additional confirmatory CQA tests. Based upon the aerial extent of the twelve Subgrade lifts, only 48 CQC and 3 CQA tests were required based upon the CMIP requirements (total of 51 tests). However, a total of 71 field tests were performed. Figures 5 through 17 show the locations of all existing surface and Subgrade field tests, Table 9 summarizes the results, and Attachment 7 provides the associated field and laboratory documentation. Testing inspection forms completed in the field are included in Attachment 6.

For the 2006 Subgrade Construction phase field-testing program, the native soil fill material was tracked as it was sampled, hauled, and placed. The associated Proctor result for every 500 cy was used to support the in-place density and moisture field tests of that 500 cy of fill material as it was placed and tested. The Subgrade lifts were relatively small making this approach feasible, although verifying the Proctor result characterizing each 500 cy of fill material that was placed, compacted, and tested was challenging. In one situation, this approach could not be followed due to laboratory reporting delays. The CQA Engineer approved proceeding with the previous Proctor results because the physical properties of the native soil fill were consistent. As more Standard Proctor results became available it was evident that the Borrow Pit fill material was relatively uniform in terms of its geotechnical characteristics, especially after screening and stockpiling.

5.1 Existing Mixed Waste Landfill Surface

Preparation of the existing MWL surface was conducted as the first part of the 2006 Subgrade Construction phase. From October 2 through October 26, 2006, the security fence was removed and the MWL surface was cleared of vegetation. After clearing, the existing surface was graded, watered, compacted, and tested in preparation for the Subgrade Construction phase. As part of site preparation work, an area immediately south of the MWL was cleared and used as the staging area for the soil stockpile, the roll-off containers for waste and recyclable metal, the container for shredded vegetation, and equipment storage. The work area boundary was marked with a rope and signs to designate the radiation control area that was in effect for the 2006 Subgrade Construction phase. After completion of the Subgrade Construction phase, which involved placement of clean soil fill over the disposal area surface, the radiological posting of the MWL was changed to an Underground Radioactive Materials Area. This allowed the 2009 ET Cover Construction phase to proceed without formal radiological controls, although SNL/NM Radiological Control Technicians continued to be involved in the early construction phases to confirm clean operations.

Soil berms were constructed around the perimeter work area as a best management practice required by the project SWPPP for the control of storm water run-on and to control runoff from the site. The berms were inspected after each significant rainfall event (i.e., more than 0.5 inches) or semimonthly at a minimum, according to the project SWPPP requirements, and repairs were made as necessary. The existing administrative security fencing was removed and stockpiled on site for radiological clearance before disposal or recycling. The vegetation removed from the existing MWL surface and the perimeter area was shredded and containerized for future disposition. The material was sampled for radiological contamination, ~~and~~ approved for reuse, and disposed of at the KAFB Landfill. Any material on the surface larger than 2 inches was removed and stockpiled. One remaining concrete pad pit cover was reduced to rubble in place and backfilled with stockpiled soil.

The existing surface was uneven due to the previously backfilled disposal trenches. The surface was graded, compacted with a vibratory roller, and water was added using a water truck to complete existing surface preparation activities.

5.1.1 Existing Surface Laboratory and Field Testing

After the surface was graded and compacted, in-place field density and moisture testing were performed to verify compaction of not less than 90 percent of the maximum dry density. Standard Proctor soil testing to support the in-place density and moisture field testing was

The following equipment was used for 2006 Subgrade Construction phase earthwork:

- Dump trucks to haul the soil ([Volvo WG 64](#))
- Two front-end loaders to haul and spread the soil in lifts ([John Deere 644G](#))
- An excavator at the soil stockpile to mix the soil with water before placing it on the MWL surface ([John Deere 240](#))
- A grader ([John Deere 670](#)) to spread the soil to the required thickness (grader later replaced with a tracked bulldozer [\[John Deere 650G\]](#))
- One water truck ([2,000 gallon Ford F650](#)) to moisture-condition the soil and to control dust in the work area
- One vibratory roller for compacting the soil lifts ([Ingersoll Rand SD 70D, 8 ton gross weight, maximum centrifugal force 32,100 pounds](#))
- A skid steer to spread the soil in tight areas and around groundwater monitoring well MWL-MW4 ([Caterpillar 246B](#))

The Subgrade was installed on top of the prepared existing surface using approximately 11,000 cy (loose) of native soil fill placed in a total of 12 lifts. The subgrade soil was placed in 8-inch loose, 6-inch compacted lifts beginning with the topographically lowest areas. In general, the lower northern side of the MWL was augmented to match the higher southern grade. The goal of the Subgrade Construction phase was to establish a surface over the MWL that mirrored the final CMIP design surface of the ET Cover (i.e., a broad, central crown or high area with a 2-percent east-to-west slope across most of the MWL).

The initial seven lifts were spatially limited and largely placed to bring depressions across the site to a level grade. Lifts 8 through 12 were placed in increasingly larger areas across the MWL. A total of 12 lifts were applied, with the total depth varying from a few inches to 40 inches (approximately 3.3 feet) at the lowest spots. To guide and control lift thickness across the area, the surveyors installed grade stakes marked in 8-inch thickness levels for each lift. Each lift was compacted to meet the CMIP specification of compaction of not less than 90 percent of the maximum dry density at +/- 2 percent of optimum moisture content, as determined by ASTM D698 (Standard Proctor testing) (ASTM, 2007a). Compaction with the vibratory roller resulted in an approximate 6-inch lift. The in-place, compacted volume of the Subgrade is approximately 7,700 cy indicating a compaction factor of approximately 30 percent.

The quantity of soil was tracked by the volume per loader bucket and the number of loads per day. A total volume of soil was recorded for each lift and the locations of each laboratory and

thickness of the Native Soil Layer. The thickness of this soil layer is not considered part of the Biointrusion Layer or the Native Soil Layer, both of which meet minimum thickness specifications of the CMIP without including this layer. Grid points and surrounding areas where the thin soil layer exceeded 3 inches were rechecked and adjusted using the JD 670 motor grader where feasible. If the soil layer could not be scraped and thinned without encountering the underlying rock, no further adjustment was made.

All grid points that were altered were resurveyed, and the final average thickness of the thin soil layer overlying the Biointrusion Layer was 0.25 feet (Table 12). Final approval of the thin soil layer occurred on June 17, 2009 (Section 3.4 and Table 3).

The final average thickness of the completed Biointrusion Layer was 1.25 feet, which equals the CMIP upper tolerance thickness. The complete volume of rock used for the Biointrusion Layer is estimated at 6,800 cy. The in-place surveyed volume is approximately 5,800 cy. The 1,000-cy discrepancy (approximately 15 percent reduction) is most likely attributable to the fact that the Subgrade surface elevation was lowered approximately 1 to 2 inches during the scarification process prior to installing the Biointrusion Layer rock material. Initial volume estimates of the received rock may have also been biased slightly high.

5.4 Native Soil Layer

Construction of the Native Soil Layer was conducted from June 16 through August 4, 2009. Construction started on the side slopes around the northern end of the MWL, which were built up in lifts to meet the 6 to 1 slope requirement from June 16 through June 22, 2009. Construction of the Native Soil Layer on the surface of the MWL started on June 18, 2009, after the thin soil layer overlying the Biointrusion Layer was approved on June 17, 2009 (Table 3). Construction of the side slopes around the northern end of the MWL and the first Native Soil lift (Wedge Lift 1) on the MWL surface proceeded concurrently from June 18 through June 22, 2009.

To support construction of the Native and Topsoil Layers, additional soil fill material was excavated, screened to 2-inch minus, and stockpiled at the Borrow Pit from June 12 to July 24, 2009. During this time period, the soil berm around the MWL site originally installed as part of the 2006 Subgrade Construction phase SWPPP was excavated, hauled to the Borrow Pit, and screened for use as native soil fill (a perimeter silt fence had been installed around the berm in late May 2009). The quantity of \$ soil fill stockpiled at the Borrow Pit in 2006 based on CMIP estimates was not sufficient to complete construction of the Native Soil and Topsoil Layers. During the Quality Resolution Meeting held on July 14, 2009, estimates were finalized for

7.0 Cover Layer Approvals, Nonconformances, and Design Changes

Documentation associated with the 2009 Quality Resolution Meetings and ET Cover layer approval is summarized in Sections 3.3 and 3.4, Table 3, and Attachments 1 and 2. Based upon the final CQC survey data (Table 12) and 2009 as-built drawings (Figures No. 2 and 3 in tabbed section at the end of this report), the final ET Cover surface meets the 2-percent east-to-west surface design slope, and all side slopes meet or exceed (i.e., are flatter) than the 6 to 1 specification. All cover layers were approved prior to starting construction of the next layer as stipulated in the CMIP CQA Plan (SNL/NM, November 2005–Appendix B).

Consistent with the CMIP CQA Plan, nonconformances are defined as deviations or changes to construction and/or design specifications. If it is determined by the CQA Engineer that a nonconformance has that have an adverse impact on quality of the ET Cover, and therefore require a corrective action plan and documentation of corrective action implementation are also required. Design changes are minor variances from construction and/or design specifications that do not have an adverse impact on quality and therefore do not require corrective action. However, nonconformances and design changes must be documented.

Two nonconformances were identified. During the 2006 Subgrade construction phase, CQC versus CQA in-place density and moisture field tests were not clearly distinguished and the CQA Team directed/Performed all of the field testing instead of the construction team performing/directing the required CQC tests. The actual in-place density and moisture testing performed during Subgrade construction exceeded the CMIP specifications of 5 CQC tests per acre per lift plus at least 5% additional confirmatory CQA tests. Based upon the aerial extent of the 12 Subgrade lifts, 48 CQC and 3 CQA field tests were required; however, a total of 71 field tests were performed. In the judgment of the CQA Engineers, the testing performed exceeded requirements and there was no quality impact to the Subgrade of the MWL ET Cover.

The second nonconformance occurred during the 2009 ET Cover construction phase and involved saturated hydraulic conductivity tests performed using the ASTM D-5856 rigid wall (remolded) method on the Native Soil Layer fill material. Although the term “rigid wall” is used twice in the CMIP construction specifications (Appendix A, Section 02200 Earthwork) and is a valid method for determining the saturated hydraulic conductivity in these types of soils, the intent of the CMIP specification appears to indicate the use of the ASTM D-5084 flexible wall (undisturbed) method. After discussion at the June 16, 2009 Quality Resolution Meeting, the

project team agreed that the ASTM D5856-95 rigid wall method was the best method for two main reasons: 1) samples could be collected without compromising the integrity of the installed Native Soil Layer lift (i.e., without punching holes in the lift surface), and 2) compaction of the sample in the laboratory could be controlled to accurately simulate compaction achieved in the field. In the judgment of the CQA Engineer there was no impact on the quality of the ET Cover and a corrective action plan was not required.

There were no ET Cover construction nonconformances.—All design changes are summarized in Table 14, along with a brief explanation of why they had no adverse quality impact. For both the 2006 Subgrade and 2009 ET Cover Construction phases, all technical issues and design changes were addressed by the respective project teams and resolved through a team approach in documented meetings and project-specific approval forms as discussed in Chapter 3.0. The project teams included Sandia Oversight, CQA Team, and Construction Team representatives. The design changes were approved by the CQA Engineer and did not result in an adverse impact on the quality of the final cover. In all instances, the implemented design changes had a neutral or positive impact on ET Cover quality.

For the 2006 Subgrade construction activities, the compaction and in-place density and moisture field-testing approach for the existing MWL surface, supported by Standard Proctor results, provided a more quantitative approach for verifying adequate compaction than the CMIP-specified approach of “counting 10 passes of a roller with ballasted weight of 25 tons and a minimum tire pressure of 90 psi.” The overall relative uniformity of the Borrow Pit soil fill material, particularly after screening and stockpiling procedures, is demonstrated by the large number of Standard Proctor, Gradation, and Classification results collected throughout the 2006 and 2009 construction phases (Tables 4, 5, 6, and 7; Figure 20). These data support the conclusion that the existing MWL surface soil is very similar to the Borrow Pit soil. In addition, the data support the use of relatively few Proctors for the 2009 in-place density and moisture field-testing program, as well as the use of one Proctor to cover approximately 1,500 cy of soil fill during the 2006 Subgrade Construction phase field-testing program, as approved by the respective CQA Engineers.

On May 22, 2009, a Quality Resolution Meeting was held to discuss the 2009 existing Subgrade surface, which did not meet the 2-percent east-to-west surface design slope across the eastern side of the cover from the central portion to the southern end of the MWL (slopes ranged from 1.8 to 1.9 percent in this area). After evaluating the CQC survey data and discussing possible solutions, Sandia Oversight, Construction Team, and CQA Team representatives determined that

8.0 Conclusions

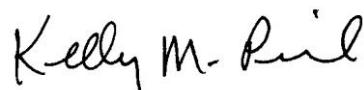
For the 2006 Subgrade Construction phase only, an independent MWL CQA Plan (SNL/NM, May 2006) was prepared that incorporated the regulatory guidance and design and specification requirements for the construction of the MWL cover as defined in the CMIP (SNL/NM, November 2005). For the 2009 ET Cover Construction phase, the CQA Plan in Appendix B of the CMIP (SNL/NM, November 2005) was used directly.

For both the 2006 and 2009 phases, a representative of the CQA team was at the site each workday to inspect and oversee construction activities and the field and laboratory testing. The results of the inspections and oversight are provided on the inspection forms, daily reports, and approval forms attached to this report. This report also presents a summary of the construction activities, CQC and CQA laboratory and field-testing results, CQC and CQA survey results, as-built drawings documenting cover construction, and photographic records of the activities.

All nonconformances and design changes are documented and were made in consultation between the Construction Team, Sandia Project Staff, and the CQA Team. These Design changes did not result in an adverse impact on the quality of the final cover, ~~were not considered nonconformances~~, and did not require corrective action. All cover layers were approved as stipulated by the CQA Plan in Appendix B of the CMIP (SNL/NM November 2005) prior to starting construction of the next layer, and all cover-related design changes resulted in a more protective cover. This report and the attachments provide the required documentation to verify that the MWL existing surface, Subgrade, ET Cover layers (Biointrusion, Native Soil, and Topsoil Layers), and site drainage features were prepared and installed in accordance with the CMIP (SNL/NM, November 2005) construction and design specifications. A New Mexico-registered Professional Engineer has certified that the MWL alternative cover construction was performed in accordance with the plans and specifications (Chapter 9.0).

9.0 Engineering Certification

During construction of the ~~2006~~ ~~Subgrade installation~~, I have performed tasks required of the CQA Engineer in accordance with the CQA Plan for the MWL Alternative Cover construction at ~~SNL/NM (SNL/NM, May 2006)~~ Sandia National Laboratories, New Mexico. I certify that the MWL ~~Subgrade~~ has been prepared and constructed in accordance with construction plans and specifications ~~provided in the MWL CMIP (SNL/NM, November 2005) and the MWL Cover Construction Quality Assurance Plan~~. I certify that to the best of my knowledge the ~~"MWL Alternative Cover Construction, Subgrade, Draft Quality Assurance Report" (MKM, August 2007), which has been incorporated into this report, CQA subgrade preparation draft report~~ accurately documents the CQA activities conducted under my responsible charge as the CQA Engineer.



Kelly M. Peil, PhD, P.E.
MKM Engineers, Inc.



Title: CQA Certifying Engineer
Date: August 31, 2007

State: New Mexico

Registration No. 9718

Note: The certification statement above pertains to the 2006 Subgrade Construction effort only.
The CQA subgrade preparation draft report referenced in the statement above was incorporated
into this January 2010 CQA Report as explained in Section 1.3

During the construction of the 2009 ET Cover, I have performed tasks required of the CQA Engineer in accordance with the CQA Plan in Appendix B of the MWL CMIP (SNL/NM, November 2005). I was also involved in an oversight role during the 2006 Subgrade Construction phase and have reviewed the associated CQC and CQA data and documentation. I certify that both the 2006 Subgrade and the 2009 ET Cover for the MWL have been prepared and constructed in accordance with the construction plans, drawings, and specifications contained in the MWL CMIP (SNL/NM, November 2005), including Appendix A (MWL Landfill Alternative Cover Construction Specifications Revision 2 [July 29, 2005]) and Appendix B (CQA Plan). I certify that to the best of my knowledge this MWL Alternative Cover CQA Report, as revised to address NMED comments provided on May 20, 2011, accurately documents the construction, CQC, and CQA activities conducted under my responsible charge as the CQA Certifying Engineer.



Donald T. Lopez, PE
URS Group, Inc.



Title: CQA Certifying Engineer
Date: January 14, 2010July 12, 2011

State: New Mexico

Registration No. 5122

Table 8
Mixed Waste Landfill 2009 ET Cover Construction
Saturated Hydraulic Conductivity CQC Laboratory Results

Sample Description	Location	Date Sampled	Sample Compaction	Average Saturated Hydraulic Conductivity ¹ (K_{sat}) in cm/s ²
Native Soil Wedge Lift 1	Grid Block 8	6/19/2009	90.0%	4.02E-04
Native Soil Wedge Lift 2	Grid Block 11	6/22/2009	89.0%	3.58E-05
Native Soil Lift 3-1	Collected Prior to Placement	6/17/2009	90.2%	1.59E-06
Native Soil Lift 3-2	Collected Prior to Placement	6/17/2009	89.7%	1.81E-06
Native Soil Lift 3-3	Collected Prior to Placement	6/17/2009	91.0%	1.98E-06
Native Soil Lift 4	Grid Block 2	6/30/2009	84.6%	2.52E-04
Native Soil Lift 4	Grid Block 6	6/30/2009	81.2%	1.87E-04
Native Soil Lift 4	Grid Block 9	6/30/2009	89.8%	2.14E-04
Native Soil Lift 5	Grid Block 1	7/9/2009	90.0%	2.66E-04
Native Soil Lift 5	Grid Block 4 Retest	7/8/2009	95.3%	1.43E-04
Native Soil Lift 5	Grid Block 8 Retest	7/8/2009	94.6%	1.63E-04
Native Soil Lift 6-1	Grid Block 3	7/16/2009	90.2%	3.05E-04
Native Soil Lift 6-2	Grid Block 6	7/16/2009	90.3%	3.51E-04
Native Soil Lift 6-3	Grid Block 12	7/16/2009	89.5%	2.55E-04
Native Soil Lift 7	Grid Block 1 Retest	7/20/2009	94.8%	2.18E-04
Native Soil Lift 7	Grid Block 5 Retest	7/20/2009	94.8%	1.87E-04
Native Soil Lift 7	Grid Block 13	7/22/2009	89.5%	2.50E-04
Native Soil Lift 8	Grid Block 2	7/27/2009	90.4%	1.22E-06
Native Soil Lift 8	Grid Block 7	7/27/2009	90.0%	1.23E-06
Native Soil Lift 8	Grid Block 9	7/27/2009	90.0%	1.36E-06
Average			90.2%	1.62E-04
Geometric Mean			90.2%	4.72E-05
Median			90.0%	1.87E-04

¹ **Minimum Maximum** Value is 4.6E-04.

² Tests were performed using ASTM D5856 Rigid Wall Method.

CQC = Construction Quality Control

ET = Evapotranspirative

Revised Pages in Redline-Strikeout Format
MWL CMI Report, Appendix A - CQA Report, Volume 2
Attachment 8

APPENDIX A

**Mixed Waste Landfill Alternative Cover
Construction Quality Assurance Report**
January 2010
Revision 1

**Volume 2
Attachments**

(provided electronically on compact disc)

Attachments in Volume 2 of Appendix A are provided in electronic format (PDF files) on a CD. 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).

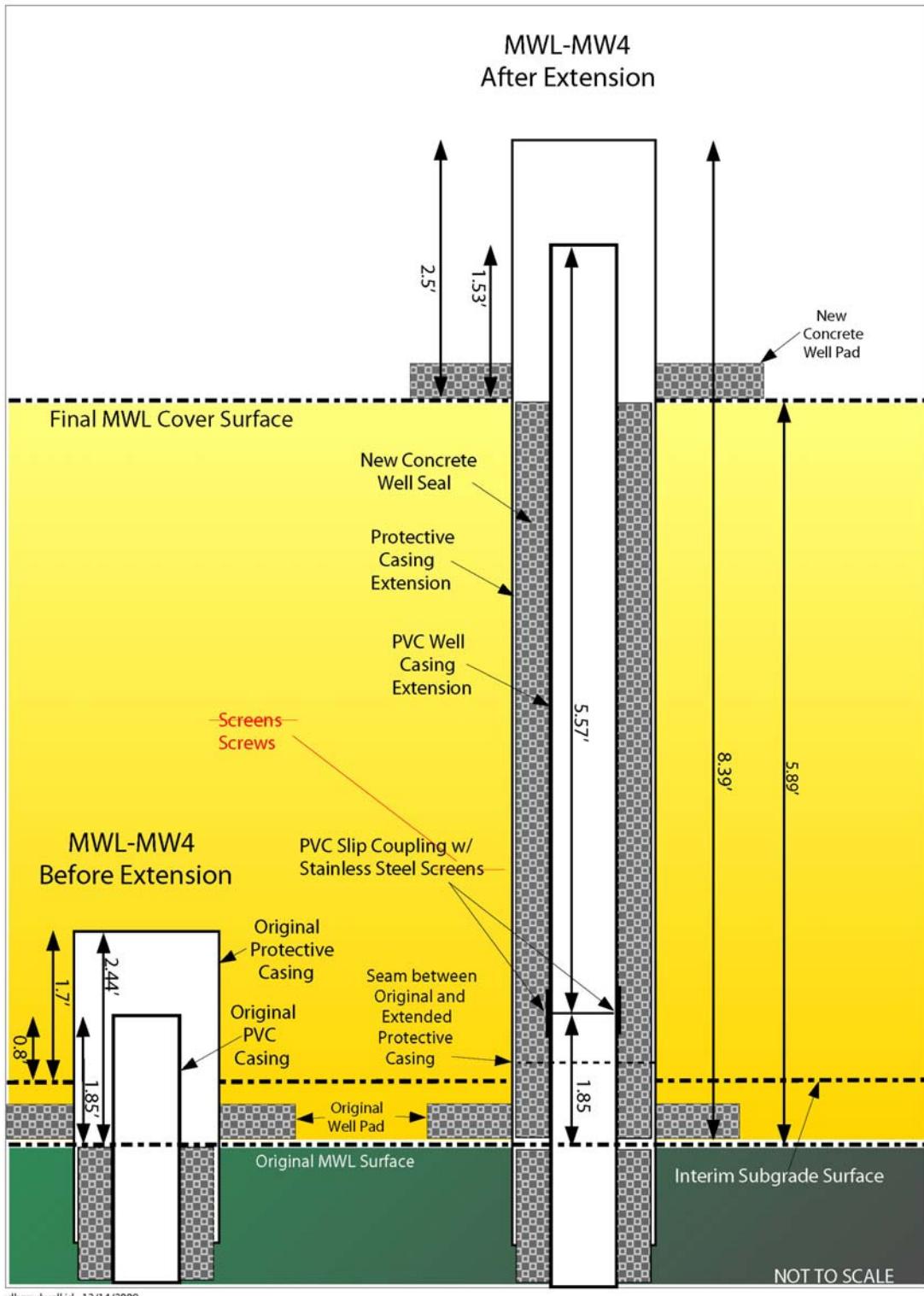


Figure 2-5
Schematic MWL-MW4 PVC Well Casing and Protective Surface Casing Extension Diagram



**Sandia
National
Laboratories**

Attachment 2

[Replacement Inserts and Pages Provided in Hard Copy Only]

MWL CMI Report and CQA Report, Volume 1 & 2 Replacement Inserts, Replacement Pages, and Replacement CQA Report Volume 2 Compact Disc

This Attachment includes the following:

Replacement Inserts

- Cover sheets and spine inserts for the two original January 2010 MWL CMI Report binders
- Entire CMI Report and Appendix A CQA Report Volume 1 text (includes Cover and Title Pages for both reports)

Individual Replacement Pages

- Table 8 of CQA Report, Volume 1 (page 15 of 33 from tabbed “Table” section in back of report)
- Revised as-built drawings for CQA Report, Volume 1 (4 drawings for 2009 ET Cover in tabbed “As-Built Drawing” section in back of report)
- Figure 2-5 of Attachment 8, CQA Report, Volume 2 (only change to this separately bound volume of the report)

Replacement CD

- Appendix A, CQA Report Volume 2 CD that goes in the plastic sleeve in the back of the CQA Report, Volume 1



**United States Department of Energy
Sandia Site Office**

Sandia National Laboratories is a multi-program laboratory managed and operated by Sandia Corporation, a wholly owned subsidiary of Lockheed Martin Corporation, for the U.S. Department of Energy's National Nuclear Security Administration under Contract DE-AC04-94AL85000.