

# **GUIDANCE DOCUMENT FOR SOLID WASTE LANDFILLS LINER CERTIFICATION REPORT**



*Prepared by*

**NEW MEXICO  
ENVIRONMENT DEPARTMENT  
*Solid Waste Bureau***  
Harold Runnels Building – Room 2050  
1190 St Francis Dr.  
PO Box 5469, Santa Fe, NM 87502-5469  
Phone (505) 827-2328 Fax (505) 827-2902

**NOTE: ALL LINER DESIGN AND INSTALLATION MUST BE IN COMPLIANCE WITH THE SOLID WASTE RULES UNDER 20.9.4.13, 20.9.4.14 AND 20.9.4.14 NMAC. IF YOU ARE NOT FAMILIAR WITH THESE REQUIREMENTS PLEASE READ THEM AND MAKE SURE THE LINER DESIGN AND INSTALLATION REQUIREMENTS ARE IN COMPLIANCE! MOST (BUT NOT ALL) ARE LISTED WITHIN THIS DOCUMENT. FAILURE TO COMPLY COULD RESULT IN ADDITIONAL TESTING REQUIREMENTS, REPLACEMENT OF PORTIONS OF THE LINER SYSTEM AND/OR POSSIBLE TOTAL DENIAL OF CERTIFICATION OF THE LINER.**

## **1.0 INTRODUCTION**

The introduction should state the intention or objective of the report.

### **1.1 PROJECT OVERVIEW**

This section should describe in general the landfill at which the construction is occurring, each activity that was performed, the date and company responsible for their activity.

### **1.2 REPORT ORGANIZATION**

Describe the organization of the report.

### **1.3 QUALIFICATIONS OF PROFESSIONAL ENGINEER LICENSED IN NM**

Provide the summary of qualifications for the licensed engineer showing experience in liner installation who will be certifying the report

### **1.4 QUALIFICATIONS OF INDIVIDUAL RESPONSIBLE FOR ALL CQA (QA/QC)**

Provide the summary of qualifications including experience in liner testing showing experience in liner installation and soils or geosynthetics engineering as appropriate

## **2.0 CELL CONSTRUCTION**

### **2.1 SUMMARY**

This section should include a description of the cell, cell location, and dates of construction activities.

### **2.2 SUBGRADE EXCAVATION AND PREPARATION**

Provide an explanation of activities performed during subgrade preparation and company associated with the subgrade preparation. If correspondence between the consultant and NMED has occurred regarding any of the subgrade preparation, reference and include within the appropriate appendices (see appendix A).

#### **2.2.1 Coordinate System**

Information should be provided to show that it meets the following requirement:

- 20.9.4.13.E(1)(c) NMAC “all liners must be constructed with a minimum two percent slop slope to promote positive drainage and facilitate leachate collection

- 20.9.4.14.B(3)(b)(iii) NMAC “total thickness (by survey) shall be tested once per acre (on grid); and
- 20.9.4.14.E(2)(b) NMAC any geosynthetic materials installed on slopes greater than 25 percent, or on any slope where waste is projected to be more than 100 feet deep, must be designed to withstand the calculated tensile forces acting upon the geosynthetic materials; the design must consider the maximum friction angle of the geosynthetic with regard to any soil-geosynthetic or geosynthetic-geosynthetic interface and must ensure that overall slope stability is maintained

### **2.2.2 Subgrade Compaction**

Information should be provided to show that it meets the following requirement(s):

- 20.9.4.13.E(3)(a) NMAC “The bottom of the geosynthetic layer shall be placed on a prepared subgrade consisting of, at a minimum, a 6-inch layer of in-situ soil or select fill compacted to 90 percent standard Proctor density”; and
- 20.9.4.13.E(3)(b) NMAC “the surface of the soil upon which a geosynthetic liner will be installed must be free of stones greater than ½ inch in any dimension, organic matter, local irregularities, protrusions, loose soil, and any abrupt changes in grade that could damage the geosynthetic liner.”

### **2.2.3 Subgrade Acceptance**

This section should be a summary of Sections 2.2.1 through 2.2.3 stating that they have met the required criteria and that the subgrade was verified and approved prior to installing the liner.

## **2.3 GEOSYNTHETIC CLAY LINER (GCL)**

### **2.3.1 Geosynthetic Clay Liner Product**

Describe the GCL product and include the amount of product used during the construction of the liner. Describe the quality control procedures that occurred upon product arrival (see Appendix B). 20.9.4.13 NMAC should be reviewed to insure compliance.

### **2.3.2 Geosynthetic Clay Liner Installation**

Describe the procedures that were followed from arrival of the GCL product to placement of GCL on the subgrade. Discuss the deployment and placement of the GCL on the subgrade. State whether manufacturer guidelines and permit requirements were followed.

Applicable regulations: 20.9.4.13.E(2)(c) NMAC “field seams in geosynthetic material shall be oriented parallel to the line of maximum slope (i.e., oriented along, not across the slope); the number of field seams in corners and irregular shaped areas shall be minimized; there shall be no horizontal seam within five feet of the toe of the slope.

### **2.3.3 Geosynthetic Clay Liner Testing**

Discuss whether manufacturer guidelines and permit requirements were followed.

Applicable regulations: 20.9.4.14.A NMAC “All testing of geosynthetic and soil materials shall be performed in accordance with applicable American Society of Testing Materials (ASTM) standards (see Appendix B).

#### ***2.3.3.1 Manufacturing Quality Control (MQC) and Manufacturing Quality Assurance (MQA)***

The MQC/MQA data package should include the following quality control certificates and information provided by the manufacturer (see Appendix B):

- Daily production and needle detection certification,
- GCL property specifications,
- Order packing list,
- GCL MQA tracking form,
- GCL manufacturing quality control test data,
- Bentonite clay certification, and
- Raw material test results.
- Conformance Testing

20.9.4.14.A NMAC “All testing of geosynthetic and soil materials shall be performed in accordance with applicable American Society of Testing Materials (ASTM) standards.

Note: Be sure on-site field samples are sent for testing; refer to section 2.3.3.1 for testing requirements. ASTM D 4354 should be used to determine sample size.

Manufacturers normally recommend the following tests:

- Mass per unit area, ASTM D5993,
- Free swell, ASTM D5890, and
- Fluid loss, ASTM D5891

#### ***2.3.3.2 Construction Quality Control (CQC) and Construction Quality Assurance (CQA)***

Describe the CQC/CQA that occurred at the site from the when the GCL arrived on the site from the logging of rolls to lining of the cell, noting any damage and repairs to GCL and visual inspections during the installations.

### **2.3.4 Geosynthetic Clay Liner Deployment Records**

Documentation of the GCL deployment and CQA review and GCL as-built panel layouts should be included in this section.

## **2.4 GEOMEMBRANE LINER**

### **2.4.1 Geomembrane Liner Product**

Describe the geomembrane product and include the amount of product used during the construction of the liner. Describe the quality control procedures that occurred upon product arrival.

### **2.4.2 Geomembrane Liner Installation**

Applicable regulations: 20.9.4.13.E(2)(c) NMAC “field seams in geosynthetic material shall be oriented parallel to the line of maximum slope (i.e., oriented along, not across the slope); the number of field seams in corners and irregular shaped areas shall be minimized; there shall be no horizontal seam within five feet of the toe of the slope.

### **2.4.3 Geomembrane Liner Testing**

Applicable regulations: 20.9.4.14.A NMAC “All testing of geosynthetic and soil materials shall be performed in accordance with applicable American Society of Testing Materials (ASTM) standards.

#### ***2.4.3.1 Manufacturer’s Quality Control (MQC)/ Manufacturer’s Quality Assurance (MQA)***

Copies of the quality control certificates should be included and contain the origin, identification and production of the resin. These quality control certificates should be provided by the manufacturer with the following tests (see Appendix B):

- Thickness, ASTM D5199,
- Density, ASTM D1505,
- Tensile properties, ASTM D6693,
- Tear resistance, ASTM D1004,
- Carbon black content, ASTM D1603,
- Carbon black dispersion, ASTM D5596,
- Puncture resistance, ASTM D4833, and
- Notched constant tensile load, ASTM D5397

Copies of quality control certificates issued by the resin supplier should be supplied.

#### ***2.4.3.2 Conformance Testing***

20.9.4.14.A NMAC “All testing of geosynthetic and soil materials shall be performed in accordance with applicable American Society of Testing Materials (ASTM) standards (see Appendix B).

These standards are listed below:

- Sampling of Geosynthetics for Testing, ASTM D4354,
- Thickness, ASTM D5199,
- Density, ASTM D1505,

- Tensile properties, ASTM D6693,
- Tear resistance, ASTM D 1004,
- Carbon black content, ASTM D1603,
- Carbon black dispersion, ASTM D5596, and
- Puncture resistance, ASTM D4833.

Sampling of Geosynthetics for Testing, ASTM D4354, should be used to determine the number of samples collected and sent to the laboratory.

#### ***2.4.3.3 Construction Quality Control (CQC)***

This section should outline the quality control procedures that were followed in order to maintain the highest standards of installation. Statements' regarding the trial welds and how they were performed should be included, as well as information regarding seam testing should also be mentioned. All activities should be conducted in compliance with the applicable regulations and construction quality assurance plan (see Appendix C).

#### ***2.4.3.4 Construction Quality Assurance (CQA)***

Information regarding activities performed by the onsite quality control personal should be included within this section (see Appendix C).

#### ***2.4.3.5 Seam Testing***

This section should include information regarding all non-destructive and destructive testing. The minimum frequency for taking seam samples for destructive testing per 20.9.4.14.B.5 NMAC is **one per 500 lineal feet of seam length, with a portion of each test sample tested in the field and another in the laboratory.** Seam samples shall be tested for peel adhesion and bonded seam strength. Non-destructive testing shall be performed for all seams, seam repairs, and liner repairs (see Appendix C).

### **2.4.4 Liner Deployment Records**

Documentation of liner deployment and testing should be included here. This should include the following (see Appendix C):

- Deployment Log
- As-built Panel Layout
- Geomembrane Pre-Weld Qualification Test Records
- Geomembrane Seaming Log
- Geomembrane Seam:
  - Pressure Test Log
  - Vacuum Test and Defect Repair Log
  - Field Destructive Test Log

## **2.5 LEACHATE COLLECTION SYSTEM**

The leachate collection system should follow sections 20.9.4.13 and 15 NMAC and the approved leachate management plan included in the permit. Items that should be included showing compliance are:

- Piping collection network should be comprised of perforated pipe having a minimum diameter of 6 inches and a minimum wall thickness of Schedule 80 PVC or equivalent, and
- Maintain a minimum of two percent slope throughout the system. If liner installation includes a leachate storage or collection pond quality control and quality assurance documentation providing proof of compliance with 20.9.4.13 NMAC (double liner system) needs to be included. Pursuant to 20.9.4.15.D NMAC, the leachate storage or collection pond must meet the requirements of 20.9.4.13 NMAC.

## **2.6 GEOTEXTILES**

Describe the geotextile product and include the amount of product used during the construction of the liner. Describe the quality control procedures that occurred upon product arrival.

### **2.6.1 Manufacturer Quality Control Documentation**

Copies of the quality control certificates should be included and contain the origin, identification and production of the resin. These quality control certificates should be provided by the manufacturer with the following tests (see Appendix B):

- Thickness, ASTM D5199,
- Trapezoid Tear, ASTM D4533,
- Puncture Resistance, ASTM D4833,
- Mullen Burst Strength, ASTM D3786,
- Grab Tensile , ASTM D4632,
- Mass/Unit Area, ASTM D5261,
- Apparent Opening Size, ASTM D4751, and
- Coefficient of Permeability, ASTM D4491.

Sampling of Geosynthetics for Testing, ASTM D4354, should be used to determine the number of samples needed to be collect.

### **2.6.2 Conformance Testing**

20.9.4.14.A NMAC “All testing of geosynthetic and soil materials shall be performed in accordance with applicable American Society of Testing Materials (ASTM) standards (see Appendix B).

These standards are listed below:

- Mass/Unit Area, ASTM D5261,
- Mullen Burst Strength, ASTM D3786,
- Puncture Resistance, ASTM D4833,
- Grab Tensile , ASTM D4632,
- Apparent Opening Size, ASTM D4751.

## **2.7 PROTECTIVE SOIL LAYER**

This section needs to include information demonstrating compliance with 20.9.4.13.E.4 NMAC (see Appendix G):

- a protective cover of at least two feet of granular soil or other material specifically approved by the department (thickness tested at least 5 times per acre).
- provide physical protection for the liner,
- facilitate the collection of leachate in the leachate collection system,
- hydraulic properties of the protective cover needs to ensure that the hydraulic leachate head never exceeds one foot, (hydraulic conductivity of no less than  $5 \times 10^{-5}$  cm/sec, unless otherwise approved),
- grain size of the soil shall be tested every 1500 yd<sup>3</sup> unless otherwise approved,
- the soil shall be free from organic matter,
- the protective cover must meet the following physical parameters:
  - portion of material passing the No. 200 sieve (0.074 mm and less fraction) no greater than 5 percent by weight, unless otherwise specifically approved; and
  - uniformity coefficient (Cu) less than 6 where Cu is defined as  $D_{60}/D_{10}$ , unless otherwise specifically approved.

## **2.8 ANY CHANGES TO ORIGINAL DESIGN PLANS (SUCH AS LINER TIE-IN DETAILS, LEACHATE/SUMP AREA, PROTECTIVE COVER, ETC.)**

## **2.9 FUTURE LINER TIE-IN DETAILS OR STORMWATER FLAP (IF APPLICABLE)**



### **3.0 FIGURES**

**Figure 1. Site Plan**

**Figure 2. Subgrade Design Grades**

**Figure 3. Subgrade As-built Survey Elevations**

**Figure 4. Subgrade Field Density Tests**

**Figure 5. GCL Panel Layout (or clay liner testing)**

**Figure 6. HDPE Panel Layout**

**Figure 7. Protective Cover Final Grade**

## **4.0 FIELD LOG AND PHOTOGRAPHS**

### **4.1 DAILY SUMMARY FIELD REPORTS**

This table should include especially any problems or repairs to include field notes by QA/QC person.

### **4.2 PROJECT PHOTOGRAPHS**

Items such as liner installation process, field seaming, destructive testing, vacuum testing, leachate trench and sump, protective cover, anchor trenches, problem issues, etc. should be included here.

## **APPENDICES**

### **APPENDIX A SUBGRADE MATERIAL TESTING**

#### **A.1 MOISTURE/DENSITY RELATIONSHIPS**

#### **A.2 DENSITY TESTING RESULTS**

### **APPENDIX B MATERIAL MANUFACTURER CERTIFICATION AND CONFORMANCE TESTING RESULTS**

#### **B.1 GCL CERTIFICATIONS**

#### **B.2 GCL CONFORMANCE TESTING RESULTS**

#### **B.3 HDPE CERTIFICATIONS**

#### **B.4 HDPE CONFORMANCE TESTING RESULTS**

### **APPENDIX C LINER INSTALLATION DOCUMENTATION**

#### **C.1 GCL DEPLOYMENT LOG**

#### **C.2 HPDE DEPLOYMENT LOG**

#### **C.3 GEOMEMBRANE PRE-WELD QUALIFICATION TEST RECORDS**

#### **C.4 GEOMEMBRANE SEAMING LOG**

#### **C.5 GEOMEMBRANE SEAM PRESSURE TEST LOG**

#### **C.6 GEOMEMBRANE SEAM VACUUM TEST AND DEFECT-REPAIR LOG**

#### **C.7 GEOMEMBRANE SEAM FIELD DESTRUCTIVE TEST LOG**

#### **C.8 GCL INVENTORY CONTROL LOG**

#### **C.9 GEOMEMBRANE INVENTORY CONTROL LOG**

#### **C.10 GEOTEXTILE INVENTORY CONTROL LOG**

#### **C.11 LEACHATE COLLECTION PIPE INVENTORY CONTROL LOG**

### **APPENDIX D INDEPENDENT LABORATORY HDPE DESTRUCTIVE TESTING RESULTS**

## **APPENDIX E LEACHATE SYSTEM CERTIFICATIONS**

### **E.1 PIPE CERTIFICATION**

### **E.2 LEACHATE SYSTEM AGGREGATE GRADATION**

### **E.3 TOP OF LEACHATE PIPE SURVEY**

## **APPENDIX F GEOTEXTILE CERTIFICATIONS**

### **F.1 GEOTEXTILE CERTIFICATION**

### **F.2 GEOTEXTILE CONFORMANCE TEST RESULTS**

## **APPENDIX G PROTECTIVE SOIL LAYER MATERIAL EVALUATION**

### **G.1 PROTECTIVE SOIL LAYER LABORATORY ANALYSES**

Hydraulic conductivity no  $< 5 \times 10^{-5}$  cm/sec, portion passing #200 Sieve no  $> 5$  % by weight, uniformity coefficient (Cu)  $< 6$ . If material is questionable a HELP model showing it will maintain  $< 12$  inches of head on the liner –Note NMED must approve this issue prior to placing protective cover)

### **G.2 PROTECTIVE SOIL LAYER THICKNESS CONFIRMATION**

Must show minimum 2 feet above liner grade with a minimum of five survey or test points per acre)

## **APPENDIX H DESIGN UPDATES TO PROJECT TECHNICAL SPECIFICATIONS**