15A NCAC 13B .1624 CONSTRUCTION REQUIREMENTS FOR MSWLF FACILITIES

(a) This Rule shall establish the performance standards and criteria for designing and constructing an MSWLF unit. Additional standards for the cap system are described in Rule .1627 of this Section.

(b) MSWLF units shall comply with the following design and construction criteria:

(1) Base liner system description. The base liner system is constructed on the landfill subgrade and shall be designed to contain, collect and remove leachate generated by the MSWLF unit. The components of the liner system shall consist of the following.

(A) A Base Liner. The base liner shall consist of one of the following designs. The design described in Subpart (i) of this Part is the standard composite liner. If a landfill owner or operator proposes to utilize one of the alternative composite liner designs described in Subparts (ii) and (iii) of this Part the owner or operator shall demonstrate through a model that the proposed design shall ensure that maximum contaminant levels (MCL) promulgated under 40 CFR 141 shall not be exceeded in the uppermost aquifer at the relevant point of compliance as established in Rule .1631(a)(2) of this Section. For these two designs, the Division may waive the site-specific modeling requirement if it can be demonstrated that a previous site for which a model was approved had similar hydrogeologic characteristics, climatic factors, and volume and physical and chemical leachate characteristics. If an alternative liner design other than Subparts (ii) and (iii) of this Part is proposed, the Division shall require site-specific, two-phase modeling as described in Subpart (iv) of this Part.

(i) A composite liner utilizing a compacted clay liner (CCL). The composite liner is one liner that consists of two components; a geomembrane liner installed above and in direct and uniform contact with a compacted clay liner with a minimum thickness of 24 inches (0.61 m) and a permeability of no more than 1.0×10^{-7} cm/sec. The composite liner shall be designed and constructed in accordance with Subparagraphs (8) and (10) of this Paragraph.

(ii) A composite liner utilizing a geosynthetic clay liner (GCL). The composite liner is one liner that consists of three components: a geomembrane liner installed above and in uniform contact with a GCL overlying a compacted clay liner with a minimum thickness of 18 inches (0.46 m) and a permeability of no more than 1.0×10^{-5} cm/sec. The composite liner shall be designed and constructed in accordance with Subparagraphs (8), (9), and (10) of this Paragraph.

(iii) A composite liner utilizing two geomembrane liners. The composite liner consists of three components; two geomembrane liners each with an overlying leachate drainage system designed to reduce the maximum predicted head acting on the lower membrane liner to less than one inch. The lower membrane liner shall overlie a compacted clay liner with a minimum thickness of 12 inches (0.31m) and a permeability of no more than 1.0×10^{-5} cm/sec. The composite liner system shall be designed and constructed in accordance with Subparagraphs (8) and (10) of this Paragraph.

(iv) An alternative base liner. An alternative base liner system may be approved by the Division if the owner or operator demonstrates through a two-phase modeling approach that the alternative liner design meets the following criteria: the rate of leakage through the alternative liner system will be less than or equal to the composite liner system defined in Subpart (i) of this Part; and the design shall ensure that maximum contaminant levels (MCL), promulgated under 40 CFR 141, will not be exceeded in the uppermost aquifer at the relevant point of compliance as established in Rule .1631(a)(2) of this Section.

(B) A leachate collection system (LCS). The LCS shall be constructed on top of the base liner to establish a zone of protection between the base liner and the waste. The LCS shall be designed and constructed to collect and remove leachate from the MSWLF unit in accordance with Subparagraphs (2), (11), (12) and (13) of this Paragraph.

(2) Leachate collection system design and operation.

(A) The leachate collection system shall be hydraulically designed to remove leachate from the landfill and ensure that the leachate head on the composite liner does not exceed one foot. A means of quantitatively assessing the performance of the leachate collection

system shall be provided in the engineering plan. The performance analysis shall evaluate the flow capacities of the drainage network necessary to convey leachate to the storage facility or off-site transport location. The engineering evaluation shall incorporate the following criteria:

(i) The geometry of the landfill and the leachate collection system shall be designed to control and contain the volume of leachate generated by the 24-hour, 25-year storm.

(ii) The performance analysis shall evaluate the leachate collection system for the flow capacities during conditions when the maximum impingement rate occurs on the LCS. The LCS flow capacity shall be designed to reduce the head on the liner system generated by the 24-hour, 25-year storm to less than one foot within 72 hours after the storm event.

(B) The leachate collection system shall be designed to provide a zone of protection of no less than 24 inches separating the composite liner from landfilling activities, or shall be subject to approval from the Division upon a demonstration of equivalent protection for the liner system.

(C) The leachate collection system shall be designed to resist clogging and promote leachate collection and removal from the landfill.

(D) The leachate collection system shall be operated to remove leachate from the landfill in a way that ensures the leachate head on the composite liner does not exceed one foot under normal operating conditions.

(3) Horizontal separation requirements.

(A) Property line buffer. MSWLF units shall have a buffer of no less than 300 feet between the MSWLF unit and all property lines.

(B) Private residences and wells. MSWLF units shall have a buffer of no less than 500 feet between the MSWLF unit and private residences and wells existing at the time that the Division issues a notification of site suitability in accordance with Rule .1618(a)(1) of this Section.

(C) Surface waters. MSWLF units shall have a buffer of no less than 50 feet between the MSWLF unit and any stream, river, lake, pond, or other waters of the State as defined in G.S. 143-212 unless the owner or operator can demonstrate to the Division that the alternative management of the water and any discharge shall be as protective to waters of the State as a 50-foot buffer; and that the construction activities will conform to the requirements of Sections 404 and 401 of the Clean Water Act.

(D) Other landfill units. A buffer shall be established between a proposed MSWLF unit and any existing landfill units to establish a groundwater monitoring system to allow monitoring of each unit separately as set forth in Rule .1631 of this Section.

(E) MSWLF units shall meet the horizontal separation requirements of G.S. 130A-295.6(b) and (d) in accordance with the effective dates and applicability requirements of S.L. 2007-550, s. 9.(b) and S.L. 2013-413, s. 59.1, as amended by S.L. 2013-410, s. 47.6, and S.L. 2007-543.

(4) Vertical separation requirements. A MSWLF unit shall be constructed so that the post-settlement bottom elevation of the base liner system is no less than four feet above the seasonal high groundwater table and the bedrock datum plane contours established in the Design Hydrogeological Report prepared in accordance with Rule .1623(b) of this Section. MSWLF units shall meet the vertical separation requirements of G.S. 130A-295.6(f) in accordance with the effective date and applicability requirements of S.L. 2007-550, s. 9.(b).

(5) Survey control. One permanent benchmark of known elevation measured from a U.S. Geological Survey benchmark shall be established and maintained for each 50 acres of developed landfill, or part thereof, at the landfill facility. This benchmark shall be the reference point for establishing vertical elevation control. Any survey performed pursuant to this Subparagraph shall be performed by a licensed professional land surveyor if required by G.S. 89C. Latitude and longitude, expressed in decimal degrees, shall be indicated at the approximate center of the facility.

(6) Location coordinates. The North Carolina State Plane (NCSP) coordinates shall be established and one of its points shall be the benchmark of known NCSP coordinates.

(7) Landfill subgrade. The landfill subgrade is the in-situ soil layer(s), constructed embankments, and select fill providing the foundation for construction of the unit. A foundation analysis shall be performed to determine the structural integrity of the subgrade to support the loads and stresses imposed by the weight of the landfill and to support overlying facility components and maintain their integrity of the components. Minimum post-settlement slope for the subgrade shall be two percent. Safety factors shall be specified for facilities located in seismic impact zones.

(A) Materials required. The landfill subgrade shall be free of organic material and consist of in-situ soils or a select fill approved by the Division in accordance with the performance standards contained in this Subparagraph.

(B) Construction requirements.

(i) The landfill subgrade shall be graded in accordance with the approved plans and specifications that are incorporated into the permit to construct in accordance with Rule .1604(b) of this Section.

(ii) The owner or operator of the MSWLF units shall notify the Division via e-mail no less than 24 hours before conducting the subgrade inspection required by Part (C) of this Subparagraph.

(C) Certification requirements. The subgrade surface shall be inspected in accordance with the following requirements:

(i) Before beginning construction of the base liner system, the project engineer shall visually inspect the exposed surface to evaluate the suitability of the subgrade and document that the surface is properly prepared and that the elevations are consistent with the approved engineering plans incorporated into the permit to construct in accordance with Rule .1604(b) of this Section.

(ii) The subgrade shall be proof-rolled using procedures and equipment specified by the design or project engineer.

(iii) The subgrade shall be tested for density and moisture content at a minimum frequency as specified in the plans incorporated into the permit to construct in accordance with Rule .1604(b) of this Section.

(8) Compacted clay liner. "Compacted clay liner" means a low permeability barrier designed to control fluid migration in a cap liner system or base liner system. A compacted clay liner shall meet the following requirements:

(A) Materials required. The soil materials used in constructing a compacted clay liner may be obtained from sources either on-site, or from off-site, or a combination of the two sources. If the native soil materials found at the source do not meet the permeability requirements, the soil materials shall be conditioned with bentonite so that they meet the permeability requirements. The soil material shall be free of particles greater than three inches in any dimension.

(B) Construction requirements. Construction methods for the compacted clay liner shall be based upon the type and quality of the borrow source and shall be verified in the field by constructing test pads. The project engineer shall ensure that the compacted clay liner installation conforms with the Division approved plans including the following requirements:

(i) A test pad shall be constructed prior to beginning installation of the compacted clay liner and whenever there is a change in soil material properties. The area and equipment, liner thickness, and subgrade slope and conditions shall be representative of full-scale construction. Acceptance and rejection criteria shall be verified for the tests specified in accordance with Part (C) of this Subparagraph. For each lift, a minimum of three test locations shall be established for testing moisture content, density, and a composite sample for recompacted lab permeability. At least one shelby tube sample for lab permeability testing, or another in-situ test that is approved by the Division as equivalent for permeability determination shall be obtained per lift.

(ii) Soil conditioning, placement, and compaction shall be maintained within the range identified in the moisture-density-permeability relation developed in accordance with Part (C) of this Subparagraph.

(iii) The final compacted thickness of each lift shall be a maximum of six inches.

(iv) Prior to placement of successive lifts, the surface of the lift in place shall be scarified or otherwise conditioned to eliminate lift interfaces.

(v) The final lift shall be protected from environmental degradation.

(C) Certification requirements. The project engineer shall include in the construction quality assurance report a discussion of all quality assurance and quality control testing required in this Subparagraph. The testing procedures and protocols shall be submitted in accordance with Rule .1621 of this Section and approved by the Division. The results of all testing shall be included in the construction quality assurance report including documentation of any failed test results, descriptions of the procedures used to correct the improperly installed material, and statements of all retesting performed in accordance with the Division approved plans including the following requirements:

(i) The quality control testing for accepting materials prior to and during construction of a compacted clay liner shall include particle size distribution analysis, Atterberg limits, triaxial cell laboratory permeability, moisture content, percent bentonite admixed with soil, and the moisture-density-permeability relation. The project engineer shall certify that the materials used in construction were tested according to the Division approved plans.

(ii) The quality assurance testing for evaluating each lift of the compacted clay liner shall include moisture content and density, and permeability testing. For each location the moisture content and density shall be compared to the appropriate moisture-density-permeability relation. The project engineer shall certify that the liner was constructed using the methods and acceptance criteria consistent with test pad construction and tested in accordance with the plans incorporated into the permit to construct in accordance with Rule .1604(b) of this Section.

(iii) Any tests resulting in the penetration of the compacted clay liner shall be repaired using bentonite or as approved by the Division.

(9) Geosynthetic clay liner. "Geosynthetic clay liner" means a geosynthetic hydraulic barrier manufactured in sheets and installed by field seaming techniques. A geosynthetic clay liner shall meet the following requirements:

(A) Materials required. Geosynthetic clay liners shall consist of natural sodium bentonite clay or equivalent, encapsulated between two geotextiles or adhered to a geomembrane. The liner material and any seaming materials shall have chemical and physical properties that are resistant to change, damage, or degradation from environmental exposure, waste placement, leachate generation, and subgrade moisture composition. Accessory bentonite, used for seaming, repairs and penetration seaming shall be made from the same sodium bentonite as used in the geosynthetic clay liner or as recommended by the manufacturer. The type of geosynthetic clay liner shall be approved by the Division according to the criteria set forth in this Part. Reinforced geosynthetic clay liners shall be used on all slopes greater than 10H:IV. The geosynthetic clay liner material shall have a demonstrated hydraulic conductivity of not more than 5×10^{-9} cm/sec under the anticipated confining pressure.

(B) Design and Construction requirements. The design engineer shall ensure that the design of the geosynthetic clay liner installation conforms to the requirements of the manufacturer's recommendations and the Division approved plans. The Division approved plans shall provide for and include the following provisions:

(i) the surface of the supporting soil upon which the geosynthetic clay liner will be installed shall be free of stones, organic matter, protrusions, loose soil, and any abrupt changes in grade that could damage the geosynthetic clay liner;

(ii) materials placed on top of the GCL shall be placed in accordance with the plans incorporated into the permit to construct in accordance with Rule .1604(b) of this Section. Equipment used to install additional geosynthetics shall be specified by the design engineer and as recommended by the manufacturer. A minimum of 12 inches of separation between the application equipment and the geosynthetic clay liner shall be provided when applying soil materials;

(iii) materials that become prematurely hydrated shall be removed, repaired, or replaced, as specified by the project engineer and in accordance with the plans

incorporated into the permit to construct prepared in accordance with Rule .1604(b) of this Section;

(iv) field seaming preparation and methods, general orientation criteria, and restrictive weather conditions;

(v) anchor trench design;

(vi) critical tensile forces and slope stability, including seismic design;

(vii) protection from environmental damage; and

(viii) physical protection from the materials installed on top of the geosynthetic clay liner.

(C) Certification requirements.

(i) Before beginning installation of the geosynthetic clay liner, the project engineer shall visually inspect the exposed surface to evaluate the suitability of the subgrade and document that the surface is prepared in accordance with and the elevations are consistent with the approved engineering plans incorporated into the permit to construct in accordance with Rule .1604(b) of this Section.

(ii) The project engineer shall ensure that the geosynthetic clay installation conforms to the requirements of the manufacturer's recommendations and the plans incorporated into the permit to construct in accordance with Rule .1604(b) of this Section.

(iii) The project engineer shall include in the construction quality assurance report a discussion of quality assurance and quality control testing to document that material is placed in accordance with plans incorporated into the permit to construct in accordance with Rule .1604(b) of this Section.

(iv) The project engineer shall include in the construction quality assurance report a discussion of the approved data resulting from the quality assurance and quality control testing required in this Subparagraph.

(v) The testing procedures and protocols for field installation shall be submitted in accordance with Rule .1621 of this Section and approved by the Division.

(vi) The results of all testing shall be included in the construction quality assurance report, including documentation of any failed test results, descriptions of the procedures used to correct the improperly installed material, and performance documentation of all retesting, in accordance with the plans incorporated into the permit to construct in accordance with Rule .1604(b) of this Section, including quality control testing of the raw materials and manufactured product; field and independent laboratory destructive testing of geosynthetic clay liner samples; and documentation prepared by the project engineer in accordance with Subpart (i) of this Part.

(10) Geomembrane liner. "Geomembrane liner" means a geosynthetic hydraulic barrier manufactured in sheets and installed by field seaming techniques. A geomembrane liner shall comply with the following requirements:

(A) Materials required. The liner material and any seaming materials shall have chemical and physical properties that are resistant to change, damage, or degradation from environmental exposure, waste placement, and leachate generation. The type of geomembrane shall be approved by the Division according to the criteria set forth in this Part. High density polyethylene geomembrane liners shall have a thickness of no less than 60 mils. The minimum thickness of any geomembrane approved by the Division shall be greater than 30 mils.

(B) Construction requirements. The project engineer shall ensure that the geomembrane installation conforms to the requirements of the manufacturer's recommendations and the Division approved plans including the following:

(i) the surface of the supporting soil upon which the geomembrane will be installed shall be reasonably free of stones, organic matter, protrusions, loose soil, and any abrupt changes in grade that could damage the geomembrane;

(ii) field seaming preparation and methods, general orientation criteria, and restrictive weather conditions;

(iii) anchor trench design;

(iv) critical tensile forces and slope stability;
(v) protection from environmental damage; and
(vi) physical protection from the materials installed on top of the geomembrane.

(C) Certification requirements. The project engineer shall include in the construction quality assurance report a discussion of the approved data resulting from the quality assurance and quality control testing required in this Subparagraph. The testing procedures and protocols for field installation shall be submitted in accordance with Rule .1621 of this Section and approved by the Division. The results of all testing shall be included in the construction quality assurance report including documentation of any failed test results, descriptions of the procedures used to correct the improperly installed material, and statements of all retesting performed in accordance with the plans incorporated into the permit to construct in accordance with Rule .1604(b) of this Section, including the following:

(i) quality control testing of the raw materials and manufactured product;
(ii) test seams shall be made upon each start of work for each seaming crew, upon every four hours of continuous seaming, every time seaming equipment is changed or if there are changes in geomembrane temperature or weather conditions that have the potential to affect seaming operations;
(iii) nondestructive testing of all seams;
(iv) field and independent laboratory destructive testing of seam samples; and
(v) evaluation of the entire liner for leaks as required by G.S. 130A-295.6(h)(1) using technology such as electronic leak detection.

(11) Leachate collection pipes. A leachate collection pipe network shall be a component of the leachate collection system and shall be hydraulically designed to convey leachate from the MSWLF unit to a leachate storage or treatment facility that is able to contain the leachate generated, or a point of off-site transport. Leachate collection piping shall comply with the following requirements:

(A) Materials required.

(i) The leachate collection piping shall have a minimum nominal diameter of six inches.
(ii) The chemical properties of the pipe and any materials used in installation shall be resistant to change, damage, or degradation from waste placement or leachate generated by the landfill.
(iii) The physical properties of the pipe shall provide adequate structural strength to support the maximum static and dynamic loads and stresses imposed by the overlying materials and any equipment used in construction and operation of the landfill. Specifications for the pipe shall be submitted in the engineering report.

(B) Construction requirements.

(i) Leachate collection piping shall be installed according to the plans incorporated into the permit to construct in accordance with Rule .1604(b) of this Section.
(ii) The location and grade of the piping network shall provide access for periodic cleaning and inspection in accordance with G.S. 130A-295.6(h)(3).
(iii) The bedding material for the leachate collection pipe shall consist of a coarse aggregate installed in direct contact with the pipe. The aggregate shall be chemically compatible with the leachate generated and shall be placed to provide adequate support to the pipe. The bedding material for main collector lines shall be extended to and in direct contact with the waste layer or a graded soil or granular filter.

(C) Certification requirements. The project engineer shall include in the construction quality assurance report a discussion of the quality assurance and quality control testing to ensure that the material is placed according to the approved plans. The testing procedures and protocols for field installation shall be submitted in accordance with Rule .1621 of this Section and approved by the Division. The results of all testing shall be included in the construction quality assurance report including documentation of any failed test results, descriptions of the procedures used to correct the improperly installed material, and statements of all retesting performed in accordance with plans incorporated into the

permit to construct in accordance with Rule .1604(b) of this Section, including the following:

(i) All leachate piping installed from the MSWLF unit to the leachate storage or treatment facility shall be watertight or provide dual containment in accordance with G.S. 130-295.6(h)(4) at landfill facilities permitted by the Division after August 1, 2007.

(ii) The seal where the piping system penetrates the geomembrane shall be inspected and tested for leakage. The testing shall not damage or destroy the seal, the piping, or the geomembrane.

(12) Drainage layers. Any soil, granular, or geosynthetic drainage nets used in the leachate collection system shall comply with the following requirements:

(A) Materials required.

(i) The chemical properties of the drainage layer materials shall be resistant to change, damage, or degradation from waste placement or leachate generated by the landfill.

(ii) The physical and hydraulic properties of the drainage layer materials shall promote lateral drainage of leachate through a zone of relatively high permeability or transmissivity under the predicted loads imposed by overlying materials.

(B) Construction requirements.

(i) The drainage layer materials shall be placed in accordance with the approved plans prepared in accordance with Rule .1604(b) of this Section and in a manner that prevents equipment from working directly on the geomembrane.

(ii) The drainage layer materials shall be stable on the slopes specified on the engineering drawings.

(C) Certification requirements. The project engineer shall include in the construction quality assurance report a discussion of the quality assurance and quality control testing to ensure that the drainage layer material is placed according to the approved plans. The testing procedures and protocols for field installation shall be submitted in accordance with of Rule .1621 of this Section and approved by the Division. The results of all testing shall be included in the construction quality assurance report including documentation of any failed test results, descriptions of the procedures used to correct the improperly installed material, and statements of all retesting performed in accordance with the approved plans prepared in accordance with Rule .1604(b) of this Section.

(13) Filter layer criteria. All filter collection layers used in the leachate collection system shall be designed to prevent the migration of fine soil particles into a courser grained material, and permit water or gases to freely enter a drainage medium such as a pipe or drainage layer without clogging. A filter layer shall comply with the following requirements:

(A) Materials required.

(i) Graded cohesionless soil filters. The granular soil material used as a filter shall have no more than five percent by weight passing the No. 200 sieve and no soil particles larger than three inches in any dimension.

(ii) Geosynthetic filters. Geosynthetic filter materials shall demonstrate adequate permeability and soil particle retention, and chemical and physical resistance which is not adversely affected by waste placement, any overlying material or leachate generated by the landfill.

(B) Construction requirements. All filter layers shall be installed in accordance with the engineering plan and specifications incorporated into the permit to construct prepared in accordance with Rule .1604(b) of this Section. Geosynthetic filter materials shall not be wrapped around leachate collection piping in any way that impedes the flow of leachate into the piping.

(C) Certification requirements. The project engineer shall include in the construction quality assurance report a discussion of the quality assurance and quality control testing to ensure that the filter layer material is placed according to the approved plans. The testing procedures and protocols for field installation shall be submitted in accordance with Rule .1621 of this Section and approved by the Division. The results of all testing shall be

included in the construction quality assurance report including documentation of any failed test results, descriptions of the procedures used to correct the improperly installed material, and statements of all retesting performed in accordance with the approved plans prepared in accordance with Rule .1604(b) of this Section.

(14) Other engineering structures. Engineering structures incorporated in the design and necessary to comply with the requirements of this Section and any other engineering structures proposed by the applicant shall be specified in the engineering plan. Material, construction, and certification requirements necessary to ensure that the structure is constructed according to the design and acceptable engineering practices shall be included in the Division approved plan.

(15) Sedimentation and erosion control. Structures and measures shall be designed and maintained to manage the rainwater that drains over land from or onto any part of the facility or unit generated by the 24-hour, 25-year storm event, and conform to the requirements of the Sedimentation Control Law (15A NCAC 04) and any required NPDES permits.

(16) Construction quality assurance (CQA) report.

(A) A CQA report shall be submitted:

(i) after completing landfill construction to qualify the constructed MSWLF unit for a permit to operate;

(ii) after completing construction of the cap system in accordance with the requirements of Rule .1629 of this Section; and

(iii) according to the reporting schedule developed in accordance with Rule .1621 of this Section.

(B) The CQA report shall include the information prepared in accordance with the requirements of Rule .1621 of this Section containing results of all construction quality assurance and construction quality control testing required in this Rule including documentation of any failed test results, descriptions of procedures used to correct the improperly installed material and results of all retesting performed. The CQA report shall contain as-built drawings noting any deviation from the approved engineering plans, and shall also contain a comprehensive narrative including daily reports from the project engineer, a series of color photographs of major project features, and documentation of proceedings of all progress and troubleshooting meetings.

(C) The CQA report shall include a statement by the project engineer that construction was completed in accordance with the CQA plan, the conditions of the permit to construct, and the requirements of the rules of this Section. If required by G.S. 89C, the statement shall be certified and bear the seal of the project engineer.

(D) The Division shall review the CQA report within 30 days of a complete submittal to ensure that the report meets the requirements of this Subparagraph.

(17) Maximum capacity, disposal area, and height for landfills permitted after August 2007. MSWLF units shall meet the requirements of G.S. 130A-295.6(i) regarding maximum allowed capacity, disposal area and height in accordance with the effective date and applicability of S.L. 2007-550, s. 9.(b).

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