



PERMIT FOR A SOLID WASTE MANAGEMENT FACILITY
NORTH DAKOTA DEPARTMENT OF ENVIRONMENTAL QUALITY – DIVISION OF WASTE
MANAGEMENT
TELEPHONE: 701-328-5166 REV. 1/2021

Pursuant to Chapter 23.1-08 of the North Dakota Century Code (NDCC), (Solid Waste Management and Land Protection Act), and Article 33.1-20 of the North Dakota Administrative Code (NDAC), (Solid Waste Management Rules), and in reliance on statements and representations heretofore made by the owner or owner's representative designated below, a permit is hereby issued authorizing such Permittee (Permittee) to construct and operate a solid waste management facility at the designated location under any and all conditions.

A. Owner/Operator (Permittee):

1. **Name:** City of Jamestown Municipal Solid Waste Landfill
2. **Mailing Address:** 102 3rd Avenue Southeast, Jamestown, ND 58401
3. **Location Address:** 8980 35th Street Southeast, Jamestown, ND 58401

B. Permit Number: 0213

C. Solid Waste Management Units:

1. Municipal Waste Landfill
2. Surface Impoundment(s)
3. Closed Municipal Solid Waste Landfill Units

D. Location Information:

1. **General:** NE 1/4 of Sec 36, TWP 140N R 63W of Stutsman County
2. **Permit Area:** As described in referenced documents and facility files – approximately 160 acres.
3. **Latitude:** 46.904854° **Longitude:** -98.570019°

E. General Conditions:

- E.1. The Permittee of the facility is subject to the Solid Waste Management and Land Protection Act (NDCC Chapter 23.1-08), the Solid Waste Management Rules (NDAC Article 33.1-20), all other North Dakota and federal laws, rules or regulations and orders now or hereafter effected by the North Dakota Department of Environmental Quality (hereinafter the Department), and to all conditions of this permit.
- E.2. Compliance with terms of this permit does not constitute a defense to any order issued or any action brought under NDCC Chapter 23.1-08, NDAC Article 33.1-20, NDCC Chapter 23.1-04, NDAC Article 33.1-24, Sections 3013, 7003, or 3008(a) of Resource Conservation and Recovery Act (RCRA), Sections 106(a), 104 or 107 of the

Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (42 U.S.C. 9601 et. seq.) or any other law providing for protection of public health or the environment.

- E.3.** Issuance of this permit does not convey property rights of any sort or any exclusive privilege, nor does it authorize any injury to persons or property, any invasion of other private rights, or any infringement of state or local law or regulations. (NDAC Section 33.1-20-02.1-06)

- E.4.** It shall not be a defense for the Permittee in an enforcement action that it would have been necessary to halt or reduce the permitted activity in order to maintain compliance with the conditions of this permit. (NDAC Section 33.1-20-02.1-04)

- E.5.** This permit is based on the premise that the information submitted by the Permittee is accurate and that the facility will be or has been constructed and will be operated or has been as specified in the application and all related documents. Any inaccuracies or misrepresentations found in the application may be grounds for the termination or modification of this permit. The Permittee must inform the Department of any deviation from, or changes in, the information in the application which would affect the Permittee's ability to comply with the applicable rules or permit conditions. (NDAC Section 33.1-20-02.1-07)

- E.6.** The Permittee shall at all times properly operate and maintain the facility, solid waste management units, and related appurtenances which are installed or used by the Permittee to achieve compliance with the conditions of this permit. Proper operation and maintenance includes effective performance, adequate funding, adequate operator staffing and training, and adequate laboratory and process controls, including appropriate quality assurance/quality control procedures. This provision requires the operation of backup or auxiliary facilities or similar systems only when necessary to achieve compliance with the conditions of this permit. (NDAC Section 33.1-20-02.1-04)

- E.7.** The Permittee shall give notice to the Department of any planned physical alterations or additions to permitted solid waste management units. Any physical change in, or change in the method of the operation of, a treatment or disposal operation shall be considered to be construction, installation or establishment of a new operation. No construction, installation or establishment of a new operation shall be commenced unless the Permittee thereof shall file an application for, and receive, a permit from the Department. (NDAC Section 33.1-20-02.1-04 and NDAC Section 33.1-20-02.1-07)
 - a.** The Permittee shall give advance notice to the Department of any planned changes in the permitted facility or activity which may result in noncompliance with permit requirements.

 - b.** The Permittee shall provide to appropriate representatives that will be involved in routine operation of the facility a copy of the approved Plan of Operation (including waste acceptance procedures). The training and educational material shall be repeated and/or amended as necessary to ensure compliance with the waste acceptance procedures and the permit.

 - c.** Whenever the Permittee becomes aware that the Permittee failed to submit any relevant facts in the permit application or submitted incorrect information in the

permit application or in any report to the Department, the Permittee shall promptly submit such facts or information.

- E.8.** The Permittee shall construct, operate, maintain and close the solid waste management units and the facility according to the criteria of law and rule, conditions of this permit, and other reasonable precautions to prevent or minimize, if applicable, any environmental impacts including, but not limited to, fugitive dust emissions, objectionable odors, air toxics and gas emissions, spills, litter, and contamination of surface water and groundwater. (NDAC Section 33.1-20-02.1-04 and NDAC Subsections 33.1-20-04.1-02(1) – (6))
- E.9.** The Permittee shall furnish to the Department, within a reasonable time, any relevant information which the Department may request to determine whether cause exists for modifying, reissuing or terminating this permit, or to determine compliance with this permit. The Permittee shall also furnish to the Department, upon request, copies of records required to be kept by this permit. (NDAC Section 33.1-20-02.1-07 and NDAC Section 33.1-20-04.1-04)
- E.10.** This permit may be modified, revoked and reissued, or terminated for cause as specified in NDAC Section 33.1-20-02.1-07. The filing of a request for permit modification, revocation and reissuance, termination, or the notification of planned changes or anticipated noncompliance on the part of the Permittee does not stay the applicability or enforceability of any permit condition.
- This permit may be renewed as specified in NDAC Section 33.1-20-02.1-08. Review of any application for a permit renewal shall consider improvements in the state of control and measurement technology, compliance with state rules and permit, as well as changes in applicable regulations.
- E.11.** This permit addresses only the environmental aspects and operational procedures of the facility. It does not supersede local zoning authority or any other requirements of any political subdivision of the state. The Permittee must obtain any and all local zoning, conditional use permits, or meet any other county, township or municipal requirements prior to commencing construction and/or operation. (NDAC Section 33.1-20-02.1-06 and SFN 19269)
- E.12.** The Permittee shall design, close, maintain and operate the facility in a manner to minimize the possibility of a fire, explosion or any unplanned sudden or nonsudden release of solid waste or solid waste constituents to air, soil, groundwater or surface water which could threaten human health or the environment. (NDAC Section 33.1-20-04.1-02)
- E.13.** Any entity that controls the permit holder (Permittee) agrees to accept responsibility for any remedial measures, closure and postclosure care or penalties incurred by the Permittee. For purposes of this permit, "control" means ownership or control, directly, indirectly, or through the actions of one or more persons of the power to vote 25% or more of any class of voting shares of a permit holder, or the direct or indirect power to control in any manner the election of a majority of the directors of a permit holder, or to direct the management or policies of a permit holder, whether by individuals, corporations, partnerships, trusts, or other entities or organization of any type. Within thirty (30) days of the issuance of this permit, if not previously provided with the

application, or within thirty (30) days of the existence of any new controlling entity, the Permittee shall submit to the Department the name of the controlling entity, a statement signed by the controlling entity in which the controlling entity agrees to accept responsibility for any remedial measures, closure, and postclosure care or penalties incurred by the Permittee and a disclosure statement from the controlling entity containing the same information as required from permit applicants under NDCC Section 23.1-08-17. (NDCC Subsection 23.1-08-09(1))

- E.14.** All personnel involved in solid waste handling and in the facility operation or monitoring must be provided a copy of this permit and shall be instructed in specific procedures to ensure compliance with the permit, the facility plans and the state rules as necessary to prevent accidents and environmental impacts. Documentation of training such as names, dates, description of instruction methods and copies of certificates awarded must be placed in the facility's operating record. (NDAC Section 33.1-20-04.1-02)
- E.15.** Except as modified by conditions of this permit or future approvals from the Department, this facility and related solid waste management units and structures shall be designed, constructed, operated and closed in accordance with previous correspondence and documents contained in Departmental files pertaining to this facility and as described in the documents listed in Attachment 1, which are hereby incorporated by reference in this permit. Future submittals approved by the Department may supersede or supplement items listed in Attachment 1. (NDAC Section 33.1-20-02.1-04)
- E.16.** All facility reports shall be submitted to the Department in a digital or electronic format as a searchable PDF format document unless otherwise requested. In some cases, the Department may request hard copies in addition to electronic format. Reports shall be sent to solidwaste@nd.gov.

Recordkeeping and reporting shall be in accordance with NDAC Section 33.1-20-04.1-04 and as described in the approved Plan of Operations.

The Permittee shall submit an annual report to the Department by March 1st of each year in accordance with NDAC Subsection 33.1-20-04.1-04(3).

The Permittee shall submit an annual groundwater report to the Department by April 1st of each year in accordance with NDAC Subsection 33.1-20-04.1-04(4).

- E.17.** The Permittee shall complete the Department's Waste Rejection Report (SFN 60120) and notify the Department within five (5) days of any wastes rejected and not accepted by the facility. (NDAC Subsection 33.1-20-04.1-02(8))
- E.18.** Within sixty (60) days of the issuance of this permit, if not already completed, the Permittee shall record a notarized affidavit with the County Recorder. The affidavit shall specify that this facility, as noted in the legal description, is permitted to accept solid wastes for disposal. This affidavit shall specify that another affidavit must be recorded upon the facility's final closure.

Upon closure, a second affidavit shall be recorded specifying any final details regarding the types of waste disposed at the facility, as well as any final details regarding the facility's location, construction, management, etc.

The Department must be provided a copy of both affidavits, certified by the County Recorder of the county in which the facility is located. The copies must be forwarded to the Department within thirty (30) days of recorded dates, or if notification has already been completed, within thirty (30) days of the permit issuance date. (NDAC Section 33.1-20-02.1-05)

F. Municipal Waste Landfill Specific Conditions:

F.1. The following wastes are prohibited from disposal at this facility:

- Hazardous waste, except in amounts normally in household waste;
- Industrial waste;
- Lead acid batteries;
- Liquids, except in amounts normally in household waste;
- Major appliances;
- Municipal waste incinerator ash;
- Other waste, if the department determines that such waste has toxic or adverse characteristics which can impact public health or environmental resources;
- Pesticide containers which are not empty and have not been triple-rinsed, except those normally in municipal waste;
- Polychlorinated biphenyls (PCB) waste as defined in 40 CFR part 761;
- Raw or digested sewage sludges, lime sludges, grit chamber cleanings, animal manure, septic tank pumpings, bar screenings, and other sludges, if not included in the permit;
- Regulated infectious waste, except in amounts normally in household waste;
- Special waste; and
- Technologically enhanced naturally occurring radioactive material (TENORM) waste
- Used oil

(NDAC Subsection 33.1-20-06.1-02(8) and NDAC Section 33.1-20-11-02)

F.2. The facility is authorized only for the disposal of municipal solid wastes, and other wastes as identified in the permit application, Departmentally-approved facility waste acceptance plan, elsewhere in this permit, or through Departmental correspondence. "Municipal waste" means solid waste that includes garbage; refuse; and trash generated by households, motels, hotels, recreation facilities, public and private facilities; and commercial, wholesale, private, and retail businesses. The term does not include special waste or industrial waste.

The facility is limited to accepting an average of less than 500 tons per day.

(NDCC Subsection 23.1-08-02(10) and NDAC Subsection 33.1-20-15-01(e))

F.3. Waste containing free liquids is not approved for transport or delivery to the facility. "Free liquid" means the liquid which separates from the solid portion of a solid waste under ambient pressure and normal, above freezing temperature. The environmental protection agency paint filter liquids test method or visual evidence must be used to determine if a waste contains free liquid. (NDAC Subsection 33.1-20-01.1-03(32))

At minimum, visual observation of the waste at both the entry to the facility and at the working face shall be used to inspect waste arriving at the facility. The EPA Paint Filter Liquids Test (Method 9095B) protocol shall be used for all waste in which visual observation is not conclusive or if there is any question on free liquids. (NDAC Item 33.1-20-04.1-03(1)(h)(4)(n))

- F.4.** Any waste sampling and analysis must be representative of the waste using approved sampling and analytical procedures. All analysis must be performed by a Departmentally certified and approved laboratory or survey procedure documenting whether the waste meets limits established by rule, permit and Department approved waste acceptance procedures. (NDAC Section 33.1-20-01.1-13 and NDAC Paragraph 33.1-20-04.1-03(1)(h)(2))
- F.5.** Waste accepted at the facility shall not be stored, stockpiled or placed anywhere on the facility other than the approved disposal area. (NDAC Subdivision 33.1-20-04.1-03(1)(b))
- F.6.** Any new or lateral expansion of a municipal solid waste landfill must be underlain with a hydraulic barrier and leachate removal system capable of collecting and removing leachate and contaminated surface water within the landfill.

The liner must consist of one of the following:

- a.** A natural soil liner constructed of at least four feet of natural soil having a hydraulic conductivity not to exceed 1×10^{-7} centimeters per second; or
- b.** A composite liner consisting of two components; the upper must consist of a minimum thirty mil flexible membrane liner, and the lower component must consist of at least a two-foot layer of compacted soil with a hydraulic conductivity of no more than 1×10^{-7} centimeters per second. Flexible membrane liner components consisting of high-density polyethylene must be at least sixty mil thick. The flexible membrane liner component must be installed in direct and uniform contact with the compacted soil component; or
- c.** An alternative liner and leachate removal system approved by the Department. The Department must consider factors such as the proposed system's ability to control leachate migration, the hydrogeologic characteristics of the site and surrounding land, the climate of the area, or the potential leachate quality.

The facility must be constructed as designed and detailed in the permit application submitted to the Department on November 2, 2023. (NDAC Subsection 33.1-20-06.1-02(2))

- F.7.** Prior to any digging or disturbance of any known underground mine area, an approved reclamation plan for all acres disturbed will be given to the Department for approval. (NDAC Paragraph 33.1-20-04.1-01(2)(a)(4))
- F.8.** Methane and other gases from waste decomposition may not be allowed to migrate laterally from the landfill to endanger structures, environmental resources, or adjacent properties.

- a. The concentration of methane gas generated by landfills on the facility must not exceed twenty-five (25) percent of the lower explosive limit for methane in structures or appurtenances on the facility.
- b. The concentration of methane gas must not exceed the lower explosive limit for methane at the facility boundary.
- c. Monitoring of methane gas must be conducted at the approved frequency within the methane monitoring plan to assure the standards of subdivisions a and b are met.
- d. If methane gas levels exceed the standards of subdivisions a and b, the owner or operator must:
 1. Immediately take action to protect public health;
 2. Notify the department within seven (7) days; and
 3. Implement remedial measures within sixty (60) days

(NDAC Subsection 33.1-20-06.1-02(4))

- F.9.** The Permittee shall submit quarterly reports to the Department by the last day of the following month. The report shall include a summary of the past quarter's construction activity, operations and inspections of the facility. At a minimum, the following information shall be included:
- a. Tonnage accepted for the quarter broken down by municipal waste, industrial waste, and inert waste
 - b. Rejected waste loads
 - c. Rainfall totals for events equal to or greater than the 25-year, 24-hour storm event
 - d. Map, including location and size (in acres) of the:
 1. Operating area
 2. Areas with interim cover
 3. Areas with final cover
 - e. Current construction projects and upcoming construction projects for both new construction and closure projects
 - f. Any significant regional event(s) which impacted the facility during the quarter, including a brief summary of:
 1. How the facility was impacted
 2. The contingency plans that were initiated
 - g. Leachate head above liner in the landfill and amount of leachate generated
 - h. Amount of freeboard in the surface impoundment(s)

i. Condition of the pump(s) for leachate management

j. Summary of training conducted

(NDAC Section 33.1-20-02.1-04)

- F.10.** The Permittee shall conduct self-inspections in accordance with the approved inspection procedures. (NDAC Subsection 33.1-20-04.1-02(8))
- F.11.** During excavation and construction of any disposal unit, surface impoundment, or other solid waste unit, any layers of materials with a higher hydraulic conductivity, including, but not limited to, areas of sand, silty sand, gravel and/or lignite over eight (8.0) inches in thickness, or any areas where in-situ clay-rich soils underlying the base of the solid waste unit are less than three (3) feet thick, the base shall be over-excavated and replaced with at least three (3) feet of carefully compacted clay-rich soil to establish a geologic barrier to leachate migration. At minimum, sand or lignite zones less than eight (8.0) inches in thickness shall be scarified, mixed with in-situ shale or clay-rich sediments to a depth of 12 inches, visually classified, recompact and tested as described in Section IV, Subbase Preparation, of the Department's *Guideline 5 – Quality Assurance for Construction of Landfill and Surface Impoundment Liners, Caps and Leachate Collection Systems* (see attachment 2). Replacement of the zones of higher hydraulic conductivity and the placement of compacted clay shall be addressed in the final quality assurance/quality control report to the Department. (NDAC Subsection 33.1-20-04.1-01(2))
- F.12.** A uniform compacted layer of six (6) inches or more of suitable earthen material or other departmentally approved material must be placed on all solid waste by the end of each working day. (NDAC Subsection 33.1-20-06.1-02(9))
- F.13.** On all areas of the landfill where final cover or additional solid waste will not be placed within one (1) month, six (6) inches or more of compacted clay-rich soil material or other departmentally approved material must be placed. (NDAC Subsection 33.1-20-06.1-02(10))
- F.14.** All earthen material must be maintained on-site (to be used for all construction, cover, closure and revegetation activities) unless removal from the site is authorized by the Department. (NDAC Subdivision 33.1-20-04.1-09(2)(k))
- F.15.** Suitable plant growth material (SPGM) topsoil and SPGM subsoil shall be used for site closure. Any extra material shall be stored in approved areas for use in site maintenance and closure repair. All SPGM shall be replaced upon site or area reclamation. (NDAC Subdivision 33.1-20-04.1-09(2)(f))
- F.16.** Sequential closure of solid waste disposal units shall be implemented as described in the approved closure plan.

The largest approved open area is 25 acres before sequential partial closure must be initiated. (NDAC Subdivision 33.1-20-04.1-03(1)(g) and NDAC Subsection 33.1-20-04.1-05(2))

F.17. The facility shall be operated in full accordance with the approved plan of operation and the waste screening provisions. (NDAC Section 33.1-20-04.1-03)

G. Surface Impoundment Specific Conditions:

G.1. All surface impoundments shall be constructed, operated, maintained and inspected in accordance with NDAC Chapter 33.1-20-08.1.

All surface impoundments shall be maintained and inspected to ensure orderly operation and ensure adequate storage capacity, and two (2) foot of freeboard must be maintained. After significant runoff events, prior to winter freeze-up, and/or in anticipation of a period of heavy precipitation, the surface impoundment's capacity shall be restored as soon as practicable to ensure at least a 25-year, 24-hour stormwater management capacity. (NDAC Paragraph 33.1-20-04.1-09(2)(3)(a))

The surface impoundments shall not be used for management of stormwater that has not been in contact with waste. The surface impoundments shall be protected from surface water run-on from adjacent areas. (NDAC Subdivision 33.1-20-04.1-09(3)(d))

H. Closed Solid Waste Landfill Units Conditions:

H.1. All closed areas must be managed and maintained in accordance with the closure and postclosure requirements of NDAC Section 33.1-20-04.1-09, an approved closure plan, an approved postclosure plan and this permit. Closed solid waste management units may not be used for cultivated crops, heavy grazing, buildings, or any other use which might disturb the protective vegetative and soil cover. (NDAC Subdivision 33.1-20-04.1-09(4)(a))

H.2. The Permittee shall conduct postclosure evaluations and investigations of the closed landfill units in accordance with the approved postclosure care plan. (NDAC Subdivision 33.1-20-04.1-09(5))

H.3. A summary of inspections, evaluation and repair of closed landfill areas shall be included in the Permittee's annual report. (NDAC Subdivision 33.1-20-04.1-04(3)(e))

Should questions or issues arise, the Permittee shall contact the North Dakota Department of Environmental Quality at 701-328-5166.

In consideration of information provided regarding the facility and its operation and in consideration of the conditions above, the North Dakota Department of Environmental Quality hereby issues a permit to the City of Jamestown.

This permit is effective as of May 9, 2024 and shall remain in effect until May 9, 2034, unless modified, superseded, or revoked under Section 33.1-20-02.1-07 NDAC or continued in accordance with Section 33.1-20-02.1-08 NDAC.



Charles R. Hyatt, Director
Division of Waste Management

5/9/24

Date

Attachments:

Attachment 1: Historical Document List

**Attachment 2: Guideline 5 – Quality Assurance for Construction of Landfill and Surface Impoundment
Liners, Caps and Leachate Collection Systems**

Attachment 1
Historical Documents

- August 2, 2023** Application for a Solid Waste Management Facility Permit – North Dakota Department of Environmental Quality - Division of Management SFN 19269 (06/22), submitted by City of Jamestown and Interstate Engineering.
- October 10, 2016** Memorandum from Chris McConn to Darrel Hournbuckle, dated October 10, 2016, Jamestown MSW Landfill Meeting Follow Up, Jamestown, ND J09-112, and received by the Department on October, 13, 2016.
- April 2016** Landfill Expansion, Hydrogeologic Investigation, submitted on behalf of the City of Jamestown by Interstate Engineering, signed by Stephen Braun and Chris McConn and dated April 2016.
- 2016** “Application for a Solid Waste Management Facility Permit - North Dakota Department of Health - Division of Waste Management (SFN 19269) (4-2010)” signed by Jeff Fuchs and Darrel Hournbuckle.
- July 2015** Jamestown Sanitary Landfill, Landfill Expansion, Permit Modification Report; Draft (pre-application), submitted on behalf of the City of Jamestown by Interstate Engineering, July 2015, Darrell Hournbuckle and Chris McConn.
- February 2008** “Application for a Solid Waste Management Facility Permit - North Dakota Department of Health - Division of Waste Management (SFN 19269) (3-2007),” received in February 2008 and signed by Jeff Fuchs and Darrel Hournbuckle.
- December 16, 1997** “Application for a Solid Waste Management Facility Permit - North Dakota Department of Health - Division of Waste Management (SFN 19269) (09/1997),” received December 16, 1997.
- November 1995** Inert Permit within Existing Landfill Area, November 1995, submitted by the City of Jamestown.
- October 1991** Hydrogeologic Investigation Work Plan - Donohue & Associates, Inc., October 1991.
- April 1991** Hydrogeological Investigation Report – Donohue & Associates, Inc., April 1991.
- 1991** Revised Solid Waste Facility “Center Portion, Closure Plan,” Jamestown, North Dakota.



GUIDELINE 5 – QUALITY ASSURANCE FOR CONSTRUCTION OF LANDFILL AND SURFACE IMPOUNDMENT LINERS, CAPS AND LEACHATE COLLECTION SYSTEMS

North Dakota Department of Environmental Quality - Division of Waste Management
4201 Normandy St., Bismarck, ND 58503-1324

Telephone: 701-328-5166 ● Fax: 701-328-5200 ● Email: solidwaste@nd.gov

Website: <https://deq.nd.gov/wm>

Updated 3-2023

I. Introduction

Quality Assurance (QA) procedures are necessary to assure proper construction of solid waste landfills and surface impoundments. The purpose of this document is to provide detailed recommendations to field personnel, engineers, and permit applicants regarding the minimum quality assurance procedures for the construction of facilities and to ensure documentation of construction. These QA recommendations do not in any way reduce the responsibilities of individual contractors or permittees to achieve facility design or performance specifications.

Quality assurance refers to the function of the owner or owner's representative, usually an independent testing company, to monitor construction activity and review construction data and reports from contractors, manufacturers, and suppliers. Contractors, manufacturers, and suppliers must supply Quality Control (QC) information for their products and equipment. The information becomes part of the project quality assurance / documentation report that is submitted to the North Dakota Department of Environmental Quality (Department).

A specific sequence of procedures is necessary for the construction of liners. These procedures are usually provided with an application for a permit and occasionally required by a permit. Documentation of each procedure becomes necessary to demonstrate that design or performance specifications have been achieved. Visual inspection, survey, field, and laboratory testing will be undertaken as appropriate. Recommendations for certifications are listed, including testing frequencies and product specifications. A qualified QA inspector and/or surveyor, independent of the owner or owner's representative, can provide oversight to certify proper construction.

This document has been prepared by the Department for the purpose of assisting owners and operators in fulfilling regulatory and permit requirements. Questions and comments are welcome and can be addressed to the Division of Waste Management, North Dakota Department of Environmental Quality, 4201 Normandy St., 2nd Fl., Bismarck, ND 58503-1324.

II. Soil Investigation

The soil material to be used for the construction or installation of any backfill or subliner, subbase, clay liner, drainage layer, or landfill cap must be clearly identified and described in a soil investigation to be submitted to the Department with any permit application or as deemed necessary (NDAC 33.1-20-03.1-02, subsection 6). The soil investigation should include a map and a description of borings along with a

determination of soil parameters for any material to be used during construction. Appropriate soil parameters for a soil investigation should include:

1. In-place moisture-density
2. Atterberg limits
3. Grain-size distribution
4. Laboratory moisture-density relationship (ASTM D698 or D1557)
5. Coefficient of permeability

III. Backfill or Subliner Installation

For some landfills in strip mined areas, it is necessary to raise the bottom elevation of the disposal units. The earthen materials used for backfill must be selected and placed to ensure proper stability for the landfill and the liners and to help minimize leachate constituent migration. The backfill placement should be documented as follows:

1. A grid pattern should be established at the base and sides of the excavation, generally 100 foot spacing. Survey points should be taken and recorded on drawings to be submitted to the Department in the QA report.
2. Minimum one (1) standard or modified proctor test for every 10,000 cubic yards with an additional test for any change in the major soil type.
3. Grain-size distribution and soil classification of backfill tested, at minimum, once each 5000 cubic yards, with any changes in the major soil type.
4. Suitability of backfill, at minimum each twelve inches, tested as follows:
 - a. Visual check of soil characteristics as the material is placed.
 - b. Density test. Meet 90 percent modified or 95 percent standard proctor density, one test per 100-foot grid.

Location method of all tests should be documented for reports.

IV. Subbase Preparation

Construction of appropriate berms, embankments and subbase preparation will occur prior to liner installation. A survey of the subgrade area is necessary prior to the start of liner construction. The subgrade surface should be smooth and free from material prior to the start of liner construction. The subgrade should be documented as follows:

1. A grid pattern should be established with additional points placed at the toe of all slopes and at the low point in each cell. Survey points should be taken and recorded on drawings for inclusion with reports.
2. Tests of the top six inches of the subgrade are needed as follows:
 - a. Minimum one (1) standard or modified proctor test (minimum 5-point curve) with an additional test for any change in major soil type.

- b. Density and in-place moisture testing. Determine in-place moisture content and meet, at minimum, 90 percent modified proctor or 95 percent standard proctor density, one test per 100-foot grid.
- c. Soil classification. Atterberg limits and grain-size distribution once per 1000 cubic yards of subgrade surface area, at a minimum, and with any change in the major soil type.
- d. Location method of all tests should be documented for reports.

V. Lysimeter Installation

Lysimeters should be installed in accordance with appropriate design details. The subgrade elevations and pipe invert elevations should be addressed in permit applications or as may be required by the Department. All values should be entered in appropriate tables. The lysimeter construction should be visually inspected during installation.

VI. Clay Liner Specifications

For clay liner (and clay caps), the selection and placement of clay soils is critical to meet the required hydraulic conductivity of 1×10^{-7} centimeters per second or less. The condition and moisture level of the soil material has to be monitored closely. Processing of the soil is very important. If the material consists of a claystone, a rock crusher and screen may be utilized to pulverize the material to an adequate consistency.

Appropriate precautions are needed to avoid rocks and gravel larger than 3/4 inch in the liner materials. At minimum, for clay liner soils placed within two feet of the top of the clay liner surface (the upper two feet of the liner), rocks and gravel larger than 3/4 inch must be screened or removed from the soil. A road reclaimer or tillage equipment may be used to break up soil clods. The addition of water or, if necessary, any drying of the soil must be provided for. Placement of the clay soil should be as follows:

1. The clay soils should be placed to achieve a maximum thickness of six inches per compacted lift and compacted to a minimum 90 percent modified proctor or 95 percent standard proctor density. Additional compaction effort may be necessary based on the moisture-density relationship and permeability information.
2. The clay that is to be compacted should be 2 to 5 percent wetter than the moisture content at maximum proctor density. The Department will consider requests for 0 to 5 percent wetter than the moisture content at maximum proctor density if required by current field conditions.
3. Placement and/or compaction of frozen soils is not recommended. Therefore, if frozen soils are identified, they should be removed from the liner. Special precautions to prevent freezing of the clay liner will be necessary. These methods may include soil cover and/or insulation.

4. Proper compaction equipment and methods are necessary. The tamp foot or sheep's foot compactor should weigh, at minimum, 30,000 pounds. However, equipment in the range of 60,000 to 70,000 pounds is better. It is necessary that field equipment properly breaks clay lumps and kneads the clay materials together. At minimum, four to six passes of the compaction equipment per lift of soil are necessary to assure structural improvement of the soil.
5. Visual control to eliminate unacceptable material is necessary. Appropriate testing and documentation during clay liner and clay cap construction are necessary. The soil testing and documentation recommendations follow:
 - a. Density and as-placed moisture content tests, as discussed in item No. 1 above, one (1) density and as-placed moisture content test per 100-foot grid pattern on the base of the cell on every lift and offset on each subsequent lift. Nuclear density testing may be utilized rather than sand cone; however, some limited sand cone testing should be utilized to verify nuclear testing methods. Use of a twelve (12) inch probe could allow for reduced frequency of testing since the probe will effectively monitor two (2) lifts per test. Nuclear density testing holes must be filled with clay or bentonite. Greater testing frequency should be utilized in confined areas, small facilities, or where thinner liners are allowed.
 - b. Moisture-density (Proctor) testing (minimum 5-point curve), at minimum, on every 5000 cubic yards or less of material used and with any change in the major soil type with a minimum of one test per lift of soil. Modified proctor density testing is preferred to standard proctor testing.
 - c. Laboratory determination of as-placed moisture content, dry density and Atterberg limits at a minimum frequency of one (1) test per every 5000 cubic yards of material used.
 - d. Soil classification tests for grain-size distribution and soil classification at a frequency of, at minimum, one (1) test per every 5000 cubic yards of clay placed or at a frequency of one (1) test per acre and with any change in the major soil type.
 - e. Hydraulic conductivity testing of the liner at a frequency equivalent to every third grain-size sample required in Section III above with a minimum of three tests per site or construction phase. Laboratory testing methods utilizing a Shelby tube or on hand carved samples from the liners are inferior and have been documented to underrepresent actual hydraulic conductivities by a factor of 900 to 1300. Some in situ testing of liner and cap construction utilizing single or double ring devices is preferable to verify lab testing results. Landfill leachate may be used instead of water in the liner tests.
 - f. Porosity should be calculated in conjunction with permeability tests.

VII. Clay Side Liner Specifications

Clay side liners may be constructed parallel to the sidewall in instances where side slopes are not overly steep. Problems could arise in achieving adequate compaction and uniform thickness on steeper slopes. Where slopes are steeper (especially steeper than 2.5 to 3 H:1V) liners should be built in horizontal lifts with a horizontal thickness equivalent to the scraper width. Horizontal lifts should be tied together and should not contain layers of coarse material. More permeable zones in horizontal lifts could result in seepage. Side liner construction and testing should be similar to that for the requirements for bottom liners, except for horizontal lifts, where the density and as-placed moisture content testing requirement should be completed on each 200 lineal feet of sidewall for each lift, and the testing should be offset on each subsequent lift.

When the cell is open for use, liners should be protected to minimize the damaging effects of desiccation (drying), freezing, erosion and traffic on the liners. Recomaction or reconstruction of damaged liners may be necessary.

VIII. Synthetic Liner Installation

Installation procedures for synthetic liners should be fully described in the permit application. Installation procedures should follow the recommended practices of the Geosynthetic Institute and/or the International Association of Geosynthetic Installers (see references). Following is a brief summary of those practices:

All synthetic liner installation must be performed under the daily supervision of a master seamer. All personnel performing seaming operations should be qualified by experience or by successfully passing seaming tests. The experience record of each of the installer's technicians should be given to the QA inspector prior to the start of synthetic liner placement. No seamer should be allowed to work until their qualifications have been reviewed by the inspector.

The manufacturer shall provide QC certification forms with results of factory testing of the geomembrane. These forms must certify that the geomembrane rolls shipped to the site meet or exceed the material property requirements of the project specifications. These QC certification forms should be received by the QA inspector prior to any synthetic liner installation.

A preconstruction meeting is necessary prior to synthetic liner placement to discuss schedule, responsibilities, testing frequencies and to review the installer's panel layout drawing.

The geomembrane rolls must be inspected upon arrival to ensure that the materials meet the project specifications. The QA inspector should record all roll numbers to verify rolls as shipped and note in a daily field report any damage to the rolls.

Prior to the placement of the liner, both installer and the QA inspector must inspect the clay liner for any uneven areas, rocks, foreign objects, etc. that may damage the liner. The installer should sign an acceptance form accepting the clay liner condition prior to synthetic liner placement. During the deployment of the liner, the inspector should be present to observe deployment, record roll numbers and panel numbers, and mark any

areas with visible damage on the liner. A panel placement form should be filled out by the inspector detailing weather conditions, etc. during deployment.

Before seaming begins, trial welds must be taken, tested, and recorded. The frequency of trial welds should be specified in the permit application. If a trial weld fails, the seamer must be required to make another complete trial seam. If this additional test fails, the seaming apparatus or seamer should not be accepted until the deficiencies are corrected and two consecutive passing trial seams are made.

Continuity (nondestructive) testing should be performed using a vacuum box unit or appropriate pressure testing methods over the entire length of each seam. This process should be observed by the QA inspector and any leaks noted, repaired, and retested. This testing should follow along the seaming process, not at the completion of all seaming.

Destructive test samples must be taken at the minimum frequency of one test per every 500 feet of seam length. These samples should be taken on a daily basis and sent to an independent laboratory for testing. The locations of these tests should be recorded and included on the as-built panel placement drawing.

IX. Cap and Liner Protection and Repair

Damage to both synthetic and clay liners and caps may occur due to exposure to wind, rain, freezing, drying, equipment traffic and other factors. The owner/operator of a landfill should address liner protection, maintenance, and repair in the permit application. The owner/operator or his representative should perform regular inspections of the cap or liner condition and repair damaged areas.

Caps and liners should be protected from damage during freezing conditions. All lined areas should have at least six feet of solid waste in place on the liner by December 15 of each year. No disposal should take place on uncovered areas after December 15 without testing the liner integrity; Department approval may be necessary.

X. Drainage Layer or Blanket Placement

Installation of the granular drainage material must be performed in a manner that prevents equipment from coming in direct contact with the liner. Placement should start at the edge of the cell and proceed by pushing the material out over the liner surface. Placement of drainage material on sidewalls should be completed by pushing the material up. Placement of drainage material around, adjacent or over leachate collection pipe and leachate collection pipe trenches should be carefully monitored.

Documentation and testing for the drainage blanket construction must include:

1. Hydraulic Conductivity. One test, at minimum, for every 2000 cubic yards of material with a minimum of one test per borrow area. At minimum, every site must be tested for at least four samples.
2. Gradation. Minimum of one (1) gradation to a 200-mesh sieve per 1000 cubic yards placed, with a minimum of one per borrow area.

3. Porosity. Calculated in conjunction with the hydraulic conductivity tests.

Lab hydraulic conductivity of the drainage blanket must be of a sample remolded to in-place density. Constant head permeability tests (ASTM D2434) are appropriate for this material. The Department may require that leachate be used in the tests and may require both chemical and physical durability be tested. Appropriate survey control should be used to document drainage layer thickness.

XI. Leachate Collection Transmission Pipes

Pipes must be placed in locations and elevations as shown on plans provided with the permit application. Transmission line joints and PVC pipes should be sealed with solvent-based glue. Slip joints for leachate collection lines may be approved if calculations suggest that substantial subsidence may occur. Pipes should be properly supported to prevent movement and concentration of loads. The coarse aggregate used as pipe bedding and cover should be tested for gradation and compared with gradation of drainage blanket at a frequency of twice per cell. Geomembrane, granular filters, or filter fabric placed around the pipe bedding should be appropriately specified, based on results of material gradations, and properly placed. Deflection testing of the collection pipe should be conducted using a mandrel. The cable should be strung through the pipe sections as they are installed. The mandrel should be attached and pulled through the pipe following placement of the granular drainage layer.

XII. Landfill Caps

Construction of a prescriptive moisture-barrier landfill cap should be completed in a manner similar to the construction of landfill clay liners. Special precautions are necessary to assure the disposed waste will support the landfill cap as constructed.

Construction of an alternative landfill cap is allowed under the solid waste management rules. The permit applicant must demonstrate that an alternative design will appropriately limit percolation of liquid into the waste through one of the following:

- a. Hydrologic modeling;
- b. Lysimetry or instrumentation using a field-scale test section;
- c. Comparison of the soil and climatic conditions at the site with the soil and climatic conditions at a site where the Department has previously approved the same alternative cover design; or
- d. Other method approved by the Department.

To demonstrate that an alternative cover design will appropriately limit percolation of liquid into the waste, the alternative cover design must be shown to limit the average rate of percolation of liquid into wastes to an equal or lower value than the final cover design described in this section, or to an average long-term percolation rate less than 0.2 inches [5.0 millimeters] per year.

Evapo-transpirative landfill caps are the most common type of alternative cover design. The Department generally follows the *Technical and Regulatory Guidance for Design, Installation, and Monitoring of Alternative Final Landfill Covers*, 2003, published by the

Interstate Technology Regulatory Council (ITRC). Alternative landfill cap designs that are in conformance with these guidelines have been shown to appropriately limit percolation of liquid into the landfill. If a permit applicant wants to submit a design that does not follow the ITRC guidance, then a demonstration of performance must be submitted following one of the methods listed above.

XIII. Quality Assurance / Construction Documentation Report

Authorization to utilize a new facility is usually contingent upon Departmental review and approval of a quality assurance / construction documentation report.

An acceptable report includes, at a minimum, the following information:

1. As-built engineering drawings depicting the following information:
 - a. Completed subbase elevations.
 - b. Final liner grades.
 - c. Top of drainage blanket grades.
 - d. Leachate collection lines, clean-outs, and manholes with spot elevation every 100 feet along the lines and at all manhole entrances and exits.
 - e. Drainage features.
 - f. All monitoring devices.
 - g. Spot elevations at all breaks and slope and on approximate 100-foot centers.
 - h. All test locations.
 - i. Other site information as appropriate.
2. Engineering cross sections, a minimum of one east-west and one north-south through the completed area.
3. A comprehensive narrative explaining how construction of the project was accomplished along with an analysis of the soil, liner, and any other testing data. This report should also include an appendix containing all the raw data from the field and laboratory testing.
4. A series of color photos documenting all major aspects of the site construction.
5. Construction of the site should be certified by a registered professional engineer to have been completed in accordance with the approved plans. Any deviations from the plan should be noted and explained.

The Department reserves the right to require any measures necessary to assure proper construction and documentation of the landfill or disposal cell.

XIV. References:

ASTM D698 (standard proctor). Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft³ (600 kN-m/m³)).

ASTM D1557 (modified proctor). Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft³ (2,700 kN-m/m³)).

- ASTM D2434. Standard Test Method for Permeability of Granular Soils (Constant Head).
- Geosynthetic Institute. 2013. Field Integrity Evaluation of Geomembrane Seams (and Sheet) Using Destructive and/or Nondestructive Testing, GRI Test Method GM29*.
<https://geosynthetic-institute.org/grispeccs/gm29.pdf>
- International Association of Geosynthetic Installers. 2015. Guidelines for Installation of: HDPE and LLDPE Geomembrane Installation Specification.
https://www.iaqi.org/assets/docs/InstallationDocs/iaqi_nov2015_PE%20specification.pdf
- Interstate Technology and Regulatory Council. 2003. Technical and Regulatory Guidance for Design, Installation, and Monitoring of Alternative Final Landfill Covers.
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- USEPA Summary, Research and Development EPA/600/SR-93/182 September 1995: Quality Assurance and Quality Control for Waste Containment Facilities, 11pp.
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