

Chapter NR 660

LANDFILL AND SURFACE IMPOUNDMENT STANDARDS

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NR 660.01 Purpose. The purpose of this chapter is to specify the requirements and standards that apply to hazardous waste landfills and surface impoundments.

History: Cr. Register, February, 1991, No. 422, eff. 3-1-91.

NR 660.02 Applicability. Except as otherwise provided, this chapter applies to owners and operators of facilities that treat, store or dispose of hazardous waste in landfills or surface impoundments. This chapter does not apply to solid waste landfills and surface impoundments that receive only:

- (a) Non-hazardous solid waste,
- (b) Metallic mining wastes resulting from a mining operation as defined in s. 144.81 (5), Stats.,
- (c) Polychlorinated biphenyls (PCBs), except where portions of this chapter are referenced in ch. NR 157, or
- (d) A combination of wastes described in pars. (a) to (c).

History: Cr. Register, February, 1991, No. 422, eff. 3-1-91.

NR 660.03 Definitions. The definitions in s. NR 600.03 apply to this chapter.

History: Cr. Register, February, 1991, No. 422, eff. 3-1-91.

NR 660.04 Exemptions. Except as specifically provided, the requirements of this chapter do not apply to the owners and operators of the following facilities:

(1) A surface impoundment which has its discharges regulated under ch. 147, Stats., is excluded from the requirements of this chapter, if the owner or operator complies with ss. NR 630.04 (3) and 660.19.

(2) A solid waste disposal facility that is licensed under chs. NR 500 to 522 if the only hazardous waste the facility disposes of is excluded from regulation under s. NR 600.04 and chs. NR 630 to 685 by s. NR 610.05 (1) and the facility has been approved under s. NR 506.15 to accept small quantities of hazardous waste.

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(3) Facilities used for the disposal of metallic mining wastes resulting from a mining operation as defined in s. 144.81 (5), Stats., except where requirements in this chapter are referenced in the rules adopted by the department under s. 144.435 (1m), Stats.

Note: Metallic mining wastes are regulated under ch. NR 182.

(4) A facility operating under an interim license, except to the extent that the requirements of this chapter are listed in ss. NR 680.21 (4) and (5) and 680.22.

History: Cr. Register, February, 1991, No. 422, eff. 3-1-91.

NR 660.05 General. Except as otherwise provided in s. NR 660.04, no person shall operate or maintain a hazardous waste landfill or surface impoundment unless the person has obtained an interim license, operating license, variance or waiver from the department, in accordance with the requirements of ch. NR 680.

History: Cr. Register, February, 1991, No. 422, eff. 3-1-91.

NR 660.06 Location criteria. (1) In addition to general site selection criteria in s. NR 630.18, no person may establish, construct, operate or maintain a hazardous waste landfill or surface impoundment, or permit the use of property for a hazardous waste landfill or surface impoundment, within the following areas:

(a) 1,000 feet of any navigable lake, pond or flowage.

(b) 300 feet of a navigable river or stream.

(c) 1,000 feet of the nearest edge of the right-of-way of any state trunk highway, interstate or federal aid primary highway or the boundary of any public park, unless the site is screened by natural objects, plantings, fences or other appropriate means so as to not be visible from the highway or park.

(d) an area where the department after investigation finds that there is a reasonable probability that disposal of hazardous waste within the area shall have a detrimental effect on any surface water or groundwater quality or shall cause a violation of groundwater standards adopted under ch. NR 140.

(e) 10,000 feet of any airport runway used or planned to be used by turbojet aircraft or within 5,000 feet of any airport runway used only by piston type aircraft or within other areas where a substantial potential bird hazard to aircraft may exist, unless a waiver is granted by the federal aviation administration.

(f) 1,200 feet of any public or private water supply well as specified in ch. NR 112.

(g) Areas which do not meet the following requirements:

1. Consist of clay soils which extend at least 30 feet beneath the proposed base of the facility.

2. Contain no extensive deposits of coarse grained soils within the clay soils. This shall be determined based on an interpretation of soil stratigraphy after consideration is given to the deposition and origin of the deposits and their engineering classification under the unified soil classification system specified in ASTM standard D-2487-69 (1975).

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Note: The publication containing this standard may be obtained from:

American Society for Testing and Materials
1916 Race Street
Philadelphia, PA 19103

The publication containing this standard is available for inspection at the offices of the department, the secretary of state and the revisor of statutes.

3. Have a median infield permeability of 1×10^{-6} cm/sec as determined by single well response tests.

(2) The active portion of a facility shall be located a minimum of 200 feet away from the property line of the facility.

(3) An applicant for an initial operating license or for approval of the expansion of an existing hazardous waste landfill or surface impoundment shall demonstrate to the department that the proposed site will comply with all of the locational standards of this section for which no exemption has been granted. No exemptions from compliance with sub. (1) (d) shall be granted by the department. Pursuant to s. NR 680.04, exemptions from compliance with sub. (1) (a), (b), (c), (e), (f), (g) and (h) may be granted only upon demonstration by the applicant of circumstances which warrant an exemption. The factors which will be considered by the department in determining whether or not to grant an exemption include waste types and characteristics, site or facility design and operational considerations, availability or other environmentally suitable alternatives, compliance with other state and federal regulations and the public health, safety and welfare.

History: Cr. Register, February, 1991, No. 422, eff. 3-1-91.

NR 660.07 Initial site inspection. Unless specifically exempted in s. NR 660.04, any person proposing to establish a hazardous waste landfill or surface impoundment or expand an existing facility shall contact the department to arrange for an initial site inspection.

History: Cr. Register, February, 1991, No. 422, eff. 3-1-91.

NR 660.08 Initial site report. (1) Any person, prior to submitting a feasibility report, may submit an initial site report to the department in accordance with ss. NR 680.05 (1) and 680.06 (3). The department shall review and respond to the initial site report within 65 business days of receipt. A favorable opinion under this section does not guarantee a favorable determination of site feasibility.

Note: the purpose of submitting this report is to obtain a preliminary opinion from the department on the potential of the site for development and the advisability of spending additional time and funds to prepare a feasibility report.

(2) An initial site report may be as detailed as the applicant chooses to make it. If a report is submitted, the report shall include the following information. If the following information, with the exception of par. (e), is not submitted, the department cannot guarantee that an opinion on the feasibility of the site can be given.

(a) *General site information.* Identify project title; name, address and phone number of primary contact persons for department correspondence; the consultant; present property owner; proposed facility owner and operator; site location by quarter section; total acreage of property and proposed licensed acreage; proposed site life and design capacity; municipalities, industries and collection and transportation agencies to

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be served; estimated waste types and characteristics and estimated weekly quantities to be disposed; anticipated base grades; preliminary design configuration; anticipated covering frequency and mode of operation.

(b) *Regional geotechnical information.* Include a discussion of the regional site setting to provide a basis for comparison and interpretation to site specific information obtained through field investigations and for analyzing siting and environmental considerations. Limit the discussions to information available from publications, although some field verification and updating may be desirable. Supplement discussions by maps and cross-sections may be included. Address the following items:

1. Topography, including predominant topographic features.
2. Hydrology, including surface water drainage patterns and significant hydrologic features such as surface waters, springs, drainage basins and divides and wetlands.
3. Geology, including the nature and distribution of bedrock and unconsolidated deposits.
4. Hydrogeology, including depth to groundwater, groundwater flow direction, recharge and discharge areas, groundwater divides, aquifers and the identification of the aquifers use by public and private wells beneath the facility property and within ½ mile of the proposed site.
5. Ground and surface water quality as described in available regional literature.
6. Climatology.
7. Identification of adjacent landowners.
8. Zoning.
9. Present land uses with particular emphasis on known recreational, historic or archaeological areas.
10. Present or proposed access roads and weight restrictions.
11. Factors identified in the locational criteria in s. NR 660.06.

(c) *Site specific geotechnical information.* 1. Perform field investigations to define the site specific topography, soil types and depth to bedrock and groundwater. Include the following:

a. A topographic survey of the area. On this map show the proposed fill area, property boundaries, proposed site boundary, soil borings performed and wells installed. The minimum scale should be one inch = 500 feet with the contour interval sufficient to show site relief. It is recommended that this map consist of a blowup of a USGS map, 7½ or 15-minute topographical, with supplemental information added as appropriate.

b. Soil borings extending to bedrock, unless depth to bedrock is 100 feet or more below the ground surface, or 30 feet below the anticipated facility base grade, whichever is greater. The borings shall be distributed in a grid pattern throughout the area. At least one boring per 5 acres with a minimum of 5 borings is required.

c. Soil borings shall be converted to water table observation wells and well nests in accordance with the following schedule:

1) Three wells nests consisting of a water table observation well and a piezometer in the unconsolidated material.

2) One piezometer within the competent bedrock at one of the well nest locations.

d. Analyze each significant soil layer encountered during boring investigations for grain-size distribution and classify according to the unified soil classification system.

e. At least one laboratory permeability test shall be conducted for each significant soil layer above and below the water table. Single well response tests shall be performed on all on-site wells.

f. A summary of the groundwater monitoring data obtained under ss. NR 635.12 and 635.16, where applicable.

2. Summarize the results of the subsurface investigations utilizing a series of geologic sections which connect the soil borings performed. In each section show present topography, soil borings, soil classification and other properties, interpreted soil stratigraphy, bedrock, well construction permeability results and stabilized water level readings for each well.

3. Prepare a water table contour map based on stabilized water level readings. The topographic map shall be used as a base for this map.

4. A summary of all groundwater, gas, surface water and physical features monitoring previously performed for the facility, including all monitoring required under chs. NR 600 to 685.

5. A description of any plume of contamination that has entered the groundwater from any treatment, storage or disposal unit at the time the initial site report is submitted that:

a. Delineates the extent of the plume on the map required under subd. 1.a.; and

b. Identifies the concentration of each hazardous constituent in table VI of ch. NR 605 - Appendix IV, throughout the plume or identifies the maximum concentrations of each table VI of ch. NR 605 - Appendix IV hazardous constituent in the plume.

(d) *Data analysis.* From the results of the field investigations, regional geotechnical information and land use information, analyze and make preliminary conclusions and recommendations on site development. Include a discussion of the potential for the site to meet the locational requirements in s. NR 660.06 and potential limitations on site development.

(e) *Preliminary liner assessment.* 1. One or more potential alternatives for a primary liner meeting the requirements of s. NR 660.13 (10) (a) shall be identified.

2. A description of the proposed testing program for the primary liner shall be submitted which outlines the proposed procedures for performing the tests required in s. NR 660.09 (1) (g) and the number of samples necessary to obtain representative results. All proposed testing shall

meet or exceed the requirements of the national sanitation foundation standard 54 for flexible membrane liners. The definitions of terms or words in section 2 of the national sanitation foundation standard 54 for flexible membrane liners shall apply to terms or words used in this subdivision where a dictionary definition does not exist or is not applicable. The description of the proposed testing program shall include:

a. Liner compatibility including:

- 1) The effect of soil pH.
- 2) The effect of chemical contaminants within the soil.
- 3) Short-term testing to evaluate the ability of the liners to contain the waste and waste leachate.
- 4) Long-term testing including samples of the delivered liner and actual field constructed seams.

b. Susceptibility to attack by bacteria and fungi.

c. Physical suitability including:

- 1) Tear resistance.
- 2) Puncture resistance.
- 3) Creep resistance.
- 4) Elongation potential.
5. Membrane thickness.

Note: The publication containing these standards may be obtained from:

National Sanitation Foundation
P.O. Box 1468
Ann Arbor, Michigan 48106

The publication containing these standards is available for inspection at the offices of the department, the secretary of state and revisor of statutes.

3. A description of the proposed testing program for the secondary liner shall be submitted which outlines the proposed procedures for performing the tests required in s. NR 660.09 (1) (h) and describes the number of samples necessary to obtain representative results. The description of the proposed testing program shall include:

a. For short and long-term permeability testing, the:

- 1) Types of permeant;
- 2) Proposed pressure gradients;
- 3) Number of pore volumes to be passed through the samples;
- 4) Chemical analysis of the influent through time; and
- 5) Chemical analysis and volume measurements of effluent being discharged through time.

b. A description of the physical testing program of the samples before and after permeability testing to meet the requirements of s. NR 660.09 (1) (h) 2.

(f) *Appendix.* Show the site boundaries on all maps included in the appendix. In the appendix include:

1. All new data such as boring logs, soil tests, well construction data, water level measurements and test data and results.

2. A plat map of the area.

3. A USGS quadrangle of the area, updated with locations of applicable wells installed after preparation of the quadrangle.

4. A soil conservation service soil map and interpretation, if available.

5. References.

History: Cr. Register, February, 1991, No. 422, eff. 3-1-91.

NR 660.09 Feasibility report. (1) Unless specifically exempted in s. NR 660.04, no person may establish or construct a hazardous waste landfill or surface impoundment, expand an existing facility or be issued an initial operating license under s. NR 680.32 without first obtaining approval of a feasibility report describing the physical conditions of the proposed facility and subsequently obtaining approval of a plan of operation from the department. The purpose of the feasibility report is to determine whether the facility has potential for use as a hazardous waste landfill or surface impoundment and to identify any conditions which the applicant is required to include in the plan of operation. The feasibility report shall be submitted in accordance with s. 144.44, Stats., and ss. NR 680.05 and 680.06.

(a) All information specified in s. NR 660.08 (2) shall be submitted.

1. If an initial site report has been submitted, the applicant shall include all pertinent information contained in the feasibility report.

2. If an initial site report has been reviewed by the department, additional information addressing all department review comments shall be included.

(b) The applicant shall prepare an existing site condition topographic plan which shall contain a detailed topographic survey of the facility area and all area within a distance of 1500 feet of the facility. The minimum scale of this plan shall be one inch = 200 feet with a maximum 2-foot contour interval. The contour interval shall be sufficient to clearly show the pattern of surface water flow in the vicinity of and from each operating unit of the facility. All elevations shall be related to USGS data. More than one plan sheet shall be prepared to show the required information if one sheet is too detailed to be clear. The plan or plans shall clearly show:

1. 100-year floodplain area.

2. Surface waters, including intermittent streams.

3. Homes, buildings, man-made features and utility lines.

4. Surrounding land uses, such as residential, commercial, agricultural and recreational.

5. Property boundaries, facility or waste management boundaries and fill areas, including any previous fill area.

6. Access control, such as fences and gates.
7. Water supply wells and any other wells, such as irrigation wells.
8. Well boring locations and observation well locations.
9. A wind rose, which show prevailing wind speed and direction.
10. Buildings, treatment, storage or disposal operations; or other structures such as recreation areas, runoff control systems, access and internal roads, storm, sanitary and process sewerage systems, loading and unloading areas and fire control facilities.
11. Barriers for drainage or flood control.
12. Location of operational units within the facility where hazardous waste is or will be treated, stored or disposed of, including equipment cleanup areas.

(c) Field and laboratory investigations shall be performed to further define site physical characteristics including soils, bedrock and groundwater. These investigations shall include:

1. Sufficient soil borings to adequately define the soil and bedrock conditions at the site. At a minimum, 5 soil borings for the first 5 acres and 3 borings for each additional 5 acres or portion thereof shall be performed. The borings shall be located in a grid pattern to provide at least one boring in each major geomorphic feature, such as ridges, lowlands and drainage swales. All borings shall extend at least 30 feet below the anticipated facility base grade or to bedrock, unless the depth to bedrock is 100 feet or more below the facility base grade.

2. Soil samples shall be collected utilizing standard undisturbed soil sampling techniques. Samples may not be composited for testing purposes. Soil samples shall be collected on a continuous basis from the ground surface to at least 30 feet below the anticipated base of the facility. After that point, soil samples shall be collected from each soil layer encountered and at maximum 5-foot intervals. All soil and bedrock samples shall be described and retained until the department issues a feasibility determination. Representative samples of all major soil units and bedrock formations shall be retained until the department issues an operating license for the facility.

3. Boring logs accurately recording soil and bedrock conditions encountered at the site shall be submitted for all borings. Each log shall include soil and rock descriptions, method of sampling, sample depth, date of boring, water level measurements and dates, and soil test data. All elevations shall be corrected to USGS data.

4. For each significant soil layer encountered, at least 3 soil samples shall be analyzed for grain size distribution, either mechanically or hydrometrically as appropriate to the soil type, and classified according to the unified soil classification system.

5. At least 3 laboratory permeability tests shall be conducted for each significant soil layer above and below the water table. Single well response tests shall be performed on all on-site wells.

6. Estimates and, when necessary, field and laboratory tests shall be provided for porosity, effective porosity, transmissivity, storage capacity.

ity, secondary permeability, diffusion coefficient and dispersion coefficients, cation exchange capacity, soil buffering capacity and any other physical or chemical soil characteristics that may be necessary to assess the environmental feasibility of the site.

7. Soil borings within the unconsolidated material shall be converted to water table observation wells and well nests in accordance with the following a schedule:

a. At least five water table observation wells and 3 well nests for the first 5 acres or portion thereof.

b. At least three water table observation wells and one well nest for each additional 5 acres or portion thereof.

8. Soil borings to the competent bedrock surface shall be converted to piezometers in accordance with the following schedule:

a. At least three piezometers for the first 5 acres or portion thereof.

b. At least one piezometer for each additional 10 acres or portion thereof.

9. Well construction information shall include the elevations of the ground surface, top and bottom elevation of well pipe, the bottom of the boring, and well seals; length of screened interval; diameter of boring; a description of well construction and backfill materials and boring logs as specified in subd. 3. Observation wells which may be used as monitoring wells shall meet the requirements specified in s. NR 635.12 (1) to (12) for monitoring wells shall be met.

10. Upon completion, each well shall be properly developed. At least 3 rounds of chemical testing for field conductivity, adjusted to 25°C, field pH, COD and TOC shall be performed to help determine if all the wells are properly developed. Additional development and chemical testing shall be performed as needed until all wells are chemically stabilized and produce representative samples of groundwater quality.

11. Once developed, all wells shall be pumped and successive water level measurements shall be made until stabilized readings are obtained.

12. Where public or private wells are present within one half mile of the proposed site, the groundwater aquifer shall be evaluated based on well logs, well construction reports and available pump test results, along with details on well location, ownership and well driller. The department may require the owner or operator to attempt to obtain stabilized water level readings from these wells.

13. The department may require the owner or operator to attempt to sample all public or private wells within one half mile of the proposed site and analyze for the parameters and characteristics specified in ch. NR 635.

(d) Data shall be presented as follows:

1. All raw data such as boring logs, well logs, well construction diagrams, soil tests, permeability tests and calculations, water quality and water level measurements shall be included in the report appendix.

2. A series of geologic cross-sections passing through all borings shall illustrate existing topography, soil borings, soil classification and other

properties, interpreted soil stratigraphy, bedrock, well construction and stabilized water level readings for each well.

3. At least 2 water table contour maps representing yearly high and low water table conditions shall be constructed based on stabilized water level readings. The existing site conditions plan shall be used as a base for this map. Seasonal changes in groundwater levels shall be recorded by measuring water levels in all on-site wells at least monthly from the time the initial wells are installed.

4. Groundwater flow net sections shall be prepared to illustrate horizontal and vertical flow directions. This information shall be illustrated on geologic sections.

(e) The anticipated types, amounts and characteristics of the hazardous and solid waste to be disposed at the site shall be described and evaluated with respect to design, operation, and to impacts on the air, surface water and groundwater quality. Chemical and physical tests shall be done on representative waste samples and on representative or simulated leachate samples using approved procedures. All testing shall be documented.

(f) A water balance shall be prepared for the periods of time before construction, during active operations and after site closure. Factors to be considered in preparation of the water balance are precipitation, evapotranspiration, infiltration, runoff, soil and waste moisture holding capacity, the physical and chemical characteristics of the waste, surface water and groundwater conditions, and proposed design concepts. The water balance analysis shall address leachate generation rates and the effect of the site on surface water and groundwater levels, quantity and quality for worst, average and best case conditions.

(g) The items set forth in subd. 1 to 11 shall be evaluated and discussed in accordance with procedures outlined in the national sanitation foundation standard 54 for flexible membrane liners or as otherwise approved in writing by the department to justify the type of primary liner being proposed. The definitions of terms or words in section 2 of the national sanitation foundation standard 54 for flexible membrane liners applies to terms or words used in this paragraph where a dictionary definition does not exist or is not applicable. The items which shall be evaluated and discussed include but are not limited to the following:

1. A complete description of the proposed liner material including:
 - a. Manufacturers name, address and telephone number.
 - b. Thermal properties.
 - c. Chemical resistance including the results of all waste compatibility studies.
 - d. Material formulation including additives such as:
 - 1) Antioxidants.
 - 2) Antistatic agents.
 - 3) Colorants.
 - 4) Fillers such as extenders, carriers and reinforcing agents.

- 5) Fibers.
- 6) Lubricants.
- 7) Plasticizers.
- 8) Stabilizers.
- e. Sheet size as delivered.

2. An evaluation of the compatibility of the primary liner with the existing and projected environment. This testing shall determine if the on-site soils, imported soils, waste and waste leachate are compatible with the proposed liner so that the liner does not fail before its estimated service life is reached. This testing shall include:

- a. A determination of the organic content of the underlying soils and plans for removing them from subgrade.

- b. The effect of soil pH on the proposed liner.

- c. Liner compatibility and tolerance to chemical contaminants within the soil.

- d. Short-term compatibility testing to evaluate the liner's ability to contain the waste and waste leachate.

- e. Long-term compatibility testing including samples of the as-delivered liner material and actual samples of field constructed seams.

3. The liner's susceptibility to attack by micro-organisms and macro-organisms shall be evaluated and shall include:

- a. The liner's resistance to bacteria and fungi.

- b. A general discussion on:

- 1) The proposed method for preventing vegetation from growing through the membrane liner.

- 2) The proposed method for eliminating attack by insects, rodents and burrowing animals.

- 3) How the liner will be protected from puncture by hoofed animals.

4. The physical suitability of the liner shall be determined by securing representative samples of the fabricated liner and from samples used for compatibility testing. Testing shall be undertaken to determine the following properties:

- a. Tear resistance.

- b. Puncture resistance.

- c. Creep resistance.

- d. Elongation potential.

- e. Membrane thickness.

5. Discussion of the following areas:

- a. Material properties of the proposed liner including:

- 1) Workability of the liner.
 - 2) Repairability of the liner.
 - 3) Ability to withstand objects falling directly on the liner.
 - b. The type of factory and field seams to be utilized.
 - c. The type of seam testing to be performed including:
 - 1) Non-destructive.
 - 2) Destructive.
 - d. Bedding and drainage material to protect the liner from:
 - 1) Vehicular traffic; and
 - 2) Objects driven through the drainage layer.
 - e. Proposed anchoring details to ensure liner stability.
6. A description of the constraints and limitations on working conditions under which the liner may be installed including:
- a. Maximum and minimum temperature ranges.
 - b. Humidity.
 - c. Rainfall.
 - d. Direct sunlight.
7. The potential for gas generation beneath the liner shall be evaluated and a system for venting gas shall be proposed if necessary.
8. The potential for frost heaving and subsequent damage to the liner or subgrade shall be evaluated.
9. A description of where the liner will be stored prior to construction and an estimate on the length of time storage may take place.
10. Details shall be provided on the methods to be used for joining the liner to concrete structures or pipes, if penetrations of the liner are proposed.
11. Detailed information concerning quality control and quality assurance of the liner material, factory and field seaming and construction operations related to the integrity of the liner system is required. The minimum information shall include:
- a. Persons or organizations responsible for liner manufacturing, delivery, storage, installation and testing shall be identified.
 - b. The tests utilized in the quality control and quality assurance program shall be detailed. The number and location of the tests shall be indicated.

Note: The publication containing these standards may be obtained from:

National Sanitation Foundation
P.O. Box 1468
Ann Arbor, MI 48106

The publication containing these standards is available for inspection at the offices of the department, the secretary of state and the revisor of statutes.

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(h) The following tests shall be performed in accordance with procedures approved in writing by the department, to document that the secondary liner is compatible with the expected or actual leachate:

1. Short and long term tests to determine:

a. The saturated variable head permeability of the clay samples with both distilled water and leachate.

b. Chemical analysis of the permeants over the duration of the test.

c. Chemical analysis and volume measurements of the effluent being discharged over the duration of the test.

2. Physical testing of the clay samples before and after permeability testing including:

a. Particle size, as specified in ASTM standard D-422-63 (1972).

b. Particle size for material finer than number 200 sieve, as specified in ASTM standard D-1140-54 (1971).

c. Liquid limit, as specified in ASTM standard D-423-66 (1972).

d. Plasticity index, as specified in ASTM standard D-424-59 (1971).

Note: The publications containing these standards may be obtained from:

American Society for Testing and Materials
1916 Race Street
Philadelphia, PA 19103

The publications containing these standards are available for inspection at the offices of the department, the secretary of state and the revisor of statutes.

(i) The topographic map required under par. (b) shall include a delineation of the waste boundary, the property boundary, the proposed "point of standards application" as specified in ch. NR 635, the proposed location of groundwater monitoring wells as required under ch. NR 635, and, to the extent possible, the information required in s. NR 660.08 (2) (b) 4.

(j) If the presence of hazardous constituents has not been detected in the groundwater at the time of the feasibility report is submitted, the owner or operator shall submit sufficient information, supporting data, and analysis to establish a detection monitoring program which meets the requirements of ss. NR 635.05 to 635.15. This submission shall address the following items specified under ss. NR 635.05 to 635.15:

1. A proposed list of indicator parameters, waste constituents or reaction products that can provide a reliable indication of the presence of hazardous constituents in the groundwater;

2. A proposed groundwater monitoring system;

3. Background values for each proposed monitoring parameter or constituent, or procedures to calculate the values; and

4. A description of proposed sampling, analysis and statistical comparison procedures to be utilized in evaluating groundwater monitoring data.

(k) If the presence of hazardous constituents has been detected in the groundwater at the point of standards application at the time feasibility

report is submitted the owner or operator shall submit sufficient information, supporting data, and analyses to establish a compliance monitoring program which meets the requirements of ss. NR 635.06 to 635.15. Except as provided in s. NR 635.13 (9), the owner or operator shall also submit an engineering feasibility plan for a corrective action program necessary to meet the requirements of s. NR 635.15, unless the owner or operator obtains written authorization in advance from the department to submit a proposed license schedule for submittal of the plan. To demonstrate compliance with s. NR 635.13, the owner or operator shall include the following information:

1. A description of the wastes previously handled at the facility;
2. A characterization of the contaminated groundwater, including concentrations of hazardous constituents;
3. A list of hazardous constituents for which compliance monitoring shall be undertaken in accordance with ss. NR 635.09 and 635.12;
4. Proposed concentration limits for each hazardous constituent, based on the criteria in s. NR 635.06, including a justification for establishing any alternate concentration limits;
5. Detailed plans and an engineering report describing the proposed groundwater monitoring system in accordance with the requirements of s. NR 635.09; and
6. A description of proposed sampling, analysis and statistical comparison procedure to be utilized in evaluating groundwater monitoring data.

(1) If hazardous constituents have been measured in the groundwater which exceed the concentration limits established under table I in s. NR 635.09, or if groundwater monitoring conducted at the time of feasibility report submittal under s. NR 635.14 at the waste boundary indicates the presence of hazardous constituents from the facility in groundwater over background concentrations, the owner or operator shall submit sufficient information, supporting data and analyses to establish a corrective action program which meets the requirements of s. NR 635.12. An owner or operator is not required to submit information to establish a corrective action program if the owner or operator demonstrates to the department that alternate concentration limits will protect human health and the environment after considering the criteria listed in s. NR 635.08 (2). Instead, the owner or operator shall submit sufficient information to establish a compliance monitoring program which meets the requirements of s. NR 635.12. To demonstrate compliance with s. NR 635.12, the owner or operator shall address the following items:

1. A characterization of the contaminated groundwater, including concentrations of hazardous constituents;
2. The concentration limit for each hazardous constituent found in the groundwater as in s. NR 635.09;
3. Detailed plans and an engineering report describing the corrective action to be taken; and
4. A description of how the groundwater monitoring program will demonstrate the adequacy of the corrective action.

5. The feasibility determination may contain a schedule for submittal of the information required in subds. 3. and 4., if the owner or operator obtains written authorization from the department prior to a final decision on the feasibility of the project.

(m) Recommendations on design constraints for development of the site, shall be made and reasons given for the recommendations. This shall include a discussion of the potential for the site to meet locational requirements in s. NR 660.06. Particular attention shall be given to assessing the results of the compatibility testing on the primary and secondary liners. For expansion of existing facilities, the report shall include sufficient information to assess the effectiveness of the existing facility design and operation in protecting air, surface water and groundwater quality.

(n) Based on the conclusions resulting from site analysis, a proposed site design shall be prepared. This shall consist of preliminary engineering plans and a general discussion of proposed operating procedures. This section of the report shall include the following information:

1. A plan sheet showing proposed access, lateral extent of filling, and phases of site development. The existing site conditions map shall be utilized as a base for this sheet.

2. A series of north-south and east-west cross-sections showing present topography, proposed base grades and final grades. This information shall be displayed on the geological sections.

3. Preliminary cover balance calculations.

4. Proposed methods for leachate and gas control including collection, containment and treatment. Preliminary agreements with wastewater treatment plants shall be included when applicable.

5. Proposed operating procedures including method of site development, method of access control, control of surface water, screening, covering frequency as applicable and other special design features.

6. Evaluation of proposed facility location and operation in terms of environmental soundness, safety and potential for accidental spills and other failures of environmental concern.

7. Detailed plans and an engineering report describing the proposed groundwater monitoring program to be implemented to meet the requirements of ch. NR 635.

8. Proposed groundwater, leachate, surface water, gas, air, unsaturated zone and other monitoring.

9. Proposed contingency plan and method of correcting accidents or potential failures of the proposed facility that may affect air, surface water and groundwater quality.

10. Proposed closure sequence.

11. Proposed final use.

12. Proposed method of demonstrating financial responsibility and long-term care requirements.

(o) To aid in completing an environmental assessment and in determining the need for an environmental impact report or environmental

impact statement, the feasibility report shall include a brief discussion of the following:

1. The purpose and need for the proposed project and for the recommended site.
2. The probable adverse and beneficial physical, biological, social, economic and other impacts of proposed site development.
3. The probable adverse impacts of site development that cannot be avoided.
4. The irreversible or irretrievable commitments of resources if the site is developed as proposed.
5. The alternatives to the proposed site development and alternate methods of waste disposal or recycling.
6. The direct, indirect and cumulative effects of the proposed site development.
7. Estimated construction, operation and long-term care costs for the entire project.

(p) An environmental impact statement is required under s. 1.11 (2), Stats., for a new hazardous waste disposal facility if any of the following conditions exist:

1. The total area committed to solid and hazardous waste disposal exceeds 80 acres.
2. The total volume of solid and hazardous waste intended for disposal under the plan of operation exceeds one million cubic yards.

(2) Within 60 days after a feasibility report is submitted, the department shall either determine that the report is complete or notify the applicant in writing that the report is not complete, specifying the information which the applicant shall submit before the report is deemed complete. The department shall determine whether or not the feasibility report is complete by determining whether or not the minimum requirements of this section have been met. Additional feasibility information may be required of the applicant after a determination that the feasibility report is complete only if the department establishes that a detailed review of the feasibility report indicates that site feasibility cannot be determined in the absence of additional information.

(3) If no hearing has been conducted under s. 144.44, Stats., the department shall issue the final determination of feasibility within 60 days after the 45 day notice period required under s. 144.44 (2) (1) and (m), Stats., has expired. If an informational hearing is conducted under s. 144.44 (2g), Stats., the department shall issue a final determination of feasibility within 60 days after the hearing is adjourned. If a contested case hearing is conducted under s. 144.44 (2r), Stats., a final determination of feasibility shall be issued within 90 days after the hearing is adjourned.

History: Cr. Register, February, 1991, No. 422, eff. 3-1-91.

NR 660.10 Plan of operation. (1) GENERAL. Unless specifically exempted in s. NR 660.04, no person may establish or construct a hazardous waste landfill or surface impoundment, expand an existing site or

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facility, or be issued an initial operating license under s. NR 680.32 until a plan of operation has been submitted in accordance with ss. NR 680.05 and 680.06 and s. 144.44, Stats., and approved in writing by the department. No person may establish, construct, operate, maintain, close, provide long-term care for or terminate a hazardous waste landfill or surface impoundment except in accordance with this section and with the approved plan of operation. Only persons who have obtained a favorable determination of site feasibility from the department may submit a plan of operation for review and approval.

(2) **CONTENT.** All plans of operation for hazardous waste landfills or surface impoundments shall contain complete plans and specifications necessary for the construction, operation, monitoring, closing, long-term care and termination of the project and any additional information the department may require for the analysis of environmental impacts of the project. This information shall be presented in a manner that is clear and understandable. The plan of operation shall contain the following information:

Note: The information is to be presented in a clear manner because these documents are to be used for the day-to-day operation of the site.

(a) Engineering plans consisting of the following:

1. A title sheet indicating the project title, the person who prepared the plans, the person for whom the plans were prepared, a table of contents and a location map showing the location of the site and if applicable the area to be served.

2. An existing conditions plan sheet indicating site conditions prior to development. The details and extent of coverage shall be the same as that required for the existing site conditions map in s. NR 660.09 (1) (b).

3. A base grade plan sheet indicating site base grades or the appearance of the site if it were excavated in its entirety to the base elevation, before installation of any engineering modifications or the beginning of any filling.

4. An engineering modifications plan sheet indicating the appearance of the site after installation of the secondary liner. More than one plan sheet may be required for complicated sites.

5. A fabrication plan sheet indicating how each panel of the primary liner shall be located and installed. The panels shall be numbered in the order they shall be installed. All side slope seams shall run from top to bottom of the slope, the full length of the slope.

6. A final site topography plan sheet indicating the appearance of the site at closing including the details necessary to prepare the site for long-term care.

7. A series of phasing plan sheets showing the progression of site development through time. A separate plan shall be provided for initial site preparations and for each subsequent major phase or new area where substantial site preparation shall be performed. Each plan shall include a list of construction items and quantities necessary to prepare the phase indicated.

8. A site monitoring plan sheet showing the location of all devices for the monitoring of the unsaturated zone, leachate production, ground-

water quality, surface water quality, and gas production and venting. This plan shall include a table indicating the parameters to be monitored and the frequency of monitoring before, during and after site development.

9. A long-term care plan sheet showing the site at the completion of closing and indicating those items anticipated to be performed during the period of long-term care for the site. The plan shall include a table listing the items and the anticipated schedule for monitoring and maintenance. This information may be presented on the final site topography sheet.

10. The following information shall be presented on the plan sheets:

a. All information required under s. NR 660.09 (1) (b) for the existing site conditions map unless including this information leads to confusion with the data intended for display, except that existing site topography shall be sketched lightly or otherwise indicated on the plan sheets required in subds. 3. to 7.

b. A survey grid, referenced to the state plane coordinate system, with base lines and monuments to be used for field control.

c. Limits of filling for each major or special waste type or fill area.

d. All drainage patterns and surface water drainage control structures within the actual fill area and at the site perimeter. Structures may include berms, ditches, sedimentation basins, pumps, sumps, culverts, pipes, inlets, velocity breaks, sodding, erosion matting or other methods of erosion control.

e. The direction and sequence of filling within each phase.

f. Ground surface contours at the time represented by the drawing. Spot elevations shall be indicated for key features.

g. Areas to be cleared, grubbed and stripped of topsoil.

h. Borrow areas for liner materials, gas venting materials, berms, roadway construction and cover materials.

i. All soil stockpiles including cover materials, topsoil, liner materials, gas venting materials and other excavation.

j. Access roads and traffic flow patterns to and within the active fill area.

k. All temporary and permanent fencing.

l. The methods of screening such as berms, vegetation or special fencing.

m. Leachate collection, control and treatment systems which may include pipes, manholes, trenches, berms, collection sumps or basins, pumps, risers, lines and liner splices. Invert elevations shall be provided as often as necessary to allow for proper construction of these systems.

n. Gas, leachate and groundwater monitoring devices and detection systems.

o. Severe weather operation plans.

- p. Support buildings, scale, utilities, gates and signs.
- q. Special waste handling areas.
- r. Construction notes and references to details.
- s. Other appropriate site features.

11. A series of site cross-sections shall be drawn perpendicular and parallel to the site base line through each major phase and at points of grade break and important construction features. The location of the cross-sections shall be shown on the appropriate plan sheet and the sections labeled using the site grid system. Each cross-section shall show existing and proposed base and final grades; soil borings and monitoring wells which the section passes through or is adjacent to; soil types, bedrock and water table; leachate control, collection and monitoring systems; gas venting and monitoring systems; limits of filling for each major or special waste type; drainage control structures; access roads and ramps on the site perimeter and within the active fill area; the filling sequence or phases; and other appropriate site features.

12. Detailed drawings and typical sections, as appropriate, for drainage control structures, access roads, fencing, leachate and gas control systems and monitoring devices, final cover design, buildings and other construction details.

(b) An operations manual consisting of the following information:

1. The manual shall identify the project title; engineering consultant; site owner, licensee and operator; proposed licensed acreage; site life and design capacity; municipalities, industries and collection and transportation agencies served; waste types and quantities to be disposed; and any exemptions applied for.

2. Specifications for site construction and operation shall be presented, including detailed instructions to the site operator and any contractors for all aspects of site construction and operation. References to specifications on the plan sheets and any additional instructions included, where appropriate. The specifications shall include, as applicable, the following information:

a. Initial site preparations including specifications for clearing and grubbing, topsoil stripping, other excavations, berm construction, drainage control structures, access roads and entrance, screening, fencing and other special design features.

b. A plan for initial site preparations including a discussion of the field measurements, photographs to be taken and sampling and testing procedures to be utilized to verify that the infield conditions encountered were the same as those contained in the feasibility report.

c. A proposed testing schedule to document that the secondary liner and the compacted clay portion of the final cover are constructed in accordance with the requirements of ss. NR 660.13 (10) (d) and 660.16 (1) (e) respectively. This program shall include testing to document the following:

- 1) Thickness, both overall and of each lift.
- 2) Undisturbed saturated variable head permeability.

3) Dry density, as specified in ASTM standards D-1556-82, D-2922-81 and D-2937-71 (1976).

4) Moisture-unit weight relations, as specified in ASTM standards D-698-78 or D-1557-78.

5) Moisture content, as specified in ASTM standard D-2216-80.

6) Liquid limit, as specified in ASTM standard D-423-66 (1972).

7) Plasticity index, as specified in ASTM standard D-424-59 (1971).

8) Particle size, as specified in ASTM standard D-422-63 (1972).

9) For the secondary liner, particle size for material finer than 200 sieve, as specified in ASTM standard D-1140-54 (1971).

Note: The publications containing these standards may be obtained from:

American Society for Testing and Materials
1916 Race Street
Philadelphia, PA 19103

The publications containing these standards are available for inspection at the offices of the department, the secretary of state and the revisor of statutes.

d. A proposed testing and inspection program to document that the primary liner has been constructed in accordance with the requirements of s. NR 660.13 (10) and the feasibility approval. All necessary testing shall meet or exceed the requirements of the national sanitation foundation standard 54 for flexible membrane liners. The definition of terms or words in section 2 of the national sanitation foundation standard 54 for flexible membrane liners shall apply to terms or words used in this subdivision where a dictionary definition does not exist or is not applicable. A proposal for documenting the following items shall be included:

1) Type of membrane.

2) Membrane thickness, both as delivered and as installed.

3) Testing to ensure the "as-delivered" membrane is the same material tested during the feasibility study.

4) Identification of the fabricator's role during membrane installation.

5) Methods for field inspection and testing of all joints, factory seams, field seams and mechanical seals.

6) Identification of the person or persons responsible for performing the inspections and a listing of their qualifications.

7) Location and number of tests necessary to document factory seam strength.

8) Location and number of tests necessary to document field seam strength.

9) All repairs made to the liner.

Note: The publication containing these standards may be obtained from:

National Sanitation Foundation
P.O. Box 1468
Ann Arbor, MI 48106

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The publication containing these standards is available for inspection at the offices of the department, the secretary of state and the revisor of statutes.

e. A proposed testing program for the drainage layers above the primary and secondary liners and in the final cap to document the following:

- 1) Thickness.
- 2) Saturated variable or constant head permeability.
- 3) Particle size, as specified in ASTM standard D-422-63 (1972).
- 4) Density, as specified in ASTM standards D-1556-82, D-1922-81 and D-2937-71 (1976).

Note: The publications containing these standards may be obtained from:

American Society for Testing and Materials
1916 Race Street
Philadelphia, PA 19103

The publications containing these standards are available for inspection at the offices of the department, the secretary of state and the revisor of statutes.

f. A proposal for groundwater, surface water, gas, unsaturated zone and leachate monitoring. In addition to the requirements of ch. NR 635, the proposal for groundwater, unsaturated zone and leachate monitoring shall be based on the results from the liner compatibility testing.

g. Daily operations including, as appropriate, a discussion of the timetable for development, waste types accepted or excluded, typical waste handling techniques, hours of operation, traffic routing, drainage and erosion control, windy, wet and cold weather operations, fire protection equipment, manpower, methods for handling of unusual waste types and incompatible waste, methods for vector, dust and odor control, daily clean-up, direction of filling, recordkeeping, parking for visitors and employees, monitoring, abandonment of filled areas, gas and leachate control methods, methods for managing leachate which is collected, backup equipment with names and telephone numbers where equipment may be obtained and other special design features. This may be developed as a removable section to improve accessibility for the site operator.

h. Development of subsequent phases consisting of a discussion of those items in subpars. a. to e. and g. as related to the development of subsequent phases of the site.

i. Site closing information consisting of a discussion of the anticipated sequence of events for site closing to meet the requirements of s. NR 660.15 or 660.16 and a discussion of those actions necessary to prepare the site for long-term care and final use including the type and amount of hazardous waste and hazardous waste constituents in the landfill or surface impoundment; the mobility and expected rate of migration of the hazardous waste and hazardous waste constituents; site location, topography, and surrounding land use, with respect to the potential effects of pollutant migration, such as proximity to groundwater, surface water and drinking water sources; climate, including amount, frequency, and pH of precipitation; characteristics of the cover including material, final surface contours, thickness, porosity and permeability, slope, length of run of slope and type of vegetation on the cover; and geological and soil profiles and surface and subsurface hydrology of the site.

j. Long-term care information including a discussion of the procedures to be utilized for the inspection and maintenance of run-off control structures, settlement, erosion damage, gas and leachate control feasibilities, monitoring for gas, leachate and groundwater, and other long-term care measures as required by s. NR 660.17 and the factors specified in s. NR 660.08.

k. An economic analysis including an engineer's cost estimate for the construction of each major phase of site development and daily operation, site closing and long-term care.

3. A description of how the requirements of s. NR 660.13 shall be met.

(c) A design report shall be submitted which shall include supplemental discussions and design calculations to facilitate department review and provide supplemental information on financial responsibility for closure and long-term care under ss. 144.44 and 144.441, Stats., including the following information:

1. A closure plan under ss. NR 685.05 and 660.15 or 660.16, whichever is appropriate.

2. A long-term care plan as required by ss. NR 685.06 and 660.17.

3. A discussion of the reasons for the design of the major features of the site or facility as appropriate, such as traffic routing, base grade and relationships to subsurface conditions, anticipated waste types and characteristics, phases of development, liner design, facility monitoring and similar design features, including a list of the conditions of site development as stated in the department determination of the feasibility and the measures taken to meet the conditions, shall be included. A discussion of all calculations, cover balance computations, stockpile sizing estimates, estimate of site life and surface water run-off and leachate volume estimates shall be included. The calculations shall be summarized with the detailed equations presented in the appendix.

4. A detailed analysis in accordance with s. NR 685.07 shall be made of the financial responsibility for closure and long-term care from the time of site or facility closing to termination.

(d) A contingency plan as specified in ss. NR 630.21 and 630.22 (1) and (2).

(e) An appendix shall be submitted which shall include any additional data not previously presented, calculations, material specifications, operating agreements, leachate treatment agreements, documents related to long-term care funding and other appropriate information.

(3) **COMPLETENESS.** Within 30 days after a plan of operation is submitted, the department shall notify the applicant in writing that the plan is either complete or not complete, specifying the information which shall be submitted before the report is deemed complete. The department shall determine if the plan of operation is complete by determining whether or not the minimum requirements of this section have been met. Additional plan of operation information may be required of the applicant after a determination that the plan of operation is complete only if the department establishes that a detailed review of the plan of operation indicates that the plan of operation is insufficient in the absence of additional information.

(4) **APPROVAL OR DISAPPROVAL OF PLAN OF OPERATION.** The department may not approve or disapprove a plan of operation until a favorable determination of feasibility has been issued for the facility. Upon submission of a complete plan of operation, the department shall either approve or disapprove the plan in writing within 90 days or within 60 days after a favorable determination of feasibility is issued for the facility, whichever is later.

History: Cr. Register, February, 1991, No. 422, eff. 3-1-91.

NR 660.11 Construction documentation. (1) The construction of all landfills and surface impoundments for the disposal, treatment or storage of hazardous waste shall be documented by a registered professional engineer. The engineer shall also render an opinion, based on testing results and actual field inspection, on whether the facility has been constructed in substantial conformity with the plan of operation. A construction documentation report verifying and documenting all aspects of facility construction shall be prepared following the construction of each major area. The department shall review and approve, deny or deem incomplete the request for approval of construction documentation within 65 business days after receiving the request. Operation of the facility may not commence until the construction documentation report is approved by the department, and, if necessary, a license to operate the facility has been issued by the department. The reports shall include the following information:

(a) Plan sheets documenting: the location of the leachate collection trenches, all groundwater, gas, resistivity unsaturated zone and leachate monitoring devices, the sub-base and base grade elevations of the primary liner, secondary liners and drainage liners including spot elevations, the location and types of testing performed at a given location and the location of culverts, drainage ditches, manholes, dikes, stockpiles, access roads, and any other pertinent information. In addition, invert elevations shall be provided on all leachate collection pipes, cleanouts, manholes and culverts.

(b) Engineering and geologic cross-sections shall be prepared to document the construction work. These drawings shall consist of cross-sections every 100 feet perpendicular to the leachate collection lines and along the centerline of the pipes. Data to be presented on the cross-sections shall include: existing topography, soil borings, soil classification under the unified soil classification system, soil stratigraphy based on field documentation, well construction details, water level readings, the location and invert elevations of the leachate collection system, extraction points, cleanouts and any other information as appropriate.

(c) A comprehensive narrative explaining how construction of the project was accomplished along with an analysis of the data provided. This report shall also include an appendix containing all the raw data from soil testing work.

(d) A series of 35mm slides or color prints documenting all major aspects of facility construction.

(e) A letter under the seal of a registered professional engineer which certifies whether the facility has been constructed in substantial compliance with the approved plans. Any deviations from the approved plans shall be noted.

(2) A construction documentation report shall be prepared following closure of each major sequence of operation. The reports shall contain the following information:

(a) A plan sheet or sheets showing: the portions of the facility which were properly closed, the final grades of those areas with spot elevations as necessary and the location of grassed waterways, drainage ditches, gas vents, leachate head wells and other information as appropriate.

(b) A minimum of 2 cross-sections, one north-south and one east-west through the closed portion every 100 linear feet.

(c) All raw data from the soil testing performed along with a narrative analyzing the results.

(d) A series of 35mm slides or color prints documenting proper closure of the sequence.

(e) A letter under the seal of a registered professional engineer certifying that the final cap was placed and documented in substantial compliance with the approved plans. Any deviations from the approved plans shall be noted.

History: Cr. Register, February, 1991, No. 422, eff. 3-1-91.

NR 660.12 Recording of notice. (1) Prior to licensing, the owner or operator shall submit proof that a notation of the existence of the site has been recorded for the property on which the facility is located, in the office of the register of deeds in each county in which a portion of the facility is located, that shall in perpetuity notify any potential purchaser of the property that:

(a) The land has or will be used to dispose of, treat or store hazardous waste; and

(b) Its use is restricted under s. NR 685.06 (3).

History: Cr. Register, February, 1991, No. 422, eff. 3-1-91.

NR 660.13 Minimum design and operational requirements. (1) Unless specifically exempted in s. NR 660.04, no person may operate or maintain a new or existing landfill or surface impoundment except in conformity with the approved plan of operation and the minimum requirements of this section, in addition to the applicable general facility standards in ch. NR 630.

(2) (a) Only waste types and sources listed on the license or contained in the plan of operation approval may be accepted. Any new waste stream shall be properly characterized and tested for compatibility with both the primary and secondary liners. An evaluation shall also be made to determine what effects, if any, the additional waste would have on leachate treatability. The results of these studies shall be submitted to the department in writing. If the department determines that the waste is compatible with the design of the site, written approval shall be given for acceptance of the waste. Additional conditions of approval may be specified.

(b) The owner or operator of each landfill or surface impoundment with an interim license shall notify the department at least 60 days prior to receiving waste into each new unit, replacement of an existing unit or lateral expansion of an existing unit. The owner or operator of each facil-

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ity submitting notice shall submit a feasibility report and plan of operation under ss. NR 660.09 and 660.10 within 6 months of submitting the notice to receive waste.

(3) In addition to the provisions in ch. NR 675, the following wastes may not be placed in a landfill or a surface impoundment:

(a) Ignitable waste (D001), corrosive waste (D002) or reactive waste (D003) that meet the criteria in s. NR 605.08 (1) to (4).

(b) The following wastes listed in s. NR 605.09(2)(a), table II: F001, F002, F003, F004, F005, F024, F500, K001, K009, K010, K015, K016, K017, K018, K019, K020, K021, K028, K029, K030, K032, K033, K034, K042, K073, K085, K095, K096, K097, K098 or K105.

(c) The following wastes listed in s. NR 605.09(2)(a), table II, unless the owner or operator can demonstrate that the wastes do not exhibit the characteristic of reactivity as specified in s. NR 605.08 (4): F007, F008, F009, F010 or F011.

(d) All wastes listed in s. NR 605.09 (3) (b), table IV and (c), table V, except spill residue or contaminated soil, water or other debris as specified in s. NR 605.09 (3) (a) 4.

(4) Incompatible wastes, incompatible materials or incompatible wastes and materials may not be placed in the same landfill cell or surface impoundment, unless s. NR 630.17 is complied with.

(5) Hazardous wastes F020, F021, F022, F023, F026 and F027 may not be placed in a landfill or surface impoundment unless the requirements of s. NR 660.20 are complied with.

(6) The placement of bulk or non-containerized liquid hazardous waste or hazardous waste containing free liquids, whether or not adsorbents have been added, in any landfill is prohibited.

(7) Before bulk or non-containerized liquid waste or waste containing free liquids that are not hazardous waste are placed in a landfill they shall be treated or stabilized, using a method that does not use adsorbents or adsorbents, so that free liquids are no longer present. To demonstrate the absence or presence of free liquids, the EPA test method 9095, the paint filter liquids test, described in SW-846, "Physical/Chemical Methods for Evaluating Solid Waste", second edition, 1982, as amended by update I in April, 1984 and update II in April, 1985, shall be used.

Note: This publication may be obtained from:

The Superintendent of Documents
U.S. Government Printing Office
Washington, D.C. 20402

This publication is available for inspection at the offices of the department, the secretary of state, and the revisor of statutes.

Note: Methods that do not use adsorbents or adsorbents to treat or stabilize liquid waste are described in statutory interpretative guidance documents available from EPA.

(8) (a) 1. An empty container shall be crushed flat, shredded or otherwise reduced in volume to the maximum practical extent before it is buried beneath the surface of a landfill, or

2. A container shall be at least 90% full when placed in the landfill.

(b) A container holding waste may not be placed in a landfill, unless the placement of containers is specifically allowed in the plan of operation approval and:

1. All free standing liquid has been:
 - a. Removed by decanting or other methods; or
 - b. Mixed with absorbent or solidified so that free-standing liquid is no longer observed; or
 - c. Otherwise eliminated; or
2. The container is designed to hold liquids or free liquids for a use other than storage, such as a battery or capacitor; or
3. The container is very small, such as an ampule; or
4. The container is a lab pack that meet the criteria in par. (c) and is disposed of in accordance with par. (c) and subs. (2) and (3).

(c) Lab packs, which are small containers of hazardous waste in overpacked drums, may be placed in a landfill if the following requirements are met:

1. Hazardous waste shall be packaged in non-leaking inside containers. The inside containers shall be of a design and constructed of a material, that shall not react dangerously with, be decomposed by, or be ignited by the contained waste. Inside containers shall be tightly and securely sealed. The inside containers shall be of the size and type specified in the DOT hazardous materials regulations specified in 49 CFR Parts 173, 178 and 179, November 1, 1985, if those regulations specify a particular inside container for the waste.

2. The inside containers shall be overpacked in an open head DOT specification metal shipping container specified in 49 CFR Parts 173, 178 and 179, November 1, 1985, of no more than 416 liter (110 gallon) capacity specified in and surrounded by a sufficient quantity of absorbent material to completely absorb all of the liquid contents of the inside containers. The metal outer container shall be full after packing with inside containers and absorbent material.

3. The absorbent material used may not be capable of reacting dangerously with, being decomposed by, or being ignited by the contents of the inside containers in accordance with s. NR 630.17.

4. Incompatible wastes may not be placed in the same outside container.

Note: The publications containing these standards may be obtained from:

The Superintendent of Documents
U.S. Government Printing Office
Washington, D.C. 20402

The publications containing these standards are available for inspection at the offices of the department, the secretary of state and the revisor of statutes.

5. Reactive wastes, other than cyanide-bearing or sulfide-bearing waste as specified in s. NR 605.08 (4) (a) 5., shall be treated or rendered non-reactive prior to packaging in accordance with subs. 1 to 4. Cyanide-bearing and sulfide-bearing reactive waste may be packed in accord-
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ance with subs. 1. to 4. without first being treated or rendered non-reactive.

(d) Effective March 1, 1991, the placement of any liquid which is not a hazardous waste into a landfill is prohibited unless the owner or operator of the landfill demonstrates to the department, or the department determines that:

1. The only reasonably available alternative to the placement in a landfill is placement in a landfill or unlined surface impoundment, whether or not licensed or operating under an interim license, which contains or may reasonably be anticipated to contain hazardous waste; and

2. Placement in the owner or operator's landfill will not present a risk of contamination of any underground source of drinking water.

(9) In addition to the waste analysis required by s. NR 630.12, whenever a surface impoundment is to be used to chemically treat a hazardous waste which is substantially different from waste previously treated in that impoundment or is to be used to chemically treat hazardous waste with a substantially different process than any previously used in that impoundment, the owner or operator shall, before treating the different waste or using the different process:

(a) Conduct waste analyses as specified in s. NR 630.13 and trial treatment tests, such as bench scale or pilot plant scale tests; or

(b) Obtain written, documented information on similar treatment of similar waste under similar operating conditions to show that this treatment can be accomplished in an environmentally sound manner and shall comply with the requirements of chs. NR 600 to 685.

(10) All landfills and surface impoundments for the treatment, storage or disposal of hazardous waste shall:

(a) Have a double liner system that is designed, constructed and installed to prevent any migration of wastes out of the facility to the adjacent subsurface soil, groundwater or surface water at any time during the active life, including the entire long-term care period. The primary liner shall be constructed of materials that prevent wastes from passing into the liner during the active life of the facility. The secondary liner shall be constructed with recompact clay meeting the specifications outlined in par. (d). Both liners shall be:

1. Constructed of materials that have appropriate chemical properties and sufficient strength and thickness to prevent failure due to pressure gradients, including static head and external hydrogeologic forces, physical contact with the waste or leachate to which they are exposed, climatic conditions, the stress of installation and the stress of daily operations;

2. Placed upon a foundation or base capable of providing support to the liner and resistance to pressure gradients above and below the liner to prevent failure of the liner due to settlement, compression or uplift;

3. Installed to cover all surrounding earth which shall be in contact with the waste or leachate; and

4. Compatible with all of the waste to be contained.

(b) For landfills, have a leachate collection and removal system immediately above both liners that is designed, constructed, maintained and operated to collect and remove leachate from the facility. The applicant shall submit all the necessary calculations using the appropriate analytical models to justify that the proposed design shall limit the leachate head level over both the primary and secondary liner to 30 cm (1 foot) or less. For the purposes of designing the backup leachate collection system, the applicant shall assume that the primary liner is not present and all recharge is moving directly downward to the secondary liner. For surface impoundments, have a leachate collection and removal system between the primary and secondary liners. The leachate collection and removal system for both landfills and surface impoundments shall be:

1. Constructed of materials that are:

a. Chemically resistant to the waste managed in the facility and the leachate expected to be generated; and

b. Of sufficient strength and thickness to prevent collapse under the pressures exerted by overlying wastes, waste cover materials and by any equipment used at the facility; and

2. Designed and operated to function without clogging through the scheduled closure of the facility.

(c) Have a soil drainage layer above the primary liner and between the primary and secondary liners which meets the following specifications:

1. A minimum thickness of 60 cm (2 feet).

2. A saturated variable or constant head permeability of greater than or equal to 1×10^{-3} cm/sec.

3. Is classified as SP or SW under the uniform soil classification system specified in ASTM standard D-2487-69 (1975).

(d) Have a recompacted clay secondary liner which meets the following minimum specifications:

1. A minimum thickness of 150 cm (5 feet).

2. A saturated undisturbed variable head permeability of 1×10^{-7} cm/sec or less.

3. At least 50% of material by weight passing the number 200 sieve, as determined by the test methods specified in ASTM standards D-422-63 (1972) and D-1140-54 (1971).

4. At least 25% of material by weight finer than .002 mm particle size, as determined by the test method specified in ASTM standard D-1140-54 (1971).

5. Is classified as CL or CH under the unified soil classification system, specified in ASTM standard D-2487-69 (1975).

6. Has a liquid limit of 30% or greater, as determined by the test specified in ASTM standard D-423-66 (1972).

7. Has a plasticity index of 15% or greater, as determined by the test specified in ASTM standard D-424-59 (1971).

8. Is compacted to 90% modified proctor density, as determined by the test method specified in ASTM standard D-1557-78.

9. Is constructed in lifts which do not exceed 20 cm (8 inches) after compaction.

Note: The publications containing these standards may be obtained from:

American Society for Testing and Materials
1916 Race Street
Philadelphia, PA 19103

The publications containing these standards are available for inspection at the offices of the department, the secretary of state and the revisor of statutes.

(e) Have the primary liner designed and constructed entirely above the seasonal high water table.

(f) Have a backup leachate collection system that is designed, constructed, maintained and operated to detect any migration of liquid into the space between the liners and to allow for removal of the liquid for treatment. If liquid leaks into the backup leachate collection system, the owner or operator shall:

1. Notify the department of the leak in writing within 7 days after detecting the leak; and

2. Remove the accumulated liquid as it is generated in order to limit the leachate head to 30 cm (1 foot) or less. The liquid shall be disposed of in accordance with the approved plan of operation.

(g) Have a run-on control system capable of preventing flow onto the active portion of the landfill during peak discharge from at least a 24-hour, 25-year storm.

(h) Be inspected, during construction or installation of liners and cover systems, such as membrane sheets or coatings, for uniformity, damage and imperfections, such as holes, cracks, thin spots or foreign materials. Immediately after construction or installation:

1. Synthetic liners and covers shall be inspected to ensure tight seams and joints and the absence of tears, punctures or blisters; and

2. Soil-based and admixed liners and covers shall be inspected for imperfections including lenses, cracks, channels, root holes or other structural non-uniformities that may cause an increase in the permeability of the liner or cover.

(11) The exact location and the dimensions of each cell, including depth with respect to permanently surveyed bench marks, shall be recorded and placed on a map. The contents of each cell and approximate location of each hazardous waste type shall also be recorded. These records shall be handled as specified in s. NR 630.31.

(12) Diversion structures shall be constructed so that surface water run-on shall be prevented from entering the facility.

(13) All surface water drainage ditches, culverts, sedimentation basins and other drainage control structures shall be designed, constructed, operated and maintained to collect and control at least the water volume from a 25-year, 24-hour rainfall event. All appropriate calculations justifying the proposed design shall be included in the appendix of the plan of

operation. Collection and holding facilities associated with run-on and run-off control systems shall be emptied or otherwise managed expeditiously after rainfall events to maintain the design capacity of the system. The freeboard maintained in a surface impoundment shall be sufficient to prevent any overtopping of the dike by overfilling, wave action or a storm and shall be capable of containing a rainfall from a 24-hour, 25-year storm but shall be no less than 2 feet. The owner and operator shall inspect the freeboard level at least once each operating day to ensure compliance.

Note: Examples of collection and holding facilities include tanks or basins.

(14) Surface water which has been in contact with the active portions of a landfill shall be collected and treated or disposed of as a hazardous waste in accordance with requirements of chs. NR 600 to 685, unless it is analyzed and found not to be hazardous waste as identified or listed in ch. NR 605 or it is collected and discharged into a navigable water in compliance with a WPDES permit issued by the department.

(15) Provisions shall be made for leachate treatment for all facilities.

(16) Where gases are generated within a site or facility, a gas collection and control system shall be installed to control the vertical and horizontal escape of gases.

(17) All access roads shall be constructed with a maximum grade no greater than 8%. The intersection of the access road with an existing highway shall be designed to provide sufficient sight distance and provide for minimum interference with traffic on existing highways. All access roads to the active area of an operation shall be of all weather construction and shall be maintained in good condition.

(18) All topsoil within the site of facility construction limits shall be salvaged and stored on-site in a nuisance-free manner for use in facility closure. Topsoil removed from borrow areas shall also be salvaged and placed in stockpiles in sufficient quantities to cover all the surfaces of excavated borrow areas to a depth of from 4 to 6 inches. In cases where the depth of the topsoil in the borrow area was originally less than 4 inches the topsoil shall be replaced to the original depth. After the topsoil has been replaced, excavated borrow areas and disturbed areas adjacent to them shall be fertilized and seeded.

(19) All earthen dikes shall have a protective cover of grass to minimize wind and water erosion and to preserve their structural integrity. The owner or operator shall inspect a surface impoundment, including dikes and vegetation surrounding the dike, at least once a week to detect any leaks, deterioration or failures in the impoundment. The integrity of the liner system installed in a landfill or surface impoundment shall be maintained and repaired, if physically possible, immediately upon detection of any failure, such as a liner puncture.

(20) Facility closure shall be accomplished in accordance with the approved plan of operation and s. NR 660.16 or, for those facilities with no approved plan of operation, in accordance with s. NR 660.15.

(21) The facility shall be surrounded with rapidly growing trees or shrubbery, fencing or with other appropriate means to screen it from the surrounding area and to provide a wind break.

(22) All facilities shall have a final cover designed to minimize infiltration and subsequent leachate production.

(23) Facility monitoring shall be performed in accordance with ch. NR 635 and the plan of operation approval.

(24) All soil borings and monitoring wells shall be backfilled with a chemically and physically stable sealant when the borings or wells are abandoned.

(25) All base grades for a landfill shall be designed and constructed with a minimum slope of 2%.

(26) A minimum of 6 inches of cover material shall be applied daily on active portions of a landfill. Active portions which will not have additional waste placed on them for at least one week shall be covered with 12 inches of cover material. Wind dispersal of hazardous waste or any particulate matter shall be controlled by covering or other means.

(27) During construction, installation and testing of the primary liner, the secondary liner, the drainage layers, the leachate collection systems and all 3 phases of the final cover system, a registered professional engineer shall be present on the site at all times. The professional engineer shall ensure that all construction, documentation and testing are carried out in accordance with chs. NR 600 to 685 and the plan of operation approval.

(28) (a) While a landfill is in operation, it shall be inspected weekly and after storms to detect evidence of any of the following:

1. Deterioration, malfunctions, or improper operation of run-on and run-off control systems;
2. The presence of liquids in leak detection systems;
3. Proper functioning of wind dispersal control systems, where present; and
4. The presence of leachate in and proper functioning of leachate collection and removal systems.

(b) While a surface impoundment is in operation, it shall be inspected weekly and after storms to detect evidence of any of the following:

1. Deterioration, malfunctions, or improper operation of overtopping control systems;
2. Sudden drops in the level of the impoundment's contents;
3. The presence of liquids in leak detection systems; and
4. Severe erosion or other signs of deterioration in dikes or other containment devices.

(29) Prior to the issuance of an operating license, and after any extended period of time of at least 6 months, during which a surface impoundment was not in service, the owner or operator shall obtain a certification from a registered professional engineer that the impoundment's dike, including that portion of any dike which provides freeboard, has structural integrity. The certification shall establish in particular that the dike:

(a) Will withstand the stress of the pressure exerted by the types and amounts of wastes to be placed in the impoundment; and

(b) Will not fail due to scouring or piping, without dependence on any liner system included in the surface impoundment construction.

(30) A surface impoundment shall be removed from service in accordance with sub. (31) when:

(a) The level of liquids in the impoundment suddenly drops and the drop is not known to be caused by changes in the flows into or out of the impoundment; or

(b) The dike leaks.

(31) When a surface impoundment is removed from service as required by sub. (30), the owner or operator shall:

(a) Immediately shut off the flow or stop the addition of wastes into the impoundment;

(b) Immediately contain any surface leakage which has occurred or is occurring;

(c) Immediately stop the leak;

(d) Take any other necessary steps to stop or prevent catastrophic failure;

(e) If a leak cannot be stopped by any other means, empty the impoundment; and

(f) Notify the department of the problem in writing within 7 days after detecting the problem.

(32) As part of the contingency plan, the owner or operator shall specify a procedure for complying with the requirements of sub. (31).

(33) No surface impoundment that has been removed from service in accordance with this section may be restored to service unless the portion of the impoundment which was failing is repaired and the following steps are taken:

(a) If the impoundment was removed from service as the result of actual or imminent dike failure, the dike's structural integrity shall be recertified in accordance with sub. (29);

(b) If the impoundment was removed from service as the result of a sudden drop in the liquid level:

1. For any existing impoundments without an operating license under s. NR 680.32, the owner or operator who desires to continue to operate the impoundment shall submit the necessary reports or plans to meet the requirements of this chapter and obtain an operating license in accordance with s. NR 680.32 prior to maintaining or operating the impoundment; or

2. For any other portion of the impoundment, the repaired liner system shall be certified by a registered professional engineer as meeting the design specifications approved in the plan of operation.

(34) A surface impoundment that has been removed from service in accordance with the requirements of this section and that is not being repaired shall be closed in accordance with the provisions of s. NR 660.15 or 660.16, whichever is applicable.

(35) A surface impoundment shall be designed, constructed, maintained and operated to prevent overtopping resulting from normal or abnormal operations; overfilling; wind and wave action; rainfall; run-on; malfunctions of level controllers, alarms and other equipment; and human error.

(36) A surface impoundment shall have dikes that are designed, constructed and maintained with sufficient structural integrity to prevent massive failure of the dikes. In ensuring structural integrity it may not be presumed that the liner system will function without leakage during the active life of the unit.

History: Cr. Register, February, 1991, No. 422, eff. 3-1-91.

NR 660.14 Monitoring. (1) **GAS MONITORING.** The department may require the installation of gas monitoring devices and sampling and analysis programs for protection against potential detrimental effects of gas production and to monitor the effectiveness of gas venting systems. Sample collection and analysis techniques shall be in accordance with standard methods.

(2) **SURFACE WATER MONITORING.** The department may require monitoring of surface water runoff, leachate seeps, sump pump discharges, sedimentation ponds and other surface water discharges resulting from facility operation and of surface waters which may be affected by the discharges. Sampling times and parameters shall be as specified by the department on a case-by-case basis.

(3) **MONITORING OF PHYSICAL FEATURES.** The department may require monitoring of air quality, landfill settlement, berm stability, vegetation growth, drainage control structures or other aspects of site or facility operation. The requirement shall be based upon facility characteristics and design features.

(4) **OPERATIONS REPORT.** The department may request the owner or operator of any landfill or surface impoundment to submit an operations report to assess the effectiveness and environmental acceptability of site operations. The contents of the report may include a discussion and analysis of entrance and access roads, confinement of active area, analysis of gas and leachate and other monitoring, cover to waste ratios, surface water control and erosion control, revegetation, settlement, volume utilized, site users, leachate quantity and quality, slope stability, equipment performance and volume and type of waste accepted.

History: Cr. Register, February, 1991, No. 422, eff. 3-1-91.

NR 660.15 Closure of facilities without operating licenses. (1) In addition to the closure requirements in s. NR 685.05 any person who maintains or operates a hazardous waste landfill or surface impoundment, without an operating license under s. NR 680.32, or who permits use of property for a facility shall comply with the requirements of this section. When ever a fill area or portion thereof reaches final grade or when the department determines that closure is required, the landfill or surface impoundment shall cease to accept waste. The fill area or portion thereof shall be closed

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in accordance with any plan approval issued by the department and the following requirements:

(a) Within 60 days after ceasing to accept waste, weather permitting, closure shall be accomplished as required in subds. 1 to 4. Placement of a final cover in accordance with all or a portion of the requirements of s. NR 660.16 (1) may be required if the department determines that an improved final cover system is necessary to prevent or abate the ground-water standards contained in ch. NR 140 from being attained or exceeded or to meet the requirements contained in s. NR 635.15 or 635.16 (14).

1. At final closure of the facility or upon closure of any unit or cell, the owner or operator shall cover the facility, unit or cell with a final cover designed and constructed to:

a. Provide long-term minimization of migration of liquids through the closed facility;

b. Function with minimum maintenance;

c. Promote drainage and minimize erosion or abrasion of the cover;

d. Accommodate settling and subsidence so that the cover's integrity is maintained; and

e. Have a permeability less than or equal to the permeability of any bottom liner system or natural subsoils present.

2. The entire unit or area previously used for disposal purposes shall be covered with at least 60 cm (2 feet) of compacted clay, sloped adequately to allow surface water runoff. Slopes shall be no less than 2% and no steeper than 33%. This 60 cm (2-foot) clay layer shall meet the following specifications:

a. Have a saturated undistributed hydraulic conductivity of not more than 1×10^{-7} cm/sec.

b. Be compacted to 90% modified proctor density, as determined by the test method specified in ASTM standard D-1557-78.

c. Be constructed in lifts which do not exceed 20 cm (8 inches) after compaction.

Note: The publications containing this standard may be obtained from:

American Society for Testing and Materials
1916 Race Street
Philadelphia, PA 19103

The publication containing this standard is available for inspection at the offices of the department, the secretary of state and the revisor of statutes.

3. Surface water shall be diverted to limit the potential for erosion and sedimentation. Wherever possible, surface water shall be diverted around previously filled areas. Where it is necessary to divert drainage over previously filled areas, drainage shall be conveyed by lined drainage swales having a minimum of 60 cm (2 feet) of clay.

4. The finished surface of the filled area shall be covered with a minimum of 15 cm (6 inches) of topsoil.

(b) Within 90 days after ceasing to accept waste, seeding, fertilizing and mulching of the finished surface shall be accomplished in accordance with the final site use. The seed type and amount of fertilizer shall be selected depending on the type and quality of topsoil and compatibility with native vegetation.

(c) Following final or partial closure, the facility shall be inspected and maintained by the owner or operator until it becomes stabilized or until the responsibility of the owner or operator terminates. The department may require installation of groundwater and leachate monitoring wells or other devices, groundwater and leachate quality sampling and analysis programs, gas monitoring and sampling and provisions for the protection against detrimental effects of leachate and gas migration from any landfill and surface impoundment in accordance with s. NR 660.14 and ch. NR 635.

(d) Upon final or any partial closure, all hazardous waste and hazardous waste residues including standing liquids, the liner underlying and surrounding contaminated soil and structures and equipment contaminated with waste or leachate shall be removed from surface impoundments not approved for final disposition of the wastes and shall be disposed of in accordance with chs. NR 600 to 685. Requests for department approval to allow any of the materials to be disposed of in place shall be submitted to the department prior to completion of closure, as a request for modification of a closure plan approval in accordance with s. NR 685.05. Closure of these facilities shall be accomplished in accordance with the provisions of the approved plan of operation and with all applicable requirements of this section. If necessary to support the final cover specified in the approved closure plan, the owner or operator shall treat remaining liquids, residues and soils by removal of liquids, drying, stabilization or other means.

(2) (a) Closure plans may be required by the department for any hazardous waste facility without an approved closure plan, including facilities which are no longer in operation, but which were in existence on August 1, 1981. The department may require that the plan address any or all of the information outlined in sub. (1) and ss. NR 660.09, 660.10, 660.13 and 660.14 and ch. NR 635.

(b) 1. Any closure and long-term care plan for a landfill or surface impoundment that stores, treats or disposes of hazardous waste shall include information on the potential for the public to be exposed to hazardous wastes or hazardous constituents through releases related to the hazardous waste unit. This information shall address:

a. Reasonably predictable potential releases from both normal operations and accidents at the unit, including releases associated with transportation to or from the hazardous waste unit;

b. The potential pathways of human exposure to hazardous waste or constituents as a result of releases described under subpar. a.; and

c. The potential magnitude and nature of human exposure as a result of the releases.

2. Within 90 days of March 1, 1991, all owners or operators of a landfill or surface impoundment shall submit the information in subd. 1.b. as supplemental information to their feasibility report.

(3) The owner or operator of a facility that treats hazardous waste shall, at completion of closure, remove all hazardous waste and hazardous waste residues, including, but not limited to, ash and sludges, from the treatment process or equipment, discharge control equipment and discharge confinement structures. The department may require monitoring of ground or surface waters, if the operation or design of the facility in relation to the hazard of wastes handled at the facility warrants monitoring.

History: Cr. Register, February, 1991, No. 422, eff. 3-1-91.

NR 660.16 Closure of facilities with operating licenses. In addition to the closure requirements in s. NR 685.05 any person who maintains or operates a hazardous waste landfill or surface impoundment, or who permits use of property for the facility shall also comply with the requirements of this section. When ever a fill area or portion thereof reaches final grade or when the department determines that closure is required, waste acceptance shall cease and the fill area or portion thereof shall be closed in accordance with the plan approval issued by the department and the following requirements:

(1) Within 60 days after ceasing to accept waste, weather permitting, closure shall be accomplished in the following manner:

(a) At final closure of the facility or upon closure of any cell, the owner or operator shall cover the facility or cell with a final cover designed and constructed to:

1. Provide long-term minimization of migration of liquids through the closed facility.
2. Function with minimum maintenance.
3. Promote drainage and minimize erosion or abrasion of the cover.
4. Accommodate settling and subsidence so that the cover's integrity is maintained, and
5. Have a permeability less than or equal to the permeability of any bottom liner system or natural subsoils present.

(b) The facility or cell shall be closed with final cover consisting of a vegetated top cover, a middle drainage layer and a low permeability bottom layer. The vegetated top cover shall:

1. Be at least 60 cm (2 feet) thick.
2. Support vegetation that shall effectively minimize erosion without the need for continuing application of fertilizers, irrigation or other man-applied materials to ensure viability and persistence.
3. Be planted with persistent species that shall effectively minimize erosion, but does not have a root system that shall penetrate beyond the vegetative top cover and middle drainage layer.
4. Have a minimum slope of between 3-5% after allowance for settlement and subsidence and slopes no steeper than 25%.

(c) The drainage layer shall:

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1. Be at least 30 cm (12 inches) thick with a saturated variable or constant head permeability not less than 1×10^3 cm/sec.
2. Have a final bottom slope of at least 3%, after allowing for settling and subsidence.
3. Be overlain by a graded granular filter or synthetic filter fabric to prevent clogging from fines.
4. Be designed so that discharge flows freely in the lateral direction to minimize head on and flow through the low permeability layer.
5. Consist of material classified as SP under the unified soil classification system specified in ASTM standard D-2487-69 (1975) and shall be free of rock, fractured stone, angular grains, debris, cobbles, rubbish, roots or any other materials which could potentially damage the upper component of the low permeability layer.

(d) The low permeability layer shall have 2 components. The upper component shall:

1. Consist of material which is designed, constructed and installed to prevent the migration of any liquid into the material during the entire long-term care period.
2. Have a final upper slope of at least 3% after allowances for settling.
3. Be located at least 30 cm (one foot) below the maximum recorded depth of frost penetration in the area.

(e) The lower component shall:

1. Consist of at least 60 cm (2 feet) of clay.
2. Have a saturated undistributed hydraulic conductivity of not more than 1×10^7 cm/sec.
3. Be compacted to 90% modified proctor density, as determined by the test method specified in ASTM standard D-1557-78.
4. Be constructed in lifts which do not exceed 20 cm (8 inches) after compaction.

Note: The publications containing these standards may be obtained from:

American Society for Testing and Materials
1916 Race Street
Philadelphia, PA 19103

The publications containing these standards are available for inspection at the offices of the department, the secretary of state and the revisor of statutes.

(f) Surface water shall be diverted to limit the potential for erosion and sedimentation. Wherever possible, surface water shall be diverted around previously filled areas. Where it is necessary to divert drainage over previously filled areas, drainage shall be conveyed by lined drainage swales having a minimum of 60 cm (2 feet) of clay.

(g) 1. Any closure and long-term care plan for a landfill or surface impoundment that stores, treats or disposes of hazardous waste shall include information on the potential for the public to be exposed to hazardous wastes or hazardous constituents through releases related to the hazardous waste unit. This information shall address:

a. Reasonably predictable potential releases from both normal operations and accidents at the unit, including releases associated with transportation to or from the hazardous waste unit;

b. The potential pathways of human exposure to hazardous waste or constituents as a result of releases described under subpar. a.; and

c. The potential magnitude and nature of human exposure as a result of the releases.

2. Within 90 days of March 1, 1991, all owners or operators of a landfill or surface impoundment shall submit the information in subd. 1.b. as supplemental information to their feasibility report.

(2) Within 90 days after ceasing to accept waste, seeding, fertilizing and mulching of the finished surface shall be accomplished in accordance with sub. (1) (b) and the final site use. Seed type and amount of fertilizer shall be selected depending on the type and quality of topsoil and compatibility with native vegetation.

(3) Following final or partial closure, the facility shall be inspected and maintained by the owner or operator until it becomes stabilized or until the responsibility of the owner or operator terminates. The department may require installation of groundwater and leachate monitoring wells or other devices, groundwater and leachate quality sampling and analysis programs, gas monitoring and sampling provisions for the protection against detrimental effects of leachate and gas migration from any landfill and surface impoundment in accordance with s. NR 660.14 and ch. NR 635.

(4) Upon final or any partial closure, all hazardous waste and hazardous waste residues including standing liquids, the liner, underlying and surrounding contaminated soil and structures and equipment contaminated with waste and leachate shall be removed from surface impoundments not approved for final disposition of the wastes and shall be disposed of in accordance with chs. NR 600 to 685. Requests for department approval to allow any of the materials to be disposed of in place shall be submitted to the department prior to completion of closure, as a request for modification of the closure plan approval, in accordance with s. NR 685.05. Closure of these facilities shall be accomplished in accordance with the provisions of the approved plan of operation and with all applicable requirements of this section. If necessary to support the final cover specified in the approved closure plan, the owner or operator shall treat remaining liquids, residues and soils by removal of liquids, drying or other means.

(5) The owner or operator of a facility that treats hazardous waste shall, at completion of closure, remove all hazardous waste and hazardous waste residues, including, but not limited to, ash and sludges, from the treatment process or equipment, discharge control equipment and discharge confinement structures. The department may require monitoring of ground or surface waters, if the operation or design of the facility in relation to the hazard of wastes handled at the facility warrants monitoring.

History: Cr. Register, February, 1991, No. 422, eff. 3-1-91.

NR 660.17 Long-term care. (1) The department may grant a written exemption from any of the requirements of this section and s. NR 685.06 Register, February, 1991, No. 422

as part of a closure plan or plan of operation approval or modification thereof for surface impoundments, if no hazardous waste residues including standing liquids, the liner, underlying and surrounding contaminated soil and structures and equipment contaminated with waste and leachate are left in place at final closure.

(2) After final closure, the owner or operator shall comply with all long-term care requirements contained in s. NR 685.06 and any plan of operation approval, including maintenance and monitoring throughout the long-term care period. The owner or operator shall:

(a) Maintain the integrity and effectiveness of the final cover, including making repairs to the cap as necessary to correct the effects of settling, subsidence, erosion or other events.

(b) Maintain and monitor the back-up leachate collection system in accordance with the approved plan of operation.

(c) Continue to operate the leachate collection and removal system.

(d) Maintain and monitor the groundwater monitoring system and comply with all other applicable requirements of ch. NR 635.

(e) Prevent run-on and run-off from eroding or otherwise damaging the final cover.

(f) Protect and maintain all surveyed benchmarks, including benchmarks used in complying with s. NR 660.13 (11) for the entire period of long-term care.

(g) Implement measures needed to correct contamination caused by leachate or gases generated within the landfill.

History: Cr. Register, February, 1991, No. 422, eff. 3-1-91.

NR 660.18 Waste management fund. The owners and operators of landfills and surface impoundments utilized for disposal shall contribute to the waste management fund as specified in s. NR 685.09, unless specifically exempted in s. NR 660.04.

History: Cr. Register, February, 1991, No. 422, eff. 3-1-91.

NR 660.19 Surface impoundments with discharges regulated under ch. 147, stats. (1) GENERAL. Except as otherwise provided in sub. (2), no person may operate or maintain a surface impoundment unless the person has obtained an interim license, operating license or waiver from the department in accordance with the requirements of ss. NR 600.10, 680.20 to 680.24 or 680.30 to 680.32.

(2) **EXEMPTIONS.** Unless otherwise provided, this section does not apply to:

(a) The owner or operator of a facility used for the disposal of metallic mining wastes resulting from a mining operation as defined in s. 144.81 (5), Stats.

Note: Metallic mining wastes are regulated under ch. NR 182.

(b) The owner or operator of a facility operating under an interim license, except as provided in ss. NR 680.21 (4) and (5) and 680.22.

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(3) **REGULATORY INTEGRATION.** Wherever practicable, the department shall integrate the regulation of surface impoundments under this section with the plan approval process under s. 144.04, Stats., and the permitting process under ch. 147, Stats., to avoid duplicate or contradictory actions or requirements.

(4) **GENERAL FACILITY STANDARDS.** Unless specifically exempt under sub. (2), the owner or operator of a surface impoundment with discharges regulated under ch. 147, Stats., shall comply with ss. NR 630.10 to 630.18, 630.21, 630.22, 630.30, 630.31, 630.40, 660.06, 680.06 and 685.05 to 685.08.

(5) **INITIAL SITE INSPECTION.** Unless specifically exempted under sub. (2), any person proposing to establish a hazardous waste surface impoundment with discharges regulated under ch. 147, Stats., or expand an existing facility shall contact the department to arrange for an initial site inspection.

(6) **INITIAL SITE REPORT.** Unless specifically exempted under sub. (2), any person wishing to establish a hazardous waste surface impoundment with discharges regulated under ch. 147, Stats., or expand an existing facility, shall comply with s. NR 660.08 if the person wishes to submit an initial site report.

(7) **FEASIBILITY REPORT.** Unless specifically exempted under sub. (2), any person wishing to establish a hazardous waste surface impoundment with discharges regulated under ch. 147, Stats., or expand an existing facility shall comply with s. NR 660.09.

(8) **PLAN OF OPERATION.** Unless specifically exempted under sub. (2), any person wishing to establish a hazardous waste surface impoundment with discharges regulated under ch. 147, Stats., or expand an existing facility shall comply with s. NR 660.10, except as follows:

(a) In lieu of compliance with s. NR 660.10 (2) (a) 7., 10., 11., and 12. and (b), except (b) 2. i., j., and k., the following may be submitted:

1. Detailed plans and engineering report describing how the surface impoundment shall be constructed to meet the requirements of sub. (11), including:

- a. The construction of the liner system;
- b. Prevention of overtopping; and
- c. Structural integrity of the dikes.

2. Description of how each surface impoundment, including the liner and cover systems and appurtenances for control of overtopping, shall be inspected in order to meet the requirements of s. NR 660.13 (28). This information may be included in the inspection plan submitted under s. NR 680.06 (3) (e).

3. A description of the procedure to be used in removing a surface impoundment from service, as required under subs. NR 660.13 (30), (31), (32), (33) and (34). This information shall be included in the contingency plan submitted under s. NR 660.10 (2) (d).

4. If ignitable or reactive wastes are to be placed in a surface impoundment, an explanation of how sub. (11) (a) shall be complied with.

5. If incompatible wastes, or incompatible wastes and materials shall be placed in a surface impoundment, an explanation of how s. NR 660.13 (4) shall be complied with.

(9) **SUBSTANTIAL COMPLIANCE WITH THE PLAN OF OPERATION.** Unless specifically exempt under sub. (2), the construction of all surface impoundments with discharges regulated under ch. 147, Stats., shall be certified by a qualified engineer as follows:

(a) For existing units, the certification which attests to the structural integrity of each dike, as required under s. NR 660.13 (27), shall be submitted with the plan of operation under sub. (8).

(b) For new units the engineer shall provide the certification required under par. (a) upon completion of construction in accordance with the plans and specifications and with the plan of operation under sub. (8).

(10) **RECORDING OF NOTICE.** Unless specifically exempt under sub. (2), the owner or operator of a surface impoundment with discharges regulated under ch. 147, Stats., shall comply with s. NR 660.12.

(11) **MINIMUM DESIGN AND OPERATIONAL REQUIREMENTS.** Unless specifically exempt under sub. (2), the owner or operator of a surface impoundment with discharges regulated under ch. 147, Stats., shall comply with s. NR 660.13, except as follows:

(a) In lieu of compliance with s. NR 660.13 (3), the owner or operator may comply with the following:

1. Ignitable or reactive waste may not be placed in a surface impoundment, unless the waste is placed in a surface impoundment that is used solely for emergencies or unless the waste is treated, rendered, or mixed before or immediately after placement in the surface impoundment so that:

a. The resulting waste, mixture or dissolution of material no longer meets the criteria of ignitable or reactive waste under s. NR 605.08 (2) or (4); and

b. Section NR 630.17 (2) is complied with.

(b) In lieu of compliance with s. NR 660.13 (6), (8), (10) to (18) and (25) to (27), the owner or operator may comply with the following:

1. A surface impoundment shall have a double liner system that is designed, constructed and installed to prevent any migration of wastes out of the impoundment to the adjacent subsurface soil or groundwater or surface water at any time during the active life, including the closure period of the impoundment. The primary and secondary liners shall be:

a. Constructed of materials that have appropriate chemical properties and sufficient strength and thickness to prevent failure due to pressure gradients, including static head and external hydrogeologic forces, physical contact with the waste or leachate to which they are exposed, climatic conditions, the stress of installation and the stress of daily operations;

b. Placed upon a foundation or base capable of providing support to the liner and resistance to pressure gradients above and below the liner to prevent failure of the liner due to settlement, compression or uplift; and

c. Installed to cover all surrounding earth likely to be in contact with the waste or leachate.

2. The owner or operator may be exempted from the requirements of subd. 1. if the department finds, based on a demonstration by the owner or operator, that alternate design and operating practices, together with location characteristics, shall prevent the migration of any hazardous constituents into the groundwater or surface water at any future time. Exemption requests shall be made by the owner or operator, in accordance with s. NR 680.04, in the feasibility report. In deciding whether to grant an exemption, the department shall consider:

a. The nature and quantity of the wastes;

b. The proposed alternate design and operation;

c. The hydrogeologic setting of the facility, including the attenuative capacity and thickness of the liners and soils present between the impoundment and groundwater or surface water, and

d. All other factors which would influence the quality and mobility of the leachate produced and the potential for it to migrate to groundwater or surface water.

3. A surface impoundment shall be designed, constructed, maintained and operated to prevent overtopping resulting from normal or abnormal operations; overfilling; wind and wave action; rainfall; run-on; malfunctions of level controllers, alarms and other equipment; and human error.

4. A surface impoundment shall have dikes that are designed, constructed and maintained with sufficient structural integrity to prevent massive failure of the dikes. In ensuring structural integrity it may not be presumed that the liner system shall function without leakage during the active life of the unit.

5. The department shall specify in the plan of operation approval all design and operating practices that are necessary to ensure that the requirements of this paragraph are satisfied.

6. During construction and installation, liners and cover systems, such as membranes, sheets or coatings, shall be inspected for uniformity, damage and imperfections, such as holes, cracks, thin spots or foreign materials. Immediately after construction or installation:

a. Synthetic liners and covers shall be inspected to ensure tight seams and joints and the absence of tears, punctures or blisters; and

b. Soil-based and admixed liners and covers shall be inspected for imperfections including lenses, cracks, channels, root holes or other structural non-uniformities that may cause an increase in the permeability of the liner or cover.

(12) GROUNDWATER AND LEACHATE MONITORING. The owner or operator of a surface impoundment with discharges regulated under ch. 147, Stats., shall comply with ch. NR 635, unless specifically exempt under s. NR 635.04.

(13) SPECIAL MONITORING. Unless specifically exempt under sub. (2), the owner or operator of a surface impoundment with discharges regulated under ch. 147, Stats., shall comply with ch. NR 635, unless specifically exempt under s. NR 635.04.

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lated under ch. 147, Stats., shall comply with s. NR 660.14, when required by the department.

(14) CLOSURE. Unless specifically exempt under sub. (2), the owner or operator of a surface impoundment with discharges regulated under ch. 147, Stats., shall comply with s. NR 660.15 or 660.16, whichever is applicable.

(15) LONG-TERM CARE. Unless specifically exempt under sub. (2), the owner or operator of a surface impoundment with discharges regulated under ch. 147, Stats., shall comply with s. NR 660.17.

(16) WASTE MANAGEMENT FUND. Unless specifically exempt under sub. (2), the owner or operator of a surface impoundment with discharges regulated under ch. 147, Stats., shall, if the surface impoundment is utilized for disposal of hazardous waste, contribute to the waste management fund as specified in s. NR 685.09.

History: Cr. Register, February, 1991, No. 422, eff. 3-1-91.

NR 660.20 Special requirements for hazardous wastes F020, F021, F022, F023, F026 and F027. (1) Hazardous wastes F020, F021, F022, F023, F026 and F027 may not be placed in a landfill or surface impoundment unless the owner or operator operates the landfill or surface impoundment in accordance with a management plan for these wastes that is approved by the department pursuant to the standards set out in this section and in accord with all other applicable requirements in chs. NR 600 to 685. The factors to be considered are:

(a) The volume and physical and chemical characteristics of the wastes, including their potential to migrate through soil or to volatilize or escape into the atmosphere;

(b) The attenuative properties of underlying and surrounding soils or other materials;

(c) The mobilizing properties of other materials co-disposed with these wastes; and

(d) The effectiveness of additional treatment, design or monitoring requirements or techniques.

(2) The department may determine that additional design, operating and monitoring requirements are necessary for landfills and surface impoundments managing hazardous wastes F020, F021, F022, F023, F026 and F027 in order to reduce the possibility of migration of these wastes to groundwater, surface water or air so as to protect human health and the environment.

History: Cr. Register, February, 1991, No. 422, eff. 3-1-91.