

**567—65.15(455B) Manure storage structure design requirements.** The requirements in this rule apply to all animal feeding operation structures unless specifically stated otherwise.

**65.15(1)** Drainage tile removal for new construction of a manure storage structure. Prior to constructing a manure storage structure, other than storage of manure in an exclusively dry form, the site for the animal feeding operation structure shall be investigated for drainage tile lines as provided in this subrule. All applicable records of known drainage tiles shall be examined for the existence of drainage tile lines.

*a.* Prior to excavation for the berm of an unformed manure storage structure, the owner of the unformed manure storage structure shall follow any one of the following procedures:

(1) An inspection trench of at least ten inches wide shall be dug around the structure to a depth of at least 6 feet from the original grade and at least 50 feet from the projected outside edge of the berm.

(2) A core trench shall be dug to a depth of at least 6 feet from grade at the projected center of the berm. After investigation for tile lines and any discovered tile lines are removed, an additional containment barrier shall be constructed underneath the center of the berm. The secondary containment shall meet the same percolation standards as the lagoon or basin with the lateral flow potential restricted to one-sixteenth of an inch per day.

*b.* The drainage tile lines discovered near an unformed manure storage structure shall be removed within 50 feet of the projected outside edge of the berm and within the projected site of the structure including under the berm. Drainage tile lines discovered upgrade from the structure shall be rerouted outside of 50 feet from the berm to continue the flow of drainage. Drainage tile lines installed at the time of construction to lower a groundwater table may remain where located. A device to allow monitoring of the water in the drainage tile lines installed to lower the groundwater table and a device to allow shutoff of the drainage tile lines shall be installed if the drainage tile lines do not have a surface outlet accessible on the property where the unformed manure storage structure is located. All other drainage tile lines discovered shall be rerouted, capped, plugged with concrete, Portland cement concrete grout or similar materials, or reconnected to upgrade tile lines.

*c.* The applicant for a construction permit for a formed manure storage structure shall investigate for tile lines during excavation for the structure. Drainage tile lines discovered upgrade from the structure shall be rerouted around the formed manure storage structure to continue the flow of drainage. All other drainage tile lines discovered shall be rerouted, capped, plugged with concrete, Portland cement concrete grout or similar materials or reconnected to upgrade tile lines. Drainage tile lines installed at the time of construction to lower a groundwater table may remain where located. A device to allow monitoring of the water in the drainage tile lines installed to lower the groundwater table and a device to allow shutoff of the drainage tile lines shall be installed if the drainage tile lines do not have a surface outlet accessible on the property where the formed manure storage structure is located.

*d.* An owner of a confinement feeding operation may utilize other proven methods approved by the department to discover drainage tile lines.

*e.* Variances to this subrule may be granted by the director if the owner of the confinement feeding operation provides an alternative that is substantially equivalent to the subrule or provides improved effectiveness or protection as required by the subrule. A request for a variance shall be made in writing at the time the application is submitted or prior to investigating for drainage tile, whichever is earlier. The denial of a variance may be appealed to the commission.

*f.* A waiver to this subrule may be granted by the director if sufficient information is provided that the location does not have a history of drainage tile.

**65.15(2)** Drainage tile removal around an existing manure storage structure. The owner of an aerobic structure, anaerobic lagoon or earthen manure storage basin or earthen waste slurry storage basin, other than an egg washwater storage structure, that is part of a confinement feeding operation with a construction permit granted before March 20, 1996, but after December 31, 1992, shall inspect by March 20, 1997, for drainage tile lines as provided in this subrule, and all applicable records of known drainage tiles shall be examined. The owner of an aerobic structure, anaerobic lagoon, earthen manure storage basin or earthen waste slurry storage basin, other than an egg washwater storage structure, that is part of a confinement feeding operation with a construction permit granted before January 1,

1993, but after May 31, 1985, shall have an inspection conducted by July 1, 2000, for drainage tiles as provided in this subrule, and all applicable records of known drainage tiles shall be examined.

*a.* Inspection shall be by digging an inspection trench of at least ten inches wide around the structure to a depth of at least 6 feet from the original grade and at least 50 feet from the outside edge of the berm. The owner first shall inspect the area where trenching is to occur and manure management records to determine if there is any evidence of leakage and, if so, shall contact the department for further instructions as to proper inspection procedures. The owner of a confinement feeding operation shall either obtain permission from an adjoining property owner or trench up to the boundary line of the property if the distance of 50 feet would require the inspection trench to go onto the adjoining property.

*b.* The owner of the confinement feeding operation may utilize other proven methods approved by the department to discover drainage tile lines.

*c.* The drainage tile lines discovered near an aerobic structure, anaerobic lagoon, earthen manure storage basin or earthen waste slurry storage basin, other than an egg washwater storage structure, shall be removed within 50 feet of the outside edge of the berm. Drainage tile lines discovered upgrade from the aerobic structure, anaerobic lagoon or earthen manure storage basin shall be rerouted outside of 50 feet from the berm to continue the flow of drainage. All other drainage tile lines discovered shall be rerouted, capped, plugged with concrete, Portland cement concrete grout or similar materials, or reconnected to upgrade tile lines. Drainage tile lines that were installed at the time of construction to lower a groundwater table may either be avoided if the location is known or may remain at the location if discovered.

*d.* The owner of an aerobic structure, anaerobic lagoon, earthen manure storage structure or an earthen waste slurry storage basin with a tile drainage system to artificially lower the groundwater table shall have a device to allow monitoring of the water in the drainage tile lines that lower the groundwater table and to allow shutoff of the drainage tile lines if the drainage tile lines do not have a surface outlet accessible on the property where the aerobic structure, anaerobic lagoon, earthen manure storage basin or earthen waste slurry storage basin is located.

*e.* If the owner of the confinement feeding operation discovers drainage tile that projects underneath the berm, it shall follow one of the following options:

(1) Contact the department to obtain permission to remove the drainage tile under the berm. The manure in the structure must be lowered to a point below the depth of the tile prior to removing the drainage tile from under the berm. Prior to using the structure, a new percolation test must be submitted to the department and approval received from the department.

(2) Grout the length of the tile under the berm to the extent possible. The material used to grout shall include concrete, Portland cement concrete grout or similar materials.

*f.* Variances to this subrule may be granted by the director if the applicant provides an alternative that is substantially equivalent to the subrule or provides improved effectiveness or protection as required by the subrule. A request for a variance shall be made in writing. The denial of a variance may be appealed to the commission.

*g.* A waiver to this subrule may be granted by the director if sufficient information is provided that the location does not have a history of drainage tile.

*h.* A written record describing the actions taken to determine the existence of tile lines, the findings, and actions taken to comply with this subrule shall be prepared and maintained as part of the manure management plan records.

**65.15(3)** Guidelines for drainage tile removal around an existing manure storage structure.

*a.* It is recommended that a manure storage structure, other than the storage of manure in an exclusively dry form, that is part of a confinement feeding operation with a construction permit granted before May 31, 1985, be inspected for drainage tile lines as provided in this subrule, and all applicable records of known drainage tiles may be examined. For an aerobic structure, anaerobic lagoon, earthen manure storage basin or earthen waste slurry storage basin, inspection may be by digging an inspection trench of at least ten inches wide around the structure at a depth of at least 6 feet from the original grade and at least 50 feet from the projected outside edge of the berm. The owner first should inspect the

area where trenching is to occur and manure management records to determine if there is any evidence of leakage and, if so, shall contact the department for further instructions as to proper inspection procedures.

*b.* The drainage tile lines discovered may be removed within 50 feet of the outside edge of the berm. Drainage tile lines discovered upgrade from the structure may be rerouted outside of 50 feet from the berm to continue the flow of drainage. Drainage tile lines that were installed at the time of construction to lower a groundwater table may either be avoided if the location is known or may remain at the location if discovered. All other drainage tile lines discovered may be rerouted, capped, plugged with concrete, Portland cement concrete grout or similar materials or reconnected to upgrade tile lines. The owner of a confinement feeding operation should either obtain permission from an adjoining property owner or trench up to the boundary line of the property if the distance of 50 feet would require the inspection trench to go onto the adjoining property.

*c.* If the owner of a confinement feeding operation discovers drainage tile that projects underneath the berm, it may follow one of the following options:

(1) Contact the department to obtain permission to remove the drainage tile under the berm. The manure in the structure must be lowered to a point below the depth of the tile prior to removing the drainage tile from under the berm. Prior to using the structure, a new percolation test must be submitted to the department and approval received from the department.

(2) Grout the length of the tile under the berm to the extent possible. The material used to grout may include concrete, Portland cement concrete grout or similar materials.

*d.* The owner of a confinement feeding operation with a formed manure storage structure other than dry manure storage may inspect for tile lines. Drainage tile lines discovered upgrade from the structure may be rerouted around the formed manure storage structure to continue the flow of drainage. Drainage tile lines put in place during or after construction of the formed manure storage structure to relieve hydrologic pressure may remain where located. All other drainage tile lines discovered may be rerouted, capped, plugged with concrete, Portland cement concrete grout or similar materials or reconnected to upgrade tile line.

**65.15(4)** Earthen waste slurry storage basins. An earthen waste slurry storage basin shall have accumulated manure removed at least twice each year unless there is sufficient basin capacity to allow removal of manure once each year and maintain freeboard as determined pursuant to 65.2(3)“*b.*”

**65.15(5)** Earthen manure storage basins. An earthen manure storage basin shall have accumulated manure removed at least once each year. An earthen manure storage basin may have enough manure storage capacity to contain the manure from the confinement feeding operation for up to 14 months and maintain freeboard as determined pursuant to 65.2(3)“*b.*”

**65.15(6)** Soil testing for earthen structures. Applicants for construction permits for earthen manure storage structures shall submit soils information according to this subrule for the site of the proposed structure. All subsurface soil classification shall be based on American Society for Testing and Materials Designations D 2487-92 or D 2488-90. Soil corings shall be taken to determine subsurface soil characteristics and groundwater elevation and direction of flow of the proposed site for an anaerobic lagoon, aerobic structure, earthen egg washwater storage structure, or earthen manure storage basin. Soil corings shall be conducted by a qualified person normally engaged in soil testing activities. Data from the soil corings shall be submitted with a construction permit application and shall include a description of the geologic units encountered, and a discussion of the effects of the soil and groundwater elevation and direction of flow on the construction and operation of the anaerobic lagoon, aerobic structure, earthen egg washwater storage structure, or earthen manure storage basin. All soil corings shall be taken by a method that identifies the continuous soil profile and does not result in the mixing of soil layers. The number and location of the soil corings will vary on a case-by-case basis as determined by the designing engineer and accepted by the department. The following are minimum requirements:

*a.* A minimum of four soil corings reflecting the continuous soil profile is required for each anaerobic lagoon, aerobic structure, earthen egg washwater storage structure, or earthen manure storage basin. Corings which are intended to represent soil conditions at the corner of the structure must be located within 50 feet of the bottom edge of the structure and spaced so that one coring is as close as possible to each corner. Should there be no bottom corners, corings shall be equally spaced around the

structure to obtain representative soil information for the site. An additional coring will be required if necessary to ensure that one coring is at the deepest point of excavation. For an anaerobic lagoon, aerobic structure, earthen egg washwater storage structure, or earthen manure storage basin larger than 4 acres water surface area, one additional coring per acre is required for each acre above 4 acres surface area.

*b.* All corings shall be taken to a minimum depth of ten feet below the bottom elevation of the anaerobic lagoon, aerobic structure, earthen egg washwater storage structure, or earthen manure storage basin.

*c.* At least one coring shall be taken to a minimum depth of 25 feet below the bottom elevation of the anaerobic lagoon, aerobic structure, earthen egg washwater storage structure, or earthen manure storage basin or into bedrock, whichever is shallower.

*d.* Upon abandonment of the soil core holes, all soil core holes including those developed as temporary water level monitoring wells shall be plugged with concrete, Portland cement concrete grout, bentonite, or similar materials.

**65.15(7) Hydrology.**

*a. Groundwater table.* A minimum separation of four feet between the top of the liner on any earthen aerobic structure, anaerobic lagoon, or earthen manure storage basin floor and the groundwater table is recommended; however, in no case shall the top of the liner on an earthen aerobic structure, anaerobic lagoon, or earthen manure storage basin floor be below the groundwater table. If the groundwater table is less than two feet below the top of the liner on an earthen aerobic structure, anaerobic lagoon, or earthen manure storage basin floor, the aerobic structure, anaerobic lagoon, or earthen manure storage basin shall be provided with a synthetic liner as described in 65.15(12)“f.”

*b. Permanent artificial lowering of groundwater table.* The groundwater table around an anaerobic lagoon, aerobic structure, or earthen manure storage basin may be artificially lowered to levels required in paragraph “a” by using a gravity flow tile drainage system or other permanent nonmechanical system for artificial lowering of the groundwater table. For a permitted animal feeding operation, detailed engineering and soil drainage information shall be provided with a construction permit application for an earthen aerobic structure, anaerobic lagoon or earthen manure storage basin to confirm the adequacy of the proposed permanent system to provide the required drainage without materially increasing the seepage potential of the site. (See 65.15(1)“b” for monitoring and shutoff requirements for drainage tile lines installed to lower the groundwater table.) For formed manure storage structures partially or completely constructed below the normal soil surface, a tile drainage system or other permanent system for artificial lowering of groundwater levels shall be installed around the structure if the groundwater table is above the bottom of the structure.

*c. Determination of groundwater table.* For purposes of this rule, groundwater table is the seasonal high water table determined by a licensed professional engineer, a groundwater professional certified pursuant to 567—Chapter 134, or qualified staff from the department or Natural Resources Conservation Service (NRCS). If a construction permit is required, the department must approve the groundwater table determination.

(1) Current groundwater levels shall be measured using at least one of the following for either formed or unformed structures:

1. Temporary monitoring wells. Each of the three temporary monitoring wells shall be developed according to 567—subrule 110.11(8). The top of the well screen shall be within 5 feet of the ground surface. Each well shall be extended to at least 2 feet below the bottom of the liner of an unformed manure storage structure, or to at least 2 feet below the footings of a formed manure storage structure.

- Unformed structures. For an unformed manure storage structure, each monitoring well may be installed in the existing boreholes resulting from the corings required in subrule 65.15(6).

- Formed structures. For a formed manure storage structure, at least three temporary monitoring wells shall be installed as close as possible to three corners of the structure, with one of the wells close to the corner of deepest excavation. If the formed structure is circular, the three monitoring wells shall be equally spaced and one well shall be placed at the point of deepest excavation.

2. Test pits. The department may allow use of test pits in lieu of temporary monitoring wells if seasonal variation in climatic patterns, soil and geologic conditions prevent accurate determination of the seasonal high water table or prior to the construction of an unformed manure storage structure liner to ensure that the required separation distance to the groundwater table is being met. Test pits will be configured 3 feet × 4 feet × 4 feet, or equivalent volume, and the bottom of each pit shall be 2 feet below the floor of the proposed anaerobic lagoon, earthen manure storage basin, earthen aerobic structure or settled open feedlot effluent basin. Each pit shall be allowed to remain open and unaltered for a minimum of seven days for viewing by the department or NRCS qualified staff for the determination of soil characteristics and related groundwater influence. Adequate protection (temporary berms and covers) shall be provided to prevent surface runoff from entering the test pits. One test pit shall be located in each corner and one in the center of the proposed manure control structure, unless otherwise specified by the department. A description of the materials present in the test pit shall be documented by all of the following:

- Digital photos;
- Description of soils including mottling;
- Construction specifications; and
- Weather conditions both prior to and during the period in which test pits are open.

(2) The seasonal high water table shall be determined by measuring the groundwater level in the temporary monitoring wells not earlier than seven days following installation and shall include consideration of NRCS soil survey information, soil characteristics such as color and mottling, other existing water table data, and other pertinent information. If a drainage system for artificially lowering the groundwater table will be installed in accordance with the requirements of paragraph 65.15(7) “b,” the level to which the groundwater table will be lowered will be considered to represent the seasonal high water table.

**65.15(8)** Karst features. The anaerobic lagoon or earthen manure storage basin shall not be located on a site that exhibits Karst features such as sinkholes, or solution channeling generally occurring in areas underlain by limestone or dolomite.

**65.15(9)** Bedrock separation. A minimum of four feet of separation between an unformed manure storage structure bottom and any bedrock formation is required. A ten-foot separation is recommended. A synthetic liner shall be required if the unformed structure is to be located less than ten feet above a carbonate or limestone formation.

**65.15(10)** Flooding protection.

*a.* An animal feeding operation structure proposed to be constructed on land that would be inundated by Q100 shall meet requirements as specified in 567—Chapters 70 to 76, unless otherwise prohibited according to 65.15(10) “b.”

*b.* A confinement feeding operation structure shall not be constructed on the one hundred year flood plain.

**65.15(11)** Seals for anaerobic lagoons, aerobic structures, and earthen manure storage basins. A lagoon or basin shall be sealed such that seepage loss through the seal is as low as practically possible. The percolation rate shall not exceed 1/16 inch per day at the design depth of the lagoon or basin. Following construction of the lagoon or basin, the results of a testing program which indicates the adequacy of the seal shall be provided to this department in writing prior to start-up of a permitted operation. The owner of a confinement feeding operation not required to obtain a construction permit shall keep a record of the construction methods and materials used to provide the seal and any test results available on the adequacy of the seal.

**65.15(12)** Aerobic structure, anaerobic lagoon, or earthen manure storage basin liner design and construction standards. An aerobic structure, anaerobic lagoon or earthen manure storage basin which receives a construction permit after January 21, 1998, shall comply with the following minimum standards in addition to subrule 65.15(11).

*a.* If the location of the proposed aerobic structure, anaerobic lagoon or earthen manure storage basin contains suitable materials as determined by the soil corings taken pursuant to subrule 65.15(6), those materials shall be compacted to establish a minimum of a 12-inch liner. A minimum initial

overexcavation of 6 inches of material shall be required. The underlying material shall be scarified, reworked and compacted to a depth of 6 inches. The overexcavated materials shall be replaced and compacted.

*b.* If the location of the proposed aerobic structure, anaerobic lagoon or earthen manure storage basin does not contain suitable materials as determined by the soil corings taken in subrule 65.15(6), suitable materials shall be compacted to establish a minimum of a 24-inch liner.

*c.* Where sand seams, gravel seams, organic soils or other materials that are not suitable are encountered during excavation, the area where they are discovered shall be overexcavated a minimum of 24 inches and replaced with suitable materials and compacted.

*d.* All loose lift material must be placed in lifts of nine inches or less and compacted. The material shall be compacted at or above optimum moisture content and meet a minimum of 95 percent of the maximum density as determined by the Standard Proctor test after compaction.

*e.* For purposes of this rule, suitable materials means soil, soil combinations or other similar material that is capable of meeting the permeability and compaction requirements. Sand seams, gravel seams, organic soils or other materials generally not suitable for anaerobic lagoon, aerobic structure, or earthen manure storage basin construction are not considered suitable materials.

*f.* As an alternative to the above standards, a synthetic liner may be used. If the use of a synthetic liner is planned for an earthen aerobic structure, an anaerobic lagoon, or earthen manure storage basin, the permit application shall outline how the site will be prepared for placement of the liner, the physical, chemical, and other pertinent properties of the proposed liner, and information on the procedures to be used in liner installation and maintenance. In reviewing permit applications which involve use of synthetic liners, DNR will consider relevant synthetic liner standards adopted by industry, governmental agencies, and professional organizations as well as technical information provided by liner manufacturers and others.

**65.15(13)** Anaerobic lagoon design standards. An anaerobic lagoon shall meet the requirements of this subrule.

*a. General.*

(1) Depth. Liquid depth shall be at least 8 feet but 15 to 20 feet is preferred if soil and other site conditions allow.

(2) Inlet. One subsurface inlet at the center of the lagoon or dual (subsurface and surface) inlets are preferred to increase dispersion. If a center inlet is not provided, the inlet structure shall be located at the center of the longest side of the anaerobic lagoon.

(3) Shape. Long, narrow anaerobic lagoon shapes decrease manure dispersion and should be avoided. Anaerobic lagoons with a length-to-width ratio of greater than 3:1 shall not be allowed.

(4) Aeration. Aeration shall be treatment as an “add-on process” and shall not eliminate the need for compliance with all anaerobic lagoon criteria contained in these rules.

(5) Manure loading frequency. The anaerobic lagoon shall be loaded with manure and dilution water at least once per week.

(6) Design procedure. Total anaerobic lagoon volume shall be determined by summation of minimum stabilization volume; minimum dilution volume (not less than 50 percent of minimum stabilization volume); manure storage between periods of disposal; and storage for 8 inches of precipitation.

(7) Manure storage period. Annual or more frequent manure removal from the anaerobic lagoon, preferably prior to May 1 or after September 15 of the given year, shall be practiced to minimize odor production. Design manure storage volume between disposal periods shall not exceed the volume required to store 14 months’ manure production. Manure storage volume shall be calculated based on the manure production values found in Table 5 at the end of this chapter.

*b. Minimum stabilization volume and loading rate.*

(1) For all animal species other than beef cattle, there shall be 1000 cubic feet minimum design volume for each 5 pounds of volatile solids produced per day if the volatile solids produced per day are 6000 pounds or fewer and for each 4 pounds if the volatile solids produced per day are more than 6000

pounds. For beef cattle, there shall be 1000 cubic feet minimum design volume for each 10 pounds of volatile solids produced per day.

(2) In Lyon, Sioux, Plymouth, Woodbury, Osceola, Dickinson, Emmet, Kossuth, O'Brien, Clay, Palo Alto, Cherokee, Buena Vista, Pocahontas, Humboldt, Ida, Sac, Calhoun, and Webster counties for all animal species other than beef there shall be 1000 cubic feet minimum design volume for each 4.5 pounds of volatile solids per day if the volatile solids produced per day are 6000 pounds or fewer. However, if a water analysis as required in 65.15(3)“c”(2) below indicates that the sulfate level is below 500 milligrams per liter, then the rate is 1000 cubic feet for each 5.0 pounds of volatile solids per day.

(3) Credit shall be given for removal of volatile solids from the manure stream prior to discharge to the lagoon. The credit shall be in the form of an adjustment to the volatile solids produced per day. The adjustments shall be at the rate of 0.50 pound for each pound of volatile solids removed. For example, if a swine facility produces 7000 pounds of volatile solids per day, and if 2000 pounds of volatile solids per day are removed, the volatile solids produced per day would be reduced by 1000 pounds, leaving an adjusted pounds of volatile solids produced per day of 6000 pounds (for which the loading rate would be 5 pounds according to subparagraph (1) above).

(4) Credit shall be given for mechanical aeration if the upper one-third of the lagoon volume is mixed by the aeration equipment and if at least 50 percent of the oxygen requirement of the manure is supplied by the aeration equipment. The credit shall be in the form of an increase in the maximum loading rate (which is the equivalent of a decrease in the minimum design volume) in accordance with Table 8.

(5) If a credit for solids removal is given in accordance with subparagraph (3) above, the credit for qualified aeration shall still be given. The applicant shall submit evidence of the five-day biochemical oxygen demand (BOD5) of the manure after the solids removal so that the aeration credit can be calculated based on an adjustment rate of 0.50 pound for each pound of solids removed.

(6) American Society of Agricultural Engineers (ASAE) standards, “Manure Production and Characteristics,” D384.1, or Midwest Plan Service-18 (MWPS-18), Table 2-1, shall be used in determining the BOD5 production and volatile solid production of various animal species.

*c. Water supply.*

(1) The source of the dilution water discharged to the anaerobic lagoon shall be identified.

(2) The sulfate concentration of the dilution water to be discharged to the anaerobic lagoon shall be identified. The sulfate concentration shall be determined by standard methods as defined in 567—60.2(455B).

(3) A description of available water supplies shall be provided to prove that adequate water is available for dilution. It is recommended that, if the sulfate concentration exceeds 250 mg/l, then an alternate supply of water for dilution should be sought.

*d. Initial lagoon loading.* Prior to the discharge of any manure to the anaerobic lagoon, the lagoon shall be filled to a minimum of 50 percent of its minimum stabilization volume with fresh water.

*e. Lagoon manure and water management during operation.* Following initial loading, the manure and water content of the anaerobic lagoon shall be managed according to either of the following:

(1) For single cell lagoons or multicell lagoons without a site-specific lagoon operation plan. The total volume of fresh water for dilution added to the lagoon annually shall equal one-half the minimum stabilization volume. At all times, the amount of fresh water added to the lagoon shall equal or exceed the amount of manure discharged to the lagoon.

(2) For a two or three cell anaerobic lagoon. The manure and water content of the anaerobic lagoon may be managed in accordance with a site-specific lagoon operation plan approved by the department. The lagoon operation plan must describe in detail the operational procedures and monitoring program to be followed to ensure proper operation of the lagoon. Operational procedures shall include identifying the amounts and frequencies of planned additions of manure, fresh water and recycle water, and amount and frequencies of planned removal of solids and liquids. Monitoring information shall include locations and intervals of sampling, specific tests to be performed, and test parameter values used to indicate proper lagoon operation. As a minimum, annual sampling and testing of the first lagoon cell for electrical

conductivity (EC) and either chemical oxygen demand (COD) or total ammonia (NH<sub>3</sub> + NH<sub>4</sub>) shall be required.

*f. Manure removal.* If the anaerobic lagoon is to be dewatered once a year, manure should be removed to approximate the annual manure volume generated plus the dilution water used. If the anaerobic lagoon is to be dewatered more frequently, the anaerobic lagoon liquid level should be managed to maintain adequate freeboard.

**65.15(14)** Concrete standards. A formed manure storage structure which is constructed of concrete on or after March 24, 2004, that is part of a confinement feeding operation other than a small animal feeding operation shall meet the following minimum standards. For the purpose of this subrule, a “PE” is a professional engineer licensed in the state of Iowa and an “NRCS engineer” is an engineer working for the USDA Natural Resources Conservation Service (NRCS). (CAVEAT: These standards are not intended to address other site-related engineering and construction considerations beyond the department’s jurisdiction).

*a. Nondry manure storage.* The following minimum concrete standards are required for a formed manure storage structure other than that used for the storage of manure exclusively in a dry form. A formed manure storage structure must be designed in accordance with one of the following design methods:

(1) Engineering report, plans and specifications prepared and sealed by a PE or an NRCS engineer. Design considerations shall be in conformance with the American Concrete Institute (ACI) Building Code ACI 318, ACI 360 or ACI 350; or Portland Cement Association (PCA) publication EB075, EB001 or IS072; or MidWest Plan Service (MWPS) publication MWPS-36 or MWPS TR-9, and shall include all of the following:

1. The floors shall be a minimum of 5 inches thick. Nondestructive methods to verify the floor slab thickness may be required by the department. The results shall indicate that at least 95 percent of the floor slab area meets the minimum required thickness. In no case shall the floor slab thickness be less than 4½ inches.
2. Wire mesh shall not be used as primary reinforcement for a formed manure storage structure with a depth of 4 feet or more. Fiber shall not be used as reinforcement.
3. Waterstops shall be installed in all areas where fresh concrete meets hardened concrete. Waterstops shall be made of plastic, rolled bentonite or similar materials approved by the department.
4. The vertical steel of all walls shall be extended into the footing and be bent at 90° or a separate dowel shall be installed. As an alternate to the 90° bend, the dowel may be extended at least 12 inches into the footing, with a minimum concrete cover of 3 inches at the bottom. In lieu of dowels, mechanical means or alternate methods may be used as anchorage of interior walls to footings.

(2) If a formed manure storage structure is not designed and sealed by a PE or an NRCS engineer, the design and specifications shall be in conformance with MWPS-36 (for a belowground rectangular tank) or MWPS TR-9 (for a circular tank); or in accordance with Appendix D at the end of this chapter (for a belowground, laterally braced rectangular tank). In addition, all of the following concrete standards shall apply:

1. The finished subgrade of a formed manure storage structure shall be graded and compacted to provide a uniform and level base and shall be free of vegetation, manure and debris. For the purpose of this subrule, “uniform” means a finished subgrade with similar soils.
2. When the groundwater table, as determined in 65.15(7) “c,” is above the bottom of the formed structure, a drain tile shall be installed along the footings to artificially lower the groundwater table pursuant to 65.15(7) “b.” The drain tile shall be placed within 3 feet of the footings as indicated in Appendix D, Figure D-1, at the end of this chapter and shall be covered with a minimum of 2 inches of gravel, granular material, fabric or a combination of these materials to prevent plugging the drain tile.
3. All concrete shall have the following minimum as-placed compressive strengths and shall meet American Society for Testing and Materials (ASTM) standard ASTM C 94:
  - 4,000 pounds per square inch (psi) for walls, floors, beams, columns and pumpouts;
  - 3,000 psi for the footings.



The average concrete strength by testing shall not be below design strength. No single test result shall be more than 500 psi less than the minimum compressive strength.

4. Cementitious materials shall consist of portland cement conforming to ASTM C 150. Aggregates shall conform to ASTM C 33. Blended cements in conformance with ASTM C 595 are allowed only for concrete placed between March 15 and October 15. Portland-pozzolan cement or portland blast furnace slag blended cements shall contain at least 75 percent, by mass, of portland cement.

5. All concrete placed for walls shall be consolidated or vibrated, by manual or mechanical means, or a combination, in a manner which meets ACI 309.

6. All rebar used shall be a minimum of grade 40 steel. All rebar, with the exception of rebar dowels connecting the walls to the floor or footings, shall be secured and tied in place prior to the placing of concrete.

7. All wall reinforcement shall be placed so as to have a rebar cover of 2 inches from the inside face of the wall for a belowground manure storage structure. Vertical wall reinforcement should be placed closest to the inside face. Rebar placement shall not exceed tolerances specified in ACI 318.

8. The floor slab shall be a minimum of 5 inches thick. The floor slab of any formed manure storage structure with a depth of 4 feet or more shall have primary reinforcement consisting of a minimum of #4 rebar placed a maximum of 18 inches on center in each direction placed in a single mat. The floor slab of any formed manure storage structure with a depth less than 4 feet shall have shrinkage reinforcement consisting of a minimum of  $6 \times 6$ -W1.4  $\times$  W1.4 welded wire fabric. Floor slab reinforcement shall be located in the middle of the thickness of the floor slab. Nondestructive methods to verify the floor slab thickness may be required by the department. The results shall indicate that at least 95 percent of the floor slab area meets the minimum required thickness. In no case shall the floor slab thickness be less than  $4\frac{1}{2}$  inches.

9. The footing or the area where the floor comes in contact with the walls and columns shall have a thickness equal to the wall thickness, but in no case be less than 8 inches, and the width shall be at least twice the thickness of the footing. All exterior walls shall have footings below the frostline. Tolerances shall not exceed  $-\frac{1}{2}$  inch of the minimum footing dimensions.

10. The vertical steel of all walls shall be extended into the footing, and be bent at  $90^\circ$  or a separate dowel shall be installed as a #4 rebar that is bent at  $90^\circ$  with at least 20 inches of rebar in the wall and extended into the footing within 3 inches of the bottom of the footing and extended at least 3 inches horizontally, as indicated in Appendix D, Figure D-1, at the end of this chapter. As an alternative to the  $90^\circ$  bend, the dowel may be extended at least 12 inches into the footing, with a minimum concrete cover of 3 inches at the bottom. Dowel spacing (bend or extended) shall be the same as the spacing for the vertical rebar. In lieu of dowels, mechanical means or alternate methods may be used as anchorage of interior walls to footings.

11. All walls shall be formed with rigid forming systems and shall not be earth-formed.

12. All concrete shall be cured for at least seven days after placing, in a manner which meets ACI 308, by maintaining adequate moisture or preventing evaporation. Proper curing shall be done by ponding, spraying or fogging water; or by using a curing compound that meets ASTM C 309; or by using wet burlap, plastic sheets or similar materials.

13. All construction joints in exterior walls shall be constructed to prevent discontinuity of steel and have properly spliced rebar placed through the joint. Waterstops shall be installed in all areas where fresh concrete will meet hardened concrete as indicated in Appendix D, Figures D-1 and D-2, at the end of this chapter. The waterstops shall be made of plastic, rolled bentonite or similar materials approved by the department.

14. Backfilling of the walls shall not start until the floor slabs or permanent bracing have been installed. Backfilling shall be performed with material free of vegetation, large rocks or debris.

15. A formed manure storage structure with a depth greater than 12 feet shall be designed by a PE or an NRCS engineer.

*b. Dry manure storage.* A formed structure for the storage of manure exclusively in a dry form shall be designed and constructed in accordance with one of the following:

(1) Engineering report, plans and specifications prepared and sealed by a PE or an NRCS engineer. Design considerations shall be in conformance with the American Concrete Institute (ACI) Building Code ACI 318 or ACI 360; or Portland Cement Association (PCA) publication EB075, EB001 or IS072; or MidWest Plan Service (MWPS) publication MWPS-36.

(2) If a formed manure storage structure that stores manure exclusively in a dry form is to be constructed aboveground and the design is not prepared and sealed by a PE or an NRCS engineer, the requirements set forth in 65.15(14) "a"(2), numbered paragraphs "1," "3," "4," "5," "6," "8" and "12," shall apply. Consideration shall be given to internal and external loads including, but not limited to, wind loads, building load, manure pile and equipment vehicle loads.

(3) If the formed structure that stores manure exclusively in a dry form is to be constructed below or partially below the ground and the design is not prepared and sealed by a PE or an NRCS engineer, the requirements set forth in 65.15(14) "a"(2), numbered paragraphs "1" through "15," shall apply. Wall design shall be in accordance with Appendix D at the end of this chapter or in accordance with MWPS-36. Consideration shall be given to internal and external loads including, but not limited to, lateral earth pressures, hydrostatic pressures, wind loads, manure pile and equipment vehicle loads.

*c. Karst terrain—upgraded standards.* If the site of the proposed formed manure storage structure is located in an area that exhibits karst terrain or an area that drains into a known sinkhole, the minimum concrete standards set forth in 65.15(14) "a" or "b" shall apply. In addition, the following requirements apply to all formed manure storage structures that store nondry or dry manure:

(1) A minimum 5-foot vertical separation distance between the bottom of a formed manure storage structure and limestone, dolomite, or other soluble rock is required if the formed manure storage structure is not designed by a PE or an NRCS engineer.

(2) If the vertical separation distance between the bottom of the proposed formed manure storage structure and limestone, dolomite, or other soluble rock is less than 5 feet, the structure shall be designed and sealed by a PE or an NRCS engineer who certifies the structural integrity of the structure. A 2-foot-thick layer of compacted clay liner material shall be constructed underneath the floor of the formed manure storage structure. However, it is recommended that any formed manure storage structure be constructed aboveground if the vertical separation distance between the bottom of the structure and the limestone, dolomite, or other soluble rock is less than 5 feet.

(3) In addition, in an area that exhibits karst terrain or an area that drains into a known sinkhole, a PE, an NRCS engineer or a qualified organization shall submit a soil exploration study based on the results from soil borings or test pits to determine the vertical separation between the bottom of the formed structure and limestone, dolomite, or other soluble rock. A minimum of two soil borings or two test pits, equally spaced within each formed structure, are required. After soil exploration is completed, each soil boring and pit shall be properly plugged with concrete grout, bentonite, or similar materials.

(4) Groundwater monitoring shall be performed as specified by the department.

(5) Backfilling shall not start until the floor slats have been placed or permanent bracing has been installed, and shall be performed with material free of vegetation, large rocks, or debris.

**65.15(15) Berm erosion control.**

*a.* The following requirements shall apply to any anaerobic lagoons, earthen aerobic structures, or earthen manure storage basins constructed after May 12, 1999.

(1) Concrete, riprap, synthetic liners or similar erosion control materials or measures shall be used on the berm surface below pipes where manure will enter the anaerobic lagoon, aerobic structure, or earthen manure storage basin.

(2) Concrete, riprap, synthetic liners or similar erosion control materials or measures of sufficient thickness and area to accommodate manure removal equipment and to protect the integrity of the liner shall be placed at all locations on the berm, side slopes, and base of the anaerobic lagoon, aerobic structure, or earthen manure storage basin where agitation or pumping may cause damage to the liner.

(3) Erosion control materials or measures shall be used at the corners of the anaerobic lagoon, aerobic structure, or earthen manure storage basin.

*b.* The owner of a confinement feeding operation with an anaerobic lagoon, earthen aerobic structure, earthen manure storage basin, earthen waste slurry storage basin, or earthen egg washwater

storage structure shall inspect the structure berms at least semiannually for evidence of erosion. Erosion problems found which may impact either structural stability or liner integrity shall be corrected in a timely manner.

**65.15(16)** Agricultural drainage wells. After May 29, 1997, a person shall not construct a new or expand an existing earthen aerobic structure, earthen anaerobic lagoon, earthen manure storage basin, earthen waste slurry storage basin, or earthen egg washwater storage structure within an agricultural drainage well area.

**65.15(17)** Secondary containment barriers for manure storage structures. Secondary containment barriers used to qualify any operation for the exemption provision in subrule 65.12(5) shall meet the following:

*a.* A secondary containment barrier shall consist of a structure surrounding or downslope of a manure storage structure that is designed to contain 120 percent of the volume of manure stored above the manure storage structure's final grade. If the containment barrier does not surround the manure storage structure, upland drainage must be diverted.

*b.* The barrier may be constructed of earth, concrete, or a combination of both and shall not have a relief outlet or valve.

*c.* The base shall slope to a collecting area where storm water can be pumped out. If storm water is contaminated with manure, it shall be land-applied at normal fertilizer application rates in compliance with rule 65.3(455B).

*d.* Secondary containment barriers constructed entirely or partially of earth shall comply with the following requirements:

(1) The soil surface, including dike, shall be constructed to prevent downward water movement at rates greater than  $1 \times 10^{-6}$  cm/sec and shall be maintained to prevent downward water movement at rates greater than  $1 \times 10^{-5}$  cm/sec.

(2) Dikes shall not be steeper than 45 degrees and shall be protected against erosion. If the slope is 19 degrees or less, grass can be sufficient protection, provided it does not interfere with the required soil seal.

(3) The top width of the dike shall be no less than 3 feet.

*e.* Secondary containment barriers constructed of concrete shall be watertight and comply with the following requirements:

(1) The base of the containment structure shall be designed to support the manure storage structure and its contents.

(2) The concrete shall be routinely inspected for cracks, which shall be repaired with a suitable sealant.

**65.15(18)** Human sanitary waste shall not be directed to a manure storage structure or egg washwater storage structure.

**65.15(19)** Requirements for qualified operations. A confinement feeding operation that meets the definition of a qualified operation shall only use an aerobic structure for manure storage and treatment. This requirement does not apply to a confinement feeding operation that only handles manure in a dry form or to an egg washwater storage structure or to a confinement feeding operation which was constructed before May 31, 1995, and does not expand.

**65.15(20)** Aboveground formed manure storage structures with external outlet or inlet below the liquid level. A formed manure storage structure which is constructed to allow the storage of manure wholly or partially above ground and which has an external outlet or inlet below the liquid level shall have all of the following:

*a.* Two or more shutoff valves on any external outlet or inlet below the liquid level. At least one shutoff valve shall be located inside the structure and be operable if the external valve becomes inoperable or broken off.

*b.* All external outlets or inlets below the liquid level shall be barricaded, encased in concrete, or otherwise protected to minimize accidental destruction.

*c.* Construction shall be in compliance with the manufacturer's requirements.

*d.* An emergency response plan for retaining manure at the site and cleanup if the manure storage structure fails or there is any other type of accidental discharge. The plan shall consist of telephone numbers to comply with 65.2(9) and list of contractors, equipment, equipment technical support, and alternative manure storage or land application sites which can be used during inclement weather.