



# **Guidance for Concentrated Animal Feeding Operations (CAFO) Fulfilling Compliance with Part 22**

**(This guidance does not pertain to poultry operations.)**

## **Introduction**

Once a CAFO has reached 5,000 animal units for any one species, groundwater requirements under Part 22, Groundwater Quality (Part 22 Rules), promulgated pursuant to Part 31, Water Resources Protection, of the Natural Resources and Environmental Protection Act, 1994 PA 451, as amended (NREPA), as well as the National Pollutant Discharge Elimination System (NPDES) requirements will impact the permitting process. Five thousand animal units means: 5,000 head of slaughter or feeder cattle; 3,500 mature dairy cattle; 12,500 swine weighing more than 25 kilograms (approximately 55 pounds); 50,000 sheep or lambs; 2,500 horses; 275,000 turkeys; 150,000 laying hens or broilers; or 25,000 ducks.

Applicants will continue to apply through the NPDES process. The Department of Environmental Quality (DEQ), Water Resources Division, Groundwater Permits Unit, staff can use much of the information submitted in the NPDES permit application; however, some of the requirements of the Part 22 Rules are different from NPDES and submission of additional information will be required in order to complete our review. The outcome is one permit covering both the NPDES and Part 22 Rules requirements.

Some of the information may already be in the applicant's records and submitted with the NPDES permit application such as:

- A Comprehensive Nutrient Management Plan (CNMP)
- Field-by-Field Assessment
- Manure application history for each field for the last five years
- Maps that depict the locations of fields
- Soil sampling data, manure management plan data, phosphorus levels by field, etc.

**The following pages include:**

**Section I: Groundwater Discharge Permit Application Guidance** - describes additional information needed to complete R 323.2218 requirements.

**Section II: Groundwater Discharge Permit Guidance** - describes additional groundwater conditions that will likely appear in a dual permit for both NPDES and the Part 22 Rules.

**Section III: Manifested Waste** - describes the manifesting of waste under the dual permit.

Where used in the following pages, solid stackable manure is defined according to the NPDES permit as *“manure and manure mixed with bedding that can be piled up or stacked and will maintain a piled condition. It will also have the characteristic that it can be shoveled with a pitchfork.”*

## **Section I: Groundwater Discharge Permit Application Guidance**

It is recommended that the applicant schedule a preapplication meeting with the Groundwater Permits Unit to discuss application requirements.

When possible, it would be helpful, but not necessary, if the information described below is submitted prior to the preapplication meeting so staff may have time to review the information. If the appropriate information is submitted prior to the meeting, the extent of any hydrogeologic requirements, discharge management plan (DMP) requirements, and effluent sampling and characterization requirements can be discussed at the meeting.

Information that may not have been submitted with the NPDES permit application that is necessary for the groundwater discharge permit include the following:

- Local water well logs along with maps showing locations of well logs. Sources for water well logs and locations can be found at: [http://www.michigan.gov/documents/deq/deq-wb-dwehs-ciu-somcontamwebsites\\_299942\\_7.pdf?20150828112209](http://www.michigan.gov/documents/deq/deq-wb-dwehs-ciu-somcontamwebsites_299942_7.pdf?20150828112209)
- Latest soil sampling results by field including such parameters as Bray P<sub>1</sub>, organic matter, potassium, magnesium, calcium, pH, and cation exchange capacity (CEC).
- Use of ethylene diamine tetra-acetic acid (EDTA) or other chelator(s).
- Description of the waste streams that comprise the manure samples (i.e., silage leachate, milking center process water, and wasted feed) and any additives used in cleaning, processing, etc.
- Characterization and quantity of any additives placed into the CAFO waste that is discharged to land.
- Characterization of the wasted feed unless it is part of the solid manure annual testing.
- Site-specific engineering or hydrogeologic studies where a subsurface investigation was performed.

### **Waste Characterization**

At a minimum, waste is to be analyzed and reported separately for each of the following parameters: total Kjeldahl nitrogen, ammonium nitrogen, nitrate nitrogen, total phosphorus, total potassium, and percent (%) solids.

If the treatment or storage lagoon waste is mixed with other waste or by-products in addition to manure, analysis for metals, pH, biological oxygen demand (BOD), or other parameters depending on the nature of the products may be necessary as part of the manure analysis.

More information can be found in *Guidesheet III: Characterization of Wastewater* at [http://www.michigan.gov/documents/deq/wrd-groundwater-p22-characterization\\_564952\\_7.pdf](http://www.michigan.gov/documents/deq/wrd-groundwater-p22-characterization_564952_7.pdf) regarding additives, chemicals, or by-products that may be released or produced from the process or process material(s); any reaction by-products from the process mixture or environmental media; the collection of representative samples; appropriate number of samples to be collected; appropriate analytical methods; reporting levels; etc.

### **CAFO Waste Storage Structures and Lagoon Liner Requirements under R 323.2237**

#### **NEW CAFO Waste Storage Structures:**

If the applicant stores CAFO waste that does not meet the definition of solid stackable manure, the following paragraphs apply to the application:

Once an individual joint NPDES and groundwater discharge permit has been issued, all new CAFO waste storage structures must be constructed in compliance with the Part 22 Rules wastewater treatment or storage lagoon liner requirements outlined under R 323.2237. R 323.2237 requires wastewater treatment or storage lagoons to consist of a composite liner or a design that provides equal or greater environmental protection. Please refer to Appendix A for examples of construction alternatives for CAFO waste storage structures that under this guidance need to comply with R 323.2237. **Note that not all facilities need to comply as explained below.**

#### **EXISTING CAFO Waste Storage Structures**

Existing CAFO waste storage structures that comply with the Michigan Natural Resources Conservation Service (NRCS) Conservation Practice Standard No. 313, Waste Storage Facility (NRCS 313), will be exempt from the Part 22 Rules wastewater treatment or storage lagoon liner requirements outlined under R 323.2237. However, during each permit cycle, a CAFO waste storage structure evaluation will be required to be completed and certified by an engineer licensed under Public Act 299 of 1980, as amended, being Section 339.101 *et seq.* of the Michigan Compiled Laws and known as the Occupational Code. The purpose of this evaluation will be to verify that each CAFO waste storage structure continues to be in compliance with NRCS 313.

Evaluations should be completed according to the criteria found in the CAFO guidance at: [https://www.michigan.gov/deq/0,4561,7-135-3313\\_71618\\_3682\\_3713-96774--,00.html](https://www.michigan.gov/deq/0,4561,7-135-3313_71618_3682_3713-96774--,00.html).

Separate evaluation documents are provided for the various types of structures:

- Synthetic Structure Evaluation
- Natural Clay Structure Evaluation
- Compacted Earth Structure Evaluation
- Concrete Lined Structure Evaluation
- Synthetic - Concrete Structure Evaluation
- Reinforced Concrete Structure Evaluation
- Steel Storage Structure Evaluation
- Solid-Dry Stack Structure Evaluation

At such time as any of these CAFO waste storage structures fail to meet the NRCS 313 standard, repairs or replacements of those structures will likely be required to meet R 323.2237 or its equivalency. In addition, a CAFO is responsible for groundwater contamination under Part 201, Environmental Remediation, of the NREPA due to leakage from CAFO waste storage structures.

### **Hydrogeologic Study of Application Field(s) Receiving CAFO Waste**

R 323.2218 requires the completion of a hydrogeologic study on all property used for the disposal of waste. Once a permit application is received, the Groundwater Permits Unit will conduct a review of the application fields receiving CAFO waste to determine which, if any, require a hydrogeologic study. Information that may be used in this determination includes: soils and geologic deposits at each field, whether a field is underlain or likely to be underlain by a useable aquifer, whether the aquifer receiving the discharge is used as a drinking water source, distance to shallow drinking water wells, depth to groundwater, etc. Initially, only two or three fields may be selected for investigation. If a hydrogeologic study is required, the applicant will be notified which field(s) will require investigation and that a Hydrogeologic Study Work Plan that meets the requirements of R 323.2221(3)(b) must be submitted for review and approval. This notification may either be included under a Schedule of Compliance in the permit or under separate letter.

Once the hydrogeologic study is completed, the applicant will be required to submit a Hydrogeologic Report that meets the requirements of Rule 2221(4) of the Part 22 Rules. Additional information regarding the Hydrogeologic Report can be found in the technical guidance document for Hydrogeologic Study Requirements. The guidance document may be obtained from the Groundwater Permits Unit staff or at:

[http://www.michigan.gov/documents/deq/wrd-groundwater-p22-hydrogeo\\_564949\\_7.pdf](http://www.michigan.gov/documents/deq/wrd-groundwater-p22-hydrogeo_564949_7.pdf).

### **Discharge Management Plan (DMP)**

A DMP is required under R 323.2218 for all acreage on which waste is applied. The requirements of the DMP can be fulfilled through the CNMP of the generating CAFO when it includes additional language supporting the provisions of the Part 22 Rules.

- Land application of CAFO waste that is not covered under the CNMP must be covered under a DMP of the applicator or sent to a properly permitted NPDES surface water discharger.
- More information about the DMP can be found in the technical guidance document for developing a DMP. The guidance document may be obtained from the Groundwater Permits Unit staff or at: [http://www.michigan.gov/deq/0,4561,7-135-3313\\_4117-9782--,00.html](http://www.michigan.gov/deq/0,4561,7-135-3313_4117-9782--,00.html).

NOTE: The aforementioned information required by NPDES and submitted to MiWaters makes it available to both the NPDES Program and Groundwater Discharge Permits Program staff.

## Section II: Groundwater Discharge Permit Guidance

The following requirements may be included in the permit when the discharge of CAFO waste is also regulated by the Part 22 Rules. Possible impacts to groundwater will be determined by Groundwater Permits Unit staff on a case-by-case basis.

### CAFO Waste Sampling and Analysis

Sample data for at least five years is typically required to properly characterize waste and should be done according to the following:

1. Follow the Midwest Plan Service publication MWPS 18, Section 1, *Manure Characteristics*, Iowa State University, Ames, Iowa, 2000; or the *North Central Regional Extension Publication No. 567*. Other publications can be used if authorized in advance by the DEQ.
2. Approved analytical methods are described in the United States Environmental Protection Agency (USEPA) *Test Methods for Evaluating Solid Waste: Physical/Chemical Methods Compendium* (SW-846). Another USEPA method can be used if authorized by the DEQ.
3. Ensure that representative samples are obtained from each structure from which CAFO waste may be removed for land application. Alternate sampling protocols may be submitted for approval by the DEQ.
4. Sample CAFO waste a minimum of once per year to determine % dry solids and nutrient content for the parameters listed in No. 6, below.
5. If this is a new facility without historical sampling data, analyze a sample from each storage structure from which land application will be generated according to the following:
  - At the time of application, analyze a sample from each storage structure from which land application will be generated.
  - Record the results from above for future use.
  - Estimate the nutrient content of the CAFO waste using appropriate tables in MWPS 18 this first year only.
  - Subsequent years will use sample results.
6. Analyze CAFO waste for the following parameters and record the results on a dry weight basis:
  - % Dry Solids
  - % Total Kjeldahl Nitrogen (TKN)
  - % Ammonium Nitrogen (N as  $\text{NH}_4^+$ )
  - % Nitrate Nitrogen (N as  $\text{NO}_3^-$ )
  - % Total Phosphorus (TP as  $\text{P}_2\text{O}_5$ )
  - % Total Potassium (K as  $\text{K}_2\text{O}$ )

The DEQ may request additional analyses if it is deemed necessary due to circumstances such as, but not limited to, changes in applicable laws, substantial changes in facility operations, significant variability in chemical analytical data, or information indicating the potential presence of additional constituents of concern.

## **Groundwater Monitoring**

If the discharge is likely to impact groundwater, groundwater monitoring may be required on a quarterly basis throughout the permit cycle to gather data to evaluate any adverse environmental impacts.

## **Land Application for Groundwater Protection**

1. **Application Rate:** Under NPDES requirements, manure application rates are usually limited by phosphorus and nitrogen loading. Based on the concentration of nitrogen and phosphorus in CAFO waste, it is anticipated these nutrients will be the limiting factor for land application under the Part 22 Rules as well.
  - Care must be taken to apply CAFO waste in a manner that does not adversely restrict soil permeability or cause ponding, pooling, or runoff in the area.
2. **Spreading Season:** The most acceptable spreading season for nutrient management is from April 1 through September 21.
3. **Late Season Application:** Land application activities from September 22 to December 15 will likely have the following additional requirements:
  - Application of CAFO waste should be managed so that it will be absorbed and held within the effective rooting zone of the vegetative cover that is or will be established as described below.

Appropriate sites are comprised of soils classified by the NRCS, including those artificially drained, as well-drained, moderately well-drained, or somewhat poorly drained.

- **Before November 1:** CAFO waste may be applied to the ground surface prior to planting the crop/cover crop provided soil temperatures adequate to germinate the seed are in the 10-day forecast prior to planting.
- **After November 1 and until December 15:** Either a viable, growing crop/cover crop must exist before application or adequate growing degree days must be projected in the 10-day forecast anticipating emergence of a previously seeded crop/cover crop whose growth may not yet be apparent.
  - Injection or incorporation may not be feasible in this instance since the waste would be applied to planted crops.
  - Apply only to those fields where the waste will not enter the waters of the state.

- Light incorporation is acceptable where there is minimal loss of crop.
- The site must meet the following slope restrictions:
  - 3% or less for CAFO waste not meeting the definition of solid stackable manure.
  - 6% or less for CAFO waste meeting the definition of solid stackable manure.
- **Between December 15 and April 1:** CAFO waste applications are not typically allowed. Each waste stream should have six months of storage.
- Crop/cover crops planted for this purpose shall be perennial or at least winter hardy to intercept the spring thaw nutrient flow. The fields must be cropped the following season.

## Soil Sampling

Generally, the 3-year sampling according to the NPDES permit will satisfy the requirements of the Part 22 Rules. Particularly sensitive sites may require soil sampling more often.

The entire soil test results should be submitted, preferably including the lab report or spreadsheet listing all sites and results of all parameters analyzed, along with the field sampling layout. Soil should be analyzed for at least Bray P<sub>1</sub>, pH, and CEC.

## Nitrogen Management

It is well known that not all of the nitrogen in CAFO waste is available immediately. Ammonium and nitrate are considered immediately available when applied and readily quantified at the time manure is analyzed. Organic nitrogen becomes available over time and is not as easily quantified or estimated. However, it can account for a large portion of the nitrogen applied; therefore, it is necessary to manage nitrogen as follows:

1. At the time CAFO waste is land applied, the nitrogen content, as determined when last analyzed, is estimated to equal the sum of ammonium, nitrate, and the first year available organic nitrogen fraction, as determined by *Utilization of Animal Manure for Crop Production Bulletins MM-2 and MM-3 (Jacobs, 1995a and b)* or another approved resource.
2. Application of nitrogen as determined in No. 1, above, shall not exceed the crop recommendation, or for legumes use the crop nitrogen removal rate, for the first crop grown following the application of CAFO waste.
3. Additional nitrogen applied in the year following application of CAFO waste cannot exceed the crop recommendation reduced by the quantity determined in No. 1, above, and applied as described in No. 2, above.

4. If a nitrogen application resulting in a rate higher than the determination in No. 3 is proposed, a Pre-Sidedress Nitrate Test (PSNT) or other approved method to determine crop need must be performed prior to any nitrogen application.

### **Isolation Distances (Setbacks)**

Setbacks to protect surface water are already included in the NPDES permit. Additional setback requirements in the Part 22 Rules will be added to the permit for protection of groundwater. The various setbacks are described below.

Property boundary or roads:

- 100-foot setback:
  - For operations surface applying nonstackable manure.
  - For operations applying manure regardless of classification where the application site is adjacent to property used as residential and the property owner has not agreed to a reduced setback.
- 10-foot setback:
  - For operations applying manure classified as solid stackable where the application site is not adjacent to property used as residential.
  - For operations injecting nonstackable manure where the application site is not adjacent to property used as residential.
- The 10 foot setback for property lines may be reduced to a 5-foot setback:
  - For property lines where crop rows are next to the adjoining property crop rows.
  - For fence rows with no drainage ditches.
  - For public roads with no drainage ditches where the crop rows are next to the graveled roadway.
  - The reduction is allowable only if slopes are less than 6% or fields are bowl-shaped such that the runoff does not escape the field.

Water Supply Well Setbacks:

- Operations applying nonstackable manure must maintain a minimum of 2,000 feet from any Type I or IIa water supply well; 800 feet from any Type IIb or III water supply well; and 300 feet from a domestic well.
- Operations applying stackable manure must maintain a minimum of 200 feet from a Type I or IIa water supply well; 75 feet from a Type IIb or III water supply well; and 50 feet from a domestic well.
- Nonstackable manure that is injected where the seasonal high water table is at least 3 feet below the ground surface will be subject to the reduced setback described in the second bullet above.

## Section III: Manifested Waste

The Part 22 Rules do not have a provision for manifesting CAFO waste. Under the Part 22 Rules, control of the application of waste is to remain with the owner/certified operator. However, the NPDES CAFO permit covered by Part 21, Wastewater Discharge Permits, promulgated pursuant to Part 31 of the NREPA does allow for the manifesting of CAFO waste.

Under this dual permit, the following options are available:

1. The facility does not manifest any waste and therefore remains in control of all land applications.
2. The entity/applicator receiving the waste that is manifested has a groundwater discharge permit or is authorized to discharge to surface waters via an NPDES permit. For a groundwater discharge permit, the applicator would be required to meet the provisions of Rule 2204 of the Part 22 Rules.

### DEQ Contacts

Questions regarding the groundwater discharge permitting process can be directed to the Groundwater Permits Unit staff at 517-284-5570.

For information or assistance on this publication, please contact the Water Resource Division, Groundwater Discharge Program through the DEQ Environmental Assistance Center at 800-662-9278. This publication is available in alternative formats upon request.

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## MICHIGAN DEPARTMENT OF ENVIRONMENTAL QUALITY

## INTEROFFICE COMMUNICATION

May 3, 2004

TO: Ronda Wuycheck, Field Operations Section, Water Division

FROM: Dave Porter, Cadillac District Office, Water Division

SUBJECT: Application of Rule 323.2237 (Wastewater Treatment or Storage Lagoons) to Confined Animal Feeding Operation (CAFO) Waste Storage Facilities

This memo is intended to provide construction alternatives for CAFO waste storage facilities that comply with Rule 323.2237, including the equal or greater environmental protection clause. The legal authority for application of this rule is presented first, followed by suggested options that meet or provide equal protection. Finally, a review process for other proposed alternatives is recommended.

Authorities

PART 22 (Groundwater Quality) of NREPA was promulgated under Part 31 by authority conferred on the Department of Environmental Quality (DEQ) in Sections 3103 and 3106 of Act No. 451 of the Public Acts of 1994, as amended, being §§324.3103 and 324.3106 of the Michigan Compiled Laws. R 323.2237 (Rule 2237) provides for groundwater protection from wastewater treatment or storage lagoons discharges with a construction standard (composite liners). CAFO liquid waste storage facilities are considered wastewater treatment or storage lagoons, and as such must comply with the liner standards prescribed in Rule 2237.

Standards

Liners shall comply with Rule 2237. Soil liners shall have a hydraulic conductivity  $1 \times 10^{-7}$  cm/sec or less, and natural soil shall be free of sand lenses. Flexible Membrane Liners (FMLs) shall be a minimum of 40 mils thick polyvinyl chloride (PVC) or 60 mils thick high-density polyethylene (HDPE). Since Rule 2237 does not address concrete, it is recommended that concrete comply with American Concrete Institute standards, and that concrete be designed to provide a compressive strength of at least 4,000 pounds per square inch at a curing time of 28 days.

Liquid Storage Facilities

The following numbered alternatives meet the requirements of Rule 2237, or provide equal or greater environmental protection for wet-storage applications. No hydro-geological investigation is required if these alternatives are used.

1. Provide a waste storage structure that meets the composite liner requirements in Rule 2237, i.e., 10 feet of natural soil barrier and an approved Flexible Membrane Liner (FML); 2 feet of compacted soil liner and an approved FML; or a geo-composite clay liner and an approved FML. The FML must be in direct contact with the underlying liner. If concrete is to be placed above the liners a method of liner protection acceptable to the Department shall be utilized. The protection may be an appropriate thickness of soil place upon the liners.
2. Provide a concrete waste storage structure over a liner (either 10 feet of natural soil barrier, a two-foot installed compacted soil liner, or approved FML) with one foot of sand cushion between the concrete and the liner with a leak detection system in the sand cushion. The concrete must

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be designed and constructed in accordance with the American Concrete Institute Code for Structural Concrete (ACE 318). If leakage is detected in the soil cushion the waste storage structure must be taken out of service and repaired before further usage.

3. Provide a concrete waste storage structure upon a prepared soil cushion. The concrete must be designed and constructed in accordance with the American Concrete Institute Code for Environmental Engineering Concrete Structures (ACE 350).
4. Provide a waste storage structure with a concrete bottom designed and constructed in accordance with the ACE 350 and composite liner sides (as in option1). An engineered connection system must be provided between the concrete and both side liners such that a waterproof connection is made between the concrete and the side liners. A concrete curb or other device shall be provided to protect the engineered connection system from damage by equipment used to empty the structure.
5. Provide waste storage facility with a minimum of 20 feet of natural soil barrier under the structure.
6. Provide a waste storage structure with a base designed and constructed in accordance with the ACE 350 and with engineered sides installed above-ground such that any release would be immediately evident, e.g., glass-lined steel tanks that are often used at agriculture facilities. An engineered waterproof connection system must be provided between the concrete and the side walls. A concrete curb or other device shall be provided to protect the engineered connection system if wheeled equipment will be used inside the structure. If leakage is detected the waste storage structure must be taken out of service and repaired before further usage.
7. Provide an above the ground storage structure designed and installed such that any release would be immediately evident. If leakage is detected the waste storage structure must be taken out of service and repaired before further usage.

#### Dry Storage Facilities

Dry storage facilities are not considered Wastewater Treatment or Storage Lagoons. However, silage and 'dry' manure may leach liquids. Storage of these liquids must be in accordance with the options outlined in the memo.

#### Other Engineered Alternatives

Other waste storage structure designs may be acceptable and would be reviewed on a case-by-case basis. Evaluation of other designs will include a review of groundwater protection through hydro-geological studies, hydraulic conductivity of soils, capabilities of materials of construction, loadings imposed on the structures, etc. The design shall include a reasonable factor of safety. It is the applicant's responsibility to demonstrate that the proposed design provides equal or greater environmental protection of a composite liner system constructed according to Rule 2237.

Please contact me if you have any questions or comments on these waste storage structure alternatives.