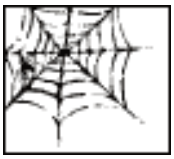
Archived Publication

This information provided in this document is for reference. Please be aware that the information in this document may be outdated or superseded by additional information.



EPA promulgated regulations for Concentrated Animal Feeding Operations (CAFOs) in February 12, 2003 that expanded the number of operations covered by the CAFO regulations and included requirements to address the land application of manure from CAFOs. The rule became effective on April 14, 2003. NPDES-authorized states were required to modify their programs by February 2005 and develop state technical standards for nutrient management. On February 28, 2005, in response to litigation brought by various organizations, the Second Circuit court issued its decision in *Waterkeeper Alliance et al. v. EPA*, 399 F.3d 486 (2d Cir. 2005). EPA has updated the CAFO rule to reflect the changes requested by the Court. Visit www.epa.gov/npdes/caforule to view the 2008 CAFO Final Rule and supporting documents.

CHAPTER 3: PREPARING FOR LAND APPLICATION OF MANURE, LITTER, OR WASTEWATER

Manure Transfers

§122.42(e)(3) Prior to transferring manure, litter, or process wastewater to other persons, Large CAFOs must provide the recipient of the manure, litter or process wastewater with the most current nutrient analysis. The analysis provided must be consistent with the requirements of 40 CFR Part 412. Large CAFOs must retain for five years records of the date, recipient name and address, and approximate amount of manure, litter or process wastewater transferred to another person.

As a practical matter, nearly all manure, litter, and process wastewater is land applied. Manure may be treated or processed into "value-added" products to make manure more transportable, uniform, or sellable, but it is still ultimately land applied. Land applied manure can either be applied to a CAFO land application site, or transferred off site to other persons for application to the land. Chapter 4 of this manual describes the requirements for land application of manure to CAFO land application areas. In the case where the manure, litter, or process wastewater is transferred to others, the CAFO must provide the recipient of the manure, litter, or process wastewater with the results of the most current nutrient analysis (i.e., nitrogen and phosphorus) of the material. In addition, CAFOs must document manure transfers with certain records (see Section B below).

A. Manure Sampling

Manure and Soil Sampling

§412.4(c)(3) Manure must be analyzed a minium of once annually for nitrogen and phosphorus content, and soil analyzed a minimum of once every five years for phosphorus content. The results of these analyses are to be used in determining application rates for manure, litter, and other process wastewater.

Knowing the nutrient content of the material provides the CAFO and/or recipient of manure transferred off site with the necessary information to calculate an appropriate application rate for the manure, litter, or process wastewater. Without the nutrient content, including various forms of the nutrients in the manure, an accurate application rate cannot be calculated. Under the requirements of the effluent guideline, CAFOs must sample manure at least once annually for nitrogen and phosphorus content (40 CFR 412.4(c)(3)). Annual nutrient sampling of manure is the minimum frequency on which to base application rates. Many states require sampling more frequently than the minimum annual frequency established by the CAFO rules. Soil factors are also used to determine appropriate application rates; these are addressed in Chapter 4 of this document.

The CAFO rules do not establish sampling methods and protocols. Soil testing procedures are best suited for particular soil types and climates, and many alternative soil testing methodologies may be used to generate useful predictions of crop response. There are also many different ways to express test results. Analytical results may also vary by testing procedure, and various testing procedures may not be compatible. Analytical results are best correlated to local growing conditions. The currently used protocols and sampling methods vary considerably by geography and climate, and the most appropriate protocols for a given locale are recommended by the local Land Grant University and Extension Offices. CAFOs should use the protocols for the sampling and analysis of manure as established in their state; see Example 3-1.

Example 3-1: Example State Protocols for Laboratory Analysis of Phosphorus

If the soil pH using water pH test is 7.5 or greater, use the Olsen P-test. If the soil pH is less than 7.5, use the Mehlich 3 or Bray P-test.

When taking representative manure samples, CAFOs should be cautioned that the appropriate sampling and analytical methods may vary by storage system. Sampling the manure as close to the time of application as practical provides the CAFO with a better measure of the nitrogen content of the manure. The most current manure nutrient analysis must be provided to the recipient of the manure transferred off site. Under 40 CFR 412.4(c)(3), the results of the manure nutrient analyses are to be used in determining land application rates. EPA interprets this to mean that CAFOs applying manure to their land application areas must show that application rates are based on the most current manure nutrient analysis (see 40 CFR 412.4(c)(3)); see Chapter 4 of this manual.

Commonly Used Testing Protocols for Phosphorus

The Mehlich 1, Mehlich 3, Morgan, and Modified Morgan extractants are predominant for soil tests for phosphorus and the cations in the Northeastern United States. They were designed to dissolve and/or desorb some fraction of the labile P and thus provide an index of the availability of phosphorus to crops over the growing season. Since the chemistry of northeastern soils primarily involves factors affecting the availability of aluminum phosphates, soil tests in the Northeast use a dilute acid solution to dissolve these minerals and extract phosphorus.

The nutrient composition of manure varies widely among farms because of differences in animal species and management, and manure handling and storage practices. Sampling the manure as close to the time of application as practical provides the CAFO with a better measure of the nutrient content (especially nitrogen) of the manure. The only method available for determining the actual nutrient content of manure for a particular operation is laboratory analysis. The rules do not allow CAFOs to use text book values in place of annual manure sampling.

What Forms of Nutrients Should Be Tested?

At a minimum, CAFOs should test for total kjedahl nitrogen (TKN), ammonia, total phosphorus, and soluble phosphorus.

Organic forms of nitrogen are converted to inorganic forms of nitrogen during a process called mineralization. The inorganic forms of nitrogen are utilized by plants. Inorganic nitrogen, such as ammonium nitrogen (NH4+), is usually attached to soil particles until used by the plants. In contrast, the nitrate form(NO3-) is highly susceptible to leaching, and can leach before used by the plant.

Adsorbed phosphorus is considered unavailable for plant growth. Erosion and runoff are common ways in which adsorbed phosphorus can transport off site and contaminate surface water. In contrast, highly permeable soils, low pH, and low organic matter allow phosphorus to leach.

Part of the information CAFOs must provide to the recipient should include the amount of nitrogen (i.e., total kjedahl nitrogen (TKN) and ammonia) and phosphorus (i.e., total phosphorus and soluble phosphorus) in the manure based on the most recent sampling.

EPA recommends CAFOs also provide the percent solids of the manure. Percent solids is used to calculate the dry weight basis of the nutrients and solids in the manure. For example, if a crop requires 10 pounds of nitrogen per acre, to determine how much manure is needed per acre to satisfy the needs of the crop one must calculate the dry weight of nitrogen in the manure; see Example 3-2.

Example 3-2: Calculating the Dry Weight of Nitrogen in Manure

The CAFOs most recent manure sample analysis indicates that the nitrogen content in lb/ton wet weight is 3.3 and the moisture content is 33 percent. To calculate the amount of nitrogen in lb/ton dry weight the CAFO uses the following equation:

$$\text{Concentration N}_{\text{dry basis}} = \text{Concentration N}_{\text{wet basis}} \times (100 - \%\ \text{moisture content})$$

$$= 3.3\ \text{lb/ton} \times (100 - 33\%)$$

$$= 2.2\ \text{lb/ton}$$

B. Records

CAFOs must record specific information when manure, litter, or process wastewater is transferred to other persons for land application. The information that must be recorded includes:

- Date of the transfer;
- The recipient's name and address; and
- Approximate amounts/volume of manure, litter, or process wastewater transferred to the recipient in either tons or gallons.

CAFOs must retain these records for a period of five years after the date of transfer. ANSI's manure utilization standard also recommends that operators execute written manure transfer agreements with all individuals who accept manure for off-site use, outside their control; see example 3-3.

Example 3-3: Sample Manure Utilization Standard

ANSI GELPP 0004-2002, *Manure Utilization* standard recommends that the operator sample and analyze all manure that is managed outside his control. ANSI recommends that sampling be representative of the manure being removed from the production area and if representative sampling is not conducted for each removal of manure, sufficient historical sample data must exist to show that the manure's nutrient and percent total solids content does not vary enough to impact nutrient application planning. At a minimum, ANSI recommends that manure being transferred off site be analyzed for percent total solids, nitrogen content (TKN and ammonia nitrogen), and total phosphorus content.

C. Additional Voluntary Controls

EPA encourages all manure applications by non-CAFOs, including manure land applied off site, to be conducted in accordance with a Nutrient Management Plan such as the type of plan outlined in USDA's Comprehensive Nutrient Management Plan (CNMP). CNMPs are developed in accordance with NRCS conservation planning policy and rely on the planning process and established conservation practice standards. For more information on USDA's CNMP Technical Guidance see: http://www.nrcs.usda.gov/programs/afo/cnmp_guide_600.50.html.

For more general information and updates on CNMP planning, see http://www.cnmpwatch.com/.