



Archived Publication

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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.



APPENDIX O - EXAMPLE TECHNICAL STANDARD

EXAMPLE EPA NUTRIENT MANAGEMENT TECHNICAL STANDARD

I. Authority

- 40 CFR 122.42
- 40 CFR 123.36
- 40 CFR 412.4
- 40 CFR 412.37

II. Applicability

This technical standard applies to all land under the control of a CAFO owner or operator, whether it is owned, rented, leased, or under an access agreement, to which manure, litter, process wastewater or sludge from the production area is or may be applied, in States, Indian Country, and other Territories and Jurisdictions where US EPA has NPDES permit authority.

III. Definition

Nutrient management is a planned process to protect water quality by managing the amount, source, placement, form, timing and method of application of agricultural nutrients and soil amendments utilized for the production of crop, forage, fiber, and forest products. It is supplying essential nutrients in adequate amounts to balance and maintain the soil for healthy biology and quality plants while avoiding conditions inimical to the ecosystem.

IV. Purposes

- A. Minimize pollution of waters of the United States from agricultural nutrient sources.
- B. Budget and supply nutrients for plant production
- C. Properly use manure, litter, process wastewater, and/or other organic by-products as a plant nutrient source.
- D. Maintain or improve the physical, chemical, and biological condition of the soil.

V. Criteria

- A. Nutrient Management Plans Shall Meet the Following General Criteria

A nutrient management plan (NMP) is a site specific, documented, management tool, prepared for reference and used by the producer or landowner, recording how nutrients are and will be used to achieve plant production and water quality protection.

1. NMPs shall comply with all applicable federal, State, and local laws and regulations. The CAFO must reviewed the NMP annually.
2. Plans for nutrient management shall be in accordance with the requirements of 40 CFR 122.42, 412.4 and 412.37. Sources of information, among other things, to assist in the development of the plan can be found in the policy requirements of the NRCS General Manual Title 450, Part 401.03 (Technical Guides, Policy and

Responsibilities) and Title 190, Part 402 (Ecological Sciences, Nutrient Management, Policy); technical requirements of the NRCS Field Office Technical Guide (FOTG); procedures contained in the National Planning Procedures Handbook (NPPH), the NRCS National Agronomy Manual (NAM) Section 503 and NRCS Conservation Practice Standard Nutrient Management (590).

3. Plans for nutrient management that are elements of a more comprehensive conservation plan shall recognize other requirements of the conservation plan and be compatible with its other requirements.
4. The use of certified specialists in developing nutrient management plans is not required, but EPA does encourage CAFOs to make use of certified planners with the expertise to develop, or review and modify nutrient management plans. A certified planner is defined as someone who has been certified to prepare CNMPs by USDA or a USDA sanctioned organization.
5. Plans developed for nutrient management that include the use of manure or other organic by-products will identify the size of the land base needed to enable plan implementation based on phosphorus, even when initial implementation will be based on nitrogen, unless other provisions that do not involve land application are made for utilizing the manure.
6. A nutrient budget for nitrogen, phosphorus, and potassium must be developed that considers all potential sources of nutrients including, but not limited to animal manure and organic by-products, wastewater, biosolids, commercial fertilizer, crop residues, legumes credits, and irrigation water.

THE FOLLOWING ARE KEY ELEMENTS IN THE DEVELOPMENT OF AN NMP

- B. Soil Sampling and Laboratory Analysis (Testing)
 1. CAFOs in nutrient **non-impaired** watersheds shall soil sample every 5 years at a minimum. CAFOs in watersheds listed on the CWA Section 303(d) list as nutrient **impaired** and CAFOs having a field(s) with Phosphorus Index Site Vulnerability Rating(s) of **high** or **very high** shall sample annually.
 2. Soil samples shall be collected and prepared according to the Land Grant University guidance or standard industry practice.
 3. Soil samples shall be analyzed according to accepted industry practice or Land Grant University guidance. Soil test analyses shall be performed by laboratories that are accepted in one or more of the following programs.
 - a. State Certified Programs
 - b. The North American Proficiency Testing Program (Soil Science Society of America), or
 - c. Laboratories whose tests are accepted by Land Grant University in the State in which the tests will be used.
 4. Soil testing shall include analysis for any nutrients and soil components for which specific information is needed to develop the nutrient plan and monitor or amend

the annual nutrient budget. Analyses are recommended for pH, electrical conductivity (EC), soil organic matter, nitrogen, phosphorus and potassium.

5. The laboratory analysis for phosphorus shall be performed using the method recommended by the Land Grant University or by the following method: where the soil pH (using water pH test) is 7.5 or greater, an Olsen P-test will be done; where the soil pH is less than 7.5, the Mehlich 3 or Bray P-test will be done.

C. Plant Tissue Sampling

1. Tissue sampling and testing, where used, shall be collected, prepared, and analyzed according to accepted industry practice or Land Grant University guidance where it should be used.

D. Manure and Wastewater Sampling (See Appendix C for waste sampling procedures)

1. Manure and wastewater shall be analyzed a minimum of once annually for nitrogen and phosphorus content. The results of this analysis is to be used in determining application rates of manure, litter and wastewater.
2. Manure and wastewater samples shall be collected, prepared, and analyzed according to accepted industry practice or Land Grant University guidance.

E. Field Risk Assessment

1. When animal manures or other organic by-products are land applied, a field-specific assessment of the potential for phosphorus transport from the field shall be completed. This assessment may be done using the Phosphorus Index or other recognized assessment tool adopted by the permitting authority. In such cases, plans shall include:
 - a. A record of the assessment rating for each field or sub-field, and
 - b. Information about conservation practices and management activities that can reduce the potential for phosphorus movement from the site.
2. Erosion, runoff, and water management controls shall be installed, as needed, on fields that receive nutrients. Practices to control erosion should be less than or equal to "T", as identified by the Revised Universal Soil Loss Equation (RUSLE).

F. Nutrient Application Rates

1. **Nitrogen Application** - The application rate for nitrogen shall be based on the utilization of crops at the recommended agronomic rates. When the plan is being implemented on a phosphorus standard, manure or other organic by-products shall be applied at rates, consistent with the phosphorus standard. In such situations, an additional nitrogen application, from non-organic sources, may be required to supply the recommended amounts of nitrogen. In no case shall manure or other organic by-products be applied above the nitrogen rate.

Manure or other organic by-products may be applied on legumes at rates equal to the estimated removal of nitrogen in harvested plant biomass.

2. **Phosphorus Application** - When manure or other organic by-products are used, the planned rates of phosphorus application shall be consistent with one of the following options:
 - a. **Phosphorus Index (PI) Rating**
Nitrogen or multi-year phosphorus based manure application on Low or Medium Risk sites, one-year phosphorus based manure application on High Risk sites and no manure application on Very High Risk Sites.
 - b. **Soil Phosphorus Threshold Values**
Nitrogen or multi-year phosphorus based manure application on sites on which soil test levels are below 0.75 times the threshold level, one-year phosphorus based manure application on sites on which soil test levels are more than 0.75 but less than 1.5 times the threshold level, and no manure application on sites on which soil test levels are more than 1.5 times the threshold level.*
 - c. **Soil Test**
Nitrogen or multi-year phosphorus based manure application on sites where there is a soil test recommendation to supply phosphorus. One-year phosphorus based manure application on sites where the soil test level is greater than 75 but less than 150 ppm Bray P1. No manure application on sites where the soil test level is equal to or greater than 150 ppm Bray P1.

*Acceptable phosphorus based manure application rates shall be determined as a function of soil test recommendations or estimated phosphorus removal in harvested plant biomass. Guidance for developing these acceptable rates is found in the NRCS General Manual, Title 190, Part 402 (Ecological Sciences, Nutrient Management, Policy), and the National Agronomy Manual, Section 503.
3. Planned rates of nutrient application, as documented in the nutrient budget, shall be determined based on soil test results, nutrient credits, waste analysis, crop need and sequence, seasonal and climatic conditions, and use and timing of irrigation water.
4. Realistic yield goals shall be established based on soil productivity information, historical yield data, climatic conditions, level of management and/or local research on similar soil, cropping systems, and soil and manure/organic by-products tests. For new crop or varieties, industry yield recommendations may be used until documented yield information is available.
5. Plans for nutrient management shall specify the form, source, amount, timing, and method of application of nutrients on each field to achieve realistic production goals, while minimizing nitrogen and/or phosphorus movement to surface and/or ground waters.
6. When actual crop yields exceed or fail to attain expected goals, the nutrient application rates for the succeeding crop must be adjusted to reflect that difference.
7. Nutrient values of manure, litter, process wastewater, sludge, and organic by-products shall be determined prior to land application based on laboratory

analysis. "Book values" shall not be used except for planning of first year application(s) during initial start-up of the facility. Acceptable book values are those values recognized by ASAE, the NRCS, and/or the Land Grant University that accurately estimate the nutrient content of the material.

8. Nutrient application rates shall not attempt to approach a site's maximum ability to contain one or more nutrients as determined by the risk assessment methods in V.F.1.and 2. Excess applications or applications that cause soil imbalances should be avoided. Excess manure nutrients generated by the CAFO must be handled by export to a good steward of the manure, or the development of alternative uses.
9. Nutrients shall be applied in such a manner as not to degrade the soil's structure, chemical properties, or biological condition.
10. The planned rates of nutrient application, as documented in the nutrient budget, shall be determined based on the following guidance:
 - a. *Nitrogen Application* - Planned nitrogen application rates shall match the recommended rates as closely as possible. When manure or other organic by-products are a source of nutrients, additional nitrogen application, from non-organic sources, may be required to supply the recommended amounts of nitrogen. Split applications of nitrogen should be practiced to provide nutrients at the time of maximum crop utilization.
 - b. *Phosphorus Application* - Planned phosphorus application rates shall match the recommended rates as closely as possible.
11. Consider the use of variable-rate technology for management of supplemental nitrogen application to account for within-field spatial and temporal variability.
12. **Multiple-year phosphorus applications ("phosphorus banking")** - A single, multiple-year application of phosphorus applied as manure, litter, process wastewater, sludge, or other organic by-product may be applied to a field that does not have a high potential for nutrient movement as determined by one of the risk assessment methods in V.F.1. and 2. above. In a nutrient **non-impaired** watershed, this application shall not exceed the one year nitrogen application rate and shall not exceed three (3) times the one year phosphorus application rate. Following a multiple-year application in a nutrient non-impaired watershed, no application may be made until the applied phosphorus has been removed from the field via harvest or crop removal. In a nutrient **impaired** watershed, this application shall not exceed the nitrogen application rate and shall not exceed two (2) times the one year phosphorus application rate. Following a multiple-year application in a nutrient impaired watershed, no application may be made until the applied phosphorus has been removed from the field via harvest or crop removal. The multiple-year rates may be applied only if erosion and runoff control practices and buffers are installed to minimize risk of nutrient movement.

G. Nutrient Application Timing

1. Manure, litter, or process wastewater shall not be surface applied when the National Weather Service predicts a 50 percent or more probability of rain in excess of the amount that is reasonably likely to generated runoff, as provided below, within 24 hours of the end of an intended application.

Minimum Quantity of Rainfall Required to Produce Runoff

Hydrologic Soil Group	Quantity of Rainfall (inches)
A	1.0
B	0.5
C	0.25
D	0.25

See Appendix A in *Urban Hydrology for Small Watersheds* (USDA-SCS 1986) for information on the Hydrologic Soil Group within which a given soil is classified. The appendix may be viewed at <http://www.wcc.nrcs.usda.gov/hydro/hydro-tools-models-tr55.html>. The National Weather Service forecast may be viewed at <http://www.nws.noaa.gov/mdl/forecast/graphics/MAV/index.html>. At that address, select the precipitation forecast product that is appropriate given the Hydrologic Soil Group that represents the predominant soil type in the field where manure, litter, or process wastewater would be applied. For Hydrologic Soil Group B soils, this would be the forecast product labeled, "24H Prob.>=0.5in.," for example. If the map that appears after selecting this product does not allow one to determine whether there is a 50 percent or more probability of the specified quantity of rain near the place where the field is located, then select the following National Weather Service address: <http://www.nws.noaa.gov/mdl/synop/products/bullform.mex.htm>. At that address, first select the state in which the field is located and then select the weather station closest to the field. Then press "Submit Query" at the bottom of the page. A table will appear after submitting the query. Locate the "Q24" entry in the first column and then locate the first number to the right of "Q24". This number will be in the range from 0 to 6. These values correspond to the following amounts of precipitation: 0 = no precipitation, 1 = 0.01 to 0.09", 2 = 0.1 to 0.24", 3 = 0.25 to 0.49", 4 = 0.5 to 0.99", 5 = 1 to 1.99", and 6 ≥ 2".

2. Graduated markers in waste retention structures allow CAFO operators to know exactly how much liquid manure and/or process wastewater is in the waste treatment lagoon or waste storage pond. Waste retention structures must be maintained below the level designated in 40 CFR 412 to contain runoff from precipitation of a 25 year, 24-hour, or 100 year, 24-hour rainfall event as applicable. An NRCS designed waste retention structure that is maintained at the catastrophic storm storage level is not being operated as designed, i.e., maintaining the capacity to contain runoff and precipitation from a 25 year, 24-hour or 100 year, 24-hour rainfall event as applicable.
 - a. Waste storage ponds should be dewatered to the sludge level during months with a crop water demand that could use the water for crop production. DO NOT EXCEED NUTRIENT APPLICATION RATES BASED ON THE SITE-SPECIFIC RISK ASSESSMENT METHOD OR THE HYDRAULIC LOADING RATES.
 - b. Waste treatment lagoons should be maintained at or just above the minimum treatment volume during months with a crop water demand that could use the water for crop production. DO NOT EXCEED NUTRIENT

APPLICATION RATES BASED ON THE SITE-SPECIFIC RISK
ASSESSMENT METHOD OR THE HYDRAULIC LOADING RATES.

3. The timing of nutrient application must correspond as closely as possible with plant nutrient uptake characteristics, while considering cropping system limitations, weather and climatic conditions, and field accessibility.
4. Avoid winter nutrient application for spring seeded crops.

H. Nutrient Application Methods

1. Except under conditions of agricultural storm water discharge as provided in 33 U.S.C. 1362(14), there must be no discharge of manure, litter, or process wastewater as a result of nutrient application by the CAFO. For example the direct discharge of to waters of the United States by spray irrigation.
2. Apply nutrient materials uniformly to application areas or as prescribed by precision agricultural techniques.
3. Consider immediate incorporation of land-applied manure, litter, sludge, and organic by-products to minimize risk of nutrient movement to surface waters.
4. Supplementary commercial fertilizer(s) and/or soil amendments may be added when the application of nutrients contained in manure and/or process wastewater alone is not sufficient to meet the soil and crop needs, or when a nutrient excess occurs such that other nutrients become unavailable to the plant or toxic conditions arise.
5. Process Wastewater Irrigation - Process wastewater application is not the same as irrigation. Process wastewater application scheduling should be based on the nutrient needs of the crop, the daily water use of the crop, the water-holding capacity of the soil, and the lower limit of soil moisture for each crop and soil. Process wastewater application via irrigation must be at rates that minimize transport of sediment, nutrients, and chemicals to waters of the United States. The amount of water applied to the field should be measured and natural precipitation should be accounted for.

I. Setbacks and Vegetated Buffers

1. A setback distance from conduits to surface water must be maintained unless the CAFO uses either one of the compliance alternatives: vegetated buffer or alternative practices.
2. Setback - means a specified distance from waters of the United States or potential conduits to such waters where manure, litter, and process wastewater may not be land applied, but where crops may continue to be grown. The minimum width of a setback is 100 feet. Examples of conduits to waters of the United States include, but are not limited to: open tile line intake structures, sinkholes, karsts, ditches, cisterns and agricultural wellheads.
3. Vegetated Buffer - means a narrow, permanent strip of dense perennial vegetation, where no crops are grown, established parallel to the contours of and perpendicular to the dominant slope of the field for the purposes of slowing water runoff, enhancing water infiltration, trapping pollutants bound to sediment, and

minimizing the risk of any potential nutrients or pollutants from leaving the field and reaching waters of the United States. The minimum width of vegetated buffer is 35 feet. On a per foot basis, it is more effective at reducing runoff than the setback. Vegetated buffers include NRCS Codes 332, 386, 391, 393, and 601. To the extent possible, the use of native vegetation should always be considered.

4. The minimum widths of setbacks and vegetated buffers must be **doubled** around a **sole-source drinking water supply wellhead**.
5. As a compliance alternative, the CAFO may demonstrate that a setback or buffer is not necessary because the implementation of alternative conservation practices of field-specific conditions will provide pollutant reductions equivalent or better than the reductions that would be achieved by the 100-foot setback.
6. Practices and management activities for vegetated buffers
 - a. Removal of vegetation in vegetated buffers will be in accordance with site production limitations, rate of plant growth, and the physiological needs of the plants.
 - b. Do not mow below the recommended height for the plant species.
 - c. Maintain adequate ground cover and plant density to maintain or improve filtering capacity of the vegetation
 - d. Maintain adequate ground cover, litter, and canopy to maintain or improve infiltration and soil condition.
 - e. Periodic rest from mechanical harvesting may be needed to maintain or restore the desired plant community following episodic events such as drought.
 - f. When weeds are a significant problem, implement pest management to protect the desired plant communities.
 - g. Prevent channels from forming.

J. Considerations

[High-quality soils prevent water pollution by resisting erosion, absorbing and partitioning rainfall, and degrading or immobilizing agricultural chemicals, manure, litter, process wastewater or other potential pollutants.]

1. Conditions of the soil
 - a. Because most coarse-textured soils have a low cation exchange (nutrient-holding) capacity, consider applications of manure, litter, sludge, process wastewater, and other organic by-products be restricted to several small applications during the growing season to minimize the chance of soluble nutrients reaching the ground water.

- b. Nutrient application on soils with less than 20 inches in depth to parent material, according to the Cooperative Soil Survey, shall not exceed the one year phosphorus application rate.
- c. Do not apply manure, litter, sludge, process wastewater, or other organic by-products over bedrock outcrops.
- d. Do not apply manure, litter, sludge, process wastewater, or other organic by-products on soils where the rock fragments in the top five feet of the surface layer are 3 - 10 inches in diameter and exceed 50% by volume.
- e. Do not apply manure, litter, sludge, process wastewater, or other organic by-products on soils where the rock fragments in the top five feet of the surface layer are >10 inches in diameter and exceed 25% by volume.
- f. Do not apply manure, litter, sludge, or process wastewater, or other organic by-products on soils where the slope is >15% according to the Cooperative Soil Survey.

2. Saline soil

- a. Balance soil fertility to allow plant roots to grow through saline layer.
- b. If available, irrigation water may be used to leach salts below the root zone. Schedule salt leaching events to coincide with low residual soil nutrients and pesticides.
- c. Use of nutrient sources with high salt content will be minimized unless provisions are used to leach salts below the crop root zone.
- d. Micronutrients have a low availability on saline soils. Work to balance nutrients in the soil.
- e. On sites where there is a high soil salinity is a concern, the potassium application rate should not exceed 100% of the requirement needed over the entire crop rotation, or three years for perennial crops.
- f. On sites with pH values exceeding 8.5, consider adding gypsum to increase the availability and utilization of nutrients by the crop.

3. Alkaline soil

- a. Alkaline soils have a high pH (above 7.0). This high pH is usually the result of too much calcium, potassium, sodium, or magnesium.
- b. Micronutrients such as iron, manganese, boron, and zinc are sparingly available in alkaline soils, leading to deficiencies in plants. Work to balance nutrients in the soil.
- c. Phosphorus deficiency may appear in plant tissue analyses as a result of little or too much phosphorus in the soil. **Do not** over apply phosphorus as determined by one of the risk assessment methods identified in V.F.1.and 2. above.

- d. On alkaline soils, potassium should be applied near the time needed by the crop to minimize leaching.
 - e. Calcium carbonate accumulations that inhibit root growth for some plants are common in many low-rainfall alkaline soils. This calcareous layer helps maintain high pH levels and constrains the availability of micronutrients. Balance the soil to optimize plant growth and nutrient uptake.
4. Flooded ground (*Flood irrigation is not a part of this definition*)
- a. Nutrient, solid or liquid, shall not be applied to flooded soils.
 - b. Agricultural waste shall not be land-applied on soils that are frequently flooded, as defined by the National Cooperative Soil Survey, during the period when flooding is expected.
 - c. Manure, litter, sludge, process wastewater, and/or other organic by-products may be applied to occasionally flooded areas during seasons when flooding is not expected and actively growing vegetation is present on over 50% of the field.
5. Saturated ground
- a. Liquid manure and process wastewater shall not be applied on saturated soil where the manure or process wastewater may discharge to waters of the United States. The rate of application for liquid manure or process wastewater application on unsaturated soils shall not exceed the infiltration rate and moisture holding capacity of the soil after taking the antecedent moisture and temperature of the soil into account.
 - b. Avoid soil compaction on soils with high moisture content.
6. Drainage management
- Subsurface drainage expedites the transport of nitrate-nitrogen from the soil zone with the result that a significant amount of unused nitrogen (nitrate N) from farm fields ends up in nearby streams and other surface waters.
- a. The use of cover crops to utilize residual nitrates is recommended.
 - b. Fields that are subsurface (tile) drained require additional precautions. When liquid wastes are applied to fields with subsurface (tile) drains, the liquid can follow soil macropores directly to the tile drains, creating a surface water pollution hazard from direct tile discharge.
 - i. Do not apply application rates (volume) that would exceed the lesser of the available water capacity (AWC) in the upper 8 inches, or 13,000 gallons/acre per application. See Appendix E, **Available Water Capacity (AWC) Practical Soil Moisture Interpretations for Various Soils, Textures, and Conditions to Determine Liquid Waste Volume Applications not to Exceed AWC, to Determine AWC** and the amount (volume) that can be applied to reach the AWC.

- ii. Prior to manure application, use a tool that can disrupt/close (using horizontal fracturing) the preferential flow paths (worm holes, cracks, root channels) in the soil, or till the surface of the soil 3 -5 inches deep to a condition that will absorb the liquid wastes. The purpose is to have the surface soil act as a sponge to soak up the liquid manure and keep it out of preferential flow channels. This is especially important if shallow tiles are present (<2 feet deep). Any pre-application tillage should leave as much residue as possible on the soil surface. The absorption of liquid manure by the soil in the root zone will minimize nitrogen loss and the manure/nutrient runoff potential. For perennial crops (hay or pasture), or continuous no-till fields where tillage is not an option, all tile outlets from the application area are to be plugged prior to application.
- iii. If injection, is used, inject only deep enough to cover the manure with soil. Till the soil at least 3 inches below the depth of injection prior to application, or all tile outlets from the application area are to be plugged prior to application.
- iv. In addition to tillage prior to surface liquid waste application or injection, install in-line tile flow control structures or inflatable tile plugs that can mechanically stop or regulate tile flow either prior to application, or have on site if needed to stop tile flow. Use caution not to back tile water where it may impair the functioning of an offsite subsurface drainage system.
- v. Repair broken tile or blowholes prior to application.
- c. In fields with existing drainage tiles, consider retrofitting to alternative water table management practices such as controlled drainage, subirrigation, and wetland reservoir subirrigation systems.
- d. The incorporation of BMPs like riparian zones, denitrifying ponds, and wetlands to reduce the level of nitrates before discharge into ditches and streams is encouraged.
- e. Design new subsurface drainage systems to manage soil water and water table levels through controlled drainage or subirrigation, lowering concentrations on nitrate-N in shallow ground water.

7. Drought

- a. Cropping systems should be managed to maximize nutrient uptake from the soil and protect the soil during periods when erosion and potential nutrient runoff occurs.
- b. Decrease nutrient application rates on non-irrigated areas when drought conditions occur.
- c. Decrease grazing pressure pastures to maintain desired plant community and vegetation height.

- d. Maintain adequate pasture conditions. This will maximize nutrient uptake by pasture plants and reduce nutrient flow into waterways. Overstocking pasture is a sure way to damage water quality. Overstocking damages plants, which reduces nutrient uptake and increases risk of erosion.
- e. Reducing stocking rates and grazing pressure is key to managing native rangeland and tame pastures both during and after drought. High stocking rates during drought can prompt a change in the plant community, reduce plant litter and organic matter, increase bare ground, and remove vegetation needed to trap manure solids and nutrient bearing sediment, which can decrease water infiltration from precipitation and increases runoff.

8. Frozen ground

- a. Frozen ground is any portion of the 0 - 6 inch soil layer (root depth) that is frozen.
- b. Irrigation of wastewater to snow covered or frozen ground is prohibited
- c. Adequate manure storage volume shall be provided and maintained to prevent the necessity of land applying manure on frozen and/or snow covered ground. No later than October of each year, the CAFO shall evaluate the storage capacity in their manure storage or treatment facilities and determine what steps are needed to avoid the need to land apply manure on frozen or snow covered fields for the upcoming winter. The operating record for the facility shall include documentation of the storage level as well as what was considered in this evaluation, and what actions were taken to avoid the need for land application of manure on frozen or snow covered ground.
- d. Winter application of manure, litter, and other solid waste products is not desirable because nutrients cannot soak into frozen ground and manure accumulated on the surface of frozen soil or snow can easily be carried off the field during snow melt or other runoff events. In nutrient **non-impaired** watersheds, if winter applications must be made, applications may only be made under the following conditions: The application does not exceed the one year phosphorus rate, the field has a slope not greater than 6%, cool-season crops are present and actively growing in the field, nutrients are needed to be supplied to the crop, and erosion and runoff control practices are installed to minimize risk of nutrient movement. When choosing a location for winter application; fields that are furthest from streams and waterbodies must be used first. In nutrient **impaired** watersheds, application of manure, litter, or other solid waste products to snow covered or frozen ground is prohibited.

9. Heavy metals

- a. Plans developed for nutrient management that include the use of manure or other organic by-products will recognize that some manures contain heavy metals and should be accounted for in the plan for nutrient management.

- b. When sewage sludge is applied, the accumulation of potential pollutants (including arsenic, cadmium, copper, lead mercury, selenium, and zinc) in soil shall be monitored in accordance with the US Code, Reference 40 CFR, Parts 403 and 503, and/or any applicable State and local laws or regulations.

K. Plans and Specifications

- 1. Plans and specifications shall be in keeping with this standard and shall describe the requirements for applying the practice to achieve its intended purpose(s), using nutrients to achieve production goals and to prevent or minimize water quality impairment.

L. Operation and Maintenance

- 1. Periodically conduct leak inspections of equipment used for land application of manure, litter or process wastewater.
- 2. Application equipment should be regularly (at least annually) calibrated to deliver the intended application rate and to achieve a uniform distribution pattern
 - a. Equipment used to apply solid waste from dairy and beef should be calibrated to deliver within $\pm 2 \frac{1}{2}$ tons of the intended application rate.
 - b. Equipment used to apply solid waste from swine should be calibrated to deliver within ± 1 ton of the intended application rate.
 - c. Equipment used to apply solid waste and litter from poultry and fowl should be calibrated to deliver within ± 1 ton of the intended application rate.
 - d. Equipment used to apply organic by-products and solid waste from other animals should be calibrated to deliver within ± 1 ton of the intended application rate.
 - e. Equipment used to apply liquid or slurry waste should be calibrated to deliver 10 percent of the intended application rate.
 - f. Process wastewater irrigation rate is characteristic of sprinkler hardware and operating parameters (i.e., nozzle type, size, trajectory, and pressure). Hence, irrigators should be selected to be compatible with soil infiltration rate or permeability. If irrigator application rate is higher than soil infiltration rate, the possibility for runoff is increased. Since runoff must be prevented when irrigating process wastewater, it is recommended that irrigators be selected for the lowest application rate possible.
- 3. Records specified in this technical standard and in permit terms corresponding to 40 CFR 412.37(b) and (c) shall be maintained on-site for five years, or for a period longer than five years if required by other federal, state, or local ordinances, or program or contract requirements. These records must be available to the permitting authority and the Regional Administrator, or his or her designee, for review upon request.

4. When cleaning equipment after nutrient application, remove and save fertilizers or waste in an appropriate manner. The saved residue material may be utilized on another crop as part of the fertilization program outlined in the NMP. If the equipment is flushed, keep wastewater away from high runoff areas, ponds, lakes streams, wells, and other water bodies.
5. Dispose of fertilizer containers according to any applicable label directions and federal, state, and local laws.

V. Additional Considerations

- A. Consider induced deficiencies of nutrients due to excessive levels of other nutrients.
- B. Consider additional practices to improve soil nutrient and water storage, infiltration, aeration, tillage, diversity of soil organisms, and to protect and improve water quality.
 1. Conservation Cover (327)
 2. Grassed Waterway (412)
 3. Contour Buffer Strips (332)
 4. Filter Strips (393)
 5. Irrigation Water Management (449)
 6. Riparian Forest Buffer (391A)
 7. Conservation Crop Rotation (328)
 8. Cover and Green Manure (340)
 9. Residue Management (329A, 329B, 329C, and 344)
 10. Waste Utilization (633)
- C. Consider cover crops whenever possible to utilize and recycling residual nitrogen.
- D. Consider application methods and timing that reduce the risk of nutrients being transported to ground and surface waters, or into the atmosphere. Suggestions include;
 1. Split applications of nitrogen to provide nutrients at the times of maximum crop utilization.
 2. Avoiding winter nutrient application for spring seeded crops.
 3. Band applications of phosphorus near the seed row.
 4. Applying nutrient materials uniformly to application areas or as prescribed by precision agricultural techniques, and/or
 5. Immediate incorporation of land applied manures or organic by-products.

6. Delaying field application of animal manures or other organic by-products if precipitation capable of producing runoff and erosion is forecast within 24 hours of the time of the planned application.
- E. Consider the immediate incorporation of manures into the soil after application to reduce nitrogen volatilization losses associated with the land application of animal manures. Volatilization losses can become significant, if manure is not incorporated immediately after application.
- F. Consider using soil test information no older than one year when developing new plans, particularly if animal manures are to be a nutrient source.
- G. Consider annual reviews to determine if changes in the nutrient budget are desirable (or needed) for the next planned crop.
- H. On sites on which there are special environmental concerns, consider other sampling techniques. (For example: Soil profile sampling for nitrogen, Pre-Sidedress Nitrogen Test (PSNT), Pre-Plant Soil Nitrate Test (PPSN) or soil surface sampling for phosphorus accumulation or pH changes.)
- I. Consider ways to modify the chemistry of animal manure, including modification of the animal's diet to reduce the manure nutrient content, to enhance the producer's ability to manage manure effectively.

VI. Implementation

- A. A new source CAFO shall attain implementation of this technical standard as of the date the NPDES permit is issued.
- B. An existing CAFO shall attain implementation of this technical standard according to a schedule identified by the permitting authority. The schedule for implementation of this technical standard shall not extend beyond December 31, 2006.