Natural Resources Conservation Service

CONSERVATION PRACTICE STANDARD

NUTRIENT MANAGEMENT

CODE 590

(ac)

DEFINITION

Manage rate, source, placement, and timing of plant nutrients and soil amendments while reducing environmental impacts.

PURPOSE

This practice is used to accomplish one or more of the following purposes:

- Improve plant health and productivity
- Reduce excess nutrients in surface and ground water
- Reduce emissions of objectionable odors
- Reduce emissions of particulate matter (PM) and PM precursors
- Reduce emissions of greenhouse gases (GHG)
- Reduce emissions of ozone precursors
- Reduce the risk of potential pathogens from manure, biosolids, or compost application from reaching surface and ground water
- Improve or maintain soil organic matter

CONDITIONS WHERE PRACTICE APPLIES

All fields where plant nutrients and soil amendments are applied. Does not apply to one-time nutrient applications at establishment of permanent vegetation.

CRITERIA

General Criteria Applicable to All Purposes

Develop a nutrient management plan for nitrogen (N), phosphorus (P), and potassium (K), which accounts for all known measurable sources and removal of these nutrients.

Sources of nutrients include, but are not limited to, commercial fertilizers (including starter and in-furrow starter/pop-up fertilizer), animal manures, legume fixation credits, green manures, plant or crop residues, compost, organic by-products, municipal and industrial biosolids, wastewater, organic materials, estimated plant available soil nutrients, and irrigation water.

When irrigating, apply irrigation water in a manner that reduces the risk of nutrient loss to surface and ground water.

Follow all applicable State requirements and regulations when applying nutrients near areas prone to contamination, such as designated water quality sensitive areas, (e.g., lakes, ponds, rivers and streams, sinkholes, wellheads, classic gullies, ditches, or surface inlets) that run unmitigated to surface or

groundwater. See Minnesota(MN) NRCS Agronomy Technical Note 32 for additional sensitive areas and setback distances.

Soil and tissue testing and analysis
Base the nutrient management plan on current soil test results in accordance with University of Minnesota Extension (UME) guidance.

Test analyses must include pertinent information for monitoring or amending the annual nutrient plan.

Soil Sampling frequency must meet the following:

Use soil tests no older than 2 years when developing new nutrient management plans (baseline plans). Use tissue testing, when applicable, for monitoring or adjusting the nutrient management plan in accordance with UME guidance, or industry practice when recognized by the UME.

For nutrient management plan revisions and maintenance, take soil tests on an interval recommended by the UME or as required by local rules and regulations. In Minnesota subsequent nutrient management plan revisions and maintenance, soil tests must be no older than 4 years old as recommended by (UME) and the Minnesota Pollution Control Agency (MPCA).

Collect, prepare, store, and ship all soil and tissue samples following UME guidance

Soil Sampling techniques must meet the following:

- Soil sampling areas must have similar soil type, cropping history, and management practices.
- Each sample shall consist of a composite comprised of multiple cores (e.g. 15 to 20 cores).
- On large uniform fields, one or more composite samples shall be taken per 20 acres, or per 40 acres if previous sampling showed little in-field variability.
- On smaller fields or hilly/rolling ground, one or more composite samples shall be taken per 5 acres, or per 20 acres if previous sampling shows little in-field variability.

Soil Testing must meet the following:

- Soil samples must be analyzed at a soil-testing laboratory certified by the Minnesota Department of Agriculture (MDA).
- Analyzed for phosphorus, potassium, pH, and organic matter and for other nutrients or soil information needed to develop the nutrient management plan.
- Follow (UME) guidelines regarding required analyses and test interpretations.

Maintain soil pH within ranges which enhance the adequate level for plant or crop nutrient availability and utilization. Refer to UME documentation for guidance.

For additional information on soil sampling collection see University of Minnesota.

Use other forms of testing, when applicable, such as tissue testing or nitrate testing for monitoring or adjusting the nutrient management plan in accordance with (UME) guidance.

Manure, organic by-product, and biosolids testing and analysis
Base manure or organic by-product application rates on actual analyses of the material.

Collect, prepare, store, and ship all manure, organic by-products, and biosolids following UME guidance.

Manure Testing frequency

- Manure must be sampled and tested once per year as a minimum. Sampling shall be more frequent if needed to account for operational changes (e.g., feed management, animal type,

manure handling strategy, etc.) impacting manure nutrient concentrations.

- Following initial testing, if no operational changes occur and operations can document a stable level of nutrient concentrations for the preceding 3 consecutive years, manure may be tested once every four years, unless Federal, State, or local regulations require more frequent testing.

Manure Sampling techniques

- Manure and other organic by-products will be sampled and analyzed from all significant manure sources on the farm to determine nutrient values for rate recommendations. For purposes of this standard, "significant" means manure and bedding from 15 or more animal units.
- Manure samples must be taken from enough sources so nutrient content is known for each storage area with differing animal types, housing, feed management and handling.

Manure Testing must meet the following:

- Manure samples must be analyzed at a testing laboratory certified by the MDA.
- Analyzed for total N, total P or P_2O_5, total K or K_2O, and percent solids, as a minimum.
- Follow (UME) and MPCA guidelines regarding required analyses and test interpretations.

When planning for new or modified livestock operations, and manure tests are not available yet, use the output and analyses from similar operations in the geographical area if they accurately estimate nutrient output from the proposed operation or use "book values" recognized by the NRCS (e.g., NRCS Agricultural Waste Management Field Handbook) and the UME. Values used must be acceptable to the MPCA for feedlot permitting purposes.

Calculating first and second year nutrients available to crops from manure will be consistent with procedures and availability percentages found in NRCS MN-CPA-35 or (UME) guidance on calculating manure applications rates.

Retain records of manure analysis for 6 years and use to determine if nutrient concentrations vary within or between years.

For manure analyses, use laboratories successfully meeting the requirements and performance standards of the Manure Testing Laboratory Certification program under the auspices of the Minnesota Department of Agriculture or other NRCS-approved program that considers laboratory performance and proficiency to assure accurate manure test results.

For nutrient management plans developed as a component of a comprehensive nutrient management plan for an animal feeding operation (AFO) follow policy in NRCS directive General Manual (GM) 190, Part 405, "Comprehensive Nutrient Management Plans." These plans must include documentation of all nutrient imports, exports, and on-farm transfers.

Nutrient loss risk assessments

Use current NRCS-approved nitrogen, phosphorus, and soil erosion risk assessment tools to assess the site-specific risk of nutrient and soil loss.

Complete an NRCS-approved nutrient risk assessment for N on all fields where nutrient management is planned unless the State NRCS, in cooperation with State water quality control authorities, has determined specific conditions where N leaching is not a risk to water quality, including drinking water.

Potential off-field nitrogen transport will be determined on all fields using guidance within MN NRCS Agronomy Technical Note 32.

Potential off-field phosphorus transport will be determined using the "guidance within MN NRCS Agronomy Technical Note 32).

For additional nutrient risk assessment policy and procedures see Title 190, National Instruction (NI), Part 313 Nutrient Management Policy Implementation.

Complete an NRCS-approved nutrient risk assessment for P when any of the following conditions are met—

- P application rate exceeds UME fertility rate guidelines for the planned crop(s).
- The planned area is within a P-impaired watershed.
- The site-specific conditions equating to low risk of P loss have not been determined by the NRCS in cooperation with the State water quality control authority.

Any fields excluded from a P risk assessment must have a documented agronomic need for P, based on soil test P and UME nutrient recommendations. See MN NRCS Agronomy Technical Note 32.

For fields receiving manure, where P risk assessment results equate to—

- LOW risk.—Manure can be applied at rates to supply P at greater than crop requirement not to exceed the N requirement for the succeeding crop.
- MODERATE risk.—Manure can be applied at rates not to exceed crop P removal rate or the soil test P recommended rate for the planned crops in rotation.
- HIGH risk.—Manure can be applied at rates not to exceed crop P removal rate if the following requirements are met:
  - A soil P drawdown strategy has been developed, documented, and implemented for the crop rotation.
  - Implementation of all mitigation practices determined to be needed by site-specific assessments for nutrients and soil loss to protect water quality.
  - Any deviation from these high-risk requirements that would increase the risk of P runoff requires the approval of the Chief of the NRCS.

The 4Rs of nutrient stewardship

Manage nutrients based on the 4Rs of nutrient stewardship—apply the right nutrient source at the right rate at the right time in the right place—to improve nutrient use efficiency by the crop and to reduce nutrient losses to surface and groundwater and to the atmosphere.

For nutrient application restrictions for sensitive areas in Minnesota, see MN NRCS Agronomy Technical Note 32.

Consult Minnesota Rules Chapter 7020 on animal feedlots, Minnesota Rules Chapter 1573 on groundwater protection, permit specific requirements, and any other applicable state and local laws or regulations, for details including additional nitrogen and phosphorus rate requirements near waters, in areas where groundwater is vulnerable to nitrate contamination, and high soil test levels.

Nutrient source

Choose nutrient sources compatible with application timing, tillage and planting system, soil properties, crop, crop rotation, soil organic content, and local climate to minimize risk to the environment.

Determine nutrient values of all nutrient sources (e.g. commercial fertilizers, manure, organic by-products, biosolids, irrigation water) prior to land application.

Determine nutrient contribution of cover crops, previous crop residues, and soil organic matter.

For operations following USDA's National Organic Program, apply and manage nutrient sources according to program regulations.

For enhanced efficiency fertilizer (EEF) products, use products defined by the Association of American Plant Food Control Officials (AAPFCO) as EEF and recommended for use by the MDA and (UME).

In areas where salinity is a concern, select nutrient sources that limit the buildup of soil salts. When manures are applied, and soil salinity is a concern, monitor salt concentrations to prevent potential plant or crop damage and reduced soil quality.

Apply manure or organic by-products on legumes at rates no greater than the LGU estimated N removal rates in harvested plant biomass, not to exceed P risk assessment limitations.

For any single application of nutrients applied as liquid (e.g., liquid manure, nutrients in irrigation water, fertigation)—

- Do not exceed the soil's infiltration rate or water holding capacity.
- Apply so that nutrients move no deeper than the current crop rooting depth.
- Avoid runoff or loss to subsurface tile drains.

Nitrogen and phosphorus application must be planned based on the MN NRCS Agronomy Technical Note 32 guidance.

Nutrient rate

Plan nutrient application rates for N, P, and K using UME recommendations . Lower-than-recommended nutrient application rates are permissible if the client's objectives are met.

At a minimum, determine the rate based on crop/cropping sequence, current soil test results, and NRCS-approved nutrient risk assessments. Where applicable, use realistic yield goals.

Apply manure or organic by-products on legumes at rates no greater than the (UME) estimated N removal rates in harvested plant biomass, not to exceed P risk assessment limitations.

When applying onto existing legumes, limit rates to approximately 3,000 gallons liquid or 10 tons solid per acre (unless higher rates have been shown to not damage the forage and runoff potential to nearby waters is low).

For new crops or varieties where UME guidance is unavailable, industry-demonstrated yield and nutrient uptake information may be used.

Use realistic yield goals where applicable for determining (UME) recommendations. Estimate realistic yield potentials or realistic yield goals using (UME) procedures or based on historical yield or growth data, soil productivity information, climatic conditions, nutrient test results, level of management, and/or local research results considering comparable management and production conditions. For nitrogen on corn, use UME recommendations based on Maximum Return to Nitrogen (MRTN) which can be estimated using the Corn Nitrogen Rate Calculator.

For crop rotations or multiple crops grown in one year, do not apply additional P if it was already added in an amount sufficient to supply all crop nutrient needs. P_2O_5 removal rates from crop or forage harvested plant biomass can be based on one year or multiple years (up to 6 years). When multiple years are used, the total amount of P_2O_5 applied over the entire crop sequence cannot exceed the calculated phosphorus removal for the sequence.

Calibrate application equipment yearly to ensure that commercial fertilizer and manure applications are not resulting in over or under application.

Do not recommend rates that the application equipment cannot deliver.

MN NRCS Agronomy Technical Note 32 defines when manure applications must be based on phosphorus and when manure applications should cease due to elevated phosphorus levels.

For any single application of nutrients applied as liquid (e.g., liquid manure, nutrients in irrigation water, fertigation)—

- Do not exceed the soil's infiltration rate or water holding capacity.
- Apply so that nutrients move no deeper than the current crop rooting depth
- Avoid runoff or loss to subsurface tile drains.

Nutrient application timing and placement

Consider the nutrient source, management and production system limitations, soil properties, weather conditions, drainage system, soil biology, and nutrient risk assessment to develop optimal timing of nutrients. For N, time the application as closely as practical with plant and crop uptake. For P, time planned surface application when runoff potential is low. Time the application of all nutrients to minimize potential for soil compaction.

For crop rotations or multiple crops grown in one year, do not apply additional P if it was already added in an amount sufficient to supply all crop nutrient needs.

To avoid salt damage, follow UME recommendations for the timing, placement, and rate of applied N and K in starter or pop-up fertilizer .

Do not surface apply nutrients when there is a risk of runoff, including when—

- Soils are frozen.
- Soils are snow-covered.
- The top 2 inches of soil are saturated.

Exceptions for the above criteria related to surface-applied nutrients when there is a risk of runoff can be made when specified conditions are met and adequate conservation measures are installed to prevent the offsite delivery of nutrients. NRCS, in cooperation with the State water quality control authority, will define adequate treatment levels and specified conditions for applications of manure if soils are frozen and/or snow covered or the top 2 inches of soil are saturated.

Exceptions for the State of MN are the following:

Nutrients must not be surface-applied if nutrient losses offsite are likely.

Do not apply manure and commercial nitrogen and phosphorus fertilizers to frozen, snow-covered or actively thawing areas having one or more of the following conditions:

- Within 300 feet of sensitive features including surface waters, surface tile intakes, sinkholes, water supply wells, mines and quarries.
- Uncontrolled ephemeral erosion.
- Frequently flooded soils.
- Any actively thawing field draining to surface waters.
- No solid manure applications when sheet and rill losses are greater than 4 tons per acre per year.
- No fertilizer or liquid manure applications when sheet and rill losses are greater than 2 tons per acre per year.
- Other agencies may have different requirements, consult with other state and local agencies before applying nutrients in the winter.
- See MDA's Groundwater Protection Rule for additional vulnerable area restrictions for fall and frozen soil applications.

Additional Criteria to Minimize Agricultural Nonpoint Source Pollution of Surface and Groundwater

Apply conservation practices to avoid nutrient loss and control and trap nutrients before they can leave the field(s) by surface, leaching, or subsurface drainage (e.g., tile, karst) when there is a significant risk of transport of nutrients.

Planners must use the current NRCS-approved nitrogen, phosphorus, and soil erosion risk assessment tools to assess the risk of nutrient and soil loss and implement applicable mitigation practices.

Additional Criteria to Reduce the Risk of Potential Pathogens From Manure, Biosolids, or Compost Application From Reaching Surface and Groundwater

When applicable, follow proper biosecurity measures as provided in NRCS directives GM-130, Part 403, Subpart H, "Biosecurity Preparedness and Response."

Follow all applicable Federal, Tribal, State, and local laws and policies concerning the application of manure, biosolids, or compost in the production of fresh, edible crops.

Apply manure, biosolids, or compost with minimal soil disturbance or by injection into the soil unless it is being applied to an actively growing crop, a minimum of 30 percent residue exists, or there is a living cover that has a fibrous root system with 75 percent or more cover. Do not surface apply manure if a storm event is forecast within 24 hours.

Additional Criteria to Reduce Emissions of Objectionable Odors, PM and PM Precursors, and GHG and Ozone Precursors

To address air quality concerns caused by odor, N, sulfur, and particulate emissions; adjust the source, timing, amount, and placement of nutrients to reduce the negative impact of these emissions on the environment and human health.

Do not surface apply solid nutrient sources, including commercial fertilizers, manure, or organic by-products of similar dryness/density when there is a high probability that wind will blow the material and emissions offsite. Do not surface apply liquid nutrient sources when there is a high probability that wind will blow the liquid droplets applied from sprinklers or other applicable methods offsite.

Reduce the potential for volatilization by applying sources subject to volatilization during cooler, higher humidity conditions or by placement that minimizes vulnerability to volatilization.

Additional Criteria to Improve or Maintain Organic Matter

Design the plant or crop management systems so the soil conditioning index (SCI) organic matter subfactor is positive.

Apply manure, compost, or other organic nutrient sources at a rate and with minimal disturbance that will improve soil organic matter without exceeding acceptable risk of N or P loss.

For low residue plant or cropping systems, apply adequate nutrients to optimize plant or crop residue production to maintain or increase soil organic matter.

CONSIDERATIONS

General Considerations

Consider development of nutrient management plans by conservation management unit (CMU). A CMU is a field, group of fields, or other land units of the same land use and having similar treatment needs and planned management. A CMU is a grouping by the planner to simplify planning activities and facilitate development of conservation management systems. A CMU has definitive boundaries such as fencing, drainage, vegetation, topography, or soil lines.

Develop site-specific yield maps using a yield monitoring system, multispectral imagery or other methods. Use the data to further delineate low- and high-yield areas, or zones, and make the necessary management changes. Use variable rate nutrient application based on site-specific factor variability. See NRCS directive Agronomy Technical Note (TN) 190, AGR.3, "Precision Nutrient Management Planning."

Use the adaptive nutrient management learning process to improve nutrient use efficiency on farms as outlined in NRCS' national nutrient policy in GM-190, Part 402, "Nutrient Management." Consider using an

adaptive approach to adjust nutrient rate, timing, form, and placement as soil biologic functions and soil organic matter changes over time. See NRCS directive Agronomy Technical Note (TN) 190, AGR.7, “Adaptive Nutrient Management Process.”

When developing new nutrient management plans, consider using soil test information no older than 1 year rather than 2 years.

Develop a whole farm nutrient budget (nutrient mass balance), including all imported and exported nutrients. Imports may include feed, fertilizer, animals and bedding, while exports may include crop removal, animal products, animal sales, manure, and compost.

Modify animal feed diets to reduce the nutrient content of manure following guidance contained in Conservation Practice Standard (CPS) Feed Management (Code 592).

Provide a nutrient analysis of all nutrient source exports (manure or other materials).

Excessive levels of some nutrients can cause induced deficiencies of other nutrients, (e.g., high soil test P levels can result in zinc deficiency in corn).

Use soil tests, plant tissue analyses, and field observations to check for secondary plant nutrient deficiencies or toxicity that may impact plant growth or availability of the primary nutrients.

Do not apply K in situations where an excess (greater than soil test K recommendation) causes nutrient imbalances in crops or forages.

Use bioreactors, sauturated buffers, and multistage drainage strategies to mitigate nutrient loss pathways, as applicable.

Use legume crops and cover crops to provide N through biological fixation. Cover crops with a carbon to nitrogen ratio below 20:1 can release a large amount of soluble N after being plowed or tilled into the soil when an actively growing crop is not present to take up nutrients, leading to increased risks of nitrate movement and nitrous oxide emissions. The nitrous oxide emissions often occur in high soil moisture conditions, such as when a legume cover crop is plowed down in fall or early spring. To avoid these losses, use grass-legume or grass-legume-forbs mixtures with a more balanced carbon to nitrogen ratio.

Use winter hardy grass cover crops to take up excess N after the cash crop growing season . This N will be retained in the soil and contribute nitrogen to subsequent crops.

Use conservation practices that slow runoff, reduce erosion, and increase infiltration (e.g., conservation tillage, filter strip, contour farming, or contour buffer strips).

Use application methods, timing, technologies or strategies to reduce the risk of nutrient movement or loss, such as—

- Split nutrient applications for nitrogen.
- Banded applications for phosophorous and potassium.
- Injection of nutrients below the soil surface.
- Incorporate surface-applied nutrient sources when precipitation capable of producing runoff or erosion is forecast within the time of a planned application.
- High-efficiency irrigation systems and technology.
- Enhanced efficiency fertilizers
    - Slow or controlled release fertilizers.
    - Nitrification inhibitors.
    - Urease inhibitors.
- Drainage water management.

- Tissue testing, chlorophyll meters, or real-time sensors.
- Pathogen management considerations.
- Additional practices, termed alternative management tools in the Groundwater Protection Act to reduce the risk of nitrogen movement or loss are available at MDA's website.

When a recycled product (e.g., compost) is to be used as a nutrient source on food crops or as food for humans or animals, make sure that pathogen levels have been reduced to acceptable levels (reference the Food and Drug Administration's Food Safety Modernization Act). www.fda.gov/FSMA When the recycled product has come from another farming operation, implement biosecurity measures and evaluate the risk of pathogen transfer that could cause plant or animal diseases.

Use manure treatment systems that reduce pathogen content from manure.

Implementing a soil health management system that reduces tillage or other soil disturbance, includes a diverse rotation of crops and cover crops, keeps roots growing throughout the year, and keeps the soils covered to reduce nutrient losses, and improves—

- Nutrient use efficiency, rooting depth, and availability of nutrients.
- Soil organic matter levels.
- Availability of nutrients from organic sources.
- Aggregate stability and soil structure.
- Infiltration, drainage, and aeration of the soil profile.
- Soil biological activity.
- Water use efficiency and available moisture.

Use targeted or prescribed livestock grazing to enhance nutrient cycling and improve soil nutrient cycling functions.

Elevated soil test P levels may lead to reduced mycorrhizal fungal associations and immobilize some micronutrients, such as iron, zinc, and copper.

Apply manure, compost, or other nutrient sources with minimal soil disturbance and at a rate that will improve soil organic matter without exceeding acceptable risk of N or P loss.

Encourage private well owners to test for nitrate in private wells.

Use strategies and tools developed as part of Nitrogen Fertilizer Management Plan such as alternative management tools (as defined in the GPR), new modeling techniques being developed by University of Minnesota researchers and MDA to forecast water quality outcomes of potential implementation activities, and other practices in high risk locations such as drinking water supply management areas with public wells with elevated nitrate and in townships with high nitrate in groundwater, according to MDA Township Testing results.

PLANS AND SPECIFICATIONS

Consult the Nutrient Management Plan Review Checklist (MN-ECS-15) for additional details.

In the nutrient management plan, document—

- List of fields and acres
- Farm and field maps
- Soil survey maps and legend along with map unit descriptions and applicable interpretations.
- Soil information including: soil type, surface texture, drainage class, permeability, available water capacity, depth to water table, restrictive features, and flooding and ponding frequency.

- Crop information including past yields, realistic yield goals and crop rotation.
- Soil testing information including copies of soil test reports and maps showing location of sampling areas
- Livestock operation information including type, weight, number, manure analyses and storage info if applicable.
- All available test results (e.g. compost, organic by-product, irrigation water, and plant tissue sample analyses) upon which the nutrient budget and management plan are based.
- Maps identifying sensitive features and conditions along with the associated nutrient application restrictions and setbacks.
- Results of approved risk assessment tools for N, P, and erosion losses.
- Location of nearby residences, or other locations where humans may be present on a regular basis, that may be impacted if odors or PM are transported to those locations.
- Documentation establishing the application site presents a low risk for P transport to local water if P is applied in excess of crop requirement.
- When soil P levels are increasing above an agronomic level, include a discussion of the risk associated with P accumulation and a proposed P draw-down strategy.
- Field Specific Realistic yield goals for the crops (where applicable for developing the nutrient management plan).
- Field Specific Nutrient recommendations for N, P, and K for the entire plant production sequence or crop rotation.
- Listing, quantification, application method and timing for all nutrient sources (including all enhanced efficiency fertilizer products) that are planned for use and documentation of all nutrient imports, exports, and onsite transfers.
- Guidance for implementation, operation and maintenance, and recordkeeping.

For variable rate nutrient management plans, also include—

- Geo-referenced field boundary and data collected that was processed and analyzed as a GIS layer or layers to generate nutrient or soil amendment recommendations per management zone. Must include site-specific yield maps using soils data, current soil test results, and a yield monitoring system with GPS receiver to correlate field location with yield.
- Nutrient recommendation guidance and recommendation equations used to convert the GIS base data layer or layers to a nutrient source material recommendation GIS layer or layers.
- After implementation, provide application records per management zone or as applied map within individual field boundaries (or electronic records) documenting source, timing, method, and rate of all nutrient or soil amendment applications.

If increases in soil P levels are expected above an agronomic level (i.e., when N-based rates are used), document—

- Soil P levels at which it is desirable to convert to P-based planning.
- A long-term strategy and proposed implementation timeline for soil test P drawdown from the production and harvesting of crops.
- Management activities or techniques used to reduce the potential for P transport and loss.
- For AFOs, a quantification of manure produced in excess of crop nutrient requirements.

OPERATION AND MAINTENANCE

Review or revise plans periodically to determine if adjustments or modifications are needed. At a minimum, review and revise plans as needed with each soil test cycle, changes in manure management, volume or analysis, plants and crops, or plant and crop management.

All plan components will be annually reviewed and updated. Nutrient applications will follow current (UME) nutrient guidelines.

In prevented plant or fallow decisions, nutrient management plans will need to be revised to reflect this management decision.

Monitor fields receiving animal manures and biosolids for the accumulation of heavy metals and P in accordance with LGU guidance and State law.

For animal feeding operation, significant changes in animal numbers, management, and feed management will necessitate additional manure analyses to establish a revised average nutrient content.

Calibrate application equipment to ensure accurate distribution of material at planned rates. For products too dangerous to calibrate, follow LGU or equipment manufacturer guidance on proper equipment design, plumbing, and maintenance.

Document the nutrient application rate. When the applied rate differs from the planned rate, provide appropriate documentation to explain the difference.

Protect workers from and avoid unnecessary contact with nutrient sources. Take extra caution when handling anhydrous ammonia or when managing organic wastes stored in unventilated tanks, impoundments, or other enclosures.

Use material generated from cleaning nutrient application equipment in an environmentally safe manner. Collect, store, or field apply excess material in an appropriate manner.

Recycle or dispose of nutrient containers in compliance with State and local guidelines or regulations.

Maintain records for at least 5 years to document plan implementation and maintenance. Records must include—

- All test results (soil, water, compost, manure, organic by-product, and plant tissue sample analyses) upon which the nutrient management plan is based.
- Listing and quantification of all nutrient sources (including all enhanced efficiency fertilizer products) that are planned for use and documentation of all nutrient imports, exports and onsite transfers.
- Date(s), method(s), and location(s) of all nutrient applications.
- Weather conditions and soil moisture at the time of application, elapsed time from manure application to rainfall or irrigation event(s).
- Plants and crops planted, planting and harvest dates, yields, nutrient analyses of harvested biomass, and plant or crop residues removed.
- Dates of plan review, name of reviewer, and recommended adjustments resulting from the review.

For variable rate nutrient management plans, also include—

- Maps identifying the variable application location, source, timing, amount, and placement of all plant and crop nutrients applied.
- GPS-based yield maps for crops where yields can be digitally collected.

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