Comprehensive Nutrient Management Plans

NRCS Natural Resources Conservation Service

Nebraska Conservation Planning Sheet No. 27
March 2014

What is a Comprehensive Nutrient Management Plan (CNMP)?

A CNMP is a conservation system that is unique to Animal Feeding Operations (AFOs). A CNMP is a group of conservation practices and management activities, when implemented as part of a conservation system, will help to ensure that both production and natural resource protection goals are achieved.

How it helps Water and Air Quality

CNMPs can reduce point source pollution by properly containing manure and runoff from livestock operations and reduce non-point pollution by developing nutrient budgets for manure application onto cropland. When properly implemented, CNMPs minimize the potential for surface and ground water pollution by nitrogen and phosphorous, and minimize ammonia emissions to the atmosphere. Using the nutrients more effectively in crop production can reduce production costs improving net income.

Where to get help?

For assistance in planning a manure storage system and comprehensive nutrient management plans (CNMP), contact the local Natural Resources Conservation Service (NRCS) office, a Technical Service Provider (TSP), private consultant or professional engineer that specialize in manure storage for AFOs. CNMPs must meet NRCS Nutrient Management Standard (Code 590).

CNMPs Requirements

CNMPs contain the following elements:

- Background & Site Information,
- Manure & Wastewater Handling and Storage,
- Farmstead Safety & Security,
- Land Treatment Practices,
- Soil & Risk Assessment Analyses,
- Nutrient Management (Code 590),
- Record-keeping,
- References,
- Feed Management (Optional),
- Other Utilization Options (Optional),
- Air Quality (only when identified).

In working with AFO owners, practical and technically feasible CNMP alternatives must be developed and meet their needs. Alternatives may include a mixture of structural and/or management practices.

CNMP implementation may require additional design, analysis or evaluations. Operational changes may cause partial or complete revisions to planned alternatives.

Follow-up site visits are necessary to evaluate whether the implemented alternatives are meeting the operation's needs and addressing environmental issues.

CNMP Development Guidance

1. Start CNMP planning process by collecting a resource inventory at the operation. Use NE-CPA-73 or equivalent forms.
2. Evaluate nutrient management; manure storage facility capacity, manure transfer and land treatment using appropriate tools. Estimate annual manure and wastewater production and determine if the storage structures provide adequate storage and if the operation has adequate land application sites to utilize the nutrients in the manure remaining after storage and application losses.
3. Develop plan maps for each land application site owned or controlled. Label maps and include applicable setback and sensitive areas.
4. Use Appropriate Risk Tools for Nutrient Management and Land Treatment:
   - RUSLE2, as applicable,
   - NE Phosphorus Index, and
   - Nitrogen Leaching Index.
5. Summarize risk assessments and evaluate land treatment needs.
6. List fields considered to be low runoff potential for winter application.
7. Complete a Nutrient Analysis – compare total manure produced verses Storage Containment Capacity verses Application Method/Rate/Placement verses Nutrient Utilization.
8. Check for state requirements for livestock storage structures.
9. Develop conservation plan based on client's decision. Design Land Treatment, Manure Storage, Manure Transfer Practices. Complete state permit application.
10. Layout, Install and Checkout of constructed manure storage & transfer and land treatment structures and practices.
11. Discuss with owner the operation and maintenance (O&M) of practices installed, nutrient management to be implemented and required record keeping.
12. Annually review and modify CNMPs as needed.

Crop Nutrient Budget

Develop a nutrient budget for nitrogen (N), phosphorus (P) and potassium (K) for each field in accordance with Code 590.

Soil Testing & Frequency

Collect and prepare soil samples in accordance with UNL guidelines.

- Surface soil samples at 0"-8" & test for:
  - P, K, pH & OM based on crop rotation; up to once per 5 years.
  - Nitrate-nitrogen if nitrogen will be applied (excludes starter N for soybeans). Soil sample prior to first application of nitrogen to the crop. In sandy soils, collect samples in the same season the crop is planted.
  - Micronutrients, such as iron, sulfur, zinc, etc., as recommended.
- *Optional* phosphorus surface soil test at 0-2" to determine soil P test levels is suggested for no-tilled fields with manure history and P runoff is a concern.
- Deep soil sampling at a minimum of 8"-24" for nitrate-nitrogen is required when applying nitrogen (manure, commercial N, etc.) two or more consecutive years. Collect deep soil samples prior to second continuous year that nitrogen is applied (and all continuous, subsequent years).

Collect soil samples at the same point in crop rotation and same time of year in subsequent years to determine trends.

Manure Sampling and Testing Guidelines

Adjust commercial fertilizer application rates for N, P & K to account for nutrient availability of applied manure, etc. Annually test each manure type and source for:

- Total ammonium-N,
- Total nitrogen,
- Total phosphorus,
- Total potassium and
- Percent dry/moisture content.
- Total organic –N (reported),

Use a 5-year averaged nutrient content for nutrient availability of applied manure instead of a single year analysis. For new operations, use book values until manure can be sampled.

The table below provides *estimated* 1st year N availability based on manure source & application method (NebGuide "Determining Crop Available Nutrients from Manure").

Estimated Nitrogen Credits for Manure

Manure Source	1st year N Availability - Application Method	
	Surface Applied, Not Incorp.	Injected or Incorporated Immediately
Beef Cattle Solid Feedlot Manure	6 lb/T	7 lb/T
Beef Cattle Slurry Deep Pit	3 lb/ 1000 gal	8 lb/ 1000 gal
Beef Cattle Runoff Holding Pond	3 lb/ac-in	0.9 lb/ 1000 gal
Swine Solids Hoop Barn	7 lb/T	10 lb/T
Swine – Flush Building	2 lb/ 1000 gal	13 lb/1000 gal
Swine Slurry Finisher (dry diet)	5 lb/ 1000 gal	30 lb/1000 gal
Swine Effluent Lagoon	16 lb/ac-in	3.8 lb/ 1000 gal
Dairy Cattle Solid (scraped lots)	4 lb/T	6 lb/T
Dairy Cattle Slurry Storage Pit	5 lb/T	16 lb/T
Dairy Cattle Effluent Lagoon	35 lb/ac-in	7.4 lb/ 1000 gal
Broiler Litter	18 lb/T	32 lb/T
Layer Litter	6 lb/T	23 lb/T
Sewage Sludge	2-3 lb/T	
Sheep Manure	5 lb/T	

Safety

Never enter a deep pit manure storage structure unless the proper safeguards have been taken and deemed necessary.

Manure Nitrogen Sources

Organic-nitrogen sources include compost, solid beef and dairy manure.

Inorganic-nitrogen sources include deep pit slurry (swine, dairy, beef, etc.) and fresh poultry litter.

Manure Application Timing

Adjust application timing to minimize excessive nitrogen leaching losses.

Annually complete a Nitrogen Leaching Risk Assessment for each budget based on predominated soil texture and application timing.

Nitrogen Leaching Potential of Inorganic-N

Timing of Application	Soil Texture		
	Coarse (sandy)	Medium (silt)	Fine (clay)
Fall	High	Medium – Low	Low
Spring or Pre-plant	High - Medium	Medium – Low	Low
Sidedress or Split	Medium - Low	Low	Low

Consider the following when planning manure nitrogen application:

- Avoid fall applications of high inorganic-N manure on sandy soils for spring planted crops.
- Avoid fall sub-surface applications of high inorganic-N manure on medium soils unless soil temperature is $\leq$ 50°F.

Manure Nutrient Placement

Residue / tillage management should be compatible with the application method in your conservation plan.

Adjust application method to avoid nutrient losses due to runoff, leaching and volatilization.

When possible, avoid or minimize manure application to grassed waterways.

Complete phosphorus risk assessments on each field receiving manure using the Nebraska Phosphorus-Index once every five years; unless the field is reported as a high / very high risk.

Phosphorus Risk Assessment Results Equate

Score	Risk	Nutrient Management
0-2	Low	Nitrogen based
2-5	Medium	Nitrogen based
5-15	High	Phosphorus Based
>15	Very High	No Phosphorus until P-Index score is below 15

Guidelines for Surface Application of Wastewater

Avoid application of wastewater to saturated soil (top two inches of soil are saturated from rainfall or snowmelt); unless compliant with National Pollutant Discharge Elimination System (NPDES) permit and during a chronic wet period and/or 25-yr, 24-hr storm event.

Winter Application Events

Use fields, or parts of, with a low risk for runoff if winter manure spreading or stockpiling is planned.

Low risk fields include features such as:

- Level to gentle slopes.
- Little to no channelized and/or concentrated flow areas.
- Located farthest from surface water and conduits to ground water.
- Drier ground.

Frozen and/or Snow-Covered

Surface application of manure or stockpiling on frozen ground (impenetrable due to frozen soil moisture) and/or snow-covered ground (covered by one inch or more of snow or ½ inch of ice) is restricted unless compliant with federal, state and local requirements and all the following field conditions are met:

1. Low phosphorus delivery potential of 3.0 or less (based on NE P-Index score),
2. Manure application rates are consistent with rates listed in NE P-index report,
3. Slope is 12% or less,
4. Ground cover is greater than 30%,
5. Existing land treatment practices are in good condition,
6. Management practices are appropriate for low erosion and runoff,
7. State setbacks are respected, and
8. Manure is not applied within 100 feet of tile inlets with outlets into surface water.

Manure Application Equipment

Calibrate manure application equipment annually to ensure uniform distribution.

Use safety or chemvalves on irrigation systems that mix ground water with wastewater. NRDs inspect valves annually.

Record Keeping

Maintain records for five years for manure storage, handling, application and nutrient management including, but not limited to:

- O&M compliance inspections;
- Daily livestock numbers & deads;
- Liquid manure structure storage levels & pump out dates/amount;
- Rainfall events (open lots);
- Discharge events;
- Soil, water, plant tissue and manure analysis results;
- Nutrient recommendations / planned;
- Manure transfers;
- Rate & sources of nutrients applied;
- Dates & method of application;
- Total manure applied by field;
- Weather conditions at application;
- Crops planted/harvest dates & yields;
- Calibration dates.

Other References

A complete list of all UNL publications is available at http://www.ianrpubs.unl.edu./edu/epublic/pages/index.jsp

The U.S. Department of Agriculture (USDA) prohibits discrimination in all its programs and activities on the basis of race, color, national origin, age, disability, and where applicable, sex, marital status, familial status, parental status, religion, sexual orientation, genetic information, political beliefs, reprisal, or because all or a part of an individual's income is derived from any public assistance program. (Not all prohibited bases apply to all programs.) Persons with disabilities who require alternative means for communication of program information (Braille, large print, audiotape, etc.) should contact USDA's TARGET Center at (202) 720-2600 (voice and TDD). To file a complaint of discrimination write to USDA, Director, Office of Civil Rights, 1400 Independence Avenue, S.W., Washington, D.C. 20250-9410 or call (800) 795-3272 (voice) or (202) 720-6382 (TDD). USDA is an equal opportunity provider and employer.