NPDES Compliance Inspection Manual

Appendix AO

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Appendix AO – Detailed Review of Nutrient Management Plan Implementation

DETAILED ANALYSIS OF NMP IMPLEMENTATION

Evaluation of the calculations and records associated with the NMP typically will focus on the site-specific terms of the NMP that have been incorporated as conditions of the CAFO's permit. NMP review of the land application elements will focus on the nutrient transport risk assessment, rate calculations, and land application records.

When evaluating the land application requirements of the NMP, use the elements in Table 1 to help identify potential compliance alerts and clarification questions to ask the facility.

Table 1: NMP Land Application Records and Recordkeeping Expectations

NMP Records to be Reviewed	Expectation for What Will be Recorded
How much manure does the CAFO generate each year?	This information is used to determine if the CAFO has adequate storage and land application fields or if manure must be transferred off-site.
If the CAFO does not land apply manure, can they produce manure transfer records to account for disposal of all manure?	Manure transfer records should account for all manure generated. The CAFO must also have manure test results provided to each manure hauler.
How many land application fields under the CAFO's control are used and what is the total acreage?	Amount of manure land applied divided by available acreage approximates the weight of manure applied per acre.
Does every acre receive manure every year or are the fields rotated? If rotated, does the CAFO have a quantitative approach to determine which fields receive manure each year?	If the CAFO is relying on multiyear phosphorus application,[35] they must be able to demonstrate that they are not over applying in frequency or amount.
Are setbacks or buffers from down gradient surface waters documented and implemented?	The CAFO representative will need to identify which fields have buffers or setbacks and show at least one of these to the inspector.
Do NMP records account for all forms of manure present at the CAFO (solid, slurry, and liquid)?	If the CAFOs sampling is representative, nutrient application will be based on sample results from all forms of manure. Otherwise, the CAFO may over- or under-apply as a result of not accounting for nutrients in all manure forms.
Does the CAFO have recent sampling and analysis records for all manure sources?	Nutrient application rates must be based on the most recent manure nutrient results. If manure nutrient content changes significantly from values used in the nutrient

[35] For a discussion of multiyear phosphorus application refer to section 6.3 of EPA's *Permit Writers' Manual for CAFOs* (February 2012).

NMP Records to be Reviewed	Expectation for What Will be Recorded
	management plan, the nutrient management plan should be updated to reflect the new values.
Does the CAFO have recent soil sampling and analysis records, P risk assessments, and rate calculations for all fields currently receiving or scheduled to receive manure?	Non-recent of these may not reflect current conditions and result in over- or under-application of nutrients and potential environmental harm from offsite transport of phosphorus in runoff.
What crops are planted or planned for nutrient application fields and what are the nutrient uptake rates for these crops?	Different crops have different nutrient uptake rates and timing considerations for nutrient applications. The CAFO should base application rate calculation on book value nutrient uptake rates specific to the state or region, or actual uptake rates based on recent plant tissue samples. In the latter case, the CAFO should provide laboratory reports in support of the results. The inspector should field-verify the crops being grown in one or more land application fields. Appendix I contains photos of the growth stages of common field crops.

Nutrient Application Rate Calculations

For permitted CAFOs, the permit writer will have already ensured that the methodology used to calculate rates in the NMP is consistent with the permit and applicable technical standards. The inspector's job is to verify that the actual manure application rates are being calculated in accordance with the NMP methodology. This determination will depend on whether the NMP terms were developed in accordance with the linear or narrative rate approach as discussed below.

Terms Applicable to Linear and Narrative Rate Approaches
Fields Available for Land Application

The NMP will identify each field where land application is planned. The inspector should compare the land application records with the fields identified in the NMP to ensure manure, litter, or process wastewater were not applied to fields that are not covered by the plan. Use of a land application site that is not identified in the NMP constitutes non-compliance with a permit term. Also, addition of a land application site not covered by an approved NMP constitutes a substantial change to the NMP that requires a permit modification with associated permitting authority review and public notice.

Timing Limitations for Land Application

As described in Chapter 6.5.1 of the *Permit Writers' Manual for CAFOs* this term refers to limitations described in the technical standards for when manure applications should be prohibited or delayed. The inspector should check land application records to see if the applicable timing limitations are being followed. In some cases this will be a straight-forward evaluation. Often, however, evaluating compliance will require the inspector and case officer to use professional judgment and diverse resources, as illustrated by the examples below.

Document Review Tip: Spot check records for a single field

- ✓ Does the CAFO have current soil and manure test results for the field and source of manure applied?
- ✓ Are the calculations for planned manure application rates consistent with the NMP methodology?
- ✓ Are actual manure application rates consistent with calculated rates?
- ✓ Are the total nutrient applications (from manure and other sources) consistent with crop nutrient recommendations?
- ✓ Did the CAFO perform a phosphorus index risk assessment for the field?
- ✓ Is the CAFO applying phosphorus at a rate consistent with the phosphorus transport risk assessment?
- ✓ Was manure applied on the same day as, or the day before, a significant rain event?

It is usually easiest and least expensive for a CAFO to apply manure to the field nearest the manure

EXAMPLE COMPLIANCE EVALUATION FOR TIMING LIMITATIONS

Example Timing Limitation

Manure shall not be spread between December 1 and March 15.

Compliance Evaluation

Check land application dates to ensure manure has not been spread during the restricted time frame.

Example Timing Limitation

Delay field application of animal manures or organic by-products if precipitation capable of producing runoff and erosion is forecast within 24 hours of the time of the planned application.

Compliance Evaluation

Compare land application dates with local precipitation records. If precipitation occurred within a day of land application, additional evaluation may be warranted to determine whether:

1) The precipitation was capable of producing runoff and erosion. In some cases this may be determined using on-site records, though these types of records are not common. Several modeling tools are available to predict soil erosion based on precipitation events and field conditions including, but not limited to:

- Water Erosion Prediction Project (WEPP) Model (http://www.ars.usda.gov/Research/docs.htm?docid=10621)
- CREAMS, A field scale model for Chemicals, Runoff, and Erosion from Agricultural Management Systems
- Areal Nonpoint Source Watershed Environment Response Simulator (ANSWERS)

- AGNPS model (http://go.usa.gov/KFO)

2) The precipitation was forecast at the time of application. There are many sources of historical weather information; unfortunately, historical weather forecasts are more difficult to obtain. If local newspaper archives are available, these may be a resource for determining the forecast for a specific date.

If these two pieces of information can be determined, the inspector and case officer then would have to use professional judgment to deduce whether the CAFO operator should reasonably have been aware that precipitation capable of producing runoff and erosion was forecast within 24 hours at the time the manure was applied. Because the analysis is resource-intensive and somewhat subjective, retrospective compliance determination for this type of timing limitation may not be practical. If an inspector is concerned that the CAFO operator may be applying manure without consideration for timing limitations, real-time monitoring might be a better method for evaluating compliance. Records obtained during an on-site inspection can be used to predict typical application schedules for a particular operation. It may be beneficial to conduct drive-by inspections during these time frames when significant rainfall is predicted to determine whether land application is occurring.

Example Timing Limitation

Wastewater shall not be applied when the ground is frozen or saturated or during rainfall events.

Compliance Evaluation

Determining whether manure or wastewater was applied during rainfall events is relatively straightforward but may require some judgment or interpretation. The inspector can compare land application dates with local precipitation records. CAFOs often maintain daily precipitation logs. Alternatively, Internet resources such as The Weather Underground (www.weatherunderground.com) and Utah Climate Center (http://climate.usurf.usu.edu/products/data.php) can be used to determine whether a rainfall event occurred, at least at a nearby weather station, on a specific date. Unless the data document the time of application and precipitation, it might not be possible to positively determine whether the two events were concurrent, but the inspector and case officer can use information such as the magnitude of the rainfall, whether rainfall occurred on the previous and/or subsequent days, the amount of manure or wastewater applied, and other circumstantial data to assess the likelihood that manure or wastewater was applied during a rainfall event.

Evaluating whether wastewater was applied on frozen or saturated ground is more complex. Many variables such as season, latitude, altitude, proximity of lakes and rivers, and local landscape, can affect when soils freeze and thaw. To predict soil saturation the inspector and case officer would need information on soil types including antecedent soil moisture, hydraulic conductivity, infiltration rate, and precipitation and irrigation history. Here again, the evaluation is time-consuming and because it is not based on direct observation may not result in a positive determination of non-compliance. If the land application records for a facility

suggest the CAFO operator is applying wastewater to frozen or snow-covered ground, it may be more effective for an inspector to visit CAFOs under those conditions to observe whether land application is occurring.

Outcome of the Field-Specific Assessment of the Potential for Nitrogen and Phosphorus Transport from Each Field

The inspector should ensure the calculated land application rates are consistent with the rate recommendation from the technical standards based on the outcome of the risk assessment.

Some states require CAFOs to use a nitrogen leaching index or other tool to assess the risk of nitrogen movement to groundwater. Where such a tool is required and strictly focuses on groundwater protection, use of the tool is not a federally enforceable requirement under the NPDES program. However, where there is a direct hydrologic link from groundwater to surface waters and a nitrogen leaching risk assessment is required as part of the technical standards for nutrient management, the inspector should check to ensure that any rate limitations or management practice specifications associated with the outcome of the leaching index are being implemented.

CAFO inspectors should be familiar with the phosphorus risk assessment tool required by the applicable technical standards for nutrient management. Often, this will be the state's Phosphorus Index (P Index), but could also be a soil test phosphorus method, a phosphorus environmental threshold, or other similar assessment tool. Where the risk assessment for a field indicates that manure application should be restricted to a phosphorus-based rate, any application exceeding that rate is inappropriate unless the state allows multi-year phosphorus application. Where rates are P-limited and multi-year P applications are made, the inspector should review the land application records to ensure the applications are consistent with all restrictions associated with the multi-year P flexibility (e.g., no additional P applied until the P applied in single year has been removed through uptake and harvest, the total multi-year rate does not exceed the single-year N recommendation, location or timing restrictions).

The inspector should also check to see that the risk assessment rating is being re-calculated at appropriate intervals. Some state technical standards may specify re-calculation at a specific frequency or based on specific triggers. Even if the permit or technical standards do not specifically require re-calculation of the risk assessment outcome, the inspector should be aware of circumstances under which a field should be re-assessed. These circumstances will depend on the specific risk assessment used. In general, where there is a change in any of the factors used in calculating the risk of nutrient transport, the risk should be re-assessed. For example, many P Indices account for the conservation practices implemented on a field when evaluating the risk of nutrient transport from that field. If the CAFO operator changes the conservation practices used on a field, then the P Index for that field should be re-calculated. Any change to a field that might reasonably result in an increase in the nutrient transport risk could be considered a trigger for recalculating that field's risk assessment.

In states that allow use of more than one type of phosphorus risk assessment, the inspector should check to be sure that the assessment tool used in the NMP submitted with the application for permit coverage is used throughout the permit term. A CAFO may not switch to

a different risk assessment method during the permit term unless the permit is revised to reflect the new term for the outcome of the field specific assessment, as this would trigger a substantial permit modification. See Chapter 4.1.7 of the *NPDES Permit Writers' Manual for CAFOs* (EPA, 2012a).

The examples below illustrate compliance evaluations for the most common types of risk assessment tools:

Example: Nitrogen Leaching Index Outcome

Net Score: 13

Risk Interpretation: This field has a HIGH risk for nitrogen leaching and management changes should be implemented to decrease risk. Manure should be applied at P agronomic rates. Apply nitrogen using split in-season applications at or below the agronomic rate. Changes in irrigation management and/or method may also be necessary. If there is an underlying aquifer that is shallow (< 20 ft.) or used locally as a public drinking water source, increase the risk to VERY HIGH. [Colorado NRCS. 2006, Colorado Nitrogen Leaching Index Risk Assessment (Version 2.0). Agronomy Technical Note No. 97 (revised), August 25, 2006. <http://efotg.sc.egov.usda.gov/references/public/CO/COATN_97v2.pdf >)

Compliance Evaluation

Terms like "should" and "may be necessary" complicate compliance evaluation for this type of requirement. The inspector and case officer will need to use professional judgment to determine what practices, including phosphorus-based rates and irrigation management changes, the CAFO operator should reasonably be expected to implement. In this case, split in-season nitrogen application is required; the inspector should review the NMP and land application records to ensure that this practice is used. If inorganic nitrogen sources (e.g., anhydrous ammonia, urea) are used, the inspector should keep in mind that the entire manure nitrogen contribution may be applied at one time. Local recommendations for practices like split nitrogen application can be used as guidelines for evaluating compliance if the practices are not covered in the technical standards for nutrient management; Land Grant Universities are good sources for recommendations on agricultural practices.

Example: Soil Test Phosphorus Level

Soil test phosphorus level (Bray P1/Mehlich 3 ppm): 63 ppm

Basis for nutrient application: Not to exceed 1.5 x crop P_2O_5 removal [Indiana NRCS. 2001. Conservation Practice Standard, Nutrient Management, Code 590. Indiana Natural Resources Conservation Service Field Office Technical Guide—July 2001.]

Compliance Evaluation

The inspector should verify that the soil test phosphorus result used to determine the basis for nutrient application is current and based on the appropriate extraction method. Next, the inspector should evaluate the calculated land application rates to verify that the planned application does not exceed 1.5 times the crop P_2O_5 removal rate.

Example: Soil Phosphorus Threshold Level

Soil test phosphorus threshold: 40 ppm (Olsen), 60 ppm (Bray-1), 6 ppm (Morgan)

Soil test phosphorus level: 50 ppm (Olsen)

Phosphorus application rate: Crop rotational phosphorus uptake [Idaho NRCS. 2007. Conservation Practice Standard, Nutrient Management, Code 590. Idaho Natural Resources Conservation Service Field Office Technical Guide—June 2007.]

Compliance Evaluation

The inspector should verify that the soil test phosphorus result used to determine the basis for nutrient application is current and based on the appropriate extraction method. Next, the inspector should check the calculated land application rates to verify that the planned application does not exceed the crop phosphorus uptake rate.

A Note on Phosphorus Recommendations

The inspector should be aware of differences between the several types of phosphorus recommendations that may be seen.

- Soil test phosphorus recommendation: A recommendation for the amount of additional phosphorus needed in the soil to ensure an optimal level of phosphorus to support achievement of maximum potential crop yield.
- Phosphorus crop uptake: The amount of phosphorus a crop will take up from the soil during its life cycle.
- Phosphorus crop removal: The amount of phosphorus that will be removed from the field through crop uptake and harvest. This amount may be less than the phosphorus crop uptake amount since a portion of the plant may remain in the field after harvest and the nutrients in the crop residue returned to the soil.

Example: Phosphorus Index

Phosphorus index value and risk rating: 12, Medium risk

Recommended rate basis: Nitrogen-based application

Compliance Evaluation

If not already done during the permitting process, the inspector should review the factors used to calculate the P Index value to ensure the values appear to reasonably reflect site conditions. Those factors might include soil erosion, runoff class, soil test phosphorus, phosphorus application rates, and conservation practices. Factors like soil test phosphorus, application rates, and conservation practices can be checked against facility records. Others, like runoff class or other soil properties, can be checked against soil surveys (available through NRCS's Web Soil Survey: http://websoilsurvey.nrcs.usda.gov/app/HomePage.htm). Soil erosion is usually calculated using the Revised Universal Soil Loss Equation, version 1 (RUSLE2). RUSLE2 is a computer model that uses a detailed mathematical approach for integrating multiple equations that describe how certain factors affect soil erosion. Appendix A of the *NPDES Permit Writers' Guide for CAFOs* contains a detailed discussion of RUSLE2. The inspector also should evaluate calculated land application rates to ensure that the planned nitrogen application does not exceed the recommendation.

Planned Crop or Other Use

The rate calculations in the NMP are based on the crop or crop rotation planned for each field. The inspector should evaluate land application records to ensure the crops actually grown in the field are the same as the crops that were planned for that field during that year. The only exception would be for the use of alternative crops included in the NMP, which is discussed below as a term for the narrative rate approach.

A Note on Yield Goals
The inspector should check on-site records, where available, to ensure that actual yields are consistent with the yield goals used in the NMP.

Total Nitrogen and Phosphorus Recommendations for Each Crop

During the permitting process, the permit writer will evaluate these recommendations to ensure they are consistent with the planned crops and yields in accordance with the technical standards for nutrient management. For the total nitrogen recommendation and phosphorus recommendations based on crop uptake or removal, this permitting evaluation is adequate. For a total phosphorus recommendation that is based on soil test phosphorus levels, the inspector can check the facility records for the soil phosphorus analysis used as the basis for the recommendation included in the NMP. Specifically, the inspector can check to see if the analysis uses the appropriate extraction method as specified in the technical standard for nutrient management, that the soil sample was taken at the correct depth (see S*oil Sampling* in Chapter 5.9.2 of the *NPDES Permit Writers' Manual for CAFOs* (EPA, 2012a)), and that the analysis reports phosphorus in the same form as used in the soil test recommendation. Phosphorus is commonly reported as either elemental phosphorus (or total P) or phosphorus pentoxide (P_2O_5). Total P can be converted to P_2O_5 as follows: $P_2O_5 = P \times 2.29$.

Realistic Annual Yield Goals

The realistic yield goal is an estimated potential for crop yield for a given field. The total nutrient requirements for fields are largely based on the CAFOs expected crop yields; generally, the higher the yield expectation, the higher the nutrient requirement. An unrealistic estimate can result in either a deficiency or an excess of nutrients being applied. In addition to crop variety and climate, crop yields are influenced by field-specific factors including, among others, soil fertility, soil type, crop management and pest control. Thus, estimated yields can be expected to vary for different fields. State technical standards for nutrient management need to identify acceptable methods and data sources for establishing realistic yield goals. One way to establish realistic yield goals is to use the average of the three highest yields of the five most recent years that the specific crop was grown in the field. For new operations where production records are not available, CAFOs may need to use information available through county NRCS field offices or from local farmers.

Terms Applicable to the Linear Approach
Credits for Plant Available Nitrogen in the Field

Under the linear approach, the credits from the nitrogen that will be available to the crop from all other sources are terms. These other sources include nitrogen credits from mineralization and legumes.

Nitrogen credits are a term even for a field with a phosphorus-based rate because the nitrogen credit is needed to calculate the appropriate amount of supplemental nitrogen to be added to the field to ensure that the crop's nitrogen requirement is not exceeded.

Consideration of Multi-Year Phosphorus Application

Where a phosphorus-based rate is required, technical standards for nutrient management might allow several years' worth of phosphorus to be applied in a single application. For an NMP that includes multi-year phosphorus application, the permit term will identify the field, crop, and year for the application. Where allowed, a multi-year phosphorus application should not exceed the nitrogen recommendation for the year of the application, and no additional phosphorus should be applied until the amount supplied in the multi-year application is removed through crop uptake and harvest. Technical standards for nutrient management might include additional restrictions or requirements for where or when such applications are allowed and what practices must be implemented to reduce the risk of nutrient loss from a multi-year phosphorus application. The inspector should evaluate land application records to verify that multi-year applications did not occur during any year or on any field or crop not identified in the NMP. For any field where a multi-year application was used, the inspector should also determine the number of years covered by the application and check to see that phosphorus was removed during the subsequent years through harvest as specified in the NMP and that no additional phosphorus was applied for the number of years covered by the multi-year application. In addition, the inspector should check for implementation of any specifications for multi-year in the permit or technical standards for nutrient management.

For example, Illinois' General NPDES Permit for Concentrated Animal Feeding Operations (Permit No. ILA01) requires site-specific practices, determined through assessment procedures to be specified in the NMP, to minimize runoff of P applied to land in a multi-year P application. For a permitted CAFO in Illinois, the inspector should first determine that the assessment procedures specified in the NMP were followed and ascertain the practices that were identified as a result of the assessment. Then the inspector should check to see if those practices were implemented to minimize phosphorus runoff from the multi-year phosphorus application.

Accounting for All Other Additions of Plant Available Nitrogen and Phosphorus

As described in the *NPDES Permit Writers' Manual for CAFOs* (EPA, 2012a), this term captures all non-manure nutrient sources (e.g., chemical fertilizers, biosolids, and nutrients in irrigation water). The permit term will identify the "other additions" that are planned for each field and crop for each year of permit coverage. The inspector should evaluate land application records to see if only the nutrient sources identified in the NMP were actually applied to the field. It is important to note that the term does not obligate the CAFO operator to use a specific nutrient source. So, for example, if the NMP indicates that Field X will receive nitrogen from process wastewater and irrigation water in a certain year but the land application records indicate that only manure was applied, the permit term has not been violated. However, for the same scenario, if the land application records indicate that process wastewater and anhydrous ammonia were applied, the facility would be out of compliance with the permit term because the NMP had not accounted for the use of anhydrous ammonia.

In addition, the term does not limit the amount of nutrients supplied through "other additions." For example, a CAFO's NMP indicates that Field X will receive 100 pounds of nitrogen per acre from process wastewater and 50 pounds per acre of nitrogen from irrigation water. However, rainfall was lower than average and the CAFO operator had to irrigate more than anticipated, thereby supplying more nitrogen from irrigation water than expected. The term *accounting for all other additions of plant available nitrogen and phosphorus* is not violated because additional nitrogen was applied from irrigation water. However, in this case the inspector would need to check that the amount of nitrogen supplied from process wastewater was decreased accordingly so that the total nitrogen application did not exceed the term *total nitrogen recommendation for each crop*.

Form and Source of Manure that Is Land Applied

The inspector should compare the form and source of manure to be applied to each field and crop, identified in permit terms, with the land application records to see if the planned form(s) and source(s) were used.

Timing and Method of Land Application

The permit term for timing should be as specific as needed to reflect how the timing impacts nutrient availability in the application rate calculation. Therefore, the inspector should rely on the permit term, and not necessarily the application timing specified in the NMP to evaluate compliance. The specificity of the term will be guided by the state technical standards for nutrient management and, largely, the nitrogen availability factors that are required. For example, many states provide a single availability factor or mineralization rate for seasonal (i.e., fall or spring) application. In those states, the permit term might simply specify fall or spring application. In some cases, a permit term might be as specific as "within two weeks before planting." In most cases the CAFO's NMP will include a specific date for planned applications since most nutrient management planning programs require a specific date. EPA does not expect permit terms to require a specific application date. The compliance evaluation depends on the term that was identified for *timing of land application*. The inspector must make sure the actual nutrient applications identified in the facility records are consistent with the permit term.

The permit term for method of application will specify at least whether the surface or subsurface application is planned and may be as specific as identifying the type of equipment that will be used. The term should also reflect whether the manure is to be incorporated within a certain time frame. The CAFO inspector should evaluate land application records to see if the actual method of application, including time to incorporation, is consistent with the planned method reflected in the permit term.

Maximum Amount of Nitrogen and Phosphorus from Manure, Litter and Process Wastewater

The permit term will be expressed as the maximum pounds per acre of nitrogen that may be applied to each field for each year of permit coverage. The term will also include a maximum amount of phosphorus, in pounds per acre per year, for fields where application is limited to phosphorus-based rates. The inspector should evaluate land application records to see if the actual amount of nitrogen (or nitrogen and phosphorus where applicable) applied did not

exceed the amount specified in the permit term. The inspector should verify that the land application records document nutrient application using the same chemical forms used in the permit term.

Methodology to Account for the Amount of Nitrogen and Phosphorus in the Manure to be Applied

For the linear approach, only the actual amount of manure, litter, or process wastewater to be applied should vary on an annual basis since the maximum amount of N and P to be applied from manure is a permit term. The NMP and permit term should describe the specific methodology used to make this calculation. The amount of manure to be applied will depend on the results of the annual manure analysis and the calculation will be similar to the following:

$$\frac{Pounds\ of\ N\ or\ P\ to\ be\ applied\ per\ acre}{Pounds\ of\ N\ or\ P\ per\ ton\ or\ gallon\ of\ manure} = Tons\ or\ gallons\ of\ manure\ to\ be\ applied\ per\ acre$$

The inspector should check the CAFO's records to verify that the amount of manure to be applied was calculated in accordance with the methodology specified in the permit term. In general, the following information will be needed to make this determination using the formula above:

- *Maximum amount of N (and P as applicable) from manure, litter, and process wastewater*: This is a permit term and should be identified in the permit
- *Pounds of N (and P as applicable) per ton or gallon of manure:* The source for this data is the result of the manure analysis used to calculate the manure application rates. The inspector should check to be sure that the analysis is for a recent sample, taken no more than 12 months before the date of application, and that the analysis is representative of the material applied. Most importantly, the sample should represent the actual source of the manure, litter, or process wastewater applied. A sample may represent multiple sources (i.e., storage structures) only if the manure sources and management structures for those two sources are so similar as to support a reasonable expectation that that the nutrient content of the manure will be the same.

  Consider, for example, two dairies, each with a milking parlor, outdoor confinement areas, a solids separator, and two impoundments. At Dairy A, all process wastewater, including wash water from the milking parlor, flush water from the feed lane, and runoff from the pens flows to the solids separator. Effluent from the separator can be directed to either of the two impoundments; the dairy allows one impoundment to fill and then directs wastewater to the second impoundment while the first is being emptied. Because the contents of each impoundment are from the same source and managed the same, it is reasonable to expect that a wastewater taken from one impoundment would represent the nutrient content of both impoundments. At Dairy B, milk parlor wash water and feed lane flush water are directed to the separator. Effluent from the separator can be directed to either of the two impoundments. Runoff from the pens

flows directly to one of the impoundments. At this dairy, it may not be reasonable to expect that wastewater from both impoundments would have the same nutrient content since one impoundment receives wastewater from a source that is significantly different from the other (runoff from the pens).

The inspector should also make sure that the pounds of N or P per ton or gallon of manure used to calculate the amount of manure to apply is expressed using the same chemical form as provided on the manure analysis or has been calculated or converted appropriately. For nitrogen-based application rates, planners and CAFO operators often calculate the amount of plant available nitrogen in the manure to be applied. This is calculated by adding the inorganic forms (typically ammonium and nitrate) and the portion of organic nitrogen that will be available in the first year after application (based on the mineralization rates specified in the technical standards).

Terms Applicable to Narrative Rate Approach
Maximum Amount of Nitrogen and Phosphorus from All Sources of Nutrients

Different than the linear approach where land application rates are expressed in terms of the amount of nutrients to be applied from manure, the narrative rate approach sets an upper limit on the amount of nutrients to be applied from all sources. The term is the maximum amount of nitrogen and phosphorus derived from all sources of nutrients for each crop identified in the NMP in chemical forms determined to be acceptable to the Director, in pounds per acre, for each field. In the narrative rate approach, the maximum limit is identified only for each crop but does not need to be reported each year that the crop is planted.

The maximum amount of nitrogen from all sources under the narrative rate approach is based on the maximum amount of nitrogen that can be applied to a field for the specified crop based on crop type, yield goal, and current nitrogen soil test – where required. The maximum amount of nitrogen from all sources is the same value reported for the term, total crop nitrogen recommendation.

The maximum amount of phosphorus from all sources can be set for each crop according to the maximum amount of phosphorus applied in any one year for any one crop based on the outcome of the field-specific risk assessment. This preserves the flexibility of the narrative rate approach. Because the phosphorus site index changes with different crops and years, different rates of manure can be applied according to P-Index recommended rates. Manure may be applied at N-based rates for some years and crops and P-based rates for other years and crops.

EXAMPLE COMPLIANCE EVALUATION:
MAXIMUM AMOUNT OF NITROGEN AND PHOSPHORUS FROM ALL SOURCES OF NUTRIENTS

Compliance Evaluation

To evaluate this term, the inspector will check to see if a total crop nutrient recommendation exists for each crop included in the NMP. The total nutrients land applied must not exceed the calculated total crop nutrient recommendations for a specific crop.

Compliance Issues

- Nutrients applied from all sources exceed the total crop nutrient recommendation calculated for a specific crop.
- The CAFO did not calculate the maximum amount of nutrients that can be applied to a specific crop.
- The CAFO did not account for crop type, yield goal and current soil test when determining the total crop nitrogen recommendation.
- The CAFO did not conduct a field-specific risk assessment when determining the total crop phosphorus recommendation.

Alternative Crops

The narrative rate approach allows for greater flexibility than the linear approach by allowing the NMP to include alternative crops that may be planted in lieu of those included in the planned rotation. If alternative crops are included, the NMP must also identify for each alternative crop realistic yield goals and nitrogen and phosphorus recommendations. The term includes the alternative crops listed in the NMP, along with their associated yield goals and nitrogen and phosphorus recommendations.

EXAMPLE COMPLIANCE EVALUATION: ALTERNATIVE CROPS

Example: At CAFO A the north field typically is planted in wheat. However, when wheat prices drop, CAFO A plants alfalfa. CAFO A must include wheat and alfalfa plus their respectively yield goals and, nitrogen and phosphorus recommendations in the NMP.

Under the Narrative Approach, the methodology must account for the following factors:

- ✓ Credits for PAN in the field
- ✓ Amount of nitrogen and phosphorus in the manure to be applied
- ✓ Consideration of multi-year phosphorus application
- ✓ Accounting for all other additions of plant available nitrogen and phosphorus to the field
- ✓ Form and source of manure, litter and process wastewater
- ✓ Timing and method of land application
- ✓ Soil test results
- ✓ Volatilization of nitrogen and mineralization of organic nitrogen

Compliance Evaluation

The inspector should verify that any crop listed in CAFO A's land application records or actual crop(s) planted in the land application areas are included in the NMP.

Compliance Issues

- The crop observed growing in a land application area is not included in the NMP.
- During the review of land application records, a crop included in the manure application records is not listed in the NMP.

Methodology

Unlike the linear approach where permit terms are factors of the methodology, the factors themselves are not required to be terms in the narrative approach, but rather the methodology used to account for them in the CAFO's NMP is a term. Under the narrative rate approach, the methodology is the enforceable permit term, rather than the factors included.

As long as the methodology presented in the NMP is followed and includes all necessary factors, the calculated amount of manure, litter, or process wastewater can change from year to year.

EXAMPLE COMPLIANCE EVALUATION:
METHODOLOGY

Compliance Evaluation

As previously mentioned, the permit writer will have already ensured that the methodology used to calculate rates in the NMP is consistent with the permit and applicable technical standards. The inspector should see if the actual manure application rates are being calculated in accordance with the NMP methodology.

The following factors must be accounted for in calculating the rates of manure application:

- Credits for Plant Available Nitrogen (PAN) in the field
- Amount of nitrogen and phosphorus in the manure to be applied
- Consideration of multi-year phosphorus application
- Accounting for all other additions of plant available nitrogen and phosphorus to the field
- Form and source of manure, litter and process wastewater
- Timing and method of land application
- Soil test results
- Volatilization of nitrogen and mineralization of organic nitrogen

Compliance Issues

- CAFO is not able to document values used in the application rate calculations (e.g., no laboratory results for soil and manure analyses).
- Application rate calculations are based on a different methodology than presented in the NMP.
- CAFO does not account for additional commercial fertilizer applications or other sources of nutrients.

Records for Permitted Medium and Small CAFOs

Permitted medium and small CAFOs are subject to the same requirements as a Large Permitted CAFO, with the exception of the ELG. Permitted medium and small CAFOs must maintain records to document NMP development and implementation. See Table 2 below for examples of records that might be maintained to document implementation of the nine minimum measures as well as potential compliance alerts suggesting non-compliance with the specific requirements. Permitted medium and small CAFOs are not subject to the ELG. Any technology-based requirements and associated records will be specified in the permit for a medium or small CAFO and may be similar to the ELG requirements for large CAFOs.

Records for Unpermitted Large CAFOs

Unpermitted large CAFOs are not required to develop and implement an NMP, but are required to maintain records documenting implementation of nutrient management practices that address three of the nine NMP minimum measures to qualify for the agricultural stormwater exemption. Unpermitted large CAFOs must have records indicating that they are implementing 40 CFR Part 122.42(e)(1)(vi)-(ix) on their land application sites to ensure appropriate agricultural utilization of land applied nutrients. These practices ensure that precipitation-related discharges from the land application areas qualify for the agricultural stormwater exemption. As provided in Table 2 below, records must exist for measures 6 through 8.

Table 2: Example Records to Evaluate Minimum Measures

Measure	Example Records	Potential Compliance Alerts
Identify site-specific conservation practices to be implemented, including buffers or equivalent practices, to control runoff of pollutants to waters of the United States [40 CFR Part 122.42(e)(1)(vi)	• NMP or CNMP • Engineering drawings or as built drawings showing the location and dimension of berms, buffers, setbacks, and other conservation practices between land application fields or production areas and WOUS • Narrative descriptions of conservation practices implemented to control pollutant runoff, such as NRCS conservation practice standards	• The CAFO does not have documentation of buffers, setbacks, or other conservation practices to minimize nutrient runoff to nearby WOUS. • Conservation practices are identified but do not include operation and maintenance protocols to ensure long-term effectiveness to control pollutant runoff.

Measure	Example Records	Potential Compliance Alerts
Identify protocols for appropriate testing of manure, litter, process wastewater, and soil [40 CFR Part 122.42(e)(1)(vii)	• NMP or CNMP • A facility sampling plan that identifies sampling locations, sampling frequency, analytical methods, and laboratories for manure, litter, process wastewater, and soil analysis • Laboratory reports that identify testing procedures and results for manure, litter, process wastewater, and soil	• The CAFO land applies manure or wastewater without sampling the nutrient content of manure and soil. • Soil and manure analyses are not current. • Manure and process wastewater analysis are not representative of all sources that are land applied. • Soil analyses are not available for all fields used for land application. • Soil or manure analytical results are not consistent with those used to calculate land application rates.
Establish protocols to land apply manure, litter or process wastewater to ensure appropriate agricultural utilization of the nutrients in the manure, litter or process wastewater [40 CFR Part 122.42(e)(1)(viii)]	• Site map showing land application fields • NMP or CNMP • Manure spreading agreements • Manure application rate calculations in accordance with the methodology in the NMP • Land application records • Application equipment inspection logs	• No documentation of manure application rates, protocols, or schedules. • The CAFO land applies manure and/or wastewater without agronomic rate calculations supporting the application. • Manure application at rates higher than the rates calculated in accordance with the NMP. • Manure is applied at a constant rate across all fields and crop types. • Land application records are incomplete (e.g., do not specify manure source, amount, dates, application method, etc.). • Actual amount of nutrients applied is calculated at the end of the season rather than tracked for each application event. • Manure is applied to fields that are not identified in the NMP.