



UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION III
1650 Arch Street
Philadelphia, Pennsylvania 19103-2029

CERTIFIED MAIL
RETURN RECEIPT REQUESTED

DEC 19 2012

Ms. Kathleen Stiller, Director
Division of Water
Delaware Natural Resources and Environmental Control
89 Kings Highway
Dover, Delaware 19901

Re: Technical Standards for Concentrated Animal Feeding Operations

Dear Ms. ^{Kathy} Stiller:

The United States Environmental Protection Agency (EPA) has completed its review of Delaware's state technical standards for concentrated animal feeding operations (CAFOs) as documented in the enclosed draft report. State Water Directors are required to establish a technical standard for nutrient management in accordance with 40 CFR § 123.36 and 40 CFR § 412.4(c)(2). EPA review consisted of analyzing the documents your office provided in response to our letter of June 22, 2010 requesting submission of your technical standards, and additional follow-up. We recognize that states have taken or are currently taking steps to review and revise, as necessary, their state NRCS Natural Resource Conservation Service's Nutrient Management Conservation Standard 590 to ensure consistency with the revised national 590 Standard, and/or taken other actions to address the water quality concerns in their state. These actions may impact the state technical standards that will be applied to CAFOs. Our review may not reflect all revisions, so this review document serves as a place to begin discussions.

The documents that were identified as being part of the state technical standards, and thus reviewed, are listed in the draft report. It also includes an evaluation checklist (updated from our last communication) which provides detailed information relating to the relevant portions of the regulations and reference documents for each review criteria. Based on our review, EPA finds most aspects of the technical standards are consistent with EPA's effluent limitation (technology based) guidelines, but that some portions are inconsistent. Delaware's standards lack a field-specific nitrogen assessment to evaluate the potential for nitrogen transport from the field to surface waters (see Item 4). We understand that this is a requirement of the revised 590 Standard, and may soon be addressed. We found that Delaware's field-specific assessment tool (P-Index) may not be applied to all fields and, therefore may create situations where consideration of transport is not a factor in the nutrient management planning by a CAFO (see Item 5). We have included recommendations for enhancing the state's P-Index to be consistent with NRCS standards, if not already addressed. These assessment tools are vital to ensuring

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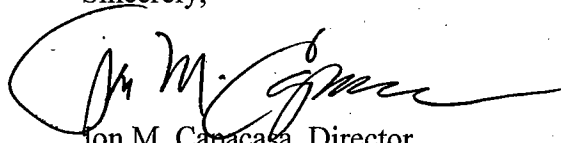
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that nutrient transport to our nation's waterways is minimized. Additionally, the technical standards criteria for Items 18, 21, and 34 need your special attention for enhancement. Enhancement may be necessary because the criterion was not addressed, did not fully conform to the review criteria, or clarification is needed to fully meet the federal requirements.

We ask that the Division of Water, in coordination with Delaware Department of Agriculture (DDA), to carefully review the findings in the draft report and consider how the state can fully meet each criterion. EPA looks forward to working with you on refinement of the technical standards needed to ensure full implementation of the National Pollutant Discharge Elimination System (NPDES) program requirements for CAFOs, and that NPDES permits are consistent with applicable TMDLs. This draft report helps serve as a starting point to discuss the sufficiency of the technical standards for protecting water quality in the context of the Chesapeake Bay TMDL and your state Watershed Implementation Plan. We will be contacting your staff to arrange conference calls to discuss this matter further.

The technical standards need to be clearly identifiable and accessible to the public for meaningful public participation during the NPDES permitting process. Technical standards will be made publically available on EPA's website <http://cfpub.epa.gov/npdes/afo/techstandards.cfm>. Should you have any questions, please contact me or your staff may contact Ashley Toy at (215) 814-2774.

Sincerely,



Jon M. Capacasa, Director
Water Protection Division

Enclosure

cc: Mark Davis, DDA

DRAFT REPORT

**Review of Delaware's CAFO State Technical Standards
December 14, 2012**

Prepared By:

U.S. Environmental Protection Agency, Region 3
1650 Arch Street (3WP42)
Philadelphia, Pennsylvania 19103-2029

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Introduction

The U.S. Environmental Protection Agency, Region 3 (EPA) has requested each Mid-Atlantic state to provide the technical standards used as the basis for developing nutrient management plans (NMPs) required by the National Pollutant Discharge Elimination System (NPDES) program. Overall, EPA expects the state's concentrated animal feeding operation (CAFO) program to achieve three primary goals.

1. Meet the minimum requirements of the federal CAFO regulations for nutrient management.
2. Conform to the January 2012 Natural Resources Conservation Service's (NRCS') Conservation Practice Standard Code 590 for Nutrient Management (revised CPS 590).
3. Ensure implementation of the nutrient management practices identified in Delaware's Phase 1 and 2 Watershed Implementation Plans (WIPs).

The intent of this report, however, is limited to Region 3's expectations for Delaware's technical standards for nutrient management (technical standards) and conformance with NRCS' revised CPS 590. The *Delaware Technical Standards* section presents the results of EPA Region 3's review of the state's technical standards. The subsequent section evaluates how Delaware's CAFO program conforms to NRCS' revised national policies for nutrient management, particularly the state's P-Index and 590 standard. EPA Region 3 will use the document as a basis for discussions with the state in a cooperative effort to improve water quality in the Chesapeake Bay.

EPA requests clarification from Delaware with regards to any of the following findings or recommendations that may have already been addressed or will be addressed in forthcoming revisions to the state's CAFO program and nutrient management tools. EPA's analysis was based on information provided by the Director and currently available to the public.

Delaware Technical Standards

Finding #1. EPA determined the Delaware technical standards to be incomplete or not addressed.

Federal regulations specify that CAFO land application rates must minimize phosphorus (P) and nitrogen (N) transport to surface waters from fields used for land application of manure, litter, and process wastewater in compliance with technical standards established by the director at 40 CFR 412.4(c)(2). The federal Effluent Limitations Guidelines (ELG) also specify minimum requirements for state technical standards, including

- Field specific assessments of N and P transport from the field to surface waters;
- Address the form, source, amount, timing, and method of application of nutrients to achieve realistic production goals while minimizing N and P movement to surface waters; and

- Appropriate flexibilities such as consideration of multi-year P applications on fields that do not have high potential for P runoff, phased implementation of P-based nutrient management, and other components.

EPA has identified the criteria that state technical standards for nutrient management must address to meet the minimum requirements outlined in the ELG. In December 2010 EPA requested each state identify the documents that constitute its technical standards for nutrient management. EPA then evaluated these documents to determine whether they adequately address the criteria identified in the checklist.

The Director of Delaware Natural Resources and Environmental Conservation (DNREC); Division of Water Resources (DWR) identified the following documents containing portions of the state's technical standards:

- NRCS-Delaware, Conservation Practice Standard - Nutrient Management (Code 590), dated May 2002
- Delaware Nutrient Management Program, Conservation Practice Standard - Soil Testing Procedures, dated July 2010
- Delaware Nutrient Management Program, Conservation Practice Standard - Pre Side-Dress Soil Nitrate Test (PSNT), dated July 2010
- Delaware Nutrient Management Program, Conservation Practice Standard - Phosphorus Site Index, dated July 2010
- Delaware Nutrient Management Program, Conservation Practice Standard - Manure Incorporation, dated July 2010
- Delaware Nutrient Management Program, Conservation Practice Standard - Manure Testing, dated July 2010
- University of Delaware (UD) Extension, *Phosphorus Removal by Delaware Crops*, dated September 2012
- University of Delaware *Nutrient Management Handbook* (Sims and Gartley, 1996)
- Mid-Atlantic Nutrient Management Handbook, Chapter 9, Manure as a Nutrient Source (MAWP 06-02, February 2006)

Additional documents reviewed:

- UD Extension, *The Phosphorus Site Index: A Phosphorus Management Strategy for Delaware's Agricultural Soils* (cited in the Phosphorus Site Index technical standard), dated January 1, 2002.
- 9 Delaware Reg. 440 (CAFOs)(cited in attachment from the State Administrator)
- Delaware Nutrient Management Notes, Vol. I., No. 9, September 2000 - Soil and Litter Sampling for Nutrient Analysis
- Delaware Nutrient Management Notes, Vol. II., No. 1, Spring 2001 - Equipment for Effective Poultry Litter Application
- Delaware Nutrient Management Program, Conservation Practice Standard - Nine Elements of a Nutrient Management Plan or Animal Waste Management Plan, not dated

- Delaware Nutrient Management Program, Conservation Practice Standard - Phosphorus Saturation Ratio, dated July 2010
- Delaware Nutrient Management Program, Conservation Practice Standard - Tissue Analysis, dated July 2010
- Phosphorus Site Index Excel Spreadsheet, 12/10/2010 in spreadsheet filename
- UD Department of Plant and Soil Sciences; David J. Hansen, Chapter 9, Manure as a Nutrient Source

The complete EPA technical standards checklist for Delaware is provided as Appendix A. The checklist identifies the EPA technical standards criteria; the state's comparable technical standard, if provided; references; EPA's expectations for each criterion; and a comparison between the state's technical standard and EPA expectations. EPA previously provided the state with a completed copy of the checklist.

Recommendation – (1) Delaware should revise the technical standards to ensure that the finalized version includes:

- A field-specific assessment tool for nitrogen (Appendix A, Item 4).
- Field specific assessment tools for N and P transport from fields to surface waters will provide quantitative and/or qualitative criteria for determining whether the rate can be N-based, P-based, or prohibited (Appendix A, Item 5).
- Acceptable method(s) for conducting the manure analysis (Appendix A, Item 17) OR Laboratories approved for manure analysis (Appendix A, Item 18).
- Methods for collecting soil samples (Appendix A, Item 21).
- Restrictions on when and/or where multi-year P application can occur (Appendix A, Item 34).

Does Delaware's CAFO Program conform to the NRCS' Revised National Policies for Nutrient Management?

Finding #2. Delaware's CAFO program does not conform to NRCS' revised national policies for nutrient management.

Conservation Practice Standard (CPS) 590 Revisions

NRCS established CPS 590 to define minimum standards for managing the amount (rate), source, placement (method of application), and timing of plant nutrients and soil amendments. CPS 590 applies to all lands where plant nutrients and soil amendments are applied, including land application areas at CAFOs. The standard promotes a comprehensive nutrient management system designed to *avoid* application of excess nutrients, *control* nutrients at the site of application, and *trap* nutrients and sediment to prevent them being transported from agricultural fields to surface waters (ACT). Avoiding and controlling nutrients are accomplished according to the "4Rs" principle of applying the *right amount* of nutrients from the *right source* in the *right place* at the *right time*. This is consistent with the nutrient

management principles of the CAFO regulations, which require NMPs that address the form, source, amount, timing, and method of application to minimize nutrient transport to surface waters. The alignment of CPS 590 and CAFO nutrient management regulations is evidenced by the fact that DNREC and many other state regulatory agencies include their state version of CPS 590 in the technical standards.

NRCS revised the national CPS 590 in January 2012 (revised CPS 590; NRCS, NHCP 2012) to help producers better manage the application of nutrients on agricultural land. The revised CPS 590 underscores and strengthens several aspects of the ACT and 4Rs concepts relevant to land application of manure. Key revisions include

- Increased emphasis on risk assessments, including use of the P-Index to assess the risk of P transport from a field to surface water and the N leaching tool to evaluate the risk of N movement to subsurface hydrology.
- Revised standards regarding surface application of nutrients to frozen, snow-covered, and saturated ground.

To complement the revised CPS 590, NRCS released concurrent revisions to the nutrient management requirements of its National Instruction (190-Ecological Sciences, Part 302-A) and General Manual (190-Ecological Sciences, Part 402.1-402.7) in December 2011. Title 190, Part 302.2 outlines the technical criteria for risk assessments used in nutrient planning, including minimum criteria for state P-Index tools [Title 190, Part 302.2(D)]. NRCS expects that each state's 590 standard will be updated by December 2012 to be consistent with the revised CPS 590.

The revised CPS 590 requires completion of an NRCS-approved nutrient risk assessment for N on all sites except when the state NRCS has determined specific conditions where nitrogen leaching is not a risk to water quality, including drinking water. The revised CPS 590 requires operators to conduct a P risk assessment when

- The P application rate exceeds land grant university fertility rate guidelines for the planned crop(s), or
- The nutrient application area is within a P impaired watershed, or
- NRCS and the state have not determined specific conditions where the risk of P loss is low.

Further, the revised CPS 590 sets forth the following criteria for all state P-Index tools.

- Consider nutrient losses caused by water and wind erosion.
- Consider soil test P (STP); time, rate, and method of P application; erosion; runoff; and leaching.
- Demonstrate that risk increases with increasing runoff, erosion, STP, application rate and depends on method of application and leaching factors.
- Include the risk categories: Low, Medium, and High.
- When manure is applied, the erosion component of the P-Index must be based on the annual soil-loss rate for the year when manure is applied.

- The P-Risk Assessment must zero-out when the environmental risk is too great to allow the application of P in any form.

In regards to nutrient application timing and placement, the revised CPS 590 prohibits surface application of nutrients when offsite losses are likely. The revised CPS 590 specifically prohibits spreading nutrients on:

- Frozen and/or snow-covered soils, and
- When the top 2 inches of soil are saturated from rainfall or snowmelt (NRCS, NHCP 2012).

The following sections compare Delaware's policies regarding nutrient application to frozen, snow-covered, and saturated soil, and N and P field risk assessments with the revised CPS 590.

Nutrient Application to Frozen, Snow-Covered, and Saturated Ground

Delaware's technical standards do prohibit nutrient application to frozen, snow-covered, and saturated ground (NRCS-Delaware 2002). Additionally, Delaware's 590 standard states that nutrients will not be applied to flooded or saturated soils when the potential for soil compaction and the creation of ruts is high (NRCS - Delaware 2002).

Recommendation - none

Delaware's Nitrogen Field Risk Assessment

Delaware's technical standards and CPS 590 (2002), do not include a nitrogen field risk assessment. The revised CPS 590 requires the completion of a nitrogen field risk assessment on all fields unless the field meets specific conditions where nitrogen leaching is not a risk to water quality as determined by state NRCS and state water quality authorities.

Recommendation - (2) Delaware's forthcoming revisions to its 590 standard should include nitrogen field risk assessment criteria consistent with the revised CPS 590. EPA expects the technical standards will be revised to include a nitrogen field risk assessment.

Delaware's Phosphorus Site Index (PSI)

According to the state's 590 standard the PSI should be completed on all fields (NRCS - Delaware 2002). When time is a limiting factor, fields will be prioritized for the PSI and P loss ratings according to these priorities:

1. All fields with a soil test P > 150 UD-FIV
2. Fields with slopes > 5% slope
3. Fields with a P leaching potential of High according to the PSI.
4. Distance of field to surface water is a value of 4 or greater, according to the PSI.

After the high priority fields have been assessed, PSI evaluations of all remaining fields should be completed as soon as possible.

The Delaware Nutrient Management Program's PSI (STS-Delaware 2010), the state's technical standard, provides operators with two options for fields with high P soil levels. Phosphorus may be applied at a three year crop removal rate or the PSI can be calculated and the appropriate P management strategy applied. STS-Delaware (2010) references the Delaware PSI and P management strategies in UD Extension (2002). High P soils are defined by the Nutrient Management Commission as having a test value greater than 150 FIV (fertility index value), 150 ppm Mehlich 3, 120 ppm Bray P1, or 75 ppm Mehlich 1. The state's PSI technical standard is inconsistent with the state's CPS 590 in that it only addresses the high priority fields, not all fields as required by the state's CPS 590.

Phosphorus loss through runoff and erosion depends not only on the amount of P in or added to a soil but also on transport processes that control soil and water movement from fields to waters of the State. Delaware's PSI scores 11 specific factors characterizing a field's potential for P loss (Table 1).

Table 1. Site characteristics and management factors used to determine Delaware's PSI (UD Delaware 2002)

Part A. Site and Transport Characteristics (P loss rating, Low to Very High)	Part B. Source and Management Characteristics (P loss rating, Low to Very High)
1. Soil erosion ($2 \times [\text{RUSLE soil erosion value (tons/acre)}]$)	1. Soil test P Fertility Index Value (FIV) ($[0.2] \times \text{FIV}$)
2. Soil surface runoff class (0, 2, 4, 6, 8)	2. P fertilizer application rate ($[0.6] \times \text{lbs P}_2\text{O}_5 \text{ applied per acre}$)
3. Subsurface drainage (0, 2, 4, 6, 8)	3. P fertilizer application method and timing (0, 15, 30, 45, 60)
4. Leaching potential (0, 2, 4)	4. Organic P source application rate ($\text{PAC}^* \times \text{lbs P}_2\text{O}_5 \text{ applied per acre}$)
5. Distance from field to surface water (0, 2, 4, 6, 8)	5. Organic P source application method and timing (0, 15, 30, 45, 60)
6. Priority of receiving water (0, 1, 2, 3, 4)	

*PAC = P availability coefficient

Each of the PSI characteristics (Table 1) is assigned a numerical value from either an interpretive rating scale (Very Low, Low, Medium, High, or Very High) or from calculations using a weighting factor based on the relationship between the characteristic and the potential for P loss from the site. The final PSI value for each field incorporates the Part A and Part B factors; however, the larger individual scores for the Part B source and management characteristics appear to drive a field's overall PSI value (Table 1).

Field values for the Part A site and transport characteristics use data obtained from a county soil survey manual, the revised universal soil loss equation (RUSLE2), and specific field measurements (i.e., distance from field to surface water). Part A factor values are summed and then multiplied by a scaling factor (0.02) to estimate the overall P transport potential on a scale from 0 to 1.0. Highly erodible sites may have an overall Part A value greater than 1.0 (UD Extension 2002).

Field values for the Part B source and management characteristics are calculated using field-specific nutrient management information provided by the farmer and current soil test results. Part B factors are summed and then multiplied by the Part A value to obtain the overall PSI value. The Delaware PSI (UD Extension 2002) recommends management options to reduce the risk of P loss from the field based in the field's overall PSI value.

The state's PSI technical standard (STS-Delaware 2010) and 590 Standard (NRCS-Delaware 2002) describe the following PSI ratings used to determine appropriate P application rates for manure and other organic amendments:

1. Phosphorus Site Index < 50. Low potential for P movement from the site given current management practices and site characteristics. There is a low probability of an adverse impact to surface waters from P losses from this site. N-based nutrient management planning is satisfactory for this site. Soil P levels and P loss potential may increase in the future due to N-based nutrient management.
2. Phosphorus Site Index = 50 – 75. Medium potential for P movement from the site given current management practices and site characteristics. Practices should be implemented to reduce P losses. N-based nutrient management should be implemented no more than one year out of three. P-based nutrient management should be implemented two years out of three during which time P applications should be limited to the amount expected to be removed from the field by crop harvest or soil test P based application recommendations, whichever is greater.
3. Phosphorus Site Index = 76 – 100. High potential for P movement from the site given current management practices and site characteristics. P-based nutrient management planning should be used for this site. Phosphorus applications should be limited to the amount expected to be removed from the field by crop harvest or soil test P based application recommendations. To be consistent with the Delaware Nutrient Management Law, P applications cannot exceed the amount of P removed in the harvested portion of the crops grown for the next three years. When P is applied at the "three-year crop removal rate", no additional P can be applied in the following two years. All practical management practices for reducing P losses should be implemented.
4. Phosphorus Site Index > 100. Very high potential for P movement from the site given current management practices and site characteristics. No P should be applied to this site. Active remediation techniques should be implemented to reduce the P loss potential from the site.

The state's PSI technical standard (STS-Delaware 2010) and 590 Standard (NRCS-Delaware 2002) include the following additional language for sites with >100 PSI. This language is not included in UD Extension (2002).

To be consistent with the Delaware Nutrient Management Law, P applications cannot exceed the amount of P removed in the harvested portion of the crops grown for the next three years. When P is applied at the "three-year crop removal rate", no additional P can be applied in the following two years. All practical management practices for reducing P losses shall be implemented, and alternatives for manure transport should be addressed. [§2247(b)]

P-Index Scenario Modeling

EPA previously conducted a comparison of Chesapeake Bay state phosphorus indices to evaluate the response of each state's P-Index to a common set of circumstances or scenarios (EPA 2011). State P-indices were reviewed to select a representative set of driving factors across the Chesapeake Bay states. Primary driving factors are soil loss, runoff class, leaching class, STP, fertilizer P application rate and method, manure P application rate and method, distance to stream, and presence or absence of a buffer. Factor values were varied across a range (e.g., fertilizer P application rate from 0 to 120 lb P₂O₅/acre) that would encompass crops and management common within the Chesapeake Bay states. Crops were selected to characterize factor values on the basis of an informal survey of crop acreage data reported in the 2007 Census of Agriculture. Five crops dominate agricultural production in the Chesapeake Bay watershed: corn (grain), soybeans, wheat, hay/alfalfa, and pasture grasses. While EPA did not use specific virtual fields to drive the comparisons, the scenarios considered crop type, typical nutrient application rates, and management practices based on values appropriate to those crops. Although this limited list omits some crops grown in the Chesapeake Bay watershed, EPA believes that the variation in P-Index input parameters encompasses a reasonable range in agricultural practices, even for crops not specifically included.

Risk assessment scenarios - Table 2 shows the selected range of values for input parameters. For each factor, EPA selected a set of variables anticipated to represent varying risk levels from very low to very high risk. Refer to EPA (2011) for a detailed discussion of these factors.

Table 2. Values used for each driving factor in P-Index computation scenarios	
Factor	Scenario options
USLE soil loss (t/ac/yr)	2/4/8/12
Runoff/drainage class (qualitative)	low/medium/high/very high
Leaching potential (qualitative)	low/moderate/high
Soil test phosphorus (mg/kg Mehlich 3/Morgan)	Mehlich-3: 20/50/80/100/250 Morgan: 2/5/20/40/60
P fertilizer application rate (lb P ₂ O ₅ /ac)	0/20/40/60/80/100/120
P fertilizer application method (qualitative)	Injected, surface/ incorp <7 d, surface Apr-Nov /incorp >7 d, surface Nov-Mar, snow or frozen ground
P fertilizer application timing (qualitative)	Will assume one application/yr
Manure P application rate (lb P ₂ O ₅ /ac)	0/20/40/60/80/100
Manure P application method (qualitative)	Injected, surface/ incorp <7 d, surface Apr-Nov /incorp >7 d, surface Nov-Mar, snow or frozen ground
Manure P application timing (qualitative)	Will assume one application/yr
Manure type (qualitative/coefficient)	Dairy
Distance to water (ft)	49/100/300/501
Buffer (qualitative)	Present/absent

Scenario sets were created using common primary driving factor values to cover all possible combinations of the different variables for each factor. A total of 1,238,400 scenarios were developed.

The scenarios were entered into Microsoft Excel spreadsheets with the driving factors in columns and the factor values in rows. Each factor value was represented to characterize all possible scenario combinations. Each state's P-Index result was calculated for each scenario. Output P-Index values were color-coded according to the risk category assigned by their respective states. Note that some scenarios based on all possible combinations of factors were deleted because they were nonsensical (e.g., manure application method/timing when manure application was zero).

P-Index Value	MD/DE	NY	PA	VA	WV
Low	8%	34%	15%	17%	3%
Medium	19%	20%	12%	41%	33%
High	22%	19%	13%	27%	54%
Very High	50%	31%	61%	15%	10%

Table 3 presents an overview of P-Index risk assessment by state for the 1,238,400 scenarios modeled; each scenario was modeled once for each state. It is immediately apparent from Table 3 that assessment of an identical set of P-Index factor values yields very different assessment of risk—and P application recommendation—for the Chesapeake Bay states. In general, Delaware, along with Maryland and Pennsylvania, appears to assess the greatest proportion of scenarios as a very high risk. In Delaware, P-Index values would restrict P application on about three-quarters of the fields represented by the scenarios, with P application prohibited in 50 percent of the modeled scenarios if these fields are assessed with the PSI, less than 50 percent if some farmers opt to apply P at a three year crop removal rate (STS-Delaware 2010).

Recommendation – (3) The state's PSI technical standard is inconsistent with the revised CPS 590 and the state's 590 standard in that it only addresses fields with high P soils, not all fields as required by the state's CPS 590. The Delaware CAFO program should require the PSI on all sites that receive manure nutrients.

(4) NRCS, NHCP (2012) requires the P-Risk Assessment *zero-out* when the environmental risk is too great to allow the application of P in any form. Delaware's 590 standard also prohibits P application at a PSI >100. Delaware's PSI technical standard, however, provides facilities with high P soils a choice of applying P at a three year crop removal rate or determine the PSI and implement the P management strategy specified in UD Extension (2002). Only the second option, determine the PSI and apply appropriate management strategies, has the potential to result in no P application when the overall PSI value is >100. The first option, applying P at a three year crop removal rate, is consistent with the Delaware Nutrient Management Law but does not prohibit P application on sites with PSI >100. As discussed above in *P-Index Scenario Modeling*, this option to apply a limited amount of P instead of zero P would apply to 50 percent (Table 3, Very High P-Index Value) of the modeled scenarios for Delaware.

Delaware is recommended to revise the PSI technical standard and the Nutrient Management Law to ensure that the PSI prohibits P application on sites with Very High potential for P movement. Having the PSI zero-out for high risk sites will make the state's CAFO program consistent with state and federal 590 standards and be protective of surface waters.

(5) The state's PSI technical standard references the PSI framework set forth in UD Delaware (2002) and includes a link to this document: <http://ag.udel.edu/extension/agnr/pdf/st-05.pdf>. This link is broken, EPA was only able to find UD Delaware (2002) on the USDA, Agricultural Research Service (ARS) website: http://www.ars.usda.gov/sp2UserFiles/Place/19020500/PhosphorousImages/DE_FactSheet.pdf. Delaware is recommended to update the link referenced in STS-Delaware (2010) and include UD Delaware (2002) on the list of nutrient management technical standards since this document appears integral to calculating PSI.

NRCS National Policies

As discussed above, NRCS' revised Title 190, Section 302 (National Instruction) establishes criteria for administering a P risk assessment and items that must be considered in the P risk assessment. The following two sections compare Delaware's P-Index with requirements in the National Instruction.

Screening Criteria

NRCS developed a P-Index Scenario Matrix to determine when a P-Index is required, not required, or no P application is allowed. For comparison with Delaware's P-Index criteria, the three situations determined by NRCS to require a P-Index are

1. Phosphorus application rates exceed land-grant university fertility rate guidelines for the planned crop(s);
2. The planned application area is within a P-impaired watershed; or
3. The site-specific conditions equating to low risk of P loss have not been determined by the NRCS and state water quality authority.

1. Phosphorus application rates exceed land-grant university fertility rate guidelines for the planned crop(s) – Delaware's Technical Standards identify the University of Delaware Extension's *Phosphorus Removal by Delaware Crops, NMI-06 (2002)* as the source for crop P removal rates. This document states that many soils in the state have abundant soil P to obtain economically optimum crop yields for years without additional inputs. However, according to the Delaware Nutrient Management Act of 1999, P applications on soils with high P levels are allowed as long as they do not exceed a three-year crop removal rate. To aid operators in meeting the requirements of this act, *Phosphorus Removal by Delaware Crops* provides information to estimate 3-year crop P (as P₂O₅) removal for the major crops grown in Delaware, and explains how much P (as P₂O₅) is removed in some typical three year cropping systems used in the state.

2. The planned application area is within a P-impaired watershed – The Delaware PSI includes a 'Priority of receiving water' factor as a Part A site and transport characteristic. The state watershed categorization scale is used to determine P loss potential. Delaware and Maryland are the only states in the CBW to incorporate this factor in their P-Index.

3. The site-specific conditions equating to low risk of P loss have not been determined by the NRCS and state water quality authority – Delaware does not have a similar P-Index screening criteria.

Recommendation – (6) Delaware should incorporate NRCS P-Index screening criteria nos. 1 and 2 to be consistent with NRCS' National Instruction.

(7) Delaware should resolve inconsistencies between the PSI (STS-Delaware 2010) and NRCS-Delaware's and DDA's 590 standards (NRCS-Delaware 2002 and DDA 2002) regarding PSI implementation. The STS-Delaware (2010) specifies a PSI only when soil FIV values are greater than 150 and the 590 standards specify a PSI for all fields.

P Risk Tool Minimum Criteria

The previous section compared Delaware's P-Index implementation requirements against NRCS P-Index Assessment Requirements. This section compares Delaware's P-Index with NRCS' six minimum criteria expected from state P-Index tools (NRCS National Instruction)

1. Consider nutrient losses caused by water and wind erosion – Soil erosion is factored in to the site and transport characteristics (Part A) of the Delaware PSI. The loss rating is calculated using the following equation: $2 \times [\text{Soil erosion value from RUSLE (tons/acre)}]$. RUSLE, the Revised Universal Soil Loss Equation, is used to estimate rates of soil erosion caused by rainfall and resultant overland flow.

Delaware *does not* evaluate nutrient losses from wind erosion.

2. Consider STP, time, rate and method of P application, erosion, runoff, and leaching – The Delaware P-Index considers soil test P (STP) in Mehlich 3 as a University of Delaware Fertility Index Value (FIV). STP is considered as a P source and management factor in Part B of the P-Index. The P Index calculates the P loss rating value by the following: $[0.2] \times [\text{FIV from University of Delaware Soil Test}]$.

Timing of P application is addressed along with 'P Fertilizer Application Method' AND 'Organic P Source Application Method' in Part B of the Delaware PSI. P loss ratings are presented for the following timing practices: 'Incorporated within 5 days of application', 'Surface applied March through November OR incorporated in > 5 days', and 'Surface applied December through February'.

Rate of P application is considered in the 'P Fertilizer Application Rate' and 'Organic P Source Application Rate' factors. P loss from P fertilizer application rate is calculated by: $[0.6] \times (\text{lbs P2O5 applied per acre})$. Organic P Source Application Rate is calculated using: $[\text{Phosphorus Availability Coefficient (PAC)} \times \text{lbs P2O5 applied per acre}]$.

Method of P application is addressed by factors such as injection/banding, incorporation, and surface application.

Soil erosion is factored in to the site and transport characteristics (Part A) of the Delaware PSI.

The Delaware PSI includes a factor for 'Soil Surface Runoff Class' which is rated from Very Low, Low, Medium, High, and Very High.

Leaching is considered by the 'Leaching Potential' factor in Part A of the P-Index.

3. Demonstrate that risk increases with increasing runoff, erosion, STP, application rate and also depends on method of application and leaching factors – Delaware’s calculated P-Index value increases with risk factors. Factors are either assigned numerical values on a sliding scale varying from least to most water quality risk or calculated based on the relationship between the characteristic and the potential for P loss from the site.

The six Part A site and transport factors (Soil Erosion, Soil Surface Runoff Class, Subsurface Drainage, Leaching Potential, Distance from Field to Surface Water, and Priority of Receiving Water) are added then multiplied by a scaling factor.

STP and application rate are based on calculations and weighted depending on loss potential.

Method of application and leaching potential are both included in the risk assessment and both receive a value based on level of risk.

4. Include the risk categories: Low, Medium, and High – The Delaware PSI includes risk ratings of Low (nutrients can be applied to meet the N crop requirement), Medium (N-based nutrient management should be implemented no more than one year out of three), High (nutrients can be applied to meet the P crop removal), and Very High (no P should be applied).

5. When manure is applied, the erosion component of the P-Index must be based on the annual soil-loss rate for the year when manure is applied – The erosion value in Delaware’s P-Index is calculated using the Revised Universal Soil Loss Equation (RUSLE). It is not clear whether Delaware expects the P-Index to be recalculated annually with that year’s soil erosion rate.

6. The P-Risk Assessment must zero-out when the environmental risk is too great to allow the application of P in any form – States must establish an upper limit of STP above which manure cannot be applied regardless of the P-Index results. The following approaches may be used to set this threshold

- Draw down STP level (e.g., set a number of years to be drawn down to optimum nutrient levels under normal cropping conditions before additional nutrients can be added.)
- Where field-based research has been conducted to develop this upper limit, this state-specific information should be used to establish the zero-out limit.

This is discussed above in *Delaware Phosphorus Site Index (PSI)*.

Recommendation – (8) Incorporate wind erosion into the Delaware PSI. Delaware must also establish an upper limit on STP above which no phosphorus application is permitted. Delaware’s PSI will meet NRCS minimum P-Index requirements with the addition of those two factors.

Summary of Delaware Findings and Recommendations

In summary, EPA recommends that Delaware evaluate the following two major findings and implement associated recommendation to ensure that the state’s technical standards meet EPA expectation and

the CAFO program conforms with NRCS national nutrient management policy. The recommendations are discussed at more length in the above sections.

Finding #1. EPA determined the Delaware technical standards to be incomplete or not addressed.

1. Delaware should revise the technical standards to ensure that the finalized version includes:
 - A field-specific assessment tool for nitrogen (Appendix A, Item 4).
 - Field specific assessment tools for N and P transport from fields to surface waters will provide quantitative and/or qualitative criteria for determining whether the rate can be N-based, P-based, or prohibited (Appendix A, Item 5).
 - Acceptable method(s) for conducting the manure analysis (Appendix A, Item 17) OR Laboratories approved for manure analysis (Appendix A, Item 18).
 - Methods for collecting soil samples (Appendix A, Item 21).
 - Restrictions on when and/or where multi-year P application can occur (Appendix A, Item 34).

Finding #2. Delaware's CAFO program does not conform to NRCS' revised national policies for nutrient management.

2. Delaware's forthcoming revisions to its 590 standard should include nitrogen field risk assessment criteria consistent with the revised CPS 590.
3. The Delaware CAFO program should require the PSI on all sites that receive manure nutrients.
4. Delaware is recommended to revise the PSI technical standard and the Nutrient Management Law to ensure that the PSI prohibits P application on sites with Very High potential for P movement from this site.
5. Delaware is recommended to update the link referenced in STS-Delaware (2010) and include UD Delaware (2002) on the list of nutrient management technical standards since this document appears integral to calculating PSI.
6. Delaware should incorporate NRCS P-Index screening criteria nos. 1 and 2 to be consistent with NRCS' National Instruction.
7. Delaware should resolve inconsistencies between the PSI (STS-Delaware 2010) and NRCS-Delaware's and DDA's 590 standards (NRCS-Delaware 2002 and DDA 2002) regarding PSI implementation. The STS-Delaware (2010) specifies a PSI only when soil FIV values are greater than 150 and the 590 standards specify a PSI for all fields.
8. Incorporate wind erosion into the Delaware PSI.

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Appendix A. Results from the EPA Region III review of Delaware's technical standards for nutrient management

ESTABLISHMENT and APPLICABILITY OF TECHNICAL STANDARDS (TS): Delaware	
1	<p>Has the Director Verified what the technical standard is?</p> <p>Yes. The Director provided a response to the initial request for identification of technical standards. In addition, the Director responded (in a file dated 4/18/2011) to a letter from EPA Region 3 evaluating the initial state response. In these two responses, the Director identified that the technical standard consists of 28 documents which are part of the 48 technical standards that collectively make the Delaware Nutrient Management Program's state technical standards. Most of these are in draft form. Only those relevant to the criteria in the checklist were reviewed, as identified above. Of those reviewed, six standards are cited in the review checklist; these standards reference additional documents.</p> <p>Stand alone document: There is no single, discrete, document. The technical standard consists of 42 documents; many are in draft form.</p> <p>Permit attachment</p> <p>Permit referenced documents</p> <p>Written into the regulations: The Director provided Appendix A - <i>Proposed Regulatory Revisions</i> (an excerpt from the Regulations Governing the Control of Water Pollution [9 DE Reg. 440 (9/1/05)]). Though not part of the formal submission, the full draft regulations were available for review. The required contents of a NMP were found in 9 Delaware Reg. 440, Section 9.5.6.1, but technical standards were not outlined.</p> <p>Regulation reference documents</p> <p>Other: The Director provided a list of Delaware state technical standards and a document entitled <i>Setback Standards and Alternative Compliance Practices to Satisfy CAFO Requirements: An assessment for the DEF-AG group</i>. All Delaware conservation practice standards are in draft form except for the NRCS-Delaware 590 Standard dated May 2002. The state's Director intentionally submitted the technical standard documents as they exist in draft form, pending EPA and peer review; they are currently accepted for use but will not be finalized until EPA, public, and further internal review are complete.</p>
2	<p>What mechanism was used by the State Director to establish the technical standard?</p> <p>The draft list of 42 standards is presented on a Delaware Department of Agriculture (DDA) web site titled "DRAFT Delaware Nutrient Management Program State Technical Standards" (http://dda.delaware.gov/nutrients/NM_TechStandards.shtml). Although the Delaware CAFO permit was not provided or found for review, the state's Director stated that the technical</p>
3	<p>How is the specific standard included as a requirement of the CAFO program?</p>

standards are referenced in the CAFO regulations. The CAFO regulations are not specifically referenced in the technical standards because the standards are intended to apply to operations, producers, applicators, and generators regardless of their regulatory status.

APPLICATION RATES			
Field Specific assessment	Criteria	Specify	Reference
Does the TS contain a clearly outlined field-specific assessment tool for N and P transport from the field for surface waters?		<p>P Transport - Y.</p> <p>Delaware Phosphorus Site Index (PSI).</p> <p>if time is a limiting factor, the P loss ratings shall first be determined according to the following priorities:</p> <ol style="list-style-type: none"> 1. All fields with a soil test P > 150 UD-FN/2 Fields with slopes > 5%; 3. Fields with a high P leaching potential; 4. Distance of field to surface water is value of 4 or greater, according to the PSI. PSI evaluations of all other fields should 	<p>Reference</p> <ul style="list-style-type: none"> • NRCS-Delaware 590 Standard/Field Risk Assessment - Phosphorus Site Index (PSI) Rating, Page 4. • Delaware Conservation Practice Standard Phosphorus Site Index. • UD Extension, The PSI Index: A Phosphorus Management Strategy for Delaware's Agricultural Soils.
			<p>EPA Expectation for what will be reported</p> <p>One of the following as defined by the NRCS, NHCP 590 standard:</p> <ul style="list-style-type: none"> - P-Index - Soil test P method or - Soil test threshold
			<p>Comparison to EPA Expectation</p> <p>Meets EPA expectation.</p> <p>According to the 4/18/2011 State Director's response, the specifics of when CAFOs are required to complete all field assessments are clearly articulated in their permit.</p>

	<p>be completed as soon as feasible.</p> <p>Nutrient management plans shall include: 1. the assessment rating for each field or management unit, and 2. Information about conservation practices and management activities that can reduce the potential for P movement from the site.</p>	<p>N Transport – N</p> <p>N leaching assessment tool as defined by the NRCS, NHCP 590 standard.</p> <p>Does not meet EPA expectation.</p> <p>The state's technical standards should include or reference a field-specific N transport risk assessment.</p> <p>The results of the risk assessment must be used to establish an appropriate rate, form, timing and method of application that minimizes N transport to surface waters. Where appropriate rate, form, timing, and method of</p>
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	<p>application are less than optimal conditions for minimization, BMPs should be required to achieve the reductions to a minimum to protect water quality. Certain types of BMPs could be targeted to critical areas.</p>				
<p>Does the assessment identified by the TS (above) provide quantitative and/or qualitative criteria for determining whether the rate can be N-based, P-based, or prohibited?</p>	<p>Y. Both the NRCS-Delaware 590 Standard and the PSI set criteria for N-based and P-based rates.</p> <p>When the PSI < 50, N-based nutrient management is satisfactory. When PSI = 50-75, P-based nutrient management (at greater of crop removal or soil test P application) should be implemented 2 years out of 3. When PSI = 75-100, P application should be limited to crop removal or soil P test-based application rate.</p>	<ul style="list-style-type: none"> NRCS-Delaware 590 Standard Phosphorus Site Index (PSI) Rating Pages 6 – 7. Delaware Conservation Practice Standard – Phosphorus Site Index. UD Extension, Phosphorus Removal by Delaware Crops, Page 1. 	<p>Qualitative criteria could be reported as a risk rating (very low, low, medium, high, very high). Qualitative criteria may not always be applicable. Quantitative criteria should be provided. A rate application should always be associated with a criterion.</p> <p><i>EPA may have concerns if there is a point at which manure application is prohibited.</i></p>	<p>May not meet EPA expectation.</p> <p>There is currently a potential conflict between different technical standard sources. Although both the Delaware PSI and NRCS-Delaware 590 standard prescribe P-based nutrient management under some conditions, the Delaware Nutrient Management Act of 1999 (DE NM Act of 1999) appears to allow application of 3 years' worth of P to high P (undefined) soils.</p> <p>According to the State Director's letter of 4/18/2011, a new 590 Standard will require a PSI for all fields where the P rate is above the U of D agronomic rate.</p>	

		When PSI > 100, no P should be applied to the site.			
6	Where the assessment requires a P-based application rate is it constrained to a 1-year P removal rate?	Y. There are specific constraints when the PSI is > 50. See Question #5.	NRCS-Delaware 590 Standard, <i>Phosphorus Site Index (PSI) Rating</i> , Pages 6 – 7.	If No, EPA expects that all criteria under 'Appropriate Flexibilities' (items 33-36) will be followed.	Meets EPA expectation.
Amount					
Criteria					
7	Does the TS provide the basis for determining expected crop yields?	Y. Crop yield goals must be based on the average of the best 4 yields in the past 7 years or, in the absence of yield data, soil productivity charts in the NRCS Field Office Technical Guide (FOTG).	NRCS-Delaware 590 Standard, <i>Criteria</i> , Page 3.	EPA Expectation for what will be reported Basis for yield should be provided. <i>EPA may have concerns if crop insurance factors are added to yield goals.</i>	Meets EPA expectation. The soil productivity charts referenced are not currently included in the technical standards. The 4/18/2011 State Director's response indicates that Delaware will consider incorporating these charts in the technical standards. Note: the url suggested as a reference in the 4/18/2011 response (http://ag.udel.edu/other/websites/DSTP/agronomic.htm) is not active.
8	Does the TS provide crop recommendations that are to be used to base applications rates for crops?	Y. NRCS-Delaware 590 standard refers to the UD <i>Nutrient Management Handbook (Sims and Gartley, 1996)</i> for crop specific	<ul style="list-style-type: none"> NRCS-Delaware 590 Standard, <i>Nutrient Application Rates</i>, Page 4. UD, <i>Nutrient Management Handbook</i>, Chapter 3 and Appendix 9 	Recommendations with the source should be provided.	Meets EPA expectation.

	<p>nutrient recommendations. The <i>Nutrient Management Handbook</i> contains specific recommendations for crop nutrient levels and discussion of adjustment factors based on manure, legumes, and other factors.</p>		<p>Y. The rate is either the amount expected to be removed from the field by crop harvest or soil test P-based application recommendations</p>	<p>Meets EPA expectation.</p>
<p>9</p> <p>Does the TS define what a P-based application rate is? (e.g. crop removal rate, soil test, or the choice of either)?</p>	<p>Y. The NRCS-Delaware 590 Standard refers to the <i>UD Nutrient Management Handbook</i> for crop specific nutrient recommendations (http://ag.udel.edu/other_websites/)</p>	<p>NRCS-Delaware 590 Standard, <i>Nutrient Application Rates</i>, Page 4. • UD Extension, <i>Phosphorus Removal by Delaware Crops</i>, Table 1, Page 2.</p>	<p>The basis should be defined and clearly stated.</p>	<p>Meets EPA expectation.</p>
<p>10</p> <p>Does the TS provide the actual removal rates, soil test recommendations or both for crops, depending on the answer to item 9?</p>	<p>Y. The NRCS-Delaware 590 Standard refers to the <i>UD Nutrient Management Handbook</i> for crop specific nutrient recommendations (http://ag.udel.edu/other_websites/)</p>	<p>NRCS-Delaware 590 Standard, <i>Nutrient Application Rates</i>, Page 4. • UD Extension, <i>Phosphorus Removal by Delaware Crops</i>, Table 1, Page 2.</p>	<p>The recommendation should be defined and clearly stated.</p>	<p>Meets EPA expectation.</p>

			<p>DSTP/crop_recom mendations.htm). The 590 Standard references UD Extension publication NM-06 <i>Phosphorus Removal by Delaware Crops</i> that includes tabular data on estimated P removal in the harvested portion of DE crops.</p>		
<p>Does the TS provide a value for N credits to be given when legume crops are planted?</p>	<p>11</p>	<p>Y. The UD <i>Nutrient Management Handbook</i> provides values for N contributions from legumes for subsequent crops.</p>	<p>UD <i>Nutrient Management Handbook</i>, Chapter 3 Table 3-13, Page 3-28.</p>	<p>Appropriate credits to be applied should be included.</p>	<p>Meets EPA expectation.</p>
<p>Are N mineralization rates provided for each type (dairy, beef, poultry, swine, etc.) of manure?</p>	<p>12</p>	<p>Y. The TS draft document for "Manure Incorporation" references "Manure as a Nutrient Source, Chapter 9" for information regarding the incorporation of</p>	<ul style="list-style-type: none"> Delaware Conservation Practice Standard, <i>Manure Incorporation</i> <i>Mid-Atlantic Nutrient Management Handbook</i>, Chapter 9, Manure as a Nutrient Source, 	<p>If rates are not provided then standard should state that all N is 100% available the year it is applied for all manure types.</p>	<p>Meets EPA expectation.</p>

		<p>manure and its potential impact on nitrogen availability to plants. Mineralization rates are provided for dairy, beef, poultry, and swine manure; data on other species would be needed if other manure is to be land applied.</p>	<p>Table 9.9 "Fraction of organic N mineralized from various manure types and application scenarios in the year of application."</p>	
<p>Does the TS address the requirement for a manure[†] analysis?</p>	<p>Y. The NRCS-Delaware 590 Standard states that nutrient values of manure and organic amendments shall be determined prior to land application; in cases where a representative sample cannot be obtained, book values may be used, but a sample must be taken in the first year of plan and the plan revised</p>	<p>NRCS-Delaware 590 Standard <i>Manure/Organic Amendment Testing</i>, Page 5.</p>	<p>Required. A separate analysis must be provided for each form (solid, semi-solid, liquid) of manure contained in the NMP.</p>	<p>Meets EPA expectation.</p>

		accordingly. Manure analysis is also required under state regulations.				
14	Does the TS address the frequency of a manure ⁺ analysis	Y. Manure nutrients must be analyzed prior to land application, as close to the application date as feasible.	NRCS-Delaware 590 Standard, <i>Manure/Organic Amendment Testing</i> , Page 5.	At least once annually.	Meets EPA expectation. It is inferred that the requirement to analyze manure prior to the land application date means that manure is analyzed at least annually; however, this is not stated explicitly.	
15	Does the TS address methods for collecting manure ⁺ samples?	Y. Methods are outlined for different manure types. The TS refers to <i>Manure as a Nutrient Source</i> for additional guidance	<ul style="list-style-type: none"> Delaware Conservation Practice Standard <i>Manure Testing</i>, Page 1. Mid-Atlantic Nutrient Management Handbook, Chapter 9. Manure as a Nutrient Source, Manure Sampling and Testing, Page 212. 	<p>Methods should be included.</p> <p><i>EPA may have concern if methods deviate from land grant university or extension recommendations.</i></p>	Meets EPA expectation.	
16	Does the TS address which components to include in the manure ⁺ analysis?	Y. Nutrients in Delaware Nutrient Management law includes nitrogen and phosphorus.		At least nitrogen and phosphorus	Meets EPA expectation.	
17	Does the TS address acceptable method(s) for	N. The NRCS-Delaware 590	NRCS-Delaware 590 Standard,	Methods should be included unless specific appropriate	Does not meet EPA expectation.	

<p>conducting the manure[†] analysis?</p>	<p>Standard states that analysis will be performed through a lab whose techniques are consistent with those recommended by UD; specific methods are not identified.</p>	<p>Manure/Organic Amendment Testing, Page 5.</p>	<p>labs are provided. EPA may have concern if methods prescribed by the land grant university or extension are not used or if methods used by the Manure Testing Laboratory Certification Program (MTLCP) are not used where applicable.</p>	<p>The State Director's letter of 4/18/2011 states, "[t]he NM Commissions Technical Sub-Committee and the STS committee should meet to revise the TS to read as follows: 'Analysis must be performed by laboratories that are certified by the Minnesota Department of Agriculture Manure Analysis Proficiency Program'. With this change, the TS would meet the EPA expectation. Note that this criterion may be addressed by meeting the EPA expectation for item 17 or 18; both are not required.</p>
<p>Does the TS address which laboratories are acceptable for performing the manure[†] analysis?</p>	<p>N. Standard is limited to stating analysis will be performed through a testing lab whose techniques are consistent with those recommended by UD. Recommendations are not provided.</p>		<p>Labs should be included unless specific appropriate methods to be followed by a lab are provided. EPA may have concern if the land grant university or extension labs are not used or where it is applicable the lab is not listed with the Manure Testing Laboratory Certification Program (MTLCP) http://www.mda.state.mn.us/licensing/pestfert/manurelab.s.htm under the auspices of</p>	<p>Does not meet EPA expectation. Note that this criterion may be addressed by meeting the EPA expectation for item 17 or 18; both are not required.</p>

			<p>the Minnesota Department of Agriculture.</p>	
<p>Does the TS address the requirement for a soil test?</p> <p>19</p>	<p>Y. The NRCS-Delaware 590 Standard states that nutrient management planning shall be based on current soil test results. In addition, PSNT is recommended as a late spring soil test for assessment of nitrogen availability.</p>	<ul style="list-style-type: none"> • NRCS-Delaware 590 Standard, Soil Sampling and Laboratory Analysis Page 3. • Delaware Conservation Practice Standard, PSNT, Page 1. 	<p>Soil testing requirement must be included.</p>	<p>Meets EPA expectation.</p>
<p>Do the TS address the frequency of the soil test?</p> <p>20</p>	<p>Y. The NRCS-Delaware 590 Standard states that current soil tests are those that are no older than 3 years.</p>	<ul style="list-style-type: none"> • NRCS-Delaware 590 Standard, Soil Sampling and Laboratory Analysis Page 3. 	<p>At least once every permit cycle.</p>	<p>Meets EPA expectation.</p>
<p>Does the TS address the methods for collecting soil samples?</p> <p>21</p>	<p>N. The NRCS-Delaware 590 Standard states that samples shall be collected and prepared according to the UD guidance and recommendations, which are not</p>	<ul style="list-style-type: none"> • NRCS-Delaware 590 Standard, Soil Sampling and Laboratory Analysis, Page 3. • Delaware 2010 	<p>Methods should be included. EPA may have concern if methods deviate from land grant university or extension recommendations.</p>	<p>Does not meet EPA expectation. The 4/18/2011 response indicates a need to incorporate the following references, the first of which provides information that addresses the EPA expectation for this criterion: - Delaware Nutrient Management Notes, V. 1, no. 9, September</p>

	<p>included.</p> <p>Delaware's soil testing procedures technical standard also references UD guidance on collecting soil samples (Delaware 2010).</p>		<p>2000 – Soil and Litter Sampling for Nutrient Analysis</p>
<p>22</p>	<p>Does the TS address which components to include in the soil analysis?</p>	<p>NRCS-Delaware 590 Standard, <i>Soil Sampling and Laboratory Analysis</i>, Page 4</p>	<p>Meets EPA expectation.</p>
<p>23</p>	<p>Does the TS address acceptable method(s) for conducting the soil analysis?</p>	<p>NRCS-Delaware 590 Standard, <i>Soil Sampling and Laboratory Analysis</i>, Page 4</p>	<p>Meets EPA expectation.</p> <p>The State Director's letter of 4/18/2011 states that the NM Commission Technical Sub-Committee and the STS Committee should meet and revise the TS to read as follows: "Analysis must be done by laboratories that are certified by the North American Proficiency Testing Program run by Soil Science Society of America (SSSA)."</p>

	<p>Does the TS address which laboratories are acceptable for performing soil analysis?</p>	<p>United States (Sims and Wolf, 1995; Donohue, 1992) published by the USDA regional committees on soil testing – NEC-67 and SERA-6. A list of recommended methods is available from UD and NRCS.</p>	<p>Y. The NRCS-Delaware 590 Standard states that soil test analyses shall be performed by laboratories who are enrolled in the North American Proficiency Testing Program (NAPT); and 2) provide soil test results for nutrients in units that are convertible to the UD's Fertility Index Values (FIV).</p>	<p>NRCS-Delaware 590 Standard, Soil Sampling and Laboratory Analysis, Page 4. • Delaware Conservation Practice Standard, Soil Testing Procedures, Page 1</p>	<p>the Soil Science Society of America are not used.</p>	<p>Meets EPA expectation.</p>
<p>24</p>			<p>Labs should be included unless specific appropriate methods to be followed by a lab are provided. EPA may have concern if the land grant university or extension labs are not used or if laboratories that do not meet or exceed the requirements and performance standards of the North American Proficiency Testing Program (NAPT) Proficiency Assessment Program (PAP) http://www.naptprogram.org/pap/ under the auspices of the Soil Science Society of America are not used.</p>			

		Labs must apply to be enrolled as participants of the Proficiency Assessment Program (PAP) each year.		
Form	Criteria	Specify	Reference	EPA Expectation for what will be reported
25	Does the amount, source, timing and form address how it is to be applied to each form of manure? (solid, semi-solid, or liquid)?	Form is addressed separately under the amount, source, timing and method of land application as it applies. Form applies to the criteria amount as it is captured by the manure analysis requirement.		Comparison to EPA Expectation
Source	Criteria	Specify	Reference	EPA Expectation for what will be reported
	Timing – The Delaware TS addresses timing of manure application through restrictions on limitations based on field and weather conditions as well as mineralization rates based on the season of application.			Comparison to EPA Expectation
26	Does the TS address when manure application should be delayed?	Y. The NRCS Delaware 590 Standard requires producers to delay field application if precipitation capable of producing runoff and erosion is forecast within 24 hours of the time	NRCS Delaware 590 Standard Considerations, Page 2.	EPA Expectation for what will be reported The criterion is addressed. EPA may have concern if not addressed.

		<p>of the planned application.</p> <p>Y. Nutrients shall not be applied to frozen, snow-covered, or saturated soil. Nutrients shall not be applied to flooded or saturated soils when the potential for soil compaction and the creation of ruts is high.</p>	<ul style="list-style-type: none"> • NRCS-Delaware 590 Standard, <i>Nutrient Application Methods</i>, Page 5. • NRCS-Delaware 590 Standard, <i>Additional Criteria to Improve the Physical, Chemical, and Biological Conditions of the Soil</i>, Page 7. 	<p><i>EPA may have concern if not addressed.</i></p>	<p>The criterion is addressed.</p> <p>Note: While the Delaware Nutrient Management Law is a reference to the technical standard, the standard may be more clear if the dates were either included or a special reference to the law was included so as that the a user sees can comprehensively read the requirements.</p>
27	<p>Does the TS address when no waste application should be made?</p>	<p>Y. Spring, fall and winter rates are listed.</p>	<p><i>Mid-Atlantic Nutrient Management Handbook</i>, Chapter 9, Manure as a Nutrient Source, Table 9.9 (Referenced in "Manure Incorporation" technical standard.)</p>	<p>if rates are not provided than standard should state that all N is 100% available at the time that it is applied.</p>	<p>The criterion is addressed.</p>
28	<p>Does the TS address mineralization rates for applications made at different times during the year?</p>	<p>N.</p>		<p>Timing considerations with different forms of manure should be included.</p> <p><i>EPA may be concerned if liquid manure application is allowed to frozen or saturated fields.</i></p>	<p>The criterion is not specifically addressed, but the overall requirements do not raise concern since prohibitions apply to all forms of manure.</p>
29	<p>Are there any timing considerations that apply to certain forms (solid, semi-solid, or liquid) of manure when land applied?</p>				
<p>Method of Application – The Delaware TS addresses method of application through volatilization rates for various application methods, time to incorporation, and types of manure.</p>					
Criteria		Specify	Reference	EPA Expectation for what	Comparison to EPA Expectation

			will be reported	
30	Does the TS provide volatilization rates to apply to different types of land application methods?	Y. The TS draft document for "Manure Incorporation" references "Manure as a Nutrient Source, Chapter 9" for information regarding the incorporation of manure and its potential impact on nitrogen availability to plants. This document includes volatilization rates for various application methods.	<p><i>Mid-Atlantic Nutrient Management Handbook</i>, Chapter 9, Manure as a Nutrient Source, Table 9.10, "Manure ammonium-N availability factors for Virginia." (Referenced in "Manure Incorporation" technical standard.)</p>	The criterion is addressed.
31	Does this include accounting for any timing delays for when manure is incorporated?	Y. <i>Manure as a Nutrient Source</i> , Chapter 9 includes volatilization rates for different times to incorporation and for no incorporation.	<p><i>Mid-Atlantic Nutrient Management Handbook</i>, Chapter 9, Manure as a Nutrient Source, Table 9.10, "Manure ammonium-N availability factors for Virginia." (Referenced in "Manure Incorporation" technical standard.)</p>	The criterion is addressed.
32	Are there any specifications	Y. <i>Manure as a</i>	<i>Mid-Atlantic Nutrient</i>	The criterion is addressed.

	<i>Nutrient Source</i> , Chapter 9 includes volatilization rates for various application methods and manure forms.	<i>Management Handbook</i> , Chapter 9, Manure as a Nutrient Source, Table 9.10, "Manure ammonium-N availability factors for Virginia." (Referenced in "Manure Incorporation" technical standard.)		
Appropriate Flexibilities				
Criteria	Specify	Reference	EPA Expectation for what will be reported	Comparison to EPA Expectation
Does the TS allow multi-year P application	Y. For sites with high risk for P transport, P applications cannot exceed the amount of P removed in the harvested portion of the crops grown for the next three years.	NRCS Delaware 590 Standard, <i>Phosphorus Site Index (PSI) Rating</i> , Pages 6 – 7.	TS does not have to include this, however if it is included items 34 – 36 are expected to be followed.	State has added this criterion.
33	If yes, does it provide restrictions on when and/or where this can occur?	N. The TS does not specify conditions under which multi-year P application cannot occur. However, the TS restricts P application to sites with very high potential for P movement. (also	Multi-year P application should not occur on sites with an elevated potential for P runoff to WOUS (as determined by the State)	Does not meet EPA expectation.
34		NRCS Delaware 590 Standard, <i>Phosphorus Site Index (PSI) Rating</i> , Pages 6 – 7.		

	<p>If yes, is there a restriction that additional P to these fields may not be applied until the amount applied in the single year has been removed through plant uptake and harvest?</p>	<p>see Question #5) Y. When P is applied at the "three-year crop removal rate", no additional P can be applied in the following two years.</p>	<p>NRCS-Delaware 590 Standard, Phosphorus Site Index (PSI) Rating, Pages 6 – 7.</p>	<p>If multi-year P is allowed by the standard this restriction would be included</p>	<p>Meets EPA expectation.</p>
35	<p>If yes, does the standard set N limits that must be met?</p>	<p>Y. The TS indicates that "Planned nitrogen application rates shall not exceed the recommended rates established by the University of Delaware and written in the nutrient management plan." Although the language of the 590 Standard does not explicitly tie N application rate restrictions to multi-year P applications, the State Director's letter of 4/18/2011 states that even if 3-year</p>	<p>NRCS-Delaware 590 Standard, Manure/Organics Applications, p. 6.</p>	<p>if multi-year P application is used, the manure application shall not exceed the annual nitrogen recommendation of the current year of application.</p>	<p>Meets EPA's expectation.</p>
36					

