CV-SALTS Subcommittee Meeting

Central Valley Management Practice Subcommittee

When: Wednesday March 28 2012 from 8:45 AM to 10:00 AM
Location: Conference Call only

Conference #: (218) 339-4600 Participant Code: 927571#

Agenda

1. Welcome and Introductions Co-Chairs Rob Neenan/Parry Klassen and Linda Dorn
2. Overview of Practice Nominations received for reviews
   a. Tom Griffith at Envirotech Potassium Substitution Practice Review Attached
   b. Parry Klassen East San Joaquin Practice Attached
   c. Paul Martin Updated Dairy Practice Attached
   d. Information Only December 2012 NRCS Nutrient MP Attached
3. Review process for changes and schedule industry segments
4. Discuss the intended final form, and function, of the toolbox?
   a. Who will do the assessments on the cost effectiveness of nominated practices?
   b. What media or format will toolbox utilize, and where will it be located?
      i. Website, directory, database, book, manual, etc.?
5. Next Steps
6. Next Meeting/Call April _____ at ________
We would like to offer some suggestions regarding how to structure the process for reviewing CV-SALTS management practice nominations. Although a thorough review of proposed BMP’s is warranted, it will be important to recognize that that the BMP Subcommittee, Technical Committee, Executive Committee, and stakeholders have limited time and resources to devote to reviewing and commenting on nomination forms. It seems to be the consensus that the toolbox will expand and improve over time, but we need to get *something* in the toolbox to get the process rolling. The committee chairs will have to strike a fine balance between understanding the details of a proposal and clarifying every possible detail. Regarding the approval process, we have the following suggestions:

- Approval by the BMP subcommittee requires a simple majority of the members present and voting.
- Approval by the Technical Committee will require a majority of the members present. In most cases, the committee should render its decision within 30 days of receiving the nomination form.
- Approval by the Executive Committee requires a simple majority of the members present and should be taken as a consent item unless there are well defined objections which must be communicated to the Executive Committee Chair in advance of the meeting. The objective here is not to revisit the same issues in three separate venues. The Executive Committee should trust the Technical Committee to have done its job. In most cases, the committee should render its decision within 30 days of receiving the nomination form. The toolbox will be presented to the Regional Board for approval.
- When reviewing nominations regarding BMP manuals (e.g. Wine Institute, CLFP, other) we suggest that the key issue is whether the *approach* should be viewed as a validated BMP. While the manuals include a large number of individual practices that may evolve over time, a holistic approach to managing wastewater essentially will not. Some of the practices may be viewed as validated or developing, however, the approach should be viewed as validated if it has been vetted.

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Rob Neenan  
California League of Food Processors
CV-SALTS Management Practice Nomination Form

This Nomination Form includes limited instructions for the completion of the form. Initial reviewer instructions are included in the Subcommittee Screening Document and will be further developed in future work. The nominator of the practice will provide all available information for the practice and may include estimated information to be verified if noted in the text. Should additional information be required to complete the review it will be requested.

In the pilot phase additional standardization of requested information on the management practices will likely be developed. Additionally review of the practice implementation and effect on overall salinity and nitrate management in the Central Valley may be further assessed at a future date. Submittal of management practices for inclusion into the toolbox should answer the following questions with the best information available to the submitter. Please annotate responses with references and source documents, list these under Question 7.

A. Is this nomination for a plan or programmatic activity as opposed to a field implementation practice or technology? ☐ YES ☑ NO

if yes, complete the following sections as appropriate, if no proceed to question 1.

1. Title – Please provide a short descriptive title for the practice

   12.5% Potassium Hypochlorite Liquid as a substitute for 12.5% Sodium Hypochlorite Liquid

2. Description – Please provide a short (1-2 paragraphs) description of the practice/technologies to summarize the practice, industries and important information

In the interests of public health, food and beverage producers and municipalities will always need to use sanitizers and antimicrobials such as sodium hypochlorite bleach, but this can lead to large discharges of sodium salts which are harmful to the soil. High levels of sodium present in the soil relative to other cations such as calcium and magnesium give rise to what are called “sodic soils” and have a deleterious effect on the soil structure as well as any plant’s ability to obtain water and nutrients from the soil. While there is obviously no single “silver bullet” for solving California’s sodicity or salinity issues, one step towards recovery and prevention is irrigation with sodium free water, which Potassium Hypochlorite accomplishes by replacing problematic sodium chloride (NaCl) with beneficial potassium chloride (KCl) in the resulting wastewater. (See Section 7 for resources on soil sodicity.)

Sodium Hypochlorite production and consumption is in the hundreds of millions of gallons per year nationally, with a significant amount being processed and used in California and ultimately ending up on land. Sodium Hypochlorite is consumed by virtually every industry including food processing, water treatment, waste water treatment, and cleaning and sanitation (see EPA Label 68838-10 for approved uses). There are virtually no known applications where Sodium Hypochlorite cannot be
interchanged with Potassium Hypochlorite, as it is EPA registered for all of the same versatile applications.

3. **Constituent Salts or Nutrients Managed** – Identify the primary and secondary constituents (EC TDS, Nitrates other nutrients etc) that are treated, reduced or managed by this practice and how they are reduced or managed.

This practice manages the sodium discharges present as a result of Sodium Hypochlorite use. The byproduct of Sodium Hypochlorite use is the problematic sodium chloride (NaCl) salt, and since Potassium Hypochlorite has no sodium in it, these salts will be completely replaced with potassium chloride (KCl, also known as potash) – a common fertilizer.

4. **Applicability** – Describe the documented application of this practice, where how and how extensively the practice has been implemented what conditions or circumstances limit the application of this practice. Industry specific application and limitations may be developed and shown as Attachment A. Such limitations may include industry, region, soil type, media or other limits.

Production will begin in first quarter 2012. Several waste water treatment companies have expressed interest in this product and are ready to use Potassium Hypochlorite to help get them into compliance with their high level sodium discharges. For each account where the product will be used, Enviro Tech will be working with chemical labs to confirm the reduction in sodium salt levels.

As mentioned in part 2 there are virtually no known applications where Sodium Hypochlorite cannot be used interchangeably with Potassium Hypochlorite. However, one potential limitation is that it does not address the issue of chlorides in wastewater, and hence it will still require appropriate management of wastewater used in irrigation to avoid issues in areas already deemed chloride impacted.

5. **Practice Benefits and Impacts** – Describe the documented benefits of implementing the practice (what does it do) including any negative impacts of implementation (including cross media/air/energy/supply etc)

As was already brought up, food and beverage producers and municipalities will always need to use sanitizers and antimicrobials such as Sodium Hypochlorite bleach. Indeed, a number of studies have agreed that sodium hypochlorite bleach is one of the safest, most cost-effective water treatment and disinfectant chemistries available. When it becomes necessary to reduce sodium discharges, Potassium Hypochlorite retains all of the safety and simplicity advantages of sodium hypochlorite over chlorine dioxide, and remains more cost-effective than alternative sodium free approaches such as peracetic acid, UV, and ozone (see section 7 for some of these studies). Furthermore, Potassium Hypochlorite is EPA registered for use in all of the same applications as Sodium Hypochlorite and is a simple “drop-in” substitute. This is a benefit over other technologies because
the end user isn’t required to purchase any new equipment, including tanks, piping, or monitoring equipment, and no new personnel, training, or other safety measures are required.

The practice is about more than just avoiding sodium – studies illustrating the beneficial effects of the potassium chloride byproducts (known otherwise as potash), are well documented, for instance by the International Potash Institute. Negative impacts associated with the use of potassium hypochlorite vs. sodium hypochlorite are only monetary in nature.

6. **Effectiveness Documentation** –

6 a. **Describe** the documented effectiveness of implementing the practice on the target constituents. Whenever possible quantify the effectiveness of the practice as completely as possible.

Currently there is no documented effectiveness of implementing the practice. Trials will take place in first quarter 2012. Industries and accounts will be announced in future CV-Salts Management Practice Conference Calls as they are developed. We expect the same efficacy using Potassium Hypochlorite as with Sodium Hypochlorite, since the active chemistry (hypochlorite anion) hasn’t changed and is present in approximately equal amounts in both products.

6 b. **Summarize** the critical factors or limitations to effectiveness. If documentation of a cost benefit study please reference it below in 7.

The critical factors for switching from Sodium Hypochlorite to Potassium Hypochlorite are limited to economics. The actual cost to the end user will be as low as 3X from their current costs of Sodium Hypochlorite to as high as 4X. The main reason for the higher costs is an increase in the cost of raw materials, as the potassium raw material is approximately 3-4 times more expensive than the sodium raw materials. There are no known limitations on the effectiveness of this new product.

7. **Supporting studies, Research and Source Documents** – List all documents referenced in responses above or other documents that provide information evidence or background on the technology or practice and electronic availability. Supporting Documents Referenced:

- **Question 2**

- **Question 5**
8. Implementation

Enviro Tech is currently meeting with representatives from the fresh produce industry to identify an appropriate candidate or two to validate the positive effects on plant and soil health achieved by replacing sodium salts with potassium salts in discharges through the use of Potassium Hypochlorite.

8.1 Costs - Summarize and document costs for implementation of this practice both Capital and Annual operations and maintenance costs. If possible, express in industry relevant units of $/acre foot or $/million gallons, $/ton or etc. to allow comparison with other practices.

Industry refers to the use of sodium hypochlorite in gallons per day, per month and per year. For consistency in this document volumes are measured in gallons per year (GPY) for a given facility and comparing the amounts of sodium vs. potassium present in these volumes for the two separate products. The following would be a typical example of a small waste water treatment plant:

- Current use of Sodium Hypochlorite of 1,000 gallons per month @ $1.75/gal is equal to $1,750/month or $21,000 per year.

- Equivalent usage of Potassium Hypochlorite requires 1,175 gallons per month @ $5.40/gal for a total of $6,345/month or $76,140/year. While this cost is significantly higher than current costs of Sodium Hypochlorite, it is much cheaper than fines for being out of compliance and is competitive with other known technologies currently being used to reduce the sodium discharge to land.

8.2 Status and Potential – Describe the Historic and current level of implementation, at the level now. List any information known on the potential full implementation of this practice.

Historic and current levels of implementation are nonexistent at this time. Currently several waste water treatment facilities have volunteered to be the first to use Potassium Hypochlorite to
confirm the viability of this product as interchangeable to Sodium Hypochlorite. Enviro Tech will supply CV-Salts this data as it becomes available.

8.3 **Monitoring Documentation** – Describe the level of monitoring and documentation available to support the practice. If known, what additional monitoring is needed? If known what level of monitoring will be needed at implementation.

Monitoring for levels of chlorine residual in waste water treatment and levels of chlorides will be documented by the end user, and will mirror the same procedures currently in place to monitor Sodium Hypochlorite.

9. **Other Regulatory Approvals or Requirements** – Has this practice been approved or required by any other government agency or independent standard setting body, if so summarize this and any information you may have on the process and status of approvals. Indicate what level of review if required for that regulatory requirement or guidance?

Potassium Hypochlorite has been meticulously scrutinized by EPA during a 3 year period prior to granting Enviro Tech its label. The State of California went through similar scrutiny prior to issuing Cal EPA approval. No new approvals are needed at this time. Active ingredient, KOCl is registered with state and Federal EPA #63838-10.
Standards and information repeated for the Nominator from the Subcommittee screening document.

4 Standards
Screening of practices to include in the toolbox requires the review of practices for effectiveness in reducing salt and nitrate in the system. The Screening tool uses the following standards as documented by the proposer of the practice for screening.

4.1 Technical Effectiveness – does it work?
Demonstrating technical effectiveness is critical for a management practice to be implemented and accepted by industry or communities. Evidence of technical effectiveness is demonstrated by lab, pilot and demonstration studies and evaluation of the studies. Does the documentation indicate strongly that the practice removes, destroys, manages or otherwise reduce any negative impacts to beneficial uses associated with its presence and assist with compliance or improvement of the waters of the valley.

4.2 Implementability – can it be used broadly?
Implementability includes both feasibility as well as well as broad applicability. In most cases, satisfactory implementability is demonstrated by documentation of the use of the management practice by a significant portion of the sector and considers other issues related to cost and efficiency covered in other sections. Implementability of management practices may consider cross-media impacts, and look for management practices that reduce any detrimental effect to other media while achieving the goals of the management practice. These should be identified and any impact quantified if possible.

4.3 Cost effectiveness – is it economic to implement today?
Cost effectiveness is critical to being an effective best practice. Low efficiency costly practices are not likely to be broadly implemented. High value practices will likely be implemented with minimal regulatory requirements. The assessment of effectiveness related to cost is not always a simple as dollars per ton of salt or pound of nitrate, often costs include a technically trained workforce to implement, operate and maintain the practices. Additionally, this may vary across industry and across regions. The cost effectiveness should strive to take into account all benefits to the entity implementing the practice as well as direct and indirect cost of implementation. In other words not just the technology but the impacts on quality of the product or preparation or disposal of wastes and other potential cross media impacts. These costs should evaluate life cycle benefits and costs of implementations and societal and environmental benefits and costs, when possible.

4.4 Monitoring – proving it works?
Both the ability to monitor as well as the length and breadth of the monitoring history will be reviewed as a part of screening. Monitoring during the implementation stage may be greater in developing practices than fully validated practices that have already completed it.
Nomination Form Attachment 1

Applicability checklist by Industry or Process

The Subcommittee will develop these areas or others for screening by industry or process in the future.

1. Agriculture
2. Food Processing
3. Manufacturing
4. Wine Industry
5. WWTP
7. Water Treatment
8. San Joaquin
9. East Valley
10. West Valley
11. Tulare Lake
12. Sacramento
13. Lake/Foothills
14. OTHERS
CV-SALTS Management Practice Nomination Form

This Nomination Form includes limited instructions for the completion of the form. Initial reviewer instructions are included the Subcommittee Screening Document and will be further developed in future work. The nominator of the practice will provide information requested below including supporting documentation. Should additional information be required to complete the review it will be requested.

Additional standardization of requested information on the management practices will likely be developed in the future. Additionally review of the practice implementation and effect on overall salinity and nitrate management in the Central Valley may be further assessed at a future date. Submittal of management practices for inclusion into the toolbox should answer the following questions with the best information available to the nominator. Please annotate responses with references and source documents, list these under Question 9.

A. Is this nomination for a plan or programmatic activity as opposed to a field implementation practice or technology? □ YES □ NO
   if yes, complete the following sections as appropriate, if not proceed to question 1.

1. Title – Please provide a short descriptive title for the practice
   4R Plant Nutrition: A Manual for Improving the Management of Plant Nutrition is a Manual prepared by The Fertilizer Institute for use by the Agriculture Community in analyzing the proper use of fertilizers. 4R Nutrient Stewardship is a new innovative approach for fertilizer best management practices adopted by the world’s fertilizer industry. This approach considers economic, social, and environmental dimensions of nutrient management and is essential to sustainability of agricultural systems.

   In conjunction with the above, The International Plant Nutrition Institute developed a two-disc DVD set expanding, in video format, upon the concepts of the 4R Nutrient Stewardship program. "The Right Way to Grow...4R Nutrient Stewardship" and "The Right Way to Grow Wheat...4R Nutrient Stewardship" were developed and produced by IPNI to explain each "right" and it's relationship to the other three "rights". The two-disc set includes an 8 minute segment as an example of the implementation of the 4R principles applied to a wheat crop.

2. Description – Please provide a short (1-2 paragraphs) description of the practice/technologies to summarize the practice, industries and important information
   Fertilizer is a component of sustainable crop production systems, and the fertilizer industry recognizes the need to efficiently utilize these nutrients. Therefore, a new perspective on the proper use and stewardship of these elements, under the current circumstances, needs to be considered for implementation. The 4R Nutrient Stewardship Program answers the need for proper nutrient stewardship. Following are the 4 "R"s and their respective descriptions:

   Source - Ensure a balanced supply of essential nutrients, considering both naturally available
sources and characteristics of specific products, in plant-available forms.

**Rate** - Assess soil nutrient supply and plant demand.

**Time** - Assess dynamics of crop uptake, soil supply, and logistics of field operations. Determine timing of nutrient loss risks.

**Place** - Recognize root-soil dynamics. Manage spatial variability within the field to meet site-specific crop needs and to limit potential losses from the field.

3. **Constituent Salts or Nutrients Managed** – Identify the primary and secondary constituents (EC, TDS, Nitrates, other nutrients, etc.) that are treated, reduced, or managed by this practice and how they are reduced or managed.

The regulatory concerns stimulating the need for these BMPs are nitrates in the groundwater. The practices developed in the 4R Plant Nutrition Manual specify methods and concepts for applying nitrogen containing fertilizers in a manner that conforms to the 4Rs; considering stage of growth, soil type, irrigation method, and plant need.

4. **Applicability** – Describe the documented application of this practice: where it has been implemented; how has it been implemented; what conditions or circumstances limit the applications of this practice; and how extensively has the practice been implemented. Industry specific application and limitations may be developed.

The International Plant Nutrition Institute and The Fertilizer Institute have accumulated numerous documents detailing research conducted around the world dealing with the development of the 4Rs. The 4R approach to nutrient management is not only science based but incorporates a "common sense" basis for application. The only limitation to the 4R process is the willingness to adopt and the education of growers and consultants.

5. **Practice Benefits and Impacts** – Describe the documented benefits of implementing the practice (what does it do) including any negative impacts of implementation (including cross media, e.g. air quality, energy demand, /water supply, etc.)

The concepts contained within the 4R program and Manual offer a "thought process" approach to nutrient management as opposed to the "standard practice" approach as currently employed. By requiring a pre-planning and testing analysis prior to applying a nitrogen source, the practitioner is encouraged to apply on a scientific based plant need basis. While the plant need basis for determining nitrogen applications may be adequate, the plant’s needs for nitrogen are not well defined at this time. This could lead to a period of reduced optimum yields until future testing can be conducted.

6. **Effectiveness Documentation** – Describe the documented effectiveness of implementing the practice on the target constituents. Whenever possible quantify the effectiveness of the practice as completely as possible. If available, provide documentation of a cost benefit study. Summarize any critical factors or limitations to effectiveness.

The practice of applying Nitrogen to a crop on a determined needs basis will avoid applying Nitrogen in
excess of crop utilization. By pre-planning nutrient applications via a Nutrient Management Plan considerations for crop need, source determination and application timing are examined prior to use.

7. Implementation

7.1 Costs - Summarize and document costs for implementation of this practice both Capital and Annual operations and maintenance costs. If possible, express in industry relevant units of $/acre foot or $/million gallons, $/ton or etc. to allow comparison with other practices. The principles of nutrient determination and application are cost-effective in terms of minimizing over use of a nutrient source. The Manual emphasizes determining a crop's needs and the methods for determining that need prior to an application. The effect of prior planning will result in economies of crop input.

7.2 Status and Potential – Describe the Historic and current level of implementation, at the level known. List any information known on the potential full implementation of this practice. The principles described in the 4R Plant Nutrition: A Manual for Improving the Management of Plant Nutrition have been studied by scientists around the world and compiled in this Manual. Implementation of the described principles, to a limited extent, have been practiced commercially.

7.3 Monitoring Documentation – Describe the level of monitoring and documentation available to support the practice. If known, what additional monitoring is needed to document management practice effectiveness? If known what level of monitoring will be needed at full scale implementation. Records of crop nutrient applications are kept by growers and applicators. The determination of the appropriateness of such applications are not well documented or recorded other than the occasional soil analysis or plant analysis.

8. Other Regulatory Approvals or Requirements – Has this practice been approved or required by any other government agency or independent standard setting body, if so summarize this and any information you may have on the process and status of approvals. Indicate what level of review if required for that regulatory requirement or guidance?

9. Supporting studies, Research, and Source Documents – List all documents referenced in responses above or other documents that provide information on the technology or practice and electronic availability.
Standards and information repeated for the Nominator from the Subcommittee screening document.

4 Standards
Screening of practices to include in the toolbox requires the review of practices for effectiveness in reducing salt and nitrate in the system. The Screening tool uses the following standards as documented by the proposer of the practice for screening.

4.1 Technical Effectiveness – does it work?
Demonstrating technical effectiveness is critical for a management practice to be implemented and accepted by industry or communities. Evidence of technical effectiveness is demonstrated by lab, pilot and demonstration studies, and evaluation of the studies. Does the documentation indicate strongly that the practice removes, destroys, manages or otherwise reduce any negative impacts to beneficial uses associated with its presence and assist with compliance or improvement of the waters of the valley.

4.2 Implementability – can it be used broadly?
Implementability includes both feasibility as well as well as broad applicability. In most cases, satisfactory implementability is demonstrated by documentation of the use of the management practice by a significant portion of the sector and considers other issues related to cost and efficiency covered in other sections. Implementability of management practices may consider cross-media impacts, and look for management practices that reduce any detrimental effect to other media while achieving the goals of the management practice. These should be identified and any impact quantified if possible.

4.3 Cost effectiveness – is it economic to implement today?
Cost effectiveness is critical to being an effective best practice. Low efficiency costly practices are not likely to be broadly implemented. High value practices will likely be implemented with minimal regulatory requirements. The assessment of effectiveness related to cost is not always a simple as dollars per ton of salt or pound of nitrate, often costs include a technically trained workforce to implement, operate and maintain the practices. Additionally, this may vary across industry and across regions. The cost effectiveness should strive to take into account all benefits to the entity implementing the practice as well as direct and indirect cost of implementation. In other words not just the technology but the impacts on quality of the product or preparation or disposal of wastes and other potential cross media impacts. These costs should evaluate life cycle benefits and costs of implementations and societal and environmental benefits and costs, when possible.

4.4 Monitoring – proving it works?
Both the ability to monitor as well as the length and breadth of the monitoring history will be reviewed as a part of screening. Monitoring during the implementation stage may be greater in developing practices than fully validated practices that have already completed it.
CV-SALTS Management Practice Nomination Form

This Nomination Form includes limited instructions for the completion of the form. Initial reviewer instructions are included the Subcommittee Screening Document and will be further developed in future work. The nominator of the practice will provide all available information for the practice and may include estimated information to be verified if noted in the text. Should additional information be required to complete the review it will be requested.

In the pilot phase additional standardization of requested information on the management practices will likely be developed. Additionally review of the practice implementation and effect on overall salinity and nitrate management in the Central Valley may be further assessed at a future date. Submittal of management practices for inclusion into the toolbox should answer the following questions with the best information available to the submitter. Please annotate responses with references and source documents, list these under Question 7.

A. Is this nomination for a plan or programmatic activity as opposed to a field implementation practice or technology? □ YES XXX□ NO
   if yes, complete the following sections as appropriate, if no proceed to question 1.

1. Title – Please provide a short descriptive title for the practice

   Elimination of Free-choice feeding of sodium bicarbonate and sodium chloride

2. Description – Please provide a short (1-2 paragraphs) description of the practice/technologies to summarize the practice, industries and important information

   Dairy animals of all ages and stages of production and reproduction have a certain need for salt in their diet. The requirement will vary depending on the status of the animal and is published by the National Research Council (NRC) Committee on Animal Nutrition, Nutrient Requirements of Dairy Cattle: Seventh Revised Edition, 2001. However, some dairy producers feed more than is truly needed by the animal, especially Sodium Bicarbonate and Sodium Chloride as those two salts may often be offered to the animals in a free-choice fashion. Therefore, if a producer were to limit salt feeding to that recommended by the NRC and avoid free-choice feeding, he would be able to quantify exactly how much supplemental salt was being added to the salts delivered to the animals naturally in the feed ingredients. He should be able to quantify the actual reduction by comparing purchases before and after.

   The same will hold true for nitrate reductions, albeit not as directly. Protein requirements of dairy cattle are also published by the NRC. Nitrogen is a key ingredient in the protein molecules, so controlling the feeding of protein to the NRC guidelines can reduce the nitrogen excreted in the manure and therefore less N will be available for conversion to nitrate. Protein is one of the more expensive feed ingredients; therefore, while ensuring the animals get the proper amount of protein, feeding close to the NRC recommendations can be a win-win control measure.

This widely used reference has been updated and revamped to reflect the changing face of the dairy industry. New features allow users to pinpoint nutrient requirements more accurately for individual animals. The committee also provides guidance on how nutrient analysis of feed ingredients, insights into nutrient utilization by the animal, and formulation of diets to reduce environmental impacts can be applied to productive management decisions.

The book includes a user-friendly computer program on a compact disk, accompanied by extensive context-sensitive "Help" options, to simulate the dynamic state of animals.

The committee addresses important issues unique to dairy science—the dry or transition cow, udder edema, milk fever, low-fat milk, calf dehydration, and more. The also volume covers dry matter intake, including how to predict feed intake. It addresses the management of lactating dairy cows, utilization of fat in calf and lactation diets, and calf and heifer replacement nutrition. In addition, the many useful tables include updated nutrient composition for commonly used feedstuffs.

Ration sheets:

In the majority of dairy farms in the valley, professional animal nutrition consultants work directly with the dairyman to develop their feeding program according to the publication referenced above. Following the guidelines will assure that adequate salt is included for the requirements of the cow without excess to be excreted. The feeding recommendations are written in what we term “feedsheets” which tell the producers exactly what each animal (depending on the group they are in) should be getting. Then there are “load sheets” that list how much of each feed ingredient should be loaded into the feeding equipment – based on the number of animals in that group.

3. **Constituent Salts or Nutrients Managed** – Identify the primary and secondary constituents (EC TDS, Nitrates other nutrients etc) that are treated, reduced or managed by this practice and how they are reduced or managed.

Nitrate *(by accounting for the nitrate in cattle drinking water as the ration is built)*, Sodium Chloride, Sodium Bicarbonate (Bicarb)

4. **Applicability** – Describe the documented application of this practice, where how and how extensively the practice has been implemented what conditions or circumstances limit the application of this practice. Industry specific application and limitations may be developed and show as Attachment A. Such limitations may include industry, region, soil type, media or other limits.
The practice of feeding close to NRC recommendations, especially for protein, is practiced by most dairy producers, but is not currently applied from a salt management standpoint. Since the dairy water regulation limits the amount of N that can be applied to soils to 1.4 times the plant uptake and implementation of the new rules is underway, opportunity for reductions exists. On the other hand, the free choice feeding of Bicarb is very strongly advocated by those who believe in it. It is widely used as a rumen buffer to avoid acidosis in today’s high producing cows. Bovine antacid if you will. It will be difficult to change the practice and professional animal nutritionists will be needed to avoid adverse animal impacts – as well as to convince producers to use this strategy.

Alternatives are available, some private labels, others not substantiated. One that may have applicability is magnesium oxide. But the BMP is to stop feeding it free-choice and only put what is needed in the ration. Free-choice relates to letting the animal have access to a barrel of it so they can eat as much as they want (not just what they need)

The CA Dairy Quality Assurance Program conducts training at strategic times throughout the valley in order to help producers comply with the dairy WDR. Salt management can be covered more specifically, especially discouraging the practice of free-choice access to bicarb

5. **Practice Benefits and Impacts** – Describe the documented benefits of implementing the practice (what does it do) including any negative impacts of implementation (including cross media/air/energy/supply etc)

   THIS SEEMS VERY SIMILAR TO #4 and #5

The practice eliminates the excretion of excessive sodium and nitrogen

6. **Effectiveness Documentation** – 6 a. Describe the documented effectiveness of implementing the practice on the target constituents. Whenever possible quantify the effect of the practice as completely as possible. 6 b. Summarize and critical factors or limitations to effectiveness. If documentation of a cost benefits study please reference it below in 7.

   a. Less deposition is documented by less purchases of salt and Bicarb.

   b. Additionally, the balancing of salt and N using feeding software will show the effectiveness of the mitigation measure.

   c. Producer acceptance is the critical control point

7. **Supporting studies, Research and Source Documents** – List all documents referenced in responses above or other documents that provide information evidence or background on the technology or practice and electronic availability.

8. Implementation

8.1 Costs - Summarize and document costs for implementation of this practice both Capital and Annual operations and maintenance costs. If possible, express in industry relevant units of $/acre foot or $/million gallons, $/ton or etc. to allow comparison with other practices.

Costs can be calculated by pricing out the feed ingredients. This is a normal feature of the ration building software. The elimination of free-choice feeding will be a direct reduction in cost – depending on how much is no longer being used. Current price for Sodium Bicarbonate is $12.38/50 lbs.

8.1.1 Status and Potential – Describe the Historic and current level of implementation, at the level know. List any information known on the potential full implementation of this practice

Most dairy producer do or have done for them by a consultant, a formal ration building specific for the various animals they own. Those using free-choice bicarb feeding methods could eliminate doing so. Therefore less Bicarb will be used. See # 4 for the same answer here.

8.1.2 Monitoring Documentation – Describe the level of monitoring and documentation available to support the practice. If known, what additional monitoring is needed? If known what level of monitoring will be needed at implementation.

The amount of salt, bicarb and protein in the dairy ration can be monitored by presentation of the “feed sheets,” which are the documents used by the producer to measure out the various feed ingredients. The elimination of free-choice feeding will be visible from an inspection of the facility.

9. Other Regulatory Approvals or Requirements – Has this practice been approved or required by any other government agency or independent standard setting body, if so summarize this and any information you may have on the process and status of approvals. Indicate what level of review if required for that regulatory requirement or guidance?

Dairies are required to prepare and implement a Nutrient Management Plan to hold the Nitrogen application to a limit of 1.4 times plant uptake. They must test their manure, soil and plant tissue. A universal salt management plan has been prepared and producers are offered a menu of practices to choose from. This practice (Reducing salts in dairy rations) is selected from that menu).
I THINK WE COULD GET THIS DONE BY ANSWERING THE 4 QUESTIONS IN THE STANDARDS – THIS FORM SEEMS QUITE REPITIOUS TO ME.
Standards and information repeated for the Nominator from the Subcommittee screening document.

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Demonstrating technical effectiveness is critical for a management practice to be implemented and accepted by industry or communities. Evidence of technical effectiveness is demonstrated by lab, pilot and demonstration studies and evaluation of the studies. Does the documentation indicate strongly that the practice removes, destroys, manages or otherwise reduce any negative impacts to beneficial uses associated with its presence and assist with compliance or improvement of the waters of the valley.

4.2 Implementability – can it be used broadly?
Implementability includes both feasibility as well as well as broad applicability. In most cases, satisfactory implementability is demonstrated by documentation of the use of the management practice by a significant portion of the sector and considers other issues related to cost and efficiency covered in other sections. Implementability of management practices may consider cross-media impacts, and look for management practices that reduce any detrimental effect to other media while achieving the goals of the management practice. These should be identified and any impact quantified if possible.

4.3 Cost effectiveness – is it economic to implement today?
Cost effectiveness is critical to being an effective best practice. Low efficiency costly practices are not likely to be broadly implemented. High value practices will likely be implemented with minimal regulatory requirements. The assessment of effectiveness related to cost is not always a simple as dollars per ton of salt or pound of nitrate, often costs include a technically trained workforce to implement, operate and maintain the practices. Additionally, this may vary across industry and across regions. The cost effectiveness should strive to take into account all benefits to the entity implementing the practice as well as direct and indirect cost of implementation. In other words not just the technology but the impacts on quality of the product or preparation or disposal of wastes and other potential cross media impacts. These costs should evaluate life cycle benefits and costs of implementations and societal and environmental benefits and costs, when possible.

4.4 Monitoring – proving it works?
Both the ability to monitor as well as the length and breadth of the monitoring history will be reviewed as a part of screening. Monitoring during the implementation stage may be greater in developing practices than fully validated practices that have already completed it.
Nomination Form Attachment 1

Applicability checklist by Industry, Processes or Region

The following industries, processes and regions may have specific screening requirements that the Subcommittee will develop in the future.

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NATURAL RESOURCES CONSERVATION SERVICE
CONSERVATION PRACTICE STANDARD

NUTRIENT MANAGEMENT

(Ac.)

CODE 590

DEFINITION
Managing the amount (rate), source, placement (method of application), and timing of plant nutrients and soil amendments.

PURPOSE
• To budget, supply, and conserve nutrients for plant production.
• To minimize agricultural nonpoint source pollution of surface and groundwater resources.
• To properly utilize manure or organic by-products as a plant nutrient source.
• To protect air quality by reducing odors, nitrogen emissions (ammonia, oxides of nitrogen), and the formation of atmospheric particulates.
• To maintain or improve the physical, chemical, and biological condition of soil.

CONDITIONS WHERE PRACTICE APPLIES
This practice applies to all lands where plant nutrients and soil amendments are applied. This standard does not apply to one-time nutrient applications to establish perennial crops.

CRITERIA

General Criteria Applicable to All Purposes
A nutrient budget for nitrogen, phosphorus, and potassium must be developed that considers all potential sources of nutrients including, but not limited to, green manures, legumes, crop residues, compost, animal manure, organic by-products, biosolids, waste water, organic matter, soil biological activity, commercial fertilizer, and irrigation water.

Enhanced efficiency fertilizers, used in the State must be defined by the Association of American Plant Food Control Officials (AAPFCO) and be accepted for use by the State fertilizer control official, or similar authority, with responsibility for verification of product guarantees, ingredients (by AAPFCO definition) and label claims.

For nutrient risk assessment policy and procedures see Title 190, General Manual (GM), Part 402, Nutrient Management, and Title 190, National Instruction (NI), Part 302, Nutrient Management Policy Implementation.

To avoid salt damage, the rate and placement of applied nitrogen and potassium in starter fertilizer must be consistent with land-grant university guidelines, or industry practice recognized by the land-grant university.

The NRCS-approved nutrient risk assessment for nitrogen must be completed on all sites unless the State NRCS, with the concurrence of State water quality control authorities, has determined specific conditions where nitrogen leaching is not a risk to water quality, including drinking water.

The NRCS-approved nutrient risk assessment for phosphorus must be completed when:
• phosphorus application rate exceeds land-grant university fertility rate guidelines for the planned crop(s), or
• the planned area is within a phosphorus-impaired watershed (contributes to 303d-listed water bodies), or
• the NRCS and State water quality control authority have not determined specific conditions where the risk of
phosphorus loss is low.

A phosphorus risk assessment will not be required when the State NRCS, with concurrence of the State water quality control authority, has determined specific conditions where the risk of phosphorus loss is low. These fields must have a documented agronomic need for phosphorus; based on soil test phosphorus (STP) and land-grant university nutrient recommendations.

On organic operations, the nutrient sources and management must be consistent with the USDA’s National Organic Program.

Areas contained within minimum application setbacks (e.g., sinkholes, wellheads, gullies, ditches, or surface inlets) must receive nutrients consistent with the setback restrictions.

Applications of irrigation water must minimize the risk of nutrient loss to surface and groundwater.

Soil pH must be maintained in a range that enhances an adequate level for crop nutrient availability and utilization. Refer to State land-grant university documentation for guidance.

Soil, Manure, and Tissue Sampling and Laboratory Analyses (Testing).

Nutrient planning must be based on current soil, manure, and (where used as supplemental information) tissue test results developed in accordance with land-grant university guidance, or industry practice, if recognized by the university.

Current soil tests are those that are no older than 3 years, but may be taken on an interval recommended by the land-grant university or as required by State code. The area represented by a soil test must be that acreage recommended by the land-grant university.

Where a conservation management unit (CMU) is used as the basis for a sampling unit, all acreage in the CMU must have similar soil type, cropping history, and management practice treatment.

The soil and tissue tests must include analyses pertinent to monitoring or amending the annual nutrient budget, e.g., pH, electrical conductivity (EC) and sodicity where salts are a concern, soil organic matter, phosphorus, potassium, or other nutrients and test for nitrogen where applicable. Follow land-grant university guidelines regarding required analyses.

Soil test analyses must be performed by laboratories successfully meeting the requirements and performance standards of the North American Proficiency Testing Program-Performance Assessment Program (NAPT-PAP) under the auspices of the Soil Science Society of America (SSSA) and NRCS, or other NRCS-approved program that considers laboratory performance and proficiency to assure accuracy of soil test results. Alternate proficiency testing programs must have solid stakeholder (e.g., water quality control entity, NRCS State staff, growers, and others) support and be regional in scope.

Nutrient values of manure, organic by-products and biosolids must be determined prior to land application.

Manure analyses must include, at minimum, total nitrogen (N), ammonium N, total phosphorus (P) or P2O5, total potassium (K) or K2O, and percent solids, or follow land-grant university guidance regarding required analyses.

Manure, organic by-products, and biosolids samples must be collected and analyzed at least annually, or more frequently if needed to account for operational changes (feed management, animal type, manure handling strategy, etc.) impacting manure nutrient concentrations. If no operational changes occur, less frequent manure testing is allowable where operations can document a stable level of nutrient concentrations for the preceding three consecutive years, unless federal, State, or local regulations require more frequent testing.

Samples must be collected, prepared, stored, and shipped, following land-grant university guidance or industry practice.

When planning for new or modified livestock operations, acceptable “book values” recognized by the NRCS (e.g., NRCS Agricultural Waste Management Field Handbook) and the land-grant university, or analyses from similar operations in the geographical area, may be used if they accurately estimate nutrient output from the proposed operation.

Manure testing analyses must be performed by laboratories successfully meeting the requirements and performance standards of the Manure Testing Laboratory Certification program (MTLCP) under the auspices of the Minnesota Department of Agriculture, or other NRCS-approved program that considers laboratory
performance and proficiency to assure accurate manure test results.

**Nutrient Application Rates.**

Planned nutrient application rates for nitrogen, phosphorus, and potassium must not exceed land-grant university guidelines or industry practice when recognized by the university.

At a minimum, determination of rate must be based on crop/cropping sequence, current soil test results, realistic yield goals, and NRCS-approved nutrient risk assessments.

If the land-grant university does not provide specific guidance that meets these criteria, application rates must be based on plans that consider realistic yield goals and associated plant nutrient uptake rates.

Realistic yield goals must be established based on historical yield data, soil productivity information, climatic conditions, nutrient test results, level of management, and local research results considering comparable production conditions.

Estimates of yield response must consider factors such as poor soil quality, drainage, pH, salinity, etc., prior to assuming that nitrogen and/or phosphorus are deficient.

For new crops or varieties, industry-demonstrated yield, and nutrient utilization information may be used until land-grant university information is available.

Lower-than-recommended nutrient application rates are permissible if the grower’s objectives are met.

Applications of biosolids, starter fertilizers, or pop-up fertilizers must be accounted for in the nutrient budget.

**Nutrient Sources.**

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

**Nutrient Application Timing and Placement.**

Timing and placement of all nutrients must correspond as closely as practical with plant nutrient uptake (utilization by crops), and consider nutrient source, cropping system limitations, soil properties, weather conditions, drainage system, soil biology, and nutrient risk assessment results.

Nutrients must not be surface-applied if nutrient losses offsite are likely. This precludes spreading on:

- frozen and/or snow-covered soils, and
- when the top 2 inches of soil are saturated from rainfall or snow melt.

Exceptions for the above criteria can be made for surface-applied manure when specified conditions are met and adequate conservation measures are installed to prevent the offsite delivery of nutrients. The adequate treatment level and specified conditions for winter applications of manure must be defined by NRCS in concurrence with the water quality control authority in the State. At a minimum, the following site and management factors must be considered:

- slope,
- organic residue and living covers,
- amount and form of nutrients to be applied, and
- adequate setback distances to protect local water quality.

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

Planners must use the current NRCS-approved nitrogen, phosphorus, and soil erosion risk assessment tools to assess the risk of nutrient and soil loss. Identified resource concerns must be addressed to meet current planning criteria (quality criteria). Technical criteria for risk assessments can be found in NI-190-302.

When there is a high risk of transport of nutrients, conservation practices must be coordinated to avoid, control, or trap manure and nutrients before they can leave the field by surface or subsurface drainage (e.g., tile). The number of applications and the application rates must also be considered to limit the transport of nutrients to tile.

Nutrients must be applied with the right placement, in the right amount, at the right time, and from the right source to minimize nutrient losses to surface and groundwater. The
following nutrient use efficiency strategies or technologies must be considered:

- slow and controlled release fertilizers
- nitrification and urease inhibitors
- enhanced efficiency fertilizers
- incorporation or injection
- timing and number of applications
- soil nitrate and organic N testing
- coordinate nutrient applications with optimum crop nutrient uptake
- Corn Stalk Nitrate Test (CSNT), Pre-Sidedress Nitrate Test (PSNT), and Pre-Plant Soil Nitrate Test (PPSN)
- tissue testing, chlorophyll meters, and spectral analysis technologies
- other land-grant university recommended technologies that improve nutrient use efficiency and minimize surface or groundwater resource concerns.

**Additional Criteria Applicable to Properly Utilize Manure or Organic By-Products as a Plant Nutrient Source**

When manures are applied, and soil salinity is a concern, salt concentrations must be monitored to prevent potential crop damage and/or reduced soil quality.

The total single application of liquid manure:

- must not exceed the soil’s infiltration or water holding capacity
- be based on crop rooting depth
- must be adjusted to avoid runoff or loss to subsurface tile drains.

Crop production activities and nutrient use efficiency technologies must be coordinated to take advantage of mineralized plant-available nitrogen to minimize the potential for nitrogen losses due to denitrification or ammonia volatilization.

Nitrogen and phosphorus application rates must be planned based on risk assessment results as determined by NRCS-approved nitrogen and phosphorus risk assessment tools.

For fields receiving manure, where phosphorus risk assessment results equate to LOW risk, additional phosphorus and potassium can be applied at rates greater than crop removal not to exceed the nitrogen requirement for the succeeding crop. For fields receiving manure, where phosphorus risk assessment results equate to MODERATE risk, additional phosphorus and potassium may be applied at a phosphorus crop removal rate for the planned crops in the rotation. When phosphorus risk assessment results equate to HIGH risk, additional phosphorus and potassium may be applied at phosphorus crop removal rates if the following requirements are met:

- a soil phosphorus drawdown strategy has been implemented, and
- a site assessment for nutrients and soil loss has been conducted to determine if mitigation practices are required to protect water quality.
- any deviation from these high risk requirements must have the approval of the Chief of the NRCS.

Manure or organic by-products may be applied on legumes at rates equal to the estimated removal of nitrogen in harvested plant biomass, not to exceed land grant university recommendations.

Manure may be applied at a rate equal to the recommended phosphorus application, or estimated phosphorus removal in harvested plant biomass for the crop rotation, or multiple years in the crop sequence at one time. When such applications are made, the application rate must not exceed the acceptable phosphorus risk assessment criteria, must not exceed the recommended nitrogen application rate during the year of application or harvest cycle, and no additional phosphorus must be applied in the current year and any additional years for which the single application of phosphorus is supplying nutrients.

**Additional Criteria to Protect Air Quality by Reducing Odors, Nitrogen Emissions and the Formation of Atmospheric Particulates**

To address air quality concerns caused by odor, nitrogen, sulfur, and/or particulate emissions; the source, timing, amount, and placement of nutrients must be adjusted to minimize the
negative impact of these emissions on the environment and human health. One or more of the following may be used:

- slow or controlled release fertilizers
- nitrification inhibitors
- urease inhibitors
- nutrient enhancement technologies
- incorporation
- injection
- stabilized nitrogen fertilizers
- residue and tillage management
- no-till or strip-till
- other technologies that minimize the impact of these emissions

Do not apply poultry litter, manure, or organic by-products of similar dryness/density when there is a high probability that wind will blow the material offsite.

**Additional Criteria to Improve or Maintain the Physical, Chemical, and Biological Condition of the Soil to Enhance Soil Quality for Crop Production and Environmental Protection**

Time the application of nutrients to avoid periods when field activities will result in soil compaction.

In areas where salinity is a concern, select nutrient sources that minimize the buildup of soil salts.

**CONSIDERATIONS**

Elevated soil test phosphorus levels are detrimental to soil biota. Soil test phosphorus levels should not exceed State-approved soil test thresholds established to protect the environment.

Use no-till/strip-till in combination with cover crops to sequester nutrients, increase soil organic matter, increase aggregate stability, reduce compaction, improve infiltration, and enhance soil biological activity to improve nutrient use efficiency.

Use nutrient management strategies such as cover crops, crop rotations, and crop rotations with perennials to improve nutrient cycling and reduce energy inputs.

Use variable-rate nitrogen application based on expected crop yields, soil variability, soil nitrate or organic N supply levels, or chlorophyll concentration.

Use variable-rate nitrogen, phosphorus, and potassium application rates based on site-specific variability in crop yield, soil characteristics, soil test values, and other soil productivity factors.

Develop site-specific yield maps using a yield monitoring system. Use the data to further diagnose low- and high- yield areas, or zones, and make the necessary management changes. See Title 190, Agronomy Technical Note (TN) 190.AGR.3, Precision Nutrient Management Planning.

Use manure management conservation practices to manage manure nutrients to limit losses prior to nutrient utilization.

Apply manure at a rate that will result in an “improving” Soil Conditioning Index (SCI) without exceeding acceptable risk of nitrogen or phosphorus loss.

Use legume crops and cover crops to provide nitrogen through biological fixation and nutrient recycling.

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

Soil test information should be no older than 1 year when developing new plans.

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

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

Use the adaptive nutrient management learning process to improve nutrient use efficiency on farms as outlined in the NRCS’ National Nutrient Policy in GM 190, Part 402, Nutrient Management.
Potassium should not be applied in situations where an excess (greater than soil test potassium recommendation) causes nutrient imbalances in crops or forages.

Workers should be protected from and avoid unnecessary contact with plant nutrient sources. Extra caution must be taken when handling anhydrous ammonia or when dealing with organic wastes stored in unventilated enclosures.

Material generated from cleaning nutrient application equipment should be utilized in an environmentally safe manner. Excess material should be collected and stored or field applied in an appropriate manner.

Nutrient containers should be recycled in compliance with State and local guidelines or regulations.

Considerations to Minimize Agricultural Nonpoint Source Pollution of Surface and Groundwater.

Use conservation practices that slow runoff, reduce erosion, and increase infiltration, e.g., filter strip, contour farming, or contour buffer strips. These practices can also reduce the loss of nitrates or soluble phosphorus.

Use application methods and timing strategies that reduce the risk of nutrient transport by ground and surface waters, such as:

- split applications of nitrogen to deliver nutrients during periods of maximum crop utilization,
- banded applications of nitrogen and/or phosphorus to improve nutrient availability,
- drainage water management to reduce nutrient discharge through drainage systems, and
- incorporation of surface-applied manures or organic by-products if precipitation capable of producing runoff or erosion is forecast within the time of planned application.

Use the agricultural chemical storage facility conservation practice to protect air, soil, and water quality.

Use bioreactors and multistage drainage strategies when approved by the land-grant university.

Considerations to Protect Air Quality by Reducing Nitrogen and/or Particulate Emissions to the Atmosphere.

Avoid applying manure and other by-products upwind of inhabited areas.

Use high-efficiency irrigation technologies (e.g., reduced-pressure drop nozzles for center pivots) to reduce the potential for nutrient losses.

PLANS AND SPECIFICATIONS

The following components must be included in the nutrient management plan:

- aerial site photograph(s)/imagery or site map(s), and a soil survey map of the site,
- soil information including: soil type surface texture, pH, drainage class, permeability, available water capacity, depth to water table, restrictive features, and flooding and/or ponding frequency,
- location of designated sensitive areas and the associated nutrient application restrictions and setbacks,
- for manure applications, location of nearby residences, or other locations where humans may be present on a regular basis, and any identified meteorological (e.g., prevailing winds at different times of the year), or topographical influences that may affect the transport of odors to those locations,
- results of approved risk assessment tools for nitrogen, phosphorus, and erosion losses,
- documentation establishing that the application site presents low risk for phosphorus transport to local water when phosphorus is applied in excess of crop removal,
- current and/or planned plant production sequence or crop rotation,
- soil, water, compost, manure, organic by-product, and plant tissue sample analyses applicable to the plan,
- soil test phosphorus and/or risk assessment levels at which the plan would require that no phosphorus in any form be applied,
- when soil phosphorus levels are increasing, include a discussion of the risk associated
with phosphorus accumulation and a proposed phosphorus draw-down strategy,

- realistic yield goals for the crops,
- complete nutrient budget for nitrogen, phosphorus, and potassium for the plant production sequence or crop rotation,
- listing and quantification of all nutrient sources and form,
- all enhanced efficiency fertilizer products that are planned for use,
- in accordance with the nitrogen and phosphorus risk assessment tool(s), specify the recommended nutrient application source, timing, amount (except for precision/variable rate applications specify method used to determine rate), and placement of plant nutrients for each field or management unit, and
- guidance for implementation, operation and maintenance, and recordkeeping.

In addition, the following components must be included in a precision/variable rate nutrient management plan:

- Document the geo-referenced field boundary and data collected that was processed and analyzed as a GIS layer or layers to generate nutrient or soil amendment recommendations.

- Document the nutrient recommendation guidance and recommendation equations used to convert the GIS base data layer or layers to a nutrient source material recommendation GIS layer or layers.

- Document if a variable rate nutrient or soil amendment application was made.

- Provide application records per management zone or as applied map within individual field boundaries (or electronic records) documenting source, timing, method, and rate of all applications that resulted from use of the precision agriculture process for nutrient or soil amendment applications.

- Maintain the electronic records of the GIS data layers and nutrient applications for at least 5 years.

If increases in soil phosphorus levels are expected (i.e., when N-based rates are used), the nutrient management plan must document:

- the soil phosphorus levels at which it is desirable to convert to phosphorus based planning and/or no further phosphorus application,
- the potential plan for soil test phosphorus drawdown from the production and harvesting of crops, and
- management activities or techniques used to reduce the potential for phosphorus transport and loss,
- for AFOs, a quantification of manure produced in excess of crop nutrient requirements, and
- a long-term strategy and proposed implementation timeline for reducing soil P to levels that protect water quality and allow for application of P at crop-removal rates,
- a rationale for P applications in excess of crop removal when the phosphorus risk assessment equates to a low risk for P transport to surface or groundwater.

**OPERATION AND MAINTENANCE**

Conduct periodic plan reviews to determine if adjustments or modifications to the plan are needed. At a minimum, plans must be reviewed and revised, as needed with each soil test cycle, changes in manure volume or analysis, crops, or crop management.

Fields receiving animal manures and/or biosolids must be monitored for the accumulation of heavy metals and phosphorus in accordance with land-grant university guidance and State law.

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

Calibrate application equipment to ensure accurate distribution of material at planned rates.

Document the nutrient application rate. When the applied rate differs from the planned rate, provide appropriate documentation for the change.

Records must be maintained for at least 5 years to document plan implementation and maintenance. As applicable, records include:
• soil, plant tissue, water, manure, and organic by-product analyses resulting in recommendations for nutrient application,
• quantities, analyses and sources of nutrients applied,
• dates, and method(s) of nutrient applications, source of nutrients, and rates of application,
• weather conditions and soil moisture at the time of application; lapsed time to manure incorporation; rainfall or irrigation event,
• crops planted, planting and harvest dates, yields, nutrient analyses of harvested biomass, and crop residues removed,
• dates of plan review, name of reviewer, and recommended changes resulting from the review, and
• all enhanced efficiency fertilizer products used.

Additional records for precision/variable rate sites must include:

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

REFERENCES


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