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# CONSIDERATIONS FOR DAIRY FARMS REGARDING USE OF SEWAGE SLUDGES, SLUDGE PRODUCTS AND SEPTAGE

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## Introduction

Sewage sludges and sludge-based products can be used as agricultural soil amendments. They can provide a free or low-cost source of organic matter, nutrients and sometimes lime. Those entities responsible for sludge management provide farmers with their assessment of the benefits of land application. There are specific considerations regarding sludge use on dairy farms for animal, human, soil and plant health as well as for relationships with neighbors. This document is intended to help dairy farmers and their advisors make informed decisions regarding the use of sewage sludges, sludge-based products and septage and to outline measures that can reduce the risks that may be associated with application on dairy farms.

## **Summary Guidance**

## General Guidelines

- Be sure you have a reason to use the material. If your operation is "land lean" (having more manure nutrients than needed for the amount of land in production), accepting additional nutrients in the form of sludges may not be a good idea. Dairy producers that have more than 1.5-2 animal units per spreadable acre may not want to import more nutrients via sludge, particularly on land that regularly receives manure. (1.5 animal units per acre is a little more than one mature Holstein cow per acre. 2 animal units per acre is about 1 mature cow plus her replacement per acre.)
- Be sure the economics are favorable. In calculating fertilizer value of sludge materials, consider whether the P is a benefit or a detriment (if P is already in excess on the farm).
- Have a sound nutrient management plan. Use the material at agronomically sound rates considering both N and P.
- **Do a mass nutrient balance for your farm.** Understand how importing more nutrients in sludge impacts this balance.
- **Consider animal nutrition.** Become familiar with potential interactions of copper (Cu), molybdenum (Mo), sulfur (S), iron (Fe) and cadmium (Cd) with each other and with other elements in soils and animals. Consider the concentration of these elements in the sludges you apply. Sludges with more than 10mg/kg (parts per million, ppm) of Mo or Cd should probably not be used on dairy farms.
- Inject or till into the soil whenever possible. This process minimizes odor and the possibility of runoff from a rainstorm or blowing off site. Stockpiling increases the risks of odors.
- Be cautious if applying to hayfields and pastures. Because of concern about direct ingestion, apply just after cutting and allow sufficient regrowth before recut to minimize sludge on surfaces of plants. The risks posed by direct ingestion of the sludge or sludge product by livestock is higher if they are applied to hay crops or pasture.
- Think about neighbors and runoff risk reduction. Most sludge products have an odor. Avoid applying on weekends and fields close to houses. Minimize time spent loading, unloading and spreading. Observe good housekeeping practices with equipment, stockpile areas and travel routes. Ensure that application will not result in sludge entering a waterway or well.
- Obtain test results for the specific load of material being applied to your land (particularly for Mo). Be aware that testing of sludge is reported on a dry weight basis, but products are delivered as liquids or semi-solids. Test results commonly provided will be average values from occasional samples taken over a year.
- Consider freezing and labeling a sample from each load in case questions arise in the future. The analysis supplied with the product is not likely from the specific load delivered to your farm. Variability among loads may be significant.

- Randomly analyze loads on your own periodically for nutrients and contaminants. (Refer to the "What to Test For" section below.)
- Record what, where and how much is spread, the supplier of the material, who did the spreading, when, and at what rate per acre. These documents may be invaluable if questions arise in the future.
- Minimize the amount of persistent bioaccumulative chemicals that may be ingested by the farm family. Sludges contain toxic chemicals that build up in body fat and last a long time (so called "persistent bioaccumulative toxics" such as PCBs). There is no requirement for testing of sludges for these chemicals. High intake of products from animals exposed to sludges (particularly if sludges are applied to pasture or forages without tilling into the soil so that the animals may ingest sludges directly) would increase risks.
- Minimize human exposure to Class B sludges. Ensure workers immediately wash hands after working with the material. Wash outer clothing before rewearing. Do not track the material inside on shoes or via pets.
- Find out about the experience of others. Talk with others that have or are using products from the same company or generator.
- Check with NYSDEC, the municipality, the farm lender, and dairy processors to determine applicable requirements before applying sludge or sludge products. Dairy What to Test for processors, milk handlers and farm lenders Suggested analyses for farmers: may apply restrictions on the use of these Sludge or septage - nitrate, ammonia, TKN, P, fecal products. Check on their policies before coliform bacteria, trace metals\* application.
- Clearly define legal responsibilities. Enter into a signed contractual arrangement and obtain indemnification from the generator and/or spreader. Talk with the generator and/or spreader about any concerns.

Forage - nitrate, sulfur, calcium, magnesium, potassium, trace metals\* Soil - soluble nitrate, available P, sulfur, trace metals\* \*Total Cd, Co, Cu, Fe, Hg, Mn, Mo, Ni, Pb, Zn using EPA methods 3050 or 3051 (nitric acid digestion)

### Site Specific Considerations

- Soil test your fields and assess environmental risks. Know exactly what you need for your cropping system. Request reports for Mo, Cd and S with your soil tests. Use the N-leaching index and the P index to assess potential movement to groundwater.
- Be sure soil conditions are appropriate when spreading. Avoid spreading on wet soils to limit compaction. Incorporate into the soil before next forecast rainfall.
- Calculate the cumulative addition of metals resulting from application on each field. Follow guidelines in the current Cornell Guide for Integrated Field Crop Management (refer to Table 1).
- Be sure the spread pattern is uniform. Know the lower application limits of your spreader. Some spreaders are not accurate under 3-4 tons/acre. Material should be evenly applied for maximum efficiency and to avoid "hot spots." For low application rates (less than 3-4T/ac), this can be difficult.
- For more guidelines, refer to USDA NRCS (Natural Resource Conservation Service) standard NY590, Nutrient Management and NY633, Waste Utilization. (http://www.ny.nrcs.usda.gov/standards/ index.htm).

#### Use of Advanced Alkaline Stabilized Sludge Product for pH Adjustment

- Consider Mo concentration in the product and the Cu:Mo ratio in animal diet. While many metals are less soluble at high pH, Mo is more soluble and more readily taken up into crops at high pH.
- Soil test your fields. Get current pH readings.
- **Do a cost analysis**. Ensure there is a cost benefit over standard lime based on effective neutralizing value (ENV).
- **Consider the nutrients.** Even though used for pH adjustment, advance alkaline stabilized sludge products contain nutrients that should be accounted for in your nutrient management plan. (One typical product contained 0.4% total N or 8 lb/ton dry wgt; 2% P<sub>2</sub>O<sub>5</sub> or 40 lb/ton and 0.3% K or 6 lb/ton.)
- Apply product at the recommended rate for achieving desired pH adjustment. Use the lime evaluation chart in the current Cornell Guide for Integrated Field Crop Management handbook. If your soil tests show that you need more than 4 tons/acre of 100% ENV lime, split the application. Work in the first half with primary tillage and the second half in the upper soil profile with secondary tillage. The lime in this product is much more alkaline, fast acting and available than standard ground limestone, so do not overapply. Recheck soil pH the following year since the pH change may not persist.
- More intensive management is needed if soil pH is less than 5. Many soil tests tend to be inaccurate at the extreme lower and upper ranges of the pH scale. If you have a really low pH consider split application of a total of no more than 8-10 tons/acre of advanced alkaline stabilized biosolids and then recheck the following year. Adjust as needed. Check with your soil lab and ask what the lower limits of the test are.
- Increasing soil pH takes time. Usually lime or liming byproducts need to be applied 1 year in advance of seeding or planting sensitive crops such as soybeans and alfalfa.
- Avoid stockpiling if possible. If stockpiling product is necessary, locate the piles where water will not collect. Exclude or divert run off water from entering the pile. Piles may have odor, so locate them appropriately.

### **Minimizing Odors**

- Immediately incorporate or inject the sludge directly into the soil. This is the best way of keeping application odors to a minimum.
- Avoid stockpiling the material. Since stockpiles may create odors and generate runoff, they should be avoided if possible.
- **Consider time of day and weather**. Cold weather reduces volatilization and resultant odors. Morning may be best in warm weather since increasing air temperatures cause air to rise and carry odors away. Drying during the day also reduces odors before neighbors' evening activities begin. Avoid spreading immediately before weekends and holidays when neighbors are likely to be engaged in outdoor recreational activities. Dry, windy days produce fewer odors than calm, humid days. The wind provides greater dilution of the odors. However, strong winds may blow sludge off-site.
- **Be sensitive to neighbor homes and public spaces.** Be aware of wind direction and avoid fields that are upwind of specific odor-sensitive areas.
- Apply close to the ground in a thin layer. Use of spreading equipment that applies sludge closer to the ground produces less odor than spreading equipment that discharges sludge into the air. Spreading sludges in a thin layer will promote drying and reduce the length of time that the odors will be generated.

#### **Risk Reduction Measures**

Issue	<b>Potential/concern</b>	<b>Potential Causes</b>	<b>Risk Reduction Measures</b> <sup>1</sup>
Animal health	Hypocuprosis	Excess Mo, Cd, S, Fe	<ul> <li>Don't apply sludges with &gt;10ppm Mo or Cd</li> <li>Limit bovine diet to &lt;300ppm Fe</li> <li>Consider need for dietary supplement</li> </ul>
Animal health	Various	Pathogens Chemicals	<ul> <li>Incorporate sludge into soil</li> <li>Observe waiting period before harvesting forage and grazing</li> <li>Avoid pasture application</li> <li>Apply only Class A sludges</li> </ul>
Crop production	Phytotoxicity, reduced yields	Excess Cu, Ni, Zn	<ul><li>Obtain data on the sludge</li><li>Select sludge low in metals</li><li>Limit cumulative amount applied</li></ul>
Crop production	Phytotoxicity, reduced yields	Decreased pH	• Monitor and adjust pH <sup>2</sup>
Water pollution	Nutrient loading	Excess N Excess P	<ul> <li>Consider N and P needs and sources</li> <li>Test soils</li> <li>Obtain data on the specific loads of sludge applied to your land</li> <li>Apply according to management plan</li> </ul>
Human health	Cancer Developmental impacts	Toxic organic compounds <sup>3</sup>	<ul> <li>Limit consumption of animal products from animals exposed to sludges</li> <li>Avoid application of sludges to pasture</li> <li>Incorporate sludges into the soil</li> </ul>
Human health	Various	Pathogens Endotoxins Irritant gases	<ul> <li>Minimize contact with sludge, dusts, aerosols</li> <li>Incorporate sludges into the soil</li> <li>Practice good hygiene</li> </ul>
Nuisance	Odors Vectors (flies)	Poorly stabilized sludge	<ul> <li>Incorporate sludge into soil</li> <li>Reject loads that are odorous</li> <li>Be considerate about when sludge is applied</li> </ul>
Liability	Lawsuits	Odors Other nuisances Disease Water or land contamination	<ul> <li>Obtain indemnification agreement from supplier</li> <li>Execute a contract with supplier and applicator</li> <li>Accept only non-odorous sludges</li> <li>Apply according to management plan</li> <li>Incorporate sludges into the soil promptly</li> <li>Keep records</li> <li>Obtain data on the specific sludge applied to your land</li> <li>Archive sludge samples</li> </ul>

<sup>1</sup> These are measures that may help to reduce but may not eliminate the risks.

<sup>2</sup> Note that many metals are more prone to leaching and uptake into plants at low pH, but that molybdenum is more leachable and available to plants at higher pH.

<sup>3</sup> Many of the toxic organics that may be present in sludges tend to accumulate in animal products.