Minnesota Pollution Control Agency

Proper Storage of Silage

Avoiding Leachate and Seepage Problems

Water Quality/Feedlots #8-20 • Updated December 2007

Liquids from silage storage are considered "process wastewaters" in accordance with feedlot rules and, therefore, must meet all requirements for storage, handling, and land application.

MPCA Area Offices:
Rochester area:
507/285-7343
Mankato area:
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Corn silage, potato, and sugar beet pulp are important feedstocks for animals. However, when improperly stored and handled, the leachate (excess moisture from silage and pulp) can contaminate surface and ground water and poorly cased wells as it travels over land and through permeable soils. Leachate can become a serious environmental pollutant if it enters a ditch, stream, or waterway, and may even result in a fish kill. With a few straightforward precautions, the leachate created by silage and other feedstock can be effectively managed by livestock producers without creating a pollution hazard.

Field corn silage and potato and sugar beet silage leachate can be the most polluting organic material produced by farming. The potential oxygen-consuming capacity of the leachate is measured by the biochemical oxygen demand (BOD), the amount of oxygen it removes from the water. Corn silage leachate has a high BOD value, ranging from 12,000 to 90,000 mg/L, approximately 200 times stronger than raw domestic sewage. A significant discharge of leachate into a watercourse can remove so much oxygen that fish and other aquatic life die immediately. For example, as little as one gallon of field corn silage leachate can lower the oxygen of 10,000 gallons of surface water to a level that would not allow fish and other aquatic life to survive. Additionally, most leachate spills are measured in the thousands of gallons. Canning company waste, potato, and sugar beet pulp are often used for silage, and frequently contain excess moisture, which increases the potential for leachate production and discharges to surface and ground waters.

Sweet corn silage has a higher moisture content and, therefore, generates more leachate. Sweet corn silage leachate is more acidic (lower pH) than field corn silage, potato waste, and sugar beet pulp necessitating additional storage safeguards. Sweet corn silage leachate also has a higher BOD - as concentrations of leachate enter the water, oxygen levels decrease. Consequently, the stacking area and collection and storage system for sweet corn silage must be designed to manage greater volumes of leachate created and to withstand the corrosion caused by the lower pH. Anyone who stores fewer than 1,000 tons of sweet corn silage on site at any one time is expected to follow the Best Management Practices referred to in the factsheet entitled "Best Management Practices for Storage of Sweet Corn Silage Used as Animal Feed" (Water/Land Application #1.03). A copy of this factsheet may be obtained from the MPCA web site at www.pca.state.mn.us/publications/wq-lndapp1-03.pdf.

Anyone who stores more than 1,000 tons of sweet corn silage on site at any one time must obtain an industrial permit from the state of Minnesota and have the storage site designed by a licensed engineer.

Best Management Practices

The following practices can be implemented to reduce the potential for silage or haylage or other feedstock leachate discharging to surface or ground waters.

Siting and Management

Proper siting and management can significantly reduce the risk of discharge to surface or ground water.

- Locate the storage site on flat ground, avoiding slopes, to prevent quick movement of any spill or discharge to a waterway.
- Locate a safe distance from wells and surface waters such as streams, ditches, tile inlets, ponds, wetlands, and intermittent streams to reduce the risk of leachate seepage or discharge.
- Locate stockpiles on soils that have a minimum of three feet to the seasonal high water table and five feet to bedrock unless an impervious surface is used for the stockpile.
- Wells should be located at least 50 feet upgradient from outside silage stockpiles, leachate, and leachate collection systems.
- High moisture silage should be stored on concrete or asphalt with some form of leachate collection system.
- Process and store silage at or below 65 percent moisture.
- Cover outside silage stockpiles tightly with a non-permeable material.

Crop Handling

- Harvest silage at low moisture content (65 percent or less).
- Plant shorter maturity varieties of corn to produce a drier crop and, therefore, smaller volumes of leachate.
- Add dry materials to silage to absorb excess moisture to create low or no leachate discharge, such as dry corncobs, ground corn, dry hay or straw, or dry chopped corn stalks and other dry feedstock materials.
- Cover silage with a plastic cover or roof to prevent precipitation from entering the stockpiled feedstock and leaching through the silage. If covered properly, the addition of a plastic cover can also reduce feed losses.
- Divert all surface water runoff away from the storage area to prevent contamination or co-mingling of surface water and leachate.
- Take precautions to prevent seepage of leachate into ground water.

Proper Leachate Disposal

- Land application of leachate is allowed if applied at rates that do not exceed the nutrient requirements of the crop.
- Leachate may also be used as a feed additive supplement. Special care must be taken to avoid toxic effects. Feed with expert advice only.

Minnesota Rules Related to Proper Silage Storage

Discharge of pollutants such as silage leachate/seepage to waters of the state is regulated by state rules.

Land application of leachate is allowed if applied at rates that do not exceed the nutrient requirements of the crop and all other requirements of manure application are followed in accordance with Minn. R. ch. 7020.2225.

Liquids from silage storage are considered "process wastewaters" in accordance with feedlot rules and, therefore, must meet all requirements for storage, handling, and land application associated with process wastewaters in Minn. R. ch. 7020.

For More Information

For more information about the revised feedlot rule or to download a copy of the revised rule, log onto the MPCA website at: http://www.pca.state.mn.us/hot/feedlots.html.

Additional information can be obtained at the Environmental Protection Agency's site "Improving Silage Storage on the Farm" at: http://danpatch.ecn.purdue.edu/~epados/farmstead/silo/src/main.htm or from your county feedlot officer or MPCA feedlot regional office (phone numbers on front).