



Proper Storage of Silage

Permit Requirements for Storage and Avoiding Leachate and Seepage Problems

Anyone who stores 1,000 tons or more of sweet corn silage at any one time must obtain a permit from the Minnesota Pollution Control Agency (MPCA).

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.

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 kill vegetation and contaminate surface and groundwater 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, potato, and sugar beet silage

The field corn, 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. 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 groundwaters.

Sweet corn silage

The sweet corn silage has a higher moisture content than most other silages and, therefore, generates more leachate. Sweet corn silage leachate is more acidic (lower potential of Hydrogen (pH)) than field corn silage, potato waste, and sugar beet pulp necessitating additional storage safeguards. The site must be designed to manage greater volumes of leachate created and to withstand the corrosion caused by the lower pH.

Permit Requirements for Silage/Feedstock Storage

Requirements for storage of sweet corn silage

Anyone who stores 1,000 tons or more of fresh sweet corn silage on site at any one time must obtain a permit from the MPCA. For purposes of permitting all sweet corn silage is considered to be “fresh” silage, including sweet corn silage that is pressed to remove some of the water content.

If the silage storage area is located at a feedlot, the requirements for the sweet corn silage storage area can be incorporated into an Individual National Pollutant Discharge Elimination System (NPDES)/State Disposal System (SDS) feedlot permit. The conditions of the Individual NPDES/SDS Permit would not only apply to the silage storage area, but also to the feedlot facility as a whole.

If the feedlot is already required to maintain NPDES/SDS Permit coverage based on the number of animals at the site, or if the feedlot chooses to apply for a NPDES/SDS permit to authorize storage and management of 1,000 tons or more of sweet corn silage, the feedlot will need to comply with the discharge standard of the NPDES/SDS permit for all components of the feedlot operation.



Leachate Being Generated

Issuance of a feedlot NPDES/SDS permit may necessitate significant investment to upgrade other parts of the feedlot facility. The Individual NPDES/SDS feedlot permit has an application fee of \$1,860 and an annual fee of \$1,230.

If the silage storage area is not located at a feedlot, or if the feedlot owner chooses, an SDS permit will be issued to authorize the storage and management of more than 1,000 tons of sweet corn silage. This SDS permit will only apply to the storage and management of silage and will contain no permit requirements for the feedlot facility.

The facility may qualify for coverage under the Industrial By-Products (IBP) General Permit. This permit has an application fee of \$1,240 and an annual fee of \$345. If the facility does not qualify for coverage under the IBP General permit, the facility must apply for an Individual Industrial SDS permit. This permit has an application fee of \$9,300 and an annual fee of \$1,230.

The applicable permit must be obtained prior to storing 1,000 tons or more of sweet corn silage at any site.

Requirements for storage of other feedstocks

A permit is not required for storage for any other type of feedstocks. However, a permit may be required if the storage of feedstocks causes non-attainment with applicable water quality discharge standards.

Table 1. Feedstock Storage Permit Requirement and Fee Summary

Storage Site Type	Feedstock Storage	Permit Requirements	Permit Application Fee	Permit Annual Fee
Non-Feedlot	Storage of 1,000 or more tons of sweet corn silage	Industrial SDS	General - \$1,240 Individual - \$9,300	General - \$345 Individual - \$1,230
All Feedlots	Storage of 1,000 or more tons of sweet corn silage	Feedlot NPDES/SDS Can choose Industrial SDS	Individual - \$1,860	Individual - \$1,230
All Sites	Storage of less than 1,000 ton of sweet corn silage or any amount of other feedstocks	None Unless pollution to waters of the state is evident	None	None

Requirements for construction of storage areas

In general, a permit or permit modification is only necessary for construction or expansion of a feedstock storage area for feedlot sites required to maintain coverage under a feedlot NPDES/SDS permit.

A NPDES/SDS permitted feedlot constructing or expanding a feed storage area, that does not store 1,000 tons or more of sweet corn silage, may qualify for coverage under the Feedlot General NPDES/SDS Permit. This permit has an application fee of \$640 and an annual fee of \$345. If the facility does not qualify for coverage under the General Permit, the facility must apply for an Individual Feedlot NPDES/SDS permit.

The applicable permit must be obtained **prior** to starting construction of any type of feed storage area at a NPDES/SDS permitted feedlot site.

More information specific to when a permit is required to construct and/or modify a feed storage area can be found in the “[Livestock feed storage areas Permitting and operation](http://www.pca.state.mn.us/index.php/view-document.html?gid=13961)” factsheet found on the MPCA website: <http://www.pca.state.mn.us/index.php/view-document.html?gid=13961>.

Management of Silage Leachate

State rules regarding silage leachate

Liquids from all types of silage storage areas at feedlots are defined as “process wastewaters” in accordance with the feedlot rules. Therefore, the liquids from all silage storage areas must meet all requirements for storage, handling, and land application associated with process wastewaters in Minn. R. ch. 7020.

Leachate from feed storage areas at feedlots that do not maintain coverage under a NPDES/SDS permit are subject to the discharge standard as defined in Minn. R. 7020.2003. When a feedlot is required to maintain coverage under a NPDES/SDS Permit, all leachate must be contained, as the feedlot is required to maintain zero discharge to waters of the state.

Additionally, as required in Minn. R. ch. 7060, all leachate is prohibited from being discharged to the unsaturated zone (the soil profile between the surface and water table). The Best Management Practices identified in this document are designed to assist in meeting these rule requirements.

Storage of leachate

Anyone who stores 1,000 tons or more of sweet corn silage on site **at any one** time must install a leachate collection system that consists of concrete, synthetic, or earthen lined storage basins or tanks.

Additionally, a feedlot that maintains coverage under a NPDES/SDS permit must contain and manage leachate from **all types** of feedstock silage in accordance with its NPDES/SDS Permit. The leachate management system for other types of feedstock silage may also include vegetative treatment in accordance with all applicable permit requirements and design criteria.

Concrete, synthetic, or earthen lined storage leachate basins or tanks located at a feedlot, must be designed by a professional engineer in accordance with Minn. R. 7020.2100.

For silage storage areas of 1,000 tons or more of sweet corn silage **not located at a feedlot**, a basin or tank intended to store leachate must be designed by a professional engineer in accordance with applicable design standards.

A permit or permit modification is necessary **prior** to the commencement of construction of all leachate storage structures.

Utilization of leachate

Land application of all types of leachate is allowed if it is applied at rates that do not exceed the nutrient requirements of the crop and **all manure application requirements** of Minn. R. 7020.2225 are followed.

In addition, if a Feedlot NPDES/SDS Permit or Industrial SDS Permit is required, land application must also occur in accordance with all Permit conditions and requirements.

Best Management Practices

Regardless of the need for permit coverage, the following practices should be implemented to reduce the potential for silage leachate discharging to waters.

- Locate the feed storage area on flat ground away from surface waters such as streams, ditches, tile inlets, wetlands, and intermittent streams.
- Wells should be located at least 100 feet from silage stockpiles and leachate storage areas.
- Establish the feed storage area on concrete, asphalt or a soil with at least one foot of soil categorized by NRCS practice standard 313 as group III or IV.
(*Two feet of soil should be used in sensitive areas such as those with shallow depth to fractured bedrock.*)
- Locate stockpiles on soils that have a minimum of three feet to the seasonal high water table and five feet to bedrock unless concrete or asphalt is used.
- Divert all surface water runoff away from the storage area to prevent contamination or co-mingling of surface water and leachate.
- Cover silage with plastic to prevent precipitation from entering the stockpile and creating leachate.
- Install a leachate collection system, such as storage tank or basin. (*A permit is required.*)
- Harvest silage at a moisture content of 65 percent or less.
- Plant shorter maturity varieties of corn to produce a drier crop and, therefore, less leachate volume.
- Add dry materials to silage to absorb excess moisture to create less leachate volume.

For More Information

Additional information can be obtained from a MPCA regional office or the MPCA website at: <http://www.pca.state.mn.us/topics/feedlots/feedlots.html>.

MPCA area offices

Brainerd area	218-828-2492
Detroit Lakes area	218-847-1519
Duluth area	218-828-2492
Mankato area	507-389-5977
Marshall area	507-537-7146
Metro area	651-297-6300
Rochester area	507-285-7343
Willmar area	320-214-3786