



# Manure Stockpiling

## Technical Guidelines

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**S**tockpiling of manure is a common method of storing solid manure (defined as having at least a 15 percent solids content or able to hold a 3-1 ratio when stacked) and used as bedding/litter until it can be applied to cropland as fertilizer.

This method is generally used by small horse, dairy, beef and poultry operations because their size makes the expense of a manure storage structure prohibitive. This fact sheet describes Minnesota rules for stockpiling manure at both feedlot and land application sites.

### Definitions

For clarification, the following terms used in this document are defined below.

**Manure Storage Area:** Area where animal manure or process wastewaters are stored or processed. Short-term and permanent stockpile sites are manure storage areas. Stockpiles can be classified as short-term or permanent, depending on how long the stockpile is stored. Short-term stockpiles must have the manure removed and land-applied within one year of the date when the stockpile was formed and permanent stockpiles can be stored for over a year. Short-term sites do not need a permit, if the owner is not the owner of the feedlot. Construction of permanent sites containing manure from 300 to 999 animal units requires a construction short form permit. A NPDES/SDS permit is required if the site contains manure from 1,000 or more animal units.



**Karst Topography:** Found in southeastern Minnesota where the soils are shallow and lay over fractured or cavernous bedrock. Sinkholes, caves and rock outcroppings are common features of this type of topography. This area is very sensitive to ground-water contamination.

### Environmental Impacts

Stockpiling of manure can be a reasonably environmentally safe method of manure storage if site selection is carefully considered. When rain or snowmelt water comes in contact with manure, the water can pick up particles of manure and manure leachate and transport it off-site. The pollutants can be solids that are visible to the naked eye or dissolved nutrients, pathogens or oxygen-demanding materials that cannot be seen.

As manure-contaminated water leaves the site, some of it flows overland and some seeps into the ground. Depending on the site, this water may flow to surface and/or ground water. Both can have significant negative impacts on water quality and human health.

A new manure storage area may not be constructed within 1,000 feet of a community water-supply well or wells serving a public school, private school (excluding home sites) or a licensed child care center where the well is vulnerable according to Minnesota Department of Health standards. Unless, the Minnesota Department of Health has approved a drinking water supply management area for the well, the manure storage area is not within the drinking water supply area, and the manure storage area is not within 200 feet of the well. In addition, stockpile sites may not be located in rock quarries, gravel pits, sand pits, or any other mining excavation sites.

A manure storage area may not be located:

- Shoreland
- Floodplain
- 300 feet of a sinkhole
- Within 100 feet of a private well with at least 50 feet of watertight casing

In general, manure stockpiling sites must be located and constructed such that manure-contaminated runoff from the site does not discharge to surface water and ground water.

### **Stockpile Site Selection Based on Soils**

To prevent a pollution problem from developing, manure cannot be stockpiled in rock quarries, gravel or sand pits, on bedrock or on any mining excavation sites. Other considerations include:

**Soil permeability and soil layer profile:** The permeability of the soil, a measure of how fast water will percolate through the soil, is an important consideration in determining if a site is suitable for stockpiling manure. Sandy soil has a high permeability and will allow water-borne pollutants to leach quickly through the soil layers to the ground water. On the other hand, denser soil or clay will prevent the leachate from flowing through the soil profile at such a rapid rate, and will hold the effluent longer allowing more contaminant detention and treatment.

**Depth to the seasonal high water table:** The thickness of the soil layer(s) above the water table also is a factor in site selection. Saturated soils do not treat pollutants nearly as well as unsaturated soils. Saturated soils also allow much more rapid percolation compared to unsaturated soils. The percolation time and contaminant treatment of the effluent through the soil depends on the soil type and total depth of the unsaturated soil profile.

Thicker unsaturated soil profiles lessen the risk of ground-water contamination.

**Karst topography and other fractured bedrock:** The depth to bedrock is another important consideration. Ground-water vulnerability is increased by fractured bedrock which provides a direct conduit from the soil layer to the deeper ground water. Sinkholes also provide a direct conduit to ground water, allowing little to no contaminant treatment. Therefore, manure must not be stockpiled within 300 feet of a sinkhole.

### **Agronomic Need of the Crop**

The size of a short-term stockpile is limited to what the crop will need. The largest allowed stockpile is the volume needed to fertilize crops on a 320-acre field.

### **Requirements: Short-Term Stockpiling**

The MPCA has developed the following requirements beginning October 2001, for the stockpiling of all manure and/or bedding material containing manure:

**Manure may not be stockpiled for more than one year.** The same stockpile site cannot be used from year to year. All of the accumulated manure is required to be removed from the site at least once per year and spread on cropland at agronomic rates as fertilizer. A vegetative cover must then be established on the site for at least one full growing season before the site can have manure stockpiled on it again.

Exceptions to establishing a vegetative cover between stockpiling use is made for cattle at open lots with 100 animal units or less and where the stockpile is land-applied in fewer than 10 days. The latter exception is only allowed six times per year.

### **Short-term stockpiles cannot be located within:**

1. 300 feet of flow distance and at least 50 feet horizontal distance to surface water, sinkholes, rock outcroppings, open tile intakes, and any uncultivated wetlands which are not seeded to annual farm crops or crop rotations involving perennial grasses or forages.
2. 300 feet of flow distance to any road ditch that flows to the features identified in Number 1 above or 50 feet of any road ditch where Number 1 does not apply.
3. 100 feet of any private water supply or unused-unsealed well and 200 feet from any private well with less than 50 feet of watertight casing and that is

not cased through a confining layer at least ten feet thick.

- 100 feet from field drain tile that is three feet or less from the soil surface.

A minimum distance of two feet between the base of the stockpile and the seasonal high-water table or saturated soils must be maintained.

The most recent USDA/NRCS Soil Survey Manual can be used or a site-specific soils investigation can be done.

**Stockpiles are also prohibited:**

- On land with greater than six-percent slope.
- On land with slopes between two and six percent, except where clean-water diversions and erosion-control practices are installed.
- On soils where the soil texture to a depth of five feet (measured from plow depth) is coarser than a sandy loam as identified in the most recent USDA/NRCS Soil Survey Manual or based on a site-specific soils investigation. This provision impacts only special cases where a field may sit on a potential gravel resource or an old river bed. Most fields would not have coarse soil conditions across the entire site.

**Recordkeeping: Short-Term Stockpile Sites**

The owner of the feedlot where the manure was produced must keep records on file for each manure stockpile site for at least three years. MPCA staff or the county feedlot officer may review them by request. The records should include information on:

- Location of each stockpile
- Date it was piled
- Volume of manure in the stockpile
- Nitrogen and phosphorus content of the manure
- Date when the stockpile was land-applied

**Permanent Stockpile Sites**

Manure stockpiled for more than one year needs to be placed on a pad. The owner may need to install a liquid

**Setback Guidelines**

**300 feet**

River, Stream (shoreland)      Drainage ditch (public or private)

Uncultivated wetland & other waters of state

**100 feet**

Private well

**1,000 feet**

Lake, pond or flowage, (shoreland)      Community water supply wells

Rock outcroppings      Open tile intakes

Road ditch      Sinkhole

manure storage area to collect the runoff if necessary to prevent manure-contaminated runoff from discharging to surface and ground water. The owner must apply for a construction short form permit if the manure results from 300 to 999 animal units or, apply for a NPDES/SDS permit for manure from 1,000 or more animal units.

**Cohesive Soil Pads**

**Soils Investigation**

A soils investigation to determine the depth to ground water and the estimated depth to the seasonal high-water table must be completed prior to construction. The seasonal high-water table is determined from soil color readings conducted by a qualified soils analyst. Interpretation of soil colors to determine seasonally saturated conditions should be done in accordance with soil taxonomy (United States Department of Agriculture).

A minimum of two soil borings must be taken (within the boundaries of the proposed site) for the first 1/2-acre of stockpile surface area. A minimum of one additional soil boring must be taken for each additional one acre of stockpile surface area. These borings must be performed on a pattern which represents the range of soil conditions throughout the stockpile site. The

elevation and location of each soil boring, relative to the site must be recorded.

## Construction of Cohesive Soil Pad

When constructing the pad, it is very important to remold and compact the soil so that voids and lift interfaces are eliminated. The goal during cohesive soil construction is to minimize hydraulic conductivity and soil compressibility, and to eliminate secondary features such as clod and lift interfaces and desiccation cracks. This is more complex than simply constructing to achieve a specified soil density.

Remolding the soil and eliminating clods may require increasing the equipment weight, thereby increasing the compactive energy. To eliminate lift interfaces, it is important to scarify the surface of previously compacted lifts prior to placement of the next lift, and to have deep-footed rollers which penetrate into this previous lift. Protection from cracking or desiccation of the in-place pad may require periodic moistening of the in-place floor on a hot, dry day or reworking the previous lift prior to placement of the next lift.

The following construction methods will provide reasonable certainty that the compacted soil will provide adequate protection to groundwater resources.

- Soils used for the pad should have at least 30% of the particles passing a #200 sieve, less than 20% retained on a #4 sieve, and no rocks greater than 3 inches. (Sieve analysis according to ASTM D-422)
- Soils should have a plasticity index greater than 7% (ASTM D4318)
- Soils during placement should be maintained at a moisture content of 0 to 5% above optimum (ASTM D-698 or ASTM D-1557 during construction)
- Soils should be placed in multiple lifts and compacted with at least three passes of a “sheeps-foot” type roller with feet that extend through the loose lift and into the previously compacted lift or compacted until achievement of 90% of standard proctor density, verified (ASTM 2922) at a frequency of one sample per 3,000 sq ft.

The soil liner must have a completed thickness of at least two feet and be constructed so that the hydraulic conductivity is  $10^{-7}$  cm/sec or less after construction. If other liner materials are used, a  $10^{-7}$  cm/sec conductivity must be achieved.

Verification that the soil liner material meets the hydraulic conductivity of  $10^{-7}$  cm/sec is not required, unless requested by the MPCA. If verification is desired, or requested, permeability tests will be required at the frequency of 2 tests per acre with a minimum of 2 tests. Documentation that the construction methods outlined previously were followed may suffice for sufficient verification of the soil liner material.

## Other Considerations

The site must be constructed using diversion structures, elevated platform construction, or other devices to prevent surface waters from entering and passing through the stockpile site. Where upgradient slopes are greater than two percent, clean water diversions must be constructed that surround at least the three upgradient sides of the stockpile site. Diversions must be of sufficient height to prevent outside water from passing over them during snowmelt or rainfall events less than the 25-year, 24-hour storm event.

A permanent stockpile site must be operated and maintained in a manner so as to protect the integrity and structural reliability of the manure storage area.

An owner should notify the MPCA or county feedlot officer of intent to construction a minimum of three days prior to commencement of construction and within three days following completion of construction. Notification must be completed by letter, telephone, or facsimile and include:

- Permit number, if applicable
- Owner’s name, and the name of the facility, if different than the owner
- Site location by county, township, section, and quarter section
- Name of the contractor responsible for installing the permanent stockpile liner

## 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/feedlot-rules.html>.

Or, for information call your area office listed on the first page of this fact sheet and ask for the feedlot officer.