Poultry Barn Floors

Technical Guidelines for Construction

Minnesota Pollution Control Agency

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Research indicates that ground-water pollution can occur below poultry facilities with permeable floors. Proper construction of this flooring is critical to creating an effective barrier between the manure and groundwater.

To minimize the impact to groundwater, the Minnesota Pollution Control Agency (MPCA) requires poultry facilities to construct cohesive soil flooring in total confinement barns and cohesive soil pads for permanent manure storage pads located outside of barns and at field sites.

This fact sheet addresses construction of poultry barn flooring and recordkeeping for poultry barn floors. For information on stockpiling of manure, refer to the MPCA fact sheet titled "Technical Guidelines for Stockpiling of Manure".

Note: You will need to hire a consultant who is qualified to perform the soil investigation, tests, and analysis outlined in this document. Your local County Extension Agent, Soil and Water Conservation District staff, or County Zoning Officer may be able to assist you in finding a qualified consultant.

How Should My Poultry Barn Floor be Constructed and Maintained?

All new concrete-lined or asphalt-lined poultry barn floors must be constructed and maintained according to the following:

1. The floor thickness must be a minimum of 3.5 inches for concrete and a minimum of two inches for asphalt;
2. The floors must be inspected by the owner or operator after each cleaning of the poultry barn floors;
3. Cracks and joints, which may extend through the concrete-lined or asphalt-lined floor, must be sealed.

Earthen Floor Construction

The entire earthen floor in all new poultry barns is to be constructed as follows:

1. The floor must be constructed of a minimum of twelve (12) inches of compacted cohesive soil; or
2. Eight (8) inches or more of compacted soil placed over an underlay that consists of:
   - Three inches of sand consisting of at least 80 percent particles passing a number four sieve, less than 10 percent particles passing a number 200 sieve, and no particles greater than one inch. Particle size analyses must be performed according to ASTM D-422; or
   - A geotextile fabric that weighs at least 12 ounces per square yard and has a minimum hydraulic conductivity of 0.30 cm/sec.

Soils used for construction of the floor must meet the following requirements:

- Have at least 30 percent particles passing a number 200 sieve, less than 20 percent retained on a number three sieve, and no rocks greater than three inches in diameter. Particle size analyses must be performed according to ASTM-D-422;

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Rochester area: 507/285-7343
Mankato area: 507/389-5977
Marshall area: 507/537-7146
Willmar area: 320/214-3786
Detroit Lakes area: 218/847-1519
Brainerd area: 218/828-2492
Duluth area: 218/723-4660
Metro area: 651/296-6300
Toll-Free Number: 800/657-3864

- Have a plasticity index greater than seven percent according to ASTM D-4318;
- Be placed in a minimum of two lifts, each lift being a minimum of four inches of in-place thickness;
- Be maintained at a moisture content of zero to five percent above optimum as determined by ASTM D-698 or ASTM D-1557 during construction; and
- Be compacted:
  1. with at least three passes of a sheepsfoot or padfoot-type compaction equipment with feet that extend through the loose lift of soil into the previous lift; or
  2. until achievement of 90 percent of standard proctor density. The density must be verified according to ASTM D-2922, at a frequency of one sample per 3,000 square feet.

The completed elevation of the compacted soil floors needs to be at least three feet above the seasonal high water table elevation or bedrock as determined in the soil investigation; and

- After construction is complete, you need to record and retain on permanent file the results of all testing done prior to and during construction. These records must be made available to the MPCA or delegated county upon request.
- You need to notify the MPCA or delegated county of intent to construct a minimum of three business days prior to commencement of construction and within three business days following completion of construction. Notification must be completed by letter, telephone, or facsimile and include:
  1. The owner's name and the name of the facility if different than the owner;
  2. The site location by county, township, section, and quarter section; and
  3. The name of the contractor responsible for installing the floor.

Soil Testing

The following information needs to be gathered before construction:

Soil investigation: Must be completed by a qualified soils analyst to determine the depth to groundwater and the depth to the seasonal high-water table at the proposed building site. Interpretation of soil colors (mottling) to determine seasonally saturated conditions should be done in accordance with the Soil Survey Manual (USDA) or other method (provide reference). The elevation and location of each soil boring, relative to the building site, should also be recorded.

A minimum of two soil borings shall be taken (within the boundaries of the proposed building site) for the first 1/2 acre of barn surface area. One additional soil boring shall be taken for each additional one acre of barn surface area. For example, a 50′ x 650′ barn will have a surface area of 0.75 acres and will require three soil borings. These borings shall be performed on a pattern representing the range of soil conditions throughout the barn area. The borings are to be done to a depth of at least five feet below the elevation of the finished barn floor.

The following tests are to be performed on samples collected during the soils investigation:

Acceptable test results for tests to be performed: cohesive soil:

Particle Size (Sieve Analysis) *ASTM D-422*	Percent passing no. 200 sieve is greater than 50 percent Percent retained on no. 4 sieve is less than 20 percent
Atterberg Limits *ASTM D-4318*	P.I. greater than 7 percent and less than 30 percent
Optimum Moisture Content *ASTM D-698, ASTM D-1557*	During construction, material must be maintained at a moisture content of zero to five percent above optimum.

ASTM (American Standards of Testing and Measurement)

Note: The uncompacted liner soil is to be tested at a frequency of at least once per 5,000 cubic yards of material.

Note: Soils that fall outside of the parameters described above may be accepted on a site by site basis. These must be approved by the MPCA prior to use as liner material.

The following information must be gathered during construction.

Moisture Content *ASTM D-2216,* *ASTM D-4643,* *ASTM D-4959,* *ASTM D-4944*	Moisture content of the soil must also be monitored during construction to determine if it is within the acceptable range of optimum.

Note: The uncompacted liner soil is to be tested at a frequency of at least once per 2,500 cubic yards of material.

Construction of Cohesive Soil Floors

When constructing the floor, 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. During construction, protection from cracking or desiccation of the in-place floor 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.

Compaction of Cohesive Soil Floors

The following conditions and procedures must be followed:

1. Moisture content must be maintained at zero to five percent above optimum for compaction, as determined by preconstruction testing of the floor pad material;
2. Frozen soils or rocks larger than three inches are not allowed in the fill material;
3. The soils to be used for construction of the barn floors should be placed in four-inch lifts. A sheepsfoot or padfoot roller or other similar compaction equipment must be used to compact the soil. Track-type and loaded rubber tire equipment are not acceptable for liner compaction;
4. Each lift should be compacted by sufficient passes of compaction equipment to remold soil clods and eliminate macropores and lift interfaces. Compaction equipment will typically "walk out" once sufficient compaction effort has been completed.
5. Cracks that may extend through the floor must be repaired.
6. The floor must not be saturated at any time during the service life of the floor.

For More Information

For more information about poultry barn floors, the feedlot rule or to download a copy of the 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.