

Manure Spills: What You Need to Know and Environmental Consequences

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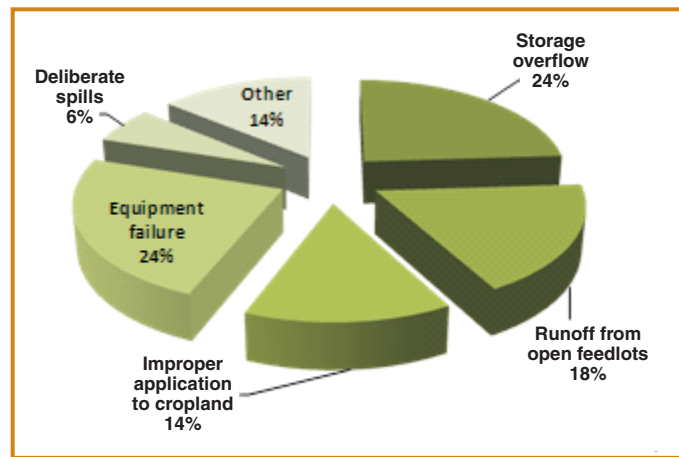


Figure 1.
Causes of manure
spills in Iowa.

(Source: Armstrong
et al. 2010)

Manure Spills

Manure spills are defined as manure that is released to the environment in a manner that exceeds the rate of nutrient uptake by plants or applied in a manner that is not identified in the “Nutrient Management Plan.” Manure spills may occur during manure storage, transportation and land application.

One Iowa State University study indicated that both equipment failure and storage overflow are the main causes of on-farm manure spills (Fig. 1). Similarly, Erb (2010) indicated

that 40 to 48 percent of manure spills in Wisconsin were attributed to manure storage equipment failure and lagoon breaches, followed by land application (29 percent) and transportation (30 percent). The focus of this publication is preventing manure spills during manure storage, transportation and land application.

Spills From Manure Storage

Typically, liquid manure is stored in a manure storage pond or lagoon for six to 12 months. During this period, manure is added to the storage pond on a regular basis. In addition, feedlot runoff and direct precipitation are added to the storage pond.

Permitted animal feeding operations (North Dakota Administrative Code sections 33-16-03.1-04 and

33-16-03.1-05) in North Dakota are required to have a liquid level marker or indicator (Fig. 2, page 2) in earthen manure storage ponds or runoff ponds (North Dakota Livestock Program Design Manual 5.2) to help the farmer track and manage manure levels.

However, this regulation is ignored or the marker is missing in many situations. As a result, the manure storage or runoff pond may not have enough capacity to take more manure and can overflow.

Inspecting manure storage ponds frequently is a good practice to detect any leakage and rodent/erosion damage to the embankment and alongside pipes, as well as wet areas/seepage on the back slope of a liquid manure storage pond. Any damage should be repaired immediately. Otherwise, liquid manure will stress these weak spots and a manure spill will occur.

Prevention is always the best means to minimize the risk of manure spills and the resulting environmental damage. Take the following steps to prevent manure spills from storage ponds:

- Install a pond marker/staff gauge to monitor the liquid level.
- Make proper liquid level management a year-round priority.
- Reserve maximum storage capacity for periods when the receiving crop is dormant or extended rainy spells prevent manure application.
- Pump down the liquid level or take action to remove liquid from storage and properly apply or transfer it to another storage structure when the pond has reached its maximum operating level.

Conducting periodic inspections of embankments can minimize the risk of a storage pond spill. Producers should look for:

- Cracking or holes on the embankment and around pipes
- Wet areas on the back slope
- Erosion
- Rodent or tree damage

If leakage from the base or sidewall of a lagoon or earthen storage structure has occurred, take the following steps to stop the release of manure:

- Stop additional leakage by fixing weak spots with clay-type soil
- Dig a small well or ditch to catch all seepage
- Trap or remove animals if holes are caused by burrowing animals, fill holes and compact with a clay-type soil
- Seek engineering assistance

Modifications to any pond or storage operation should be done with technical assistance from a conservation agency, such as the Natural Resources Conservation Service or your local Soil and Water Conservation District.

If lagoon/storage pond overflow has occurred, take the following steps to minimize additional manure loss:

- Stop all additional flow into the lagoon and direct it to appropriate storage, or land apply the manure if weather and conditions allow.
- Lower the volume in the storage pond by applying the manure to fields at rates provided in the Nutrient Management Plan.

- Make sure no excess surface water is entering lagoon by checking clean-water diversions (for example, gutters, ditches) and water sources in the barn, such as pipes and watering systems.
- Add soil to the berm to increase the elevation of the dam with approval of regulatory authorities.

Spills During Manure Transport

Manure spillage can occur while pumping and transporting manure from the storage system to the crop field. Often manure is applied through pivot irrigation or other automatic means.

Mechanical failure during pumping is one of the largest causes of manure spills. Mechanical failure may occur due to the pump/pipe/hose connections malfunctioning or breakage.

Periodically checking connections for leakage or obstructions during pumping is important. If something, such as manure solids, sand or other material, is obstructing the manure's flow, the pipe connection may burst and manure will end up in an unwanted area.

Monitoring line pressure while pumping manure is important because pressure buildup may indicate an obstruction and pressure loss may indicate a leak.

If you find leaks from the manure distribution system, take the following steps to stop spills:

- Stop irrigation pump
- Close valves or clamp hoses to eliminate further discharge
- Separate pipes to create an air gap and stop flow
- Repair all leaks before restarting pumps

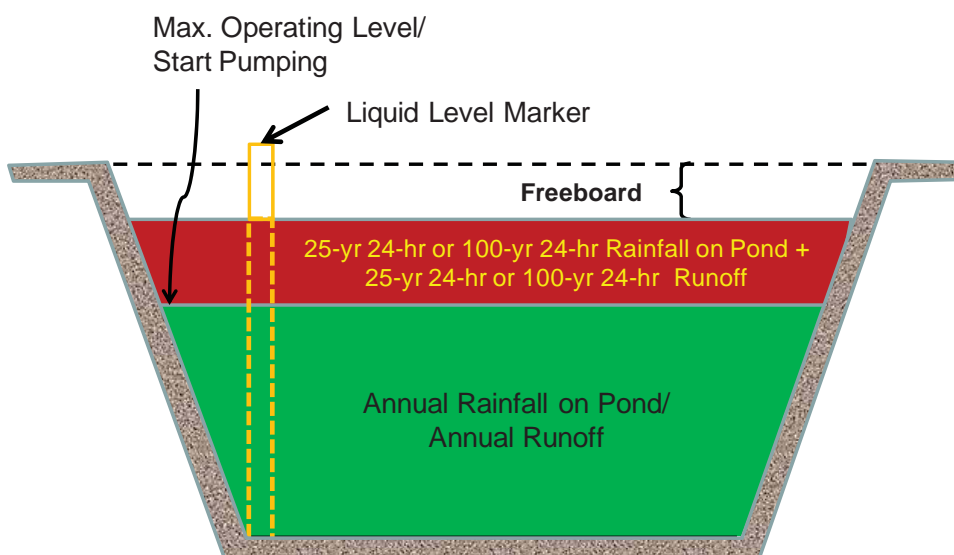


Figure 2. Capacity of a runoff storage pond (not to scale).

Spills During Land Application

Manure is land-applied to meet the crop's nutrient requirements. When application equipment is not properly calibrated, manure may not be applied at rates to meet the crop's needs. Over application of manure can result. Additionally, if manure is not incorporated into the soil, the risk of surface runoff increases.

Frozen ground prevents manure incorporation and uptake by the soil and plants, and increases the chance of manure running off the intended field.

Several ways are available to stop manure from entering water streams. For example, a setback distance (minimum 100 feet) or buffer can be established around manure-application areas to prevent manure runoff into surface water.

Avoid winter application of manure; however, application to fields with some vegetation and minimal slopes will help prevent manure loss. However, if runoff is occurring from the application field, the following actions can help minimize spills while applying manure to cropland:

- Stop manure application immediately
- Create a temporary diversion or berm to contain the manure on the field
- Incorporate to reduce further runoff
- Evaluate and eliminate the cause or causes of the runoff (application rates, equipment failure, soil moisture, time of application) before resuming field application

Unintentional off-site manure movement also occurs on tile-drained fields. Note that tile drainage provides a means of removing excess water from poorly drained agricultural soils.

If liquid manure is applied on tile-drained soil, the tile system can become an easy route for nutrients to migrate from a field to surface water when the solids content of the manure is less than 2½ percent, high rates of liquid manure are injected and fields have been in no-till or strip tillage for a number of years. We do not recommend applying manure when tile is flowing. Tiles outflow should be checked during and after application to ensure no manure is leaving the field.

How to Handle a Manure Spill

Even if the manure does not come into immediate contact with a water system, the spill or accumulated leakage eventually can migrate to nearby surface water and/or to the aquifer. To contain the manure, do a preliminary assessment of the situation and contact the appropriate authorities. Take the following basic steps in case of manure spills:

Basic Steps

1. Devote full attention to the emergency
2. Care for any human injuries
3. Eliminate the source of the spill
4. Contain the spill, if possible
5. Assess the extent of the spill and note any obvious damages

6. Contact the appropriate agencies (within 24 hours)
7. Clean up the spill and make repairs
 - Use pump to recover manure
 - Flush the manure off of vegetation with water
 - Apply to cropland as per approved rate
8. Prepare and submit a summary report. In North Dakota, the report needs to be submitted in five days.

At the same time, prepare a preliminary assessment and notification of the situation for the appropriate authorities. The assessment and notification should include:

- Incident description
 - Your name
 - Facility name
 - Telephone number
 - Details of the incident
 - Exact location of the facility
 - Location or direction of spill movement
 - What corrective measures have been undertaken
- Whether the manure reached any surface waters
- Approximate amount of manure released and the duration
- Any damage, such as employee injury, fish kills or property damage
- Whether the spill left the property
- Whether the spill has potential to reach surface waters

According to NDAC chapters 33-16-01 and 33-16-03.1, records must be kept on site for a minimum of three years for animal feeding operations and five years for concentrated animal feeding operations

How to Avoid Spills

The majority of manure spills can be prevented through management and careful manure application.

(North Dakota Livestock Program Design Manual, 2005). Contact the appropriate department within 24 hours. In North Dakota, notification can be made by calling (701) 328-5210 (8 a.m. to 5 p.m.) or the Division of Emergency Management at (800) 472-2121 during nonworking hours (including weekends and holidays).

Management

- Inspect manure storage structure walls and berms for leaks or punctures periodically
- Install pond marker/staff gauge, which is essential for recording manure levels
- Monitor manure storage capacity and apply manure before pond is full
- Perform proper lagoon/runoff storage pond maintenance
- Make proper lagoon liquid level management a year-round priority

Apply Manure Wisely

- Apply manure at the recommended rate
- Do not apply liquid manure immediately before or after a heavy rain or snowmelt
- Watch for pressure changes and inspect pipe connections
- Make multiple smaller applications because soils can absorb them better than one larger application

Environmental Consequences of a Manure Spills

A manure spill may cause immediate or future pollution. The biggest concern with manure spillage is surface and ground-water pollution. Spills or accumulated leakage eventually can end up in the nearby surface water and/or an aquifer.

Surface water contamination due to manure spills may pose a significant threat to aquatic ecosystems, and excessive nutrients may cause eutrophication in freshwater ecosystems. Nitrate contamination (at or above 10 milligrams per liter) of ground water may lead to blue-baby syndrome in infants if contaminated ground water is used as drinking water.

Cleaning up manure spills is expensive and time-consuming. Therefore, prevention should be the goal, rather than cleaning a manure spill mess. In case of manure spills, take corrective measures immediately. Proper management practices and a little supervision can minimize manure spills and the related environmental concerns.

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