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Assessing the Risk of Surface and Ground Water Contamination From Livestock Manure Storage & Utilization

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FARM •A• SYST
Farmstead Assessment System

Assessing the Risk of Surface and Ground Water Contamination from

Livestock Manure Storage & Utilization

January 2000 **Utah Farm •A•Syst - Worksheet #7**

Why should I be concerned?

Storing livestock manure allows farmers to spread manure when conditions are favorable for nutrient use by crops. Accumulating manure in a concentrated area, however, can present a threat to water quality and to human or animal health.

Facilities for liquid manure storage on the farmstead sometimes leak or may burst, releasing large volumes of pollutants. Manure in earthen pits can form a semi-impervious seal of organic matter which does limit leaching, but seasonal filling and emptying can cause the seal to break down. Short-term solid manure storage and abandoned storage areas can also be sources of surface and ground water contamination by runoff or leaching of nutrients including nitrates and disease-causing organisms.

Nitrate-nitrogen levels in drinking water above federal and state drinking water standards of 10 milligrams per liter (mg/l) can pose health problems for infants under one year of age, including the condition known as methemoglobinemia (blue baby syndrome). Nitrate may also affect adult health.

Young livestock are also susceptible to health problems from high nitrate-nitrogen levels. Levels of 20-40 mg/l in the water supply may prove harmful, especially in combination with high levels (>1,000 ppm) of nitrate-nitrogen from feed sources.

Bacteria in livestock manure can contaminate surface and ground water, causing such infectious diseases as dysentery, typhoid and hepatitis. Some organic materials may cause an undesirable taste and odor to drinking water but are not known to be dangerous to health. However, their presence may suggest surface or ground water contamination.

High phosphorus levels contribute to algal blooms in streams, lakes and reservoirs. When these algae die and decompose, oxygen is removed from the water often causing the death of aquatic life. Phosphorus can reach surface water or ground water supplies through movement in the soil solution, with surface water runoff, or on eroding soil particles.

The Farmstead Assessment System is a cooperative project of Utah State University Extension, Utah Department of Agriculture and Food, Utah Department of Environmental Quality, Utah Farm Bureau, Utah Association of Conservation Districts, Natural Resources Conservation Service

How will this worksheet help me protect my surface and ground water?

- It will take you step by step through an evaluation of your livestock manure storage practices.
- It will rank your activities according to how they might affect surface or ground water.
- It will provide you with easy-to-understand rankings that will help you estimate the risk posed by your livestock manure storage and disposal practices.
- It will help you to identify your practices which are reasonable safe and effective, and practices which might require modification to better protect surface and ground water.

Glossary
Livestock Manure Storage & Utilization

These terms may help you make more accurate assessments when completing Worksheet #7. They may also help clarify some of the terms used in Fact Sheet #7.

Available soil water holding capacity: Amount of water a soil will hold, which is available for plant use.

Earthen pit or lagoon: A manure storage facility which is constructed below gound level according to specific engineering standards. Not simply an excavation. New pits are usually lined with synthetic liners to prevent leakage.

Engineering standards: Design and construction standards available at Natural Resources Conservation Service (NRCS) offices. These standards may come from NRCS technical guides, state regulations or land grant university engineering handbooks.

Evapotranspiration: The amount of water used by vegetative growth for transpiration and evaporation from the soil and plant surfaces for a specified time period.

Filter strip: A gently sloping grass area which can serve as a buffer around some types of short-term solid manure storage systems. Filter strips are not meant to handle all of the contents of a short-term storage facility, rather, these grass strips are used to help filter only a limited amount of runoff. In these systems, overflow manure is distributed uniformly across the high end of the strip and flows down the slope. Nutrients andsuspended material remaining in the runoff water are filtered through the grass, absorbed to the soil, and ultimately absorbed by plants. To be effective, filter strips must be designed and sized to match the characteristics of the storage system. They do not replace a properly designed long-term storage facility, nor do they eliminate the need for proper manure management practices.

Glass-lined steel storage: A type of liquid-tight, above-ground animal manure storage structure. Located on a concrete pad, it consists of steel panels bolted together and coated inside and outside with glass to provide corrosion protection.

Milligram per liter (mg/l): Concentration in water of parts per million

Poured concrete storage: A type of liquid-tight animal manure storage structure. Located on a concrete pad, it consists of poured concrete reinforced with steel.

Soil permeability: The characteristic of the soil which determines the rate at which water will percolate toward ground water. Slowly permeable soils have fine-textured materials, like clays, that permit only slow water movement. Moderately or highly permeable soils have coarse-textured materials, like sands, that permit rapid water movement.

Soil texture: The relative proportions of soil particles (clay, silt, sand) in a soil. Described by such terms as “sandy loam,” and “silty clay.”

Utah Farm•A•Syst Worksheet #7

Livestock Manure Storage: Assessing Surface and Ground Water Contamination Risk

Information derived from Farm•A•Syst worksheets is intended only to provide general information and recommendations to farmers regarding their own farmstead practices. Keep this as your private record.

1. Use a pencil. You may want to make changes.
2. For each category listed on the left that is appropriate to your farmstead, read across to the right and circle the statement that best describes conditions on your farmstead. (Skip and leave blank any categories that don't apply to your farmstead.)
3. Then look above the description you circles to find your "rank number: (4, 3, 2 or 1) and enter that number in the blank under "your rank."
4. Directions on overall scoring appear at the end of the worksheet.
5. Allow about 15-30 minutes to complete the worksheet and figure out your risk ranking for well management practices.

	LOW RISK (rank 4)	LOW-MOD RISK (rank 3)	MOD-HIGH RISK (rank 2)	HIGH RISK (rank 1)	YOUR RANK
LONG-TERM STORAGE (90 days or more)					
Steel, glass-lined (liquid-tight design, above ground)	Designed and installed according to accepted engineering standards and specifications. Properly maintained.	Designed and installed according to accepted engineering standards and specifications. Maintenance not timely.	Contents of tank are leaking. Fine to medium textured soils (clay loam, silt loam, sand).	Contents of tank are leaking. Coarse textured soils (sands, sandy loam).	_____
Concrete stave (liquid-tight design)	Designed and installed according to accepted engineering standards and specifications. Properly maintained.	Designed and installed according to accepted engineering standards and specifications. Maintenance not timely.	Contents of tank are leaking. Fine to medium textured soils (clay loam, silt loam, sand).	Concrete is cracked. Contents are leaking. Coarse textured soils (sands, sandy loam).	_____
Poured concrete (liquid-tight design)	Designed and installed according to accepted engineering standards and specifications. Properly maintained.	Designed and installed according to accepted engineering standards and specifications. Maintenance not timely.	Contents of tank are leaking. Fine to medium textured soils (clay loam, silt loam, sand).	Concrete is cracked. Contents are leaking. Coarse textured soils (sands, sandy loam).	_____

	LOW RISK (rank 4)	LOW-MOD RISK (rank 3)	MOD-HIGH RISK (rank 2)	HIGH RISK (rank 1)	YOUR RANK
Earthen waste storage pit (below ground)	Designed and installed with a liner according to accepted engineering standards and specifications. Properly maintained.	Designed and installed to meet all accepted engineering standards and specifications. Properly maintained	Designed or installed without following accepted engineering standards. Earthen lining eroding.	Design does not meet engineering standards. More than 10 years old. Earthen lining perforated.	_____
SHORT-TERM STORAGE (30-90 days)					
Stacked in field.	Stacked on level ground with berms around storage area.	Stacked on level ground with no berms or cover.	Stacked on high ground during normally dry seasons with no berms or cover.	**Stacked on high ground with no berms or cover in wet seasons.**	_____
Stacked in yard.	Covered concrete yard with curbs, gutters, berms, and/or settling basin.	Concrete yards with curbs, berms, and gutters. Grass filter strips are installed and maintained.	**Earthen yard with fine to medium textured soils (clay loam, silt loam, sand).**	**Earthen yard with coarse textured soils (sands, sandy loam).**	_____
Water-tight structure.	Facility design and installation meets all accepted engineering standards. All liquids are retained		Structure has been allowed to deteriorate or is not maintained. Contents are leaking. Fine to medium textured soils (clay loam, loam, silt loam).	Structure has been allowed to deteriorate or is not maintained. Contents are leaking. Coarse textured soils (sands, sandy loam).	_____
Stacked in open housing.	Building has concrete floor, protected from surface water runoff. Adequate bedding provided.	Building has earthen floor, protected from surface water runoff. Fine to medium textured soils (clay loam, silt loam, loam).	Building has earthen floor, protected from surface water runoff. Coarse textured soils (sands, sandy loam.)	**Building has earthen floor and is subject to surface water runoff.**	_____

	LOW RISK (rank 4)	LOW-MOD RISK (rank 3)	MOD-HIGH RISK (rank 2)	HIGH RISK (rank 1)	YOUR RANK
SITE CHARACTERISTICS (where waste is applied)					
Soil permeability.	Well-drained medium or fine-textured soils (loam, silt loam, clay loams, clays), with low permeability. (silt & clay).	Well-drained or moderately well-drained medium or fine-textured soils (loam, silt loam, clay loams, clays) with moderate permeability (loamy).	Moderately well-drained coarse-textured soils (sands, sandy loam). and/or high permeability (sandy).	Excessively well-drained coarse-textured soils (sands, sandy loam) to gravel, and/or somewhat poorly drained soils and/or very high permeability (coarse sand).	_____
Soil depth.	More than 40 inches deep.	30-40 inches deep.	Shallow (20-30 inches).	Very shallow (less than 20 inches).	_____
Available soil water holding capacity.	Medium to high.	Low to medium.	Low or soil saturated.	Soil saturated with standing water present.	_____
LIVESTOCK MANURE APPLICATION PRACTICES					
Soil testing of manure application sites.	Yearly	Every 2 years.	Every 3 years.	Less frequent than every 3 years.	_____
Application rate.	Applied at rate equal to or less than plant needs based on soil test. Application rate based on P levels.	Low rates or application rates not based on soil test results. Rate applied based on N levels.	High rates or application rates used, not based on soil test results. Rate exceeds plant need for P.	Applied at rate greater than plant needs. Annual application over 250 pounds available nitrogen.	_____
Location of waste application areas.	All application areas more than 200 feet from surface water sources or well.	75% of application areas more than 200 feet from surface water sources or well.	50% of application areas are less than 200 feet from surface water sources or well.	All application areas are less than 200 feet from surface water sources or well.	_____
Application timing and site conditions.	Incorporated into soil or applied at site with heavy vegetation. Never applied to frozen or saturated soil.	Incorporated into soil or applied at site with heavy vegetation. Rarely applied on frozen or saturated soil.	Little or no incorporation into soil. Sometimes applied to wet or frozen soil.	Applied to tilled soil with no incorporation and little vegetation. Applied to frozen, saturated or snow-covered soil.	_____

	LOW RISK (rank 4)	LOW-MOD RISK (rank 3)	MOD-HIGH RISK (rank 2)	HIGH RISK (rank 1)	YOUR RANK
LAND MANAGEMENT PRACTICES					
Distribution of manure solids to land.	Uniform application; equipment calibrated annually.	Non-uniform application; annual calibration of equipment.	Non-uniform application; calibration of equipment every other year.	Non-uniform application; no calibration of equipment.	_____
Manure distribution on cropable acreage.	All nutrients transported off farm.	Adequate cropable acreage for nutrients in stored manure. Some manure nutrients transported off farm.	Inadequate cropable acreage for nutrients in stored manure. No manure transported off farm. No commercial fertilizer applied.	Inadequate cropable acreage for manure nutrient use. No manure transported off farm. Commercial fertilizer applied.	_____
Irrigation.	Amount applied based on evapotranspiration rate. Use of evapotranspiration information or use of soil moisture monitoring for evaluating water needs.	Frequent applications that are not more than 20% in excess of crop evapotranspiration; irrigation water efficiency is more than 60%.	Infrequent applications with more than 20% in excess of crop evapotranspiration giving intermittent saturated soils; irrigation water efficiency is less than 60%.	Creates saturated soils with runoff and/or deep percolation.	_____

Boldface type: Indicates an action or situation which may constitute a violation of state or federal law.

Action Plan Based on Activities of Concern from Livestock Manure Storage and Utilization

1. List any **individual activities** or structures that you ranked as "2" (moderately high risk) or "1" (high risk).

2. For each activity you listed, fill in the "**response options**" and "**taking action**" sections.

Response options: Check one of the two boxes: either "immediate action possible" or "further planning required." This should be a quick assessment of whether the response will requires a change in practice that can be achieved relatively easily at little cost or whether it requires major effort and money.

Taking action: Decide right now on a possible first step to begin to address each concern listed. It might be as simple as making a first phone call to get information. It is important to take an initial step to begin to address each of the moderately-high and high risk concerns you have listed.

Keep this list handy and refer to it often. It provides important information for you as you plan how tomore effectively protect surface and ground water.

Individual activity identified as moderately high risk (2) or high risk (1)	**Response Options (check one)**		**Taking Action (proposed first step to address concern)**
	Immediate action [(a)]	Further planning required[(b)]	

(a) Change in practice only; cost is not a factor
(b) Requires major structural improvement or relocation, major effort or high cost