WATER QUALITY
UTAH STATE UNIVERSITY EXTENSION

Water is Life : Quality Matters

How to Manage Stored Manure and Protect Your Water

Fact Sheet 7
Revised March 2012

INSIDE:

Runoff from improperly stored or managed manure can lead to contamination of groundwater and surface water. Land application of manure at proper agronomic rates or composting of manure conserves nutrients contained in the manure and minimizes leaching and runoff of contaminants. Manure storage in an appropriate structure increases a producer's flexibility regarding the timing of land applications. Storage is also valuable during extended periods of bad weather and when crops are actively growing, making application impractical.

Proper management of stored manure depends on proper design and construction of the storage facility, a good knowledge of the physical and chemical characteristics of the soil and subsurface geologic materials within the storage area, and proper land application of manure once it leaves the storage facility.

For additional information or reading materials, refer to the contacts and references section at the end of this fact sheet.

LONG TERM MANURE STORAGE OPTIONS (MORE THAN 90 DAYS)

Livestock manure can be stored for more than 90 days either in solid, semi-solid (slurry) or liquid states.

- Solid facilities use walls and slabs for piling heavily bedded or frozen manure.
- Slurry facilities use pumps to move manure into storage areas where some solids may be separated from liquids.
- Liquid facilities hold manure in tanks, pits, earthen lagoons, evaporation ponds or bermed areas.

UtahStateUniversity
COOPERATIVE EXTENSION

Problems with Leakage

Liquid and semi-solid storage systems, in particular, must be carefully installed and maintained to ensure that they do not leak. Lagoons need to be big enough and lined with earthen or other materials to provide a very low liner hydraulic conductivity of no less than 1 x 10-7cm/sec make this a footnote. Freezing, thawing, wetting and drying cycles, and even earthworm or other animal burrows may cause leaking through a liner. The effective life for properly designed lined earthen pits is approximately 10 years.

Look for the following as a sign of leakage. If a pit has been receiving designated liquid manure amounts and you are adding additional milk house liquids, but the pit has not required pumping, it is probably leaking.

Monitoring wells installed around the pit upslope and downslope can confirm the seepage. Talk with your Utah State University county Extension agent or contact the Utah Division of Water Quality for more information.

TAKE ACTION!

Check for leaks and repair structures whenever structures or pits are emptied:

- in lined systems, check walls and bottoms for cracks in watertight seals
- in earthen pits, check for erosion of liner materials

SHORT-TERM STORAGE (30-90 DAYS)

Short term storage is not a recommended practice, because it poses a risk of contaminating surface water and ground water. However, short-term storage is sometimes necessary to hold livestock manure during periods of bad weather when daily spreading may not be feasible, when crops are growing and land is not available for applying manure or when there is a

shortage of crop acres to handle daily hauling and spreading of manure without the threat of runoff. Short term storage does not replace a properly planned long-term storage facility and livestock growers should develop a plan to reduce the need for any short-term storage system for their operation.

To minimize leakage or runoff from these sites:

- Store manure in pole sheds or other roofed areas to keep rain and snow off.
- Provide adequate bedding in piles to absorb liquids in the manure.
- Clean these areas as frequently as possible.

The best ways to handle any drainage from a short term storage facility is to channel it into a lined watertight holding pond, storage tank or into a constructed filter strip. In situations where these options are not possible, it may be necessary to build a covered (and curbed) storage area to prevent additional water from being added to temporarily piled manure.

Some solid or semi-solid manure storage systems (such as picket dams) are designed to allow minor drainage of liquids. In these cases the structure design must include containment and/or treatment of liquids that drain out.

MANURE STORAGE LOCATION

When locating a manure storage facility, several factors are important, including the depth to the water table, the type of soils and bedrock, and potential for contaminating water resources. Your Utah State University county Extension agent or local Natural Resource Conservation Service office can help you with this information.

Locate your manure storage in a site that remains above the water table throughout the entire year. Avoid areas with fractured bedrock or areas with extremely permeable soils (such as sandy soils).

To prevent runoff to surface or groundwater, locate your storage on as low a slope as possible, and downslope from surface water or well areas. If there is a possibility of water contamination, consider alternatives for your manure storage facility.

Required Separation Distances

Utah Law requires minimum separation distances between most storage facilities and wells. New private wells require minimum separation distance of 100 feet from storage areas. Existing wells are regulated by separation requirements in effect at the time of well construction. Make every effort, however, to exceed "old regulations" and strive to meet current separation distances when possible.

> ***TAKE ACTION!***
> Always locate manure storage facilities as far away and downhill from any well or surface waters.

The minimum separation distance between a manure lagoon and a public well is 100 feet if the well is in a confined aquifer or an estimated 250 day pollution plume travel time. If your well is in an unconfined aquifer, contact Utah Division of Drinking Water to determine separation distances. For liquid-tight manure storage structures, no minimum separation distance is specified but as much distance as possible should be provided.

ABANDONED PITS

Abandoned manure storage pits, especially earthen ones, can pose significant water quality problems. Any abandoned structure should be completely emptied. In the case of earthen waste storage facilities, liner materials (to a depth of about two feet) should be removed and spread over croplands. The remaining hole should be filled and leveled. Manure packs from pole sheds no longer in use should also be removed and the manure applied. If manure has been piled in fields, it should be removed and applied at appropriate agronomic rates as soon as conditions permit.

MANURE APPLICATION PRACTICES

Manure should be applied based on the nitrogen or phosphorus needs of the crop. A comprehensive nutrient management plan (CNMP) accounts for all nutrient inputs and outputs. For more information, contact Utah State University Extension, Utah NRCS or see http://extension.usu.edu/waterquality/. The amount of manure produced, along with the nutrient content, should be balanced with the amount of acres needed for proper distribution. Remember that when manure is incorporated into the soil immediately after application, it will retain more of its nutrient value.

Particular care should be taken if applying manure to sites with coarse textured soils, fractured bedrock and low water holding capacity. These sites have a high potential for leaching of nutrients, particularly nitrates, and microorganisms into the ground water.

Where the cropable acreage is not adequate, manure may be distributed to other lands (i.e., rangeland, neighbors, etc.) or composted. Composted manure can be used as bedding, feed supplements, or as soil amendments.

When bare ground is adjacent to an irrigation ditch or other water source, an appropriate set back area should be maintained. Manure should not be applied in the set back area. The distance across the set back area is determined by slope, vegetative cover, type of irrigation and other factors that influence runoff. Manure should not be applied to frozen or snow covered ground unless all runoff can be controlled.

WATER CONTAMINANTS IN MANURE

Manure contains bacteria, high levels of organic material, and high concentrations of nutrients (nitrogen and phosphorus).

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. The breakdown of organic material in surface waters can also lead to low oxygen levels, which is harmful to fish.

Excess nutrients in water can pose several problems. Nitrate-nitrogen levels in drinking water above federal and state drinking water standards of 10 milligrams per liter (parts per million) can pose health problems for infants under one year of age, including the condition known as methemoglobinemia (blue baby syndrome). High nitrate concentrations may also affect adult health. Young livestock are also susceptible to health problems from nitrate-nitrogen levels above 20-40 milligrams per liter in the water supply, especially in

combination with high levels (greater than 1,000 ppm) of nitrate-nitrogen from feed sources.

High phosphorus levels in water do not pose a health hazard to humans or livestock. Concentrations as low as 0.05 milligrams / liter in streams or lakes, however, can cause excessive plant growth, which leads to low oxygen concentrations when the plants die and decompose, ultimately harming fish and other aquatic life.

OTHER MANAGEMENT CONSIDERATIONS

Utah Code and EPA's new regulations concerning animal feeding operations (AFO's) state that no contaminated water is allowed to discharge from an AFO into surface water that leaves the farm. All AFO's with potential discharge should develop a CNMP and eliminate all discharged or may be required to obtain a discharge permit. See Contacts and References section for more information about this strategy.

TAKE ACTION!

Test soil yearly to assure nitrates and phosphorus are not building up in the soil.

Calibrate application equipment annually.

Irrigation water should be carefully managed whenever manure is applied to fields. Low irrigation efficiencies can cause surface and ground water pollution problems due to excess runoff and/or deep percolation. Good irrigation water management practices will reduce potential pollution.

Some facilities may require a groundwater permit for their livestock manure storage. Facilities with a capacity of less than 4 million gallons which receive manure from 1000 animal units or less (one animal unit is the equivalent of one, 1000-lb. slaughter steer), or are beyond 100 feet from a well or 250 day ground water travel time, do not need to apply for a ground water discharge permit from the Utah Division of Water Quality. However, good management to protect groundwater is always a good idea. For more information on ground water permits, contact the Utah Division of Water Quality at (801) 536-4300. For information on designing and constructing effective manure storage facilities contact the NRCS office nearest you.

CONTACTS AND REFERENCES

WASTE STORAGE & DESIGN

Utah Natural Resource Conservation Service:
(801) 524-4550 or http://www.ut.nrcs.usda.gov/.

Contact your Utah State University county Extension agent through your local phone book or (435) 797-2200 online at http://extension.usu.edu/htm/counties.

Agricultural Environmental Management Systems:
http://aems.aste.usu.edu.

PERMITS

Utah Division of Water Quality: (801) 536-4300 or
http://www.waterquality.utah.gov/permits/

SOIL TESTING

Utah State University Analytical Laboratories:
http://www.usual.usu.edu/

UTAH'S AFO/CAFO STRATEGY

Department of Agriculture and Food
http://ag.utah.gov/mktcons/cafo.html.

MORE READING:

Agricultural Waste Management Field Handbook, USDA Natural Resources Conservation Service
http://www.sc.nrcs.usda.gov/technical/preface.pdf

Animal Manure Waste Management, RCA Issue Brief #7
http://www.nrcs.usda.gov/wps/portal/nrcs/detail/national/technical/nra/nri/?&cid=nrcs143_014211

Calibrating and Operating Manure Spreaders (AG/WM/2003-01).
Utah State University Extension Publications:
(435) 797-2251 or
http://extension.usu.edu/cooperative/publications/.

Livestock Waste Management
Animal Science Department, University of California:
(530) 752-1250 or
http://animalscience.ucdavis.edu/extension/WasteMgt/

Manure Best Management Practices: A Practical Guide for Dairies in Colorado, Utah and New Mexico.(AGWM-04)
Utah State University Extension Publications:
(435) 797-2251 or http://www.extension.usu.edu/cooperative/publications. (Search by call number)

Midwest Plan Service Publications (livestock, manure management and soil, water and air management)
Midwest Plan Service: (800)562-3618 or
http://www.mwps.org/

NRCS Nutrient Management Online Readings
http://www.nrcs.usda.gov/technical/ (under nutrient and pest management).

A Utah Strategy to Address Water Pollution from Animal Feeding Operations
http://www.waterquality.utah.gov/documents/AFO_CAFO_strat_2001.pdf

OTHER QUESTIONS?

Contact USU Extension's Water Quality Program:
(435) 797-2580.
or on the web at http://extension.usu.edu/waterquality/.

PROJECT COORDINATED BY:
Nancy Mesner, Utah State University. Written by Leonard Massie, Department of Agricultural Engineering, University of Wisconsin-Madison, and University of Wisconsin Extension, Cooperative Extension. Adapted for use in Utah by an interagency team from materials prepared by Montana State University Extension Service, Kansas State University and Purdue University Extension Service. 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, and Natural Resources Conservation Service.

UTAH FARM •A•SYST ADVISORY COMMITTEE AND REVIEW TEAM:
Howard Deer, John Harrison, Robert W. Hill, Rich Koenig, Nancy Mesner,- Utah State University Extension; Kerry Goodrich - Natural Resources Conservation Service; Mark T. Novak - Division of Water Quality, Utah Department of Environmental Quality; Bob Lowe - Division of Drinking Water, Utah Department of Environmental Quality; Mark Quilter - Utah Department of Agriculture and Food; Mark M. Petersen - Utah Farm Bureau; Utah Association of Conservation Districts.

WE ACKNOWLEDGE THE CONTRIBUTIONS MADE BY THE FOLLOWING INDIVIDUALS:
Mike Allred, Thomas E. Bingham, Kitt Farrell-Poe, Roy Gunnell, Krista Kuester, Dean Maxwell, Stephen E. Poe, W.D. Robinson, Jay Roundy, Adam Siggler and Kyle Peterson Koyle.

Funding provided by USDA CSREES Water Quality Initiative Grant 99-EWQI-1-0542.

MARCH 2005, PEER REVIEWED

GLOSSARY

These definitions may help clarify some terms used in this Fact Sheet and may also help you make more accurate assessments when completing the Utah Farmstead Assessment for Ground Water and Surface Water Protection Survey 7 (Landowner's Survey: What's the risk to your water from stored manure?)

AGRONOMIC RATE: A quantity of animal waste or process wastewater, that when applied to fields helps crop production while meeting state nitrate and phosphorus standards.

BEDROCK: Unbroken, solid rock overlaid by soil.

BERM: A large horizontal area built or naturally formed, generally parallel to water.

EARTHEN MATERIALS: Made up of natural, from the earth substances.

LEACHING: To dissolve out a soluble material by overload of water.

LINER HYDRAULIC CONDUCTIVITY: The degree (rate) at which water moves through or reacts to a liner of a storage facility.

MICROORGANISMS: A living things too small to see with the naked eye.

MILLIGRAMS PER LITER (mg/l): The weight of a substance measured in milligrams contained in 1 liter. It is equivalent to 1 part per million in water measure.

PARTS PER MILLION (ppm): A measurement of concentration of one unit of material dispersed in one million units of another.

PERCOLATION: To cause a liquid to pass through a porous body. To filter.

PERMEABLE: A material, such as soil, that allows liquids, gases or chemicals to pass or flow through.

SECONDARY CONTAINMENT: Impermeable floor and curbs around a manure storage area that prevents leaks or spills from seeping into the ground.

SEEPAGE: Materials that pass, flow or ooze through a porous substance.

SEMI-IMPERVIOUS: A material such as soil which allows passage of some but not all liquids or chemicals.

SLURRY: A liquid containing a high concentration of a suspended solid.

This publication is issued in furtherance of Cooperative Extension work. Acts of May 8 and June 30, 1914, in cooperation with the U.S. Department of Agriculture, Jack M. Payne, Vice President and Director, Cooperative Extension Service, Utah State University.