ID-200

Environmental Compliance for Dairy Operations

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Some farmers are reluctant to talk about the environment, but because farms are under increasing review by state and federal regulatory agencies, producers need to be familiar with environmental issues and regulations. Implementing best management practices (BMPs) can help farmers continue to protect the environment and increase productivity.

Common pollutants from farms include sediment, pathogens, and nutrients coming from muddy conditions and excess manure. An Agriculture Water Quality Plan (AWQP) can resolve many of these pollution issues. This plan is required by law in Kentucky if a landowner owns 10 or more acres that are being used for agriculture or silviculture operations. These plans are designed to help producers identify potential sources of pollution on their operation and implement BMPs that protect natural resources and improve efficiency.

This publication provides dairy producers with the tools they need to accurately assess environmental challenges on their farm and provides strategies to obtain compliance and preserve environmental quality for future generations.

Confinement Facilities

Challenges

There are three general types of confinement facilities: totally enclosed, partially enclosed, and open. Each of these facilities is subject to different stormwater runoff issues. In totally enclosed facilities, animals are managed completely under a roof. Totally enclosed facilities generally do not produce polluted runoff if designed correctly. Pollution could originate from these facilities if the manure generated from these areas is not collected and managed properly or if stormwater is allowed to come in contact with the manure or other waste.

Photo: Amanda Sterrett, Animal and Food Science Department.

The second type of confinement facility is partially enclosed facilities that include a roofed building that covers part of the holding area, but animals also have access to uncovered areas. The third type are open confinement facilities with unroofed areas, where animals are held, fed, and handled. Partially enclosed and open facilities can be significant sources of polluted runoff if stormwater runoff is not properly managed. Other areas on dairies that can produce stormwater pollution include loafing areas, parlor-holding areas, silage storage areas, manure storage and handling areas, dry lots, feeding areas, and any unvegetated areas.

Best Management Practices

Open concrete lots, roofs, and other impervious areas generate significant volumes of water that must be properly managed. For example, a roof measuring 75 by 150 feet produces approximately 160,000 gallons of clean water runoff per year. To prevent the contamination of clean water and reduce the amount of water that must be managed, consider installing gutters, downspouts, and diversion ditches that collect clean water and direct it away from the confinement facilities. Diverting stormwater can significantly decrease the amount of water flowing into the confinement area. This reduces the amount of contaminated runoff that can flow offsite and into surface waters. Diversion can also decrease the amount of water flowing into liquid manure containment facilities, which allows the producer to gain storage capacity. For more information about diverting stormwater, see University of Kentucky Cooperative Extension publication "Stormwater BMPs for Confined Livestock Facilities" (AEN-103).

Totally enclosing production is another way to control pollutants coming from confinement facilities, because it prevents clean rainwater from coming into contact with manure and other pollutants. Total enclosure may be expensive initially, but collecting and storing contaminated water from unenclosed facilities takes a significant amount of land and space that could otherwise be used for additional production.

Runoff from dry lots and other confinement areas can cause erosion and generate pollution that can move offsite into surface waters. Place any high traffic or congregation areas on summit positions. Avoid placing structures not in floodplains or on slopes greater than six percent. In addition, planting filter strips using warm and cool season vegetation around these areas can prevent soil erosion (Figure 1). Install these filter strips along the down slope to filter water from

containment areas. Filter strips should be excluded from livestock most of the time, but should be periodically harvested or grazed to keep the vegetation actively growing. Actively growing vegetation takes up more nutrients compared to mature vegetation. For more information about filter strips, see the University of Kentucky Cooperative Extension publication "Enhanced Vegetative Strips for Livestock Facilities" (ID-189).

In open or partially open facilities, heavily used areas should be protected from animal traffic to prevent mud creation and erosion. Given the large amount of pressure exerted by cattle hooves, use the hardest possible surface that does not create discomfort for the animals. Install concrete around any areas where animals congregate, such as feeding areas, waterers, and bunkers, to limit the creation of mud and facilitate manure removal. Heavy use area pads constructed with the proper strength of geotextile fabric provide erosion protection and prevent mud creation. Place heavy use area protection pads in areas such as lanes and approaches, gated openings, and near shade structures. These hardened surfaces prevent erosion but also create more impervious surface, which generates more runoff, making stormwater-management measures necessary. In some areas, instead of impervious surfaces that create more runoff, consider using a deep bed of wood chips around feeding areas to absorb water, increase infiltration, and reduce the creation of mud and tags. This material can then be used the following spring to amend sacrifice areas after wintering or can be land applied as part of a nutrient management plan (NMP) to generate additional yields on pastures or cropped areas. For more information about hardened surfaces, see the University of Kentucky Cooperative Extension publication "Appropriate All Weather Surfaces for Livestock Operations" (AEN-115).

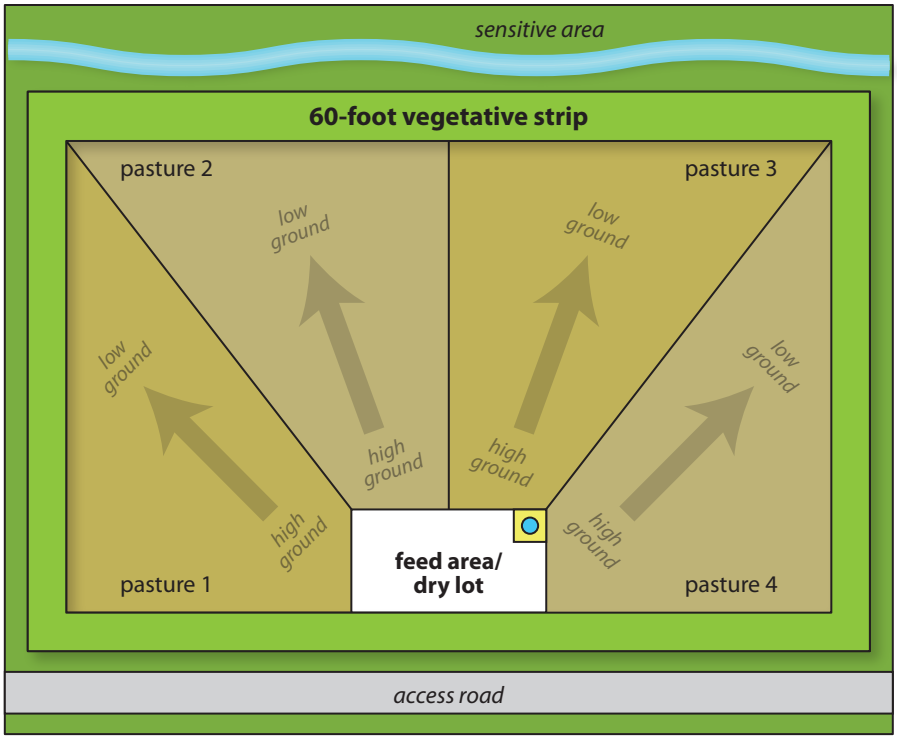

Figure 1. A pasture divided for rotational grazing includes a dry lot feeding area, an alternative water source, and a vegetative filter strip to protect sensitive areas around the adjacent stream.

Manure

Challenges

Applying manure is an environmental concern because manure contains nutrients and pathogens that can pollute natural resources. Pollution can occur if manure is spread at the wrong time of the year (when the soil is saturated or frozen) or spread on soil with high soil-test phosphorus (STP) levels. Applying during these times and using other improper land application practices can waste nutrients and pollute nearby waterways with contaminated runoff.

Manure storage facilities can also pollute the environment. Lagoons and storage ponds have the potential to pollute if the sides and bottom are not sealed correctly, allowing manure to leak out and flow to surface water bodies. In addition, liquid-manure storage facilities often do not have an adequate freeboard. Freeboard is the safety-net space in addition to the space needed to accommodate the amount of manure produced on the farm. A lack of freeboard can result in overflows during storms, which pollutes the waters of the Commonwealth. Manure also becomes a pollutant when it is spilled on roadways during transportation.

Best Management Practices

The most overlooked livestock BMP is a nutrient management plan, which is a document that helps producers carefully monitor and record all aspects of soil fertility and make the necessary adjustments so that crop needs are met while the loss of nutrients to surface water and groundwater is minimized. Federal and state agencies are now providing cost-share opportunities for producers to develop a comprehensive nutrient management plan (CNMP), which is a more elaborate version of an NMP. Regardless of which plan is required or implemented, every producer needs to understand nutrient management concepts to properly manage the manure and nutrients produced on their operation. Basic nutrient management requires producers to apply manure to a crop based on a realistic yield goal for that crop. This means that the producer first determines the nutrient concentration of the manure, calculates an application rate for the crop, and finally calibrates the manure-application equipment to apply at the appropriate rate. For more information about nutrient management, see University of Kentucky Cooperative Extension publications "Nutrient Management Concepts for Livestock Producers" (AEN 113) and "Nutrient Management Planning Guidelines" (ID 211).

Manure disposal can be handled multiple ways. Land application should

only be considered when a crop yield can remove the nutrients or if soil requires additional fertility to produce higher yields. Applying manure only when there is agronomic need ensures that soils are not overflowing with nutrients they cannot use. This manner of application prevents nutrient leaching and runoff, which causes groundwater and surface-water contamination.

Timing of manure application also is important. Land applying when vegetation will actively use the nutrients is the best pollution-control method. Newly growing vegetation actively utilizes nutrients and so it minimizes losses due to volatilization, leaching, and runoff. However, only land applying during the active growing season necessitates storing manure during winter months, which requires storage structures able to hold manure (liquid or solid) for at least 180 days. Given the large unexpected amount of precipitation that occurs every few years, producers should have liquid storages with a storage capacity of approximately 240 days.

Manure storage often is more appropriate than daily application because spreading manure on land that underutilizes nutrients can result in polluted runoff. Enclosing manure stacking facilities does prevent runoff, but seepage of nutrients and pathogens can remain an issue. By installing vegetative buffers along streams and waterways runoff and seepage can be controlled. These buffers help catch pollutants and prevent them from entering surface water and groundwater.

Lagoons and liquid storages need to be managed to minimize the amount of clean water that can enter the system. Clean water reduces storage capacity, and—if not accounted for—this extra water can cause an overflow. Diverting clean water from roofs and headwaters away from storage structures and inspecting gutters and downspouts to make sure they are in good working order can help preserve storage capacity. Regulators require a manure storage facility to have a capacity that can handle the manure and runoff from the production facilities, normal rainfall events, a 24-hour 25-year storm event (which is about 5.25 inches of rain in Kentucky), and at least one foot of freeboard. Maintaining adequate freeboard is considered a high priority of the U.S. Environmental Protection Agency (EPA), and state regulators require record-keeping of the freeboard as part of a Kentucky No Discharge Operational Permit (KNDOP). Dairy producers who use a liquid waste handling system are required to have a KNDOP.

Figure 2. Cattle with full access to this stream have denuded vegetation, damaged stream banks, and polluted water resources.

Producers can haul away excess manure as an alternative to land application on their farm. Hauling manure is costly if the material is in liquid form. Solids can be much more cost-effective to transport. Either way, carefully transporting manure away from the production area controls environmental problems, since excess nutrients and pathogens are removed from the farm. Manure handling needs to be accomplished with as little spillage and contamination of air, soil, and water resources as possible.

Pastureland

Challenges

Environmental problems may arise on pastureland near gates, at stream access points, in shaded areas, or where supplemental feed is provided. These problems become worse where little or no vegetation exists. Traffic in these areas causes soil compaction, lack of vegetation, and manure buildup, which leads to high pollutant concentrations and an increased likelihood of runoff. Fields are often used as pastures because they are not well suited for crops. Pastures are often marginal, sloping, land with little vegetation near streams. Cattle are naturally attracted to streamside areas, because they typically provide shade and abundant water for drinking and loafing. The sloping land and close proximity to drainage ways, combined with a mobile pollutant source (cattle), increases the chances of water pollution. Although streamside areas may represent a small portion of a pasture, cattle can do a lot of damage to stream banks and negatively impact water quality when they have full access to streams (Figure 2).

Poor pasture management can also threaten water quality. Pastures used for exercise on dairies are usually heavily grazed, forages are not removed for hay, and manure is left in the pasture. This means that no nutrients are removed from the pasture, and nutrient buildup in the soil can occur rapidly. Soils can only absorb a finite amount of nutrients before the soil particles become saturated, allowing the nutrients to move further through the soil profile. These nutrients can be picked up in water-bearing zones, contaminating groundwater.

Trees in pastures can lead to environmental problems. The congregation of livestock under trees can lead to soil compaction, vegetation removal, and runoff of manure, nutrients, and pathogens into adjacent areas. In many cases, trees are located in vulnerable riparian areas or gullies, which magnify the potential for water pollution.

Best Management Practices

Pastureland problems can be solved by using best management practices that eliminate manure accumulation, overgrazing, and overstocking. Periodically moving feeding areas and rotating exercise lots encourages vegetation growth and disperses the manure across a larger area, preventing a concentrated buildup of manure in any one place. Restricting cattle access to surface water bodies prevents feces and urine from being deposited directly into the water. Shade, minerals, insecticide applicators, and supplemental feed can be strategically placed to lure cattle away from sensitive areas such as streams, sinkholes, and wells.

Instead of relying on trees in a pasture, consider providing supplemental portable shade structures to lure cattle away from environmentally sensitive areas. For more information about providing shade for livestock while protecting water quality, see University of Kentucky Co-

operative Extension publication "Shade Options for Grazing Cattle" (AEN-99).

Areas adjacent to streams should be excluded from livestock. These areas can be taken out of production and enrolled in programs that compensate the livestock producer for the lost production area and provide funds for alternative water sources. Producers can consider flash grazing these riparian areas if the practice is managed properly and if cost share program conditions allow. For more information about restricting cattle from riparian areas, see University Cooperative Extension publication "Riparian Buffers: A Livestock Best Management Practice for Protecting Water Quality" (ID-175).

Excluding livestock access to streams does not mean losing access to adjacent pastures. Hardened stream crossings that allow cattle to move across the stream can be installed, allowing access to additional acreage while also protecting water quality. For more information about installing a stream crossing, see University of Kentucky Cooperative Extension publication "Stream Crossings for Cattle" (AEN-101).

Farm ponds are often a necessity, but allowing cattle to loaf in ponds pollutes water resources and can lead to significant disease problems for the herd. Ideally, farm ponds should be fenced off from livestock, but that does not mean the water cannot be utilized. A gravity-fed watering system or pumping system can be installed using pond or lake water. These systems can potentially increase herd production by providing a clean drinking-water source. City water also may be installed, which can aid in the establishment of a rotational grazing system. For more information on rotational grazing, see University of Kentucky Cooperative Extension publication "Rotational Grazing" (ID-143).

Silage Leachate

Challenges

Silage sometimes produces a leachate (also called silage liquor) during storage, depending on the moisture content when it was harvested. A good rule of thumb is that silage with over 70 percent moisture in horizontal silos and 60 percent moisture in tower silos can cause silage leachate problems. Even if an effort is made to put up silage under this moisture level, it can be nearly impossible to ensile all of the silage at its ideal moisture content. Silage liquor contains high levels of nutrients and has extremely high pH and biochemical oxygen demand (BOD). These factors make it one of the most concentrated agricultural pollutants—depleting oxygen in streams and killing fish and other aquatic organisms if released into surface waters.

Table 1. On-farm method for determining moisture content of silage.

Result of twisting a handful of silage	Silage dry matter	Silage percent moisture
Liquid comes out easily	18%	82%
Liquid comes out with difficulty	18-22%	78-82%
No liquid, but your hands are moist	22-27%	73-78%
No liquid and your hands are dry	>30%	<70%

Another issue associated with silage is the temporary bags that are used for storage. This material can easily blow away and be deposited in streams, which is considered pollution. Other problems associated with silage include locating silage piles close to a water source, constructing silage pits so that groundwater or surface water can enter and drain through the silage, and poorly covering and sealing silage stacks.

Best Management Practices

Silage liquor is mainly a problem in high-moisture silage, so wilting grass and alfalfa in the field and harvesting corn at a later stage can reduce moisture and increase the quality of the feed. Silage dry matter can be assessed by twisting a handful of silage (Table 1).

When it is not possible to ensile all silage at the ideal moisture level, other measures can be taken to prevent water pollution. Silage liquors can be controlled by building diversion channels, installing a low-flow system, or creating wastewater-treatment strips. A low-flow system carries liquor away from storage structures and filters it. The liquor is then seeped into a storage area, which allows it to be pumped into the farm's lagoon. Also, preventing rainwater from entering silage-collection systems prevents additional runoff, and collecting temporary silage bags and disposing of them properly prevents deposition in streams.

Milkhouse Wastewater

Challenges

Milkhouse wastewater is the combination of water used for cleaning cows and equipment mixed with excess milk. This wastewater may contain low concentrations of manure, food-grade cleansers, and other water contaminants. Milkhouse wastewater is a concern because it can flow directly into streams and surface waters, where it can deposit nutrients and pathogens that decrease water quality. Because of its high nutrient content, it can have a potent stench and it requires more oxygen to decompose than manure. This waste is generated daily and can cause year-round problems with surface water runoff and seepage if not managed correctly.

Older dairy operations or small operations with limited space may use systems that are not well suited for managing this type of waste, such as septic systems, dry wells, settling basins with an attached filter strip or wastewater treatment strip, leach fields, chimney drains, or oxidation ditches. Vegetative filter strips and wastewater treatment strips are not suitable for treatment of milkhouse wastewater in Kentucky. Abundant precipitation overwhelms these strips, especially when considering additional stormwater runoff from the production area and the lack of freezing conditions, which can slow flow in the winter. The constantly saturated conditions usually choke out existing vegetation. Choosing the right plants for filter strips is also important. Dairies need vegetation that can filter and actively grow year-round.

Best Management Practices

Installing a pipe that transports milk-house waste to a lagoon or storage pond minimizes the possibility of a point source discharge (which is not allowed if the operation has a KNDOP) and puts all the liquid waste in one system that can be land applied and easily managed.

Figure 3. These fallen dairy cows have been placed in a composting structure, which is a good practice for disposing of fallen livestock when the approved state guidelines are used. These animals will be covered with 3-4 feet of bedding material to complete the pile, which deters vermin.

Figure 4. These livestock compost piles have been properly covered. The windrow system allows for easy access and creation.

Animal Mortalities

Challenges

Dead-animal pickup is not available everywhere, so disposal of animal mortalities has become a challenge. The improper disposal of animals can lead to water-quality problems, especially when carcasses are disposed of in sinkholes or streams. Some producers choose to bury animals, but a fine could result if carcasses are not buried properly.

Best Management Practices

Burial, landfills, and composting are the preferred ways to dispose of animal mortalities. Composting is the most efficient and cost-effective way to dispose of animal mortalities (Figures 3 and 4). Choosing a location is the most important factor to minimize environmental risks. For more information about composting and other disposal methods, see the University of Kentucky Cooperative Extension publications "On-Farm Disposal of Animal Mortalities" (ID-167) and "On-Farm Composting of Animal Mortalities" (ID-166).

Nuisance Complaints

Challenges

The number of complaints filed against livestock operations concerning pollution to the environment, property damages as a result of this pollution, and infringement on individual rights, are on the rise. With this increase in the number of complaints, it is becoming more important for all livestock operations to maintain good public relations.

Best Management Practices

Developing and fully implementing an AWQP is the best course of action for producers. If an AWQP is implemented correctly, most complaints can be avoided entirely.

The largest source of dairy complaints from the public is odor, which is also the most uncontrollable nuisance. The odor produced by the anaerobic decomposition of manure is a much larger problem than that of the odor of fresh manure. Chemical odor control can be effective, but the best methods of controlling odor are those of good housekeeping. This includes providing adequate drainage and keeping channels clean, maintaining dry pens, and preventing overflow from watering systems. In some cases, keeping your facility out of public view and using shelterbelts will prevent odor complaints. Quick removal of animal carcasses and proper waste storage and disposal can help minimize odor.

In addition to odor nuisances, the surrounding community might also find noise, dust, flies, and allergen nuisances a problem. The roadside view is a crucial point that can be used to influence public opinion about a dairy operation. To positively influence the public, the dairy needs to be clean and presentable. Tasteful architecture, landscaping, hedging, mowing, and strategic tree planting can help achieve a clean appearance.

Summary

To prevent polluting the environment, producers need to identify potential sources of pollution on their operation and implement best management practices. The best time to gauge how well a dairy is controlling pollution is after a rainstorm, when drainages can be examined clearly and any pollution leaving the operation can be detected. Typically, BMPs can be used to remediate pollution problems, but they must be tailored to each individual operation. In many cases, multiple BMPs and adaptive management are needed to address a problem. In addition, cost share opportunities that can offset the expense of BMP implementation are available. Technical assistance from state and federal agencies also can be used to help design BMPs and infrastructure improvements. For more information, contact a local Natural Resource Conservation Service (NRCS), Conservation District, or Cooperative Extension office.

BMP Checklist and Suggested Guidance Documents

- ❑ Place shade structures in the feedlot to provide livestock with relief from the heat and to lure cattle away from streams and ponds. Small animals need approximately 7.5 to 13 square feet per animal, while large animals need approximately 19 to 27 square feet per animal.
  - "Shade Options for Grazing Cattle" (AEN-99)
- ❑ Install alternative water sources such as developed springs or gravity-fed watering systems, making sure that cattle do not have to travel more than 600 feet to obtain water.
  - "Alternative Water Source: Developing Springs for Livestock" (AEN-98)
  - "Drinking Water Quality Guidelines for Cattle" (ID-170)
- ❑ Exclude livestock from streams, ponds, sinkholes, and any other environmentally-sensitive areas.
  - "Riparian Buffers: A Livestock Best Management Practice for Protecting Water Quality" (ID-175)
  - "Sinkhole Management for Agricultural Producers" (AEN-109)
- ❑ Strategically place mineral and salt blocks away from riparian areas.
- ❑ Implement proper grazing use and rotational grazing practices to protect soil and preserve pasture quality.
  - "Pasture Feeding, Streamside Grazing, and the Kentucky Agriculture Water Quality Plan" (AEN-105)
  - "Planning Fencing Systems for Intensive Grazing Management" (ID-74)
- ❑ Install stream crossings to prevent erosion and stability problems.
  - "Stream Crossings for Cattle" (AEN-101)
- ❑ Install windbreaks and mounds to provide protection from the elements and reduce mud.
- ❑ Install heavy-use area pads around areas that receive a lot of traffic, such as waterers, feeders, shade structures, mineral blocks, and windbreaks.
  - "High Traffic Area Pads for Horses" (ID-164)
  - "Using Dry Lots to Conserve Pastures and Reduce Pollution Potential" (ID-171)
- ❑ Clean manure from congregation and feeding areas. Apply this manure to a crop field or place it in a covered stack pad for later application.
  - "Paved Feeding Areas and the Kentucky Agriculture Water Quality Plan" (AEN-107)
  - "Nutrient Management Concepts for Livestock Producers" (AEN 113)
  - "Nutrient Management Planning Guidelines" (ID 211).
- ❑ Manage mortalities by composting or some other legal means of disposal.
  - "On-Farm Composting of Animal Mortalities" (ID-166)
  - "On-Farm Disposal of Animal Mortalities" (ID-167)
- ❑ Control erosion by implementing proper grazing techniques and installing structures such as gully erosion structures where appropriate.
  - "Building a Grade Stabilization Structure to Control Erosion" (AEN-100)
- ❑ Relocate mineral blocks, feed wagons, and ring feeders to reduce the generation of mud and accumulation of manure.
- ❑ Provide facilities or structures to reduce the creation of mud, especially during the winter months.
  - "Strategic Winter Feeding of Cattle using a Rotational Grazing Structure" (ID-188)
  - "Woodland Winter Feeding of Cattle: Water Quality Best Management Practices" (ID-187)

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