Livestock producers frequently ask questions about pollution and pollution control methods for livestock wastes. No single agency or group can answer all questions that might be asked. However, there is now a joint effort of the Cooperative Extension Service, the State Department of Water Control, and the Soil Conservation Service to provide information and assistance to answer these questions for livestock producers in Kentucky.

There are many advantages to returning animal waste to the land to be utilized as fertilizer. But, because of limitations on the amount of manure that can be put on the land, and because nitrogen fertilizers are still available in large quantities at relatively reasonable prices, disposal techniques which are not always environmentally acceptable are used by some animal producers. In most cases, the waste generated by farm animals is a liability rather than an asset, and the farmer will attempt to dispose of it in the cheapest possible manner. The farmer is sometimes unknowingly in violation of laws and regulations when he uses certain methods of disposal. The Cooperative Extension Service is continually reviewing literature on waste management and published laws and regulations governing disposal of livestock waste in an attempt to provide sound recommendations and advice to livestock producers about this problem.

1. WHAT IS POLLUTION?

In general, pollution may be defined as "the addition of anything to water, air, or soil which would degrade its usefulness for its intended purpose or normal use." The degree of pollution varies, of course, with the type and amount of pollutants added to the water, air, or soil. In agriculture, we are concerned with both point source (discharge from lagoons, feedlots, etc.) and non point source water pollution (runoff from open agricultural land).

2. WHAT ARE THE COMMON POLLUTANTS FROM AGRICULTURAL ACTIVITIES?

Animal wastes, animal odors, agricultural chemicals, and soil sediment are the major sources of pollution. Other sources may be dead animals, trash, smoke, noise, crop residues, and chaff.

3. HOW DOES ANIMAL WASTE CAUSE WATER POLLUTION?

Animal waste which is allowed to enter streams, ponds, lakes, or ground water is a major concern because of four factors:

a. **Nutrients**: The fertilizing effect of such wastes can enrich surface waters to the point of promoting nuisance growths of aquatic plants and weeds. Nitrate nitrogen levels over 10 ppm (parts per million) can render a domestic water unsafe.

b. **Oxygen Depletion**: Microflora in water will use the plentiful supply of organic nutrients furnished by the manure and grow at such a fast rate that they will deplete the natural oxygen supply in the water. This can result in injury and death to fish and other aquatic life.

c. **Suspended Solids**: Particles which are so small that they will not settle cause discoloration and turbidity in a stream or lake which affect its use for recreational, agricultural, and other uses and may be injurious to the fish and aquatic life in a stream.

d. **Bacteriological Quality**: High levels of coliform and other bacteria present in manure can render surface waters unsuitable for swimming, boating, and other recreational and livestock uses. In addition, other domestic and ground water supplies can be affected.

4. CAN ANY ANIMAL WASTE MATERIAL ENTER SURFACE OR GROUND WATERS WITHOUT CAUSING SOME POLLUTION?

The answer is generally no. Some streams have the ability to utilize a limited amount of the nutrients in animal...
waste and, in fact, some nutrients are needed for the normal growth of aquatic plants on which many fish and aquatic organisms feed. However, with today’s livestock operations, the most practical and positive approach to water pollution control is to protect surface and ground waters from all animal wastes.

5. WHAT STATE AGENCY DETERMINES WHEN UNLAWFUL WATER POLLUTION IS TAKING PLACE?

The Division of Water Quality, under the Kentucky Department for Natural Resources and Environmental Protection, by state law has responsibility over the control of pollution of surface and ground waters of the state. It is empowered to issue orders to prevent unlawful waste discharges. The Division of Water Quality’s orders are enforceable in the courts, and animal producers can be prosecuted under the same regulations that apply to domestic wastes, (WP-6-2).

6. DOES THE STATE WATER CONTROL BOARD OFFER ANY SPECIFIC SERVICES TO FARMERS?

Not directly, although the Division’s technical staff is available for approval or disapproval of plans for livestock manure handling systems and explanation of specific requirements applicable to a particular operation.

7. WHAT IS THE MOST COMMON AIR POLLUTION PROBLEM FOR ANIMAL PRODUCERS?

Odors from confined growing facilities and from fields where manure is spread.

8. WHAT ASSISTANCE CAN A LIVESTOCK FARMER SECURE FROM THE UNIVERSITY OF KENTUCKY PERTAINING TO LIVESTOCK WASTES?

The University of Kentucky offers two major types of service to livestock producers.

a. Through the Cooperative Extension Service, information on the planning of facilities for livestock is available chiefly through workshops, schools, and Extension publications. Additionally, specialists in the areas of Agricultural Engineering, Agronomy, Agricultural Economics, Dairy Science, Animal Science, and other pertinent areas are available for limited consultation through the local Cooperative Extension Agent for Agriculture.

b. New information is being developed in the area of agricultural waste management through the Kentucky Agricultural Experiment Station.

9. HAVE AGENCIES OF THE STATE ESTABLISHED REGULATIONS FOR CONTROL OF WASTE FOR DIFFERENT TYPES AND SIZES OF LIVESTOCK OPERATIONS?

No, agriculture has not been singled out for specific state regulations. However, the Federal Water Pollution Control Act Amendments (Public Law 92-500) requires permits to be issued to all livestock operations with 1,000 or more animal units. One thousand animal units is defined in the table below.

<table>
<thead>
<tr>
<th>TYPE OF LIVESTOCK</th>
<th>Number Required to be Considered</th>
</tr>
</thead>
<tbody>
<tr>
<td>Beef Cattle</td>
<td>1,000</td>
</tr>
<tr>
<td>Dairy Cattle (mature)</td>
<td>700</td>
</tr>
<tr>
<td>Swine (over 55 lbs.)</td>
<td>2,500</td>
</tr>
<tr>
<td>Sheep</td>
<td>10,000</td>
</tr>
<tr>
<td>Turkeys</td>
<td>55,000</td>
</tr>
<tr>
<td>Laying Hens</td>
<td>100,000</td>
</tr>
<tr>
<td>Broilers</td>
<td>100,000</td>
</tr>
</tbody>
</table>

At the present time there are only a very limited number of operations in Kentucky of the above size or larger. However, the number will grow as farm size continues to increase. In addition, as the guidelines established by Public Law 208 are examined and implemented by the state, the size of farm for which a permit is required will undoubtedly decrease.

10. DOES THE STATE EXTENSION SERVICE HAVE ANY REGULATORY POWERS CONCERNING AGRICULTURAL POLLUTION?

Absolutely not! If a farmer feels he does not have an adequate waste management system he should contact his county agent and advise him of the problem. The county agent can advise him of a meeting or workshop where he can obtain information on animal waste management methods or provide him with helpful literature. The sole objective of the Extension Service is to examine and advise the farmer of possible solutions to his waste management problem so that he can do his part in the protection of our environment and to help improve his farming operation.
11. ARE THERE CONDITIONS WHICH GREATLY INCREASE THE POTENTIAL OF POLLUTION BY LIVESTOCK WASTES?

Yes, there are several:

a. High concentrations of livestock or poultry,
b. Improper spreading of wastes on land,
c. A livestock facility which does not have sufficient land disposal areas,
d. A livestock facility with residences close by, and
e. A livestock facility located close to an open waterway or with a steep slope to an open waterway.

12. WHAT IS THE BEST WAY TO DISPOSE OF ANIMAL WASTE?

Presently, where possible, livestock wastes should be placed on the land so that the nutrients can be utilized by crops. These wastes are rich in organic substances and plant nutrients, making land and crops the best choice for disposal and utilization of the wastes. Present research seems to indicate that most soil types can receive about 30 tons (wet) of livestock wastes per acre per year without danger of depressing crop production or causing ground water pollution. This will vary, depending upon soil conditions and topography. Manure should be spread at times and at locations where it is not likely to wash into streams. Table 2 shows the approximate land requirements for waste disposal based on 30 tons per acre.

<table>
<thead>
<tr>
<th>Type of Animal</th>
<th>Waste Produced (tons/year)</th>
<th>Acres Needed for Disposal (30 ton/acre)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dairy Cow (1200 lbs.)</td>
<td>15</td>
<td>1/2</td>
</tr>
<tr>
<td>Beef Cattle (Steer, 500-1,100 lbs.)</td>
<td>8</td>
<td>1/3</td>
</tr>
<tr>
<td>Swine (50-215 lbs.)</td>
<td>1/2</td>
<td>1/60</td>
</tr>
<tr>
<td>Poultry (1000 hens)</td>
<td>45</td>
<td>1 1/2</td>
</tr>
</tbody>
</table>


13. WHAT SHOULD A LIVESTOCK PRODUCER DO TO AVOID POLLUTION PROBLEMS IF HE CONTINUES HIS OPERATION AT ITS PRESENT LEVEL FOR THE NEXT FEW YEARS?

As long as there is currently no direct runoff of wastes to a stream or lake, which might contaminate water supplies, good housekeeping and judgment in spreading livestock wastes will contribute most to the prevention of pollution. Buffer strips of grass or trees between a road, drainage way, or residences and the animal growing facilities improve appearances and may provide some assimilative capacity for pollutant uptake. If at all possible, avoid spreading manure on hot, humid, or windy days, or when there is danger that it might wash into open waterways. Remember, livestock manures contain valuable plant nutrients and you will want to utilize them in the most advantageous way.

14. WHAT SHOULD AN OPERATOR DO TO AVOID POLLUTION PROBLEMS IF A MAJOR EXPANSION OR A NEW FACILITY IS PLANNED?

Site selection and adequate land area for waste disposal are the most important considerations. Pre-planning before construction of facilities actually can save the operator many headaches. Remember, at present most legal action comes about because of "nuisance" complaints which result in a civil lawsuit. A nuisance may involve air, water, solid waste, and/or noise pollution, and anything the operator can do to avoid these will obviously be to his benefit.

15. IN THE FUTURE WILL EVERY FARM BE INSPECTED FOR POLLUTION PRACTICES?

Probably not, at least in the near future. Inspections by personnel of the state regulatory agencies are generally made on the basis of complaints, and this policy will probably continue for some time because of the difficulty involved in inspection with regards to equipment and manpower. As tighter restrictions are imposed, however, it may be anticipated that a large number of livestock facilities will be routinely inspected in the future. Environmental protection is a good policy for everyone and animal manure can provide valuable crop nutrients. Dispose of wastes wisely and obtain both of the benefits.

16. ARE THERE ACCEPTABLE SYSTEMS NOW AVAILABLE FOR UTILIZING OR DISPOSING OF ANIMAL WASTE?

Several systems, if properly planned and installed, can be used for animal waste utilization or disposal for medium or large livestock operations. These systems may involve more land area, a change in management practices, and more facilities, or perhaps, in some cases, the adaptation of practices to avoid pollution. Methods for complete disposal are limited because of the volume of wastes that must be handled and the costs of facilities required to treat them in
this way. Even partial stabilization of wastes prior to land disposal can increase the cost of handling wastes substantially. Again, in all cases, system design and/or management are critical.

Some commonly used methods are:

a. Surface application—applied to the land in one of the following ways:
   1) Broadcast with plow down or disking,
   2) Broadcast without plow down (normally utilizing a flail type spreader or liquid manure spreader)
   3) Kniving (soil injection below the soil surface), or
   4) Irrigation.

Advantages: In the case of solid manure, immediate surface spreading or injection will help minimize nitrogen loss to the air and allow soil microorganisms to start decomposing the waste, thus making the nutrients more available to plants. For liquid systems, the practice of injecting, chiseling, or kniving the manure beneath the soil surface likewise reduces nitrogen loss to the air and to runoff as well as minimizing odor problems.

Disadvantages: These systems require good management and an economic and labor investment. Also, because environmental conditions, such as rain or freezing weather, often prevent spreading, additional storage facilities are sometimes required.

b. Anaerobic lagoon—This is the most common and practical type of lagoon for livestock manure disposal. A lagoon is a large body of impounded water in which waste is placed and allowed to degrade by bacterial digestion. The most common type in agricultural operations is the anaerobic lagoon, which derives its name from the type of microorganism that is present in the lagoon. Anaerobic bacteria, which degrade the manure, do not require dissolved oxygen and can live in water of any depth. These bacteria digest organic matter by first liquifying it and then converting it to carbon dioxide, methane and other gases.

Advantages:
1) Initial investment is lower than for a liquid manure system with field spreading.
2) Labor requirement is low, and
3) Fly problem is eliminated or significantly reduced.

Disadvantages:
1) Disagreeable odor is produced.
2) Because decomposition is incomplete, sludge removal is required.
3) Mosquito habitat is provided.
4) Groundwater pollution is more likely than with surface application.
5) If a sprinkler system is used to spread the effluent, the fertilizer value may be lower than with direct surface application, and
6) Discharge water from lagoons will not meet state effluent discharge standards for release into a lake or stream, so land disposal of excess water must be provided.

c. Aerobic lagoon—The aerobic lagoon is very similar in principle to the anaerobic lagoon; both systems degrade animal manure by bacterial action, however, the aerobic bacteria needs oxygen in order to function. This oxygen must be provided by the algae which grows near the surface of the lagoon and transfers oxygen from the air above the lagoon. Oxygen can be supplied by some type of mechanical aerator.

Advantages:
1) The treated manure (effluent) can normally be discharged into streams, and
2) No offensive odor is produced.

Disadvantages:
1) The lagoons require very large surface areas or mechanical aerators in order to provide the oxygen required by the bacteria.
2) Periodic sludge removal is required.
3) Mosquito habitat is provided, and
4) Livestock lagoons are frequently unsuccessful in performing the desired decomposition of manure because of improper management, such as excessive quantities of manure being placed in them.

d. Oxidation ditches—These have been utilized mostly in very cold climates. The oxidation ditch is similar to an aerobic lagoon. A narrow circular pit is built around the facility and the manure is pumped around the ditches to maintain aerobic conditions.
Advantages:
1) Little or no odors, and
2) Effective in cold climates.

Disadvantages:
The cost of this type of operation is generally prohibitively high.

e. Stacking—Manure is placed in some type of impoundment area and the liquid is allowed to drain away, allowing the manure to be handled with common solid handling equipment.

Advantages:
Generally the impoundment area can be built without great expense, and because the manure is stacked, the surface area of the compound is less than with liquid or other solid systems.

Disadvantages:
Much of the nutrient content is lost by allowing the liquids to drain away, and these may also cause pollution problems. In addition, storage can become a problem during inclement weather.

f. Dehydration—The water content of the manure is reduced from 85% to 15% during this operation. The main application of this process has been to dry poultry manure for commercial sale as a garden fertilizer.

Advantages:
1) Allows the material to be handled in a very dry condition.

Disadvantages:
1) Relatively high nutrient losses, and
2) High energy requirements for drying.

g. Composting—This process starts with the mixing of the manure with a bulky solid such as straw and placing it in a stack. This must be done in such a way that air is free to move into the stack to provide oxygen. Turning or mixing the stack is often required. In the stack, a self-heating stabilization process performed by aerobic bacteria lowers the moisture content of the manure to around 50% and produces a coarse-textured material. At the present time, control of temperature and moisture of the material is generally too critical for satisfactory farm use under Kentucky weather conditions.

Advantages:
The final product has a low moisture content and may be marketed as fertilizer or used effectively for field spreading.

Disadvantages:
1) High labor requirements,
2) Some odor problems,
3) High energy requirement, and
4) It is sometimes difficult to find a market for the composted material.

h. Refeeding—Manure contains usable feed nutrients which can be fed back to livestock. This technique shows great promise for the future.

Advantages:
Allows the livestock producer a possible economic return from the manure by supplementing his feed, and at the same time, provides a means of disposal.

Disadvantages:
1) Suitable collection facilities must be developed, and
2) There has been a lack of acceptance because of aesthetic and health considerations.

17. ARE THERE OTHER REGULATIONS—LOCAL, STATE, OR FEDERAL—FORTHCOMING THAT APPLY TO LIVESTOCK WASTE DISPOSAL?

Undoubtedly there will be. The best source for this type of information is through your Cooperative Extension Service.

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