

Opinion Article

Livestock Waste and Water Quality

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In mid-July 1995, 1.5 million gallons of hog manure leaked from an earthen storage basin on SNB Farms, a family-owned and operated 700-sow hog farm in Hamilton County that is considered a well-run operation. The manure flowed 1.5 miles through a drainage tile line to the South Fork of the Iowa River. Soon smallmouth bass, northern pike, walleye, and a variety of other fish were belly up in a treasured stretch of the river. An estimated 8,800 fish and an unknown number of amphibians and aquatic invertebrates were killed.

The SNB incident was a wake-up call for many Iowans, an especially vivid reminder that the practices used to manage livestock waste in our state can dramatically affect the quality of our water.

This spill and other mishaps from hog confinement operations have fueled controversy about large-scale livestock farming. However, from a water quality perspective, large operations are just a part of the picture. There are thousands of small and medium-sized livestock operations employing a variety of waste management practices, with varying effects on water quality. Among the issues concerning how livestock waste is managed in Iowa, two facts are clear: Water quality is important to the state, and livestock operations are as well. In 1992, cash receipts from the sale of livestock and livestock products exceeded \$5.6 billion in Iowa. "If you look at the major livestock species, Iowa is in the top 10 nationally for all," says Lyle Asell, Assistant State Conservationist for the U.S.D.A. Natural Resources Conservation Service, in Des Moines. "Livestock operations are tremendously important to the state from an economic standpoint - and they have tremendous capability for environmental damage as well."

Water quality can be affected by a variety of common manure management practices. Many operators keep their animals in open feedlots. Without protective measures, when it rains manure runs off into surrounding ditches, streams, and rivers. Manure may also infiltrate soils to reach the groundwater. In other operations, manure is kept in earthen or cement-lined storage structures or lagoons. Leakage or spills from these structures can also move into surface waters, soils, and groundwater.

In addition, when manure storage facilities are emptied and too much manure is applied to cropland, or it is applied incorrectly, excess nutrients from the waste may contaminate surface waters and groundwater. Water pollution can also occur even when manure is appropriately applied if a hard rain occurs shortly afterward.

Agricultural drainage wells, found mainly in north-central Iowa, provide a direct line for pollutants to enter the groundwater. These wells funnel water from tile lines and sometimes surface runoff directly to the underlying bedrock through a drilled shaft.

Health concerns

Nitrogen is a major concern with manure. Ammonia, a nitrogen compound present in the

waste, readily converts to nitrite and then nitrate. This process depletes vast amounts of oxygen and can be toxic to fish and other organisms in surface water. In drinking water, nitrate concentrations above 10 parts per million are a health threat to humans, particularly infants. Drinking water contaminated by nitrate can cause a potentially fatal disease called methemoglobinemia (blue baby syndrome) by disrupting the oxygen-transporting ability of the blood. Studies indicate that bacteria in addition to nitrate in water increases the risk of this disease. A recent South Dakota study indicates blue baby syndrome is more common than previously thought. Other studies are looking at human health effects such as non-Hodgkin's lymphoma and miscarriage, as well as effects on young animals.

Phosphorus, another contaminant from manure, adheres to soil particles that enter surface waters and stimulates the growth of bacteria, plants, and algae. As with nitrogen, this process of plant growth and decomposition uses large amounts of oxygen, which can result in the death of aquatic species. Phosphorus also increases the likelihood of blue-green algae, a bacteria which can be toxic to animals. Blue-green algae has also been linked to human health effects, including respiratory illness, gastric upsets, and skin rashes.

Microbial contaminants in drinking water can cause illness and even death, as evidenced by the 1993 cryptosporidium outbreak in Milwaukee. In that outbreak, caused by cattle manure, more than a hundred people died and 400,000 became ill. In addition, manure in surface waters can transmit microbial pathogens, including parasites and viruses, that are sources of waterborne disease in swimmers, anglers, and others who enjoy water recreation.

In a 1989 survey, 44.8 percent of private water supplies tested in Iowa contained coliform bacteria contamination (from human or animal waste), and 18 percent of these wells contained high concentrations of nitrate.

New requirements

In response to concerns about water quality issues and the growth of large-scale hog confinement operations, in 1995 the Iowa legislature passed House File 519. This legislation established new requirements for livestock feeding operations, including:

- Both small and large operators are prohibited from applying manure on cropland within 200 feet from certain areas, including water wells and functional ag drainage wells, unless the manure is injected or incorporated within 24 hours after application.
- Newly constructed livestock structures, such as earthen manure storage basins and confinement buildings, must be certain distances from towns, residences, ag drainage wells, and other areas. (Small operators are exempt from this requirement.)
- A manure management plan is required before a person can receive a confinement feeding operation construction permit from the Iowa Department of Natural Resources (DNR).
- For all new earthen basins and those constructed after 1992, producers must dig an inspection trench six feet deep from the original grade around the basin to find and deal with tile lines, like the one that caused the SNB Farms spill.
- Livestock operators who receive required permits were given nuisance suit protection. In response to concerns that this limited the rights of neighbors who might be harmed, in 1996 the Iowa legislature passed a bill limiting protection for operators who are chronic violators of state environmental laws.

Debate continues about whether more or stronger requirements are needed. The concentration of large operations in some areas has led to especially strong citizen concern about environmental impact. For example, more than 100 of the 600 largest facilities are located in Wright and Hamilton counties with permits for over 725,000 hogs.

Given the potential impact, we need to consider how H.F. 519 accounts for human error, equipment failure, and natural events. For example, should spray irrigation of manure be allowed on fields with ag drainage wells, which are particularly susceptible to groundwater contamination? Are the distance requirements for land application adequate? Should there be restrictions on the siting of earthen lagoons so that they are built only on soils that offer the greatest protection from leakage?

With H.F. 519's new requirements, an understaffed Iowa DNR suddenly has a lot more work to do. There have been the equivalent of 3 1/2 full-time staff working at the DNR on livestock waste issues, according to Ubbo Agena, Staff Engineer with the department. This year, the Iowa legislature budgeted five additional positions for the department to conduct complaint investigations, site surveys, and review of permit applications and manure management plans. Despite the new positions, Agena says, "Compared to some other states, if you look at funding levels relative to the number of operations, we're far below them."

Many are hopeful that the additional staff will improve the department's ability to monitor and respond to complaints. Others are less optimistic. "There's just not enough staff for monitoring and enforcement," says Barb Grabner, Assistant Director of PrairieFire Rural Action. "On the weekends, it's especially hard to get complaints addressed."

Proper management

"Most data indicate that if we do it right, we'll have very little leakage," says Stewart Melvin, who heads the Department of Agricultural and Biosystems Engineering at Iowa State University. "However, the facilities need to be managed properly. That's my biggest concern." Mike Blaser, General Counsel for Iowa Select Farms, would concur: "If you contain manure correctly and apply it right, it shouldn't have a greater impact on water quality than anything else used as fertilizer in Iowa."

H.F. 519 rules do allow 1/16 inch per day of seepage. Current research from monitoring wells at three newly constructed earthen manure storage structures shows elevated levels of chloride and total organic carbons at two of the three sites. Although these substances may not significantly impact water quality, they indicate movement of fluids. Clearly, expanded monitoring of both new and older structures is important.

Farmers historically have not factored in the nutrient value of manure when they apply it to their land. In fact, only 48 percent of Iowa farmers adjust fertilizer rates when they apply manure, according to an Iowa Rural Life poll. Ideally, application includes incorporating the manure into the soil to prevent runoff and maximize nutrient value. If it is simply broadcast, there is the potential that half of the manure's value will be lost, according to Randy Killorn, Professor and Extension Agronomist at Iowa State University.

"We've told farmers for too long that manure is waste. We need them to think about it as fertilizer," Lyle Asell says. "Proper nutrient management can save people money by reducing the need for commercial fertilizer, and it reduces the effect on the environment. We need an intensive campaign to get this across. H.F. 519 is a step in the right direction, because it looks

at the whole system on a farm in its requirement that operators develop a manure management plan," Asell says.

Iowa does need a strong enforcement program for livestock practices that foul our waters. However, education and technical assistance are equally important. If the H.F. 519 rules were followed and appropriate management practices adopted by small operators - who generate a much greater amount of uncontrolled manure than large-scale operations - the risks of water quality contamination would be much lower.

But most of the provisions of H.F. 519 generally apply to large producers, about 600 of Iowa's 25,000 pork producers. "From a waste management standpoint, the state is doing very little to assist small producers," says Jim Gulliford, Administrator of the Division of Soil Conservation in the Iowa Department of Agriculture and Land Stewardship. "The state has chosen to invest its resources in the regulation of large producers. Across Iowa, there are not 15 people, public or private, working with the thousands of small producers. Until we develop a manure utilization education program directed at small producers, we won't achieve the water quality protection the state needs."

Another issue is local involvement. "The role of citizens needs to change," according to Jan Libbey, a small-scale farmer from Kanawha and an Iowa Environmental Council board member. "Currently, citizens are reactive, and instead they need to take an active role in what is happening in their watershed. We could, for example, have a widespread network of trained citizens doing local water monitoring."

A recent spill provides a good example of the importance of monitoring. On May 8, 1996, a Wright County Conservation employee observed manure solids in a drainage ditch. An investigation showed that waste from a lagoon on property owned by A.J. DeCoster had entered the drainage ditch through a tile line. Earlier, DeCoster's employees had voluntarily trenched around the property's lagoon in an attempt to identify and remove existing tile lines, but they had missed this one.

The spill was a small one. According to the DNR, no fish were killed and drinking water was not endangered. The line has been plugged, and the amount of penalty has yet to be determined. This spill was caught early because of the vigilance of a conservation employee. Adequate monitoring could keep many other minor events such as this one from becoming ones with major consequences.

Changing landscape

Large-scale hog confinement operations have become a part of the Iowa landscape. Permits for these operations have increased from a total of 99 in 1990 to 600 today. However, Iowa has 40 percent fewer cattle than in the early 1970s and has about the same number of hogs, according to Stewart Melvin. "Through the 1970s, we used to have livestock on every farmstead, and there was a lot of organic waste going to streams. We pushed people toward confinement operations, because we can better control waste that way," Melvin says.

Ideally, the manure generated by Iowa's livestock operations can be part of a sustainable agricultural system. John Miller, a grain and livestock farmer in Black Hawk County, is working toward that goal. "The size of our hog operation is matched to the acreage we farm," Miller says. "As part of our integrated crop management program, we do soil testing and we also test the value of the manure. That way, the manure is matched to our need for nitrogen,

phosphate, and potash. There are real benefits to the by-product."

For some, water quality concerns are impossible to separate from other considerations about the future of rural life in Iowa. "You cannot separate economics and social issues from environmental issues," Barb Grabner says. "A diversified family farmer who uses manure for fertilizer will always be better than an industrial producer that sees it as a waste to be gotten rid of as cheaply as possible."

The debate over livestock operations will continue, and the Iowa Environmental Council will play a critical role in that discussion with its commitment to protect and improve water quality in the state.

Much is at stake. Water quality is vital for human and ecological health as well as economic prosperity. Continued research, education, and technical assistance are keys. We also need adequate funding, monitoring, and enforcement as well as citizen involvement.

As John Miller says, "We need to solve water quality problems, and those solutions need to complement the whole community and its landscape."