Pollution Prevention Begins on the Farm

Doug Hamilton
Extension Waste Management Specialist
Biosystems and Agricultural Engineer
Oklahoma Cooperative Extension Service

Back in the early 70's, my aunt taped a note to her refrigerator that read, "Ecology begins at home." It was a not too subtle reminder to my cousins. "If you want to save the planet, you can start by cleaning your room."

With the release of the US EPA Region 6 CAFO General Permit, and the imminent delegation of federal NPDES permit program to Oklahoma, it might be a good idea to ask ourselves, "What are the most important steps to prevent water pollution from swine farms?"

Swine manure can pollute water in three ways: bacterial contamination, eutrophication, and dissolved oxygen depletion.

All warm blooded animals -- whether they are hogs or humans, cats or chimpanzees -- cultivate bacteria in their colon. Intestinal bacteria help animals digest food. Microbes start growing at one end of the colon and ride the flow until they leave with feces, and some bacteria can continue growing in water. The primary concern with bacterial contamination is human health. If ingested, certain intestinal bacteria can make us sick. They may also enter our bodies through mucus membranes and cuts on the skin. A basic goal of the Clean Water Act of 1972 was to make the nation's waters "swimmable and fishable", so fecal coliforms entering water used for primary contact recreation or as a source of drinking water are controlled.

Fecal coliforms themselves are not necessarily dangerous, but since growing harmful bacteria in the lab is risky, we depend on indicator organisms such as fecal coliforms and fecal streptococci to warn us of the other potentially dangerous microbes in water.

The second and third ways swine manure can potentially pollute surface water is by removing oxygen. Oxygen is difficult to maintain in aqueous environments. Oxygen must dissolve into water before it can be useful. If animals or microorganisms use Dissolved Oxygen (DO) faster than it can be replaced, the DO level drops and aerobic organisms such as fish die.

One way DO depletion occurs is when excess plant nutrients in the water cause algae, plankton, and aquatic plants to flourish. During the day, photosynthesis pumps oxygen into the water, at night plants remove DO. If nighttime removal outpaces daytime replenishment, DO is depleted. This process, called eutrophication, takes place in lakes, reservoirs, and estuaries, often far downstream from where the nutrients are introduced.

A second method of oxygen depletion occurs when aerobic bacteria living in water remove DO faster than it can be replaced. The organic matter found in manure is great food for bacteria. A shot of raw manure to a stream will cause the bacteria to grow out of control, removing DO from the water. Dissolved oxygen depletion due to microbial blooms happens close to the source of

organic matter addition. This is why the organic matter content is usually the limiting factor of wastewater discharge to streams.

You can read more about organic matter in a new OSU factsheet entitled, *Organic Matter Content of Wastewater and Manures.* The factsheet can be found on the waste management engineering website: http://osuwastemanage.bae.okstate.edu.

So, what can a hog farmer do to prevent the big three causes of water pollution from occurring? The short answer is: keep doing what you are doing. Prevent overflows and spills, reduce runoff, apply manure and effluent to meet crop nutrient needs.

Make sure manure or lagoon effluent never comes in contact with surface water. This means observing the proper freeboard on the lagoon, and pumping down to the maximum operating level when field conditions allow for irrigation. Immediately stop leaks from pipes and application equipment, and clean up puddles before they reach water. Don't forget, a standing puddle will find its way to the creek next time it rains.

Reduce the chance that manure or effluent can wash off soil or crops and enter a stream. Stop spreading manure when rain is imminent. Match application rate to the infiltration rate of the soil. Keep application depth below the moisture holding capacity of the soil. And remember, moisture holding capacity changes with soil wetness – its so called antecedent moisture condition.

Prevent over-fertilizing water by properly fertilizing crops. The place to start is having enough land available to recycle valuable manure nutrients. A good rule of thumb for irrigation systems is to have enough land available so the annual nitrogen removal of the crop matches the nitrogen available in effluent – then, triple the acreage to account for phosphorus accumulation. When it comes time to clean out the lagoon, you'll need to find additional land, or find someone willing to buy your sludge.

No one likes to be told to clean their room, but for the most part, pollution prevention is good farming.

We'll keep working to make regulations more in line with good farming.