Nutrient Impacts on Water Quality Gain Public Policy Attention

Animal manure contains nitrogen and phosphorus, nutrients that can harm environmental quality when they enter water systems. Nitrogen is easily soluble and is transported in runoff, in tile drainage, and with leachate. Phosphorus is only moderately soluble, and not as mobile in soils as nitrogen. However, erosion can transport considerable amounts of sediment-adsorbed phosphorus to surface waters. Movement of phosphorus in surface runoff or leaching to shallow ground water or underground drains may occur if manure is applied on lands that have exceeded their soil phosphorus retention levels. This is more likely the case where manure applications have long been based on crop nitrogen needs only, without regard for soil phosphorus levels.

Nitrogen and phosphorus accelerate alga production in receiving surface water and can clog pipelines, kill fish, and reduce recreational opportunities (U.S. EPA, 1998). Nitrogen is primarily a problem in brackish or salt water, while phosphorus is primarily a problem in fresh water. EPA reports that nutrient pollution is the leading cause of water quality impairment in lakes and estuaries, and is the second leading cause in rivers, behind sediment (U.S. EPA, 1998). The National Water-Quality Assessment Program found that the highest concentrations of nitrogen and phosphorus in streams occurred in basins dominated by agricultural uses (see Appendix: Animal Waste and Water Quality). High concentrations of nitrogen and phosphorus in these streams were correlated with inputs from fertilizers and manure used for crops and from livestock wastes (U.S. Department of Interior, 1999).

Current Regulations Focus on Livestock Facilities

The major Federal law affecting manure management on animal operations is the Clean Water Act, under which the National Pollutant Discharge Elimination System (NPDES) program covers animal feeding operations meeting certain criteria. NPDES permits are required by point sources (facilities that discharge directly to water resources through a discrete ditch or pipe) before they can discharge into navigable waters. The permits specify a level of treatment for each effluent source. Federal NPDES permits may be issued by EPA or any State authorized by EPA to implement the NPDES program.

Under 1974 EPA regulations, certain animal feeding operations (AFOs) may be considered a point source in the NPDES program and be designated concentrated animal feeding operations (CAFOs) if they meet the following criteria. First, an AFO is a facility where:

- Animals have been, are, or will be stabled or confined and fed or maintained for a total of 45 days or more in any 12-month period, and
- Crops, vegetation, forage growth, or postharvest residues are not sustained in the normal growing season over any portion of the lot or facility.

A CAFO is defined by EPA regulation as an AFO that:

- Confines more than 1,000 slaughter and feeder cattle, 700 mature dairy cows, 2,500 swine each weighing more than 25 kilograms, 30,000 laying hens or broilers (if a facility uses a liquid manure system), and 100,000 laying hens or broilers (if a facility uses continuous overflow watering), 55,000 turkeys, 500 horses, 10,000 sheep, 5,000 ducks, or combinations of animals totaling 1,000 animal units. The CAFO definition of animals per animal unit is specified only for slaughter and feeder cattle, mature dairy cows, swine, sheep, and horses.
- Confines more than 30 percent of the number of animals specified above **and** discharges pollutants into waters through a manmade ditch, flushing system, or similar manmade device, or directly into waters that pass through the facility.

The CAFO regulation contains an exemption for facilities that discharge pollutants only in the event of a 25-year, 24-hour storm event[3] (i.e., AFOs of any size that have facilities to contain the runoff associated with a local, 24-hour storm of a severity expected only once in 25 years do not need a permit).

The total maximum daily load (TMDL) provisions of the Clean Water Act are intended to be the second line of defense for protecting surface-water quality, and could affect animal feeding operations. When technology-based controls are inadequate for water to meet

[3] The January 12, 2001, draft regulations propose revisions to the NPDES permit manual for CAFOs that remove this exemption (U.S. EPA, 2001).

State water quality standards, Section 303(d) of the Clean Water Act requires States to identify those waters and to develop TMDLs. A TMDL is a calculation of the maximum amount of a pollutant that a water body can receive and still meet water quality standards, and an allocation of that amount to the pollutant's sources. The TMDL for the watershed is the sum of individual wasteload allocations for point sources, load allocations for nonpoint sources and natural background, and a margin of safety. Wasteload allocations for point sources generally become part of their NPDES permit. Load allocations for nonpoint sources can be met through voluntary approaches or regulation.

Section 303(d) of the Clean Water Act requires States to submit to EPA a list of impaired waters and the cause of the impairment. There are more than 20,000 such waters identified nationally, comprising more than 300,000 miles of rivers and streams and more than 5 million acres of lakes (U.S. EPA, 2000). The top impairments from the 1998 303(d) lists are sediment, nutrients, and pathogens. States, territories, and authorized tribes are responsible for establishing and implementing TMDLs. If they fail to establish the TMDLs, EPA must do it. Confined animal operations of any size in a watershed under a TMDL might face animal waste storage, handling, and disposal requirements.

CAFOs in the coastal zones of the 29 States subject to the Coastal Zone Management Act face regulations contained in the Coastal Zone Act Reauthorization Amendments (CZARA) of 1990. EPA requires that discharges from these coastal CAFOs be limited through appropriate storage and an appropriate waste utilization system (U.S. EPA, 1993). The management measures are to be applied to all new facilities regardless of size and to all new or existing facilities with 300 beef, 200 horses, 70 dairy cows, 15,000 layers or broilers, or 200 swine. Exempted are those CAFOs that are required to have an NPDES permit.

Forty-three states are certified by EPA to issue their own NPDES permits (U.S. EPA, 1999b). Of these, 35 have a combination of NPDES and State-level, non-NPDES permitting mechanisms available for addressing the environmental impacts of animal feeding operations. Typically, the non-NPDES mechanism is a construction or operating permit or set-back requirement. State NPDES permit requirements may be more stringent than the EPA requirements (but not less stringent). Of the seven States (AK, AZ, ID, MA, ME, NH, NM) not authorized to administer the NPDES program, three (AZ, ID, NM) impose some form of a State program requirement on AFOs. Of note, 32 States have a requirement covering application rates of manure on the land, and 27 States require at least some of the animal operations to develop and use waste management plans (U.S. EPA, 1999b).

In addition to the regulatory framework, voluntary agricultural programs such as the Environmental Quality Incentives Program (EQIP) and the Conservation Technical Assistance Program are designed to improve water quality by encouraging the use of improved farm nutrient management practices. EQIP, initiated in the 1996 Federal Agriculture Improvement and Reform Act, provides technical, educational, and financial assistance to farmers and ranchers for adopting structural, vegetative, and management practices that protect or enhance environmental quality. Contracts for financial assistance are for 5 to 10 years, and the annual payment limit is $10,000 per person per year, with a maximum of $50,000 per contract. By statute, half of the available funding for the program is targeted at practices related to livestock production on farms with fewer than 1,000 animal units. EQIP funding was $200 million for 1997 and 1998, declining to $174 million in 1999 (USDA, 2000a).

USDA also provides technical assistance for producers wishing to implement conservation practices, including nutrient management. The Conservation Technical Assistance program (CTA) was authorized by the Soil Conservation and Domestic Allotment Act of 1935. The Natural Resources Conservation Service (NRCS) administers the CTA program, which helps land users plan and implement conservation systems for improving soil and water quality (including nutrient management), reducing erosion, improving and conserving wetlands, enhancing fish and wildlife habitat, improving air quality, improving pasture and range conditions, reducing upstream flooding, and improving woodlands. Assistance is provided through conservation districts to land users who voluntarily apply conservation practices, including producers who must comply with local, State, or Federal laws and regulations. As a component of the CTA program, NRCS and State conservation district personnel can help State and regional planning agencies with nonpoint-source pollution control.

Future Regulations To Address Manure Application

In 1999, USDA and EPA announced the Unified National Strategy for Animal Feeding Operations (USDA–EPA, 1999), which sets forth a framework of actions USDA and EPA plan to take—under existing legal and regulatory authority—to minimize impacts to water quality and public health from animal feeding operations and to establish a national performance expectation for animal feeding operations. This coordination of effort was spurred, in part, by:

- The growing concentration and size of animal feeding operations;
- The geographic concentration of feeding operations, which can overwhelm the ability of a watershed to assimilate the nutrients contained in the waste and maintain water quality;
- More and larger animal waste storage lagoons that increase the chance for a leak or a catastrophic break. Over the past several years, major lagoon spills or leaks have occurred in Illinois, North Carolina, Iowa, Kentucky, Minnesota, Missouri, Montana, South Dakota, Utah, Virginia, Washington, and Wisconsin (U.S. EPA, 1999a).

Under the Unified Strategy, all AFO owners and operators will be expected to develop and implement technically sound, economically feasible, and site-specific comprehensive nutrient management plans (CNMP) for properly managing the animal wastes produced at their facilities, including onfarm application and offfarm uses. Nutrient management plans[4] (NMP) will be mandatory for operations that require an NPDES permit, and voluntary for other producers. Inclusion of an NMP as part of the NPDES permit means that for the first time, the application of manure on land will be a part of a required Federal permit (32 States now have alternative versions of this provision— generally for a single animal type—in State regulations).

Proposed nutrient management plans rely on the Natural Resources Conservation Service (NRCS) *Field Office Technical Guide* as the primary technical reference. The NRCS technical guide limits manure application on land to the level determined by the more limiting of the two major nutrients—nitrogen or phosphorus. In the past, manure management has focused on managing manure nitrogen. Shifting to a phosphorus-based standard will require more land on which to spread the same amount of manure; the quantity of phosphorus taken up in the growth of most field crops is much less than nitrogen (only 10 to 20 percent), and application levels depend on existing soil phosphorus levels. Soil phosphorus levels can be rapidly built up in the soil by the application of manure, but may take years to deplete to levels enabling additional manure applications (Sharpley *et al*., 1999). Therefore, basing nutrient management on phosphorus has significant implications for animal operations with excess manure by increasing (1) the acreage needed for spreading, (2) manure application costs, and (3) the number of farms that will need alternative ways to dispose of manure.

Proposed changes in permitting requirements and nutrient management could significantly increase manure management costs for confined animal producers across a range of operation sizes.

The Unified Strategy recommends that EPA review the criteria for determining which operations will require an NPDES permit (see box, "EPA Proposes Revised CAFO Regulations"). Not only will the largest operations still require a permit, NPDES permits may also be issued to smaller operations whose direct discharge through a pipe or ditch contributes to water quality impairments (U.S. EPA, 2001).[5] Knowledge of where animals are highly concentrated could assist resource managers in identifying nutrient-impaired waters and options for remediation.

[4] The Unified Strategy calls for comprehensive nutrient management plans (CNMP), and the draft regulations for the NPDES permits call for permit nutrient plans (PNP). We use "nutrient management plans" as a generic term for plans, inclusive of CNMPs and PNPs, that provide producers with information about manure application levels on farmland to minimize the movement of nutrients to the water resources.

[5] States are required by the Clean Water Act to identify impaired waters, and EPA has recently pushed States to accelerate their efforts to identify such waters and to develop remediation programs (Boyd, 2000). EPA is providing the States guidance for identifying nutrient-impaired waters, the lack of which has hindered States from identifying nutrient-related problems in the past (Gibson *et al*., 2000). These actions could focus attention to watersheds where animals, and animal operations, are concentrated.

Proposed changes in permitting requirements and nutrient management could significantly increase manure management costs for confined animal producers across a range of operation sizes. One of the first steps in evaluating the potential for increased costs from changes in manure management is to examine the extent and magnitude of the problem. The number and location of producers, land available for manure application, and the types and number of animals produced will help indicate the impact of policy change and the resources required to assist livestock and poultry producers. In this report, we apply a documented methodology to a consistent national data set to determine the number and location of operations and animals.

EPA Proposes Revised CAFO Regulations

EPA issued draft regulations for confined animal feeding operations on January 12, 2001 (U.S. EPA, 2001). After a public comment period and rewriting based on the comments received, final regulations are scheduled to be published in December 2001.

The draft regulations propose increases in the number of farms regulated under the National Pollutant Discharge Elimination System (NPDES) permit program. The proposal offers two options for public comment on the number of farms included in the NPDES permit program. One would regulate the largest 26,000 CAFOs in a system that considers only operation size. The second would regulate an estimated 36,000 operations, in a system that considers the largest 12,000 operations and another 24,000 operations based on their potential to allow nutrients to enter waterways considering 6 criteria (distance to streams, adequately sized manure storage facilities, direct contact of animals with surface water, evidence of discharge, presence of adequate nutrient management plan, significant amounts of waste transported offsite).

The draft regulations also require that a component of the NPDES permit include a nutrient management plan covering the land receiving manure. On the CAFO farm, the draft regulations require manure to be applied to crops at the minimum of the phosphorus or nitrogen agronomic level. For farms that export manure to other operators, the proposal also requires either that (1) the regulated farm keep detailed records of manure leaving the operation or (2) the receiving farm certify that manure is applied at agronomic rates.