

Chapter 6

Summary and Implications for Policy and Research

Addressing the pollution problems generated by production activities can challenge policymakers concerned with economic efficiency when more than one environmental medium is affected by a single pollution source. This is true of many environmental issues. Coordinating policy so that all potential pollution issues are addressed simultaneously has been shown in the literature to be more efficient than dealing with each issue in an uncoordinated fashion, particularly when correcting one environmental problem worsens another (policies conflict). This report illustrates the tradeoffs in environmental quality by focusing on livestock and poultry production. Nitrogen in manure from animals on feeding operations can take a number of forms; reducing one form of nitrogen to protect one environmental medium can increase the amount of another form moving to a different medium.

Current environmental policies often fail to account for these interactions between media, as is the case with animal waste policies. Revised Clean Water Act regulations focus on managing land application of manure to reduce pollution of surface water. Restricting manure nutrient applications to agronomic rates can reduce manure's threat to water quality, but imposes costs on producers, primarily increased manure hauling costs. These costs can be reduced with manure handling and application strategies that promote the creation of ammonia and its loss to the atmosphere.

Ammonia emissions are a source of haze in the atmosphere, and a potential threat to human health. Recent lawsuits, court decisions, and consent agreements have induced some States to start regulating emissions under the Clean Air Act; the Comprehensive Environmental Response, Compensation and Liability Act; and State laws.

Tradeoffs Between Air and Water Quality Are Prevalent in Manure Nitrogen Management

Tradeoffs between air and water quality exist at the farm, regional, and national level. However, the magnitude varies, depending on baseline assumptions and scale of analysis. The farm-level analysis found that CAFO regulations for reducing nitrogen runoff had only a small impact on ammonia emissions in the hog sector. Hog operations had generally adopted practices that released ammonia to the atmosphere prior to the CAFO regulations (open lagoons and surface manure application), so there was little opportunity to further increase these emissions. Model results suggest that some operations that had been incorporating slurry (presumably for odor control) would start surface-applying manure in order to reduce the amount of land needed to receive manure, but this effect was relatively small. At the national level, implementing the CAFO water quality regulations could actually reduce ammonia emissions. Estimated reductions in animal numbers outweighed any small increase in per-unit ammonia emissions.

On the other hand, when we assumed hypothetical restrictions on ammonia emissions in the absence of the CAFO regulations, excess nitrogen applications (the cause of nitrogen losses to water) increased dramatically at the farm level, and to a lesser degree at the regional and national levels. Animal operations reduced ammonia emissions by covering lagoons and incorporating manure. Excess manure nitrogen applications that existed in the baseline increased as nitrogen in manure was conserved by preventing losses to the atmosphere and land applied to the same acres.

Uncoordinated Policies Impose Extra Costs on Farmers

CAFO regulations and the hypothetical ammonia reduction regulations provide much different incentives to farmers, and so encourage different management practices. Furthermore, neither set of management practices is the most economical for addressing a joint policy where both water quality and ammonia emission goals are set. Farms that adopt a set of practices to meet the CAFO water quality requirements might need to adopt a different set to meet both water and air requirements. The cost of changing practices could be avoided under a coordinated policy. A producer may even be reluctant to comply with new regulations for fear that the rules may change in the future. (Our models do not account for uncertainty or for the economic implications of “sunk” costs for adopting a set of waste-handling technologies and then having to adopt a new set.)

These differences in production costs have broader implications for the agricultural sector. Overall impacts for animal producers, crop producers, and consumers change considerably when hypothetical ammonia reduction goals are added to the CAFO regulations. Some of the regional shifts in production predicted for the CAFO regulations do not occur under a coordinated policy. This implies that some of the adjustment costs from a sequential (uncoordinated) implementation of regulations would have been avoided if they had been introduced together.

Unintended Consequences Can Lessen Environmental Gains

Should ammonia emission standards induce farmers to adopt manure management practices that reduce nitrogen emissions, the manure applied to land will have a higher nitrogen content. Depending on how the air quality regulations are applied, this can have two impacts on CAFOs and water quality. First, those farms identified as CAFOs may need to increase the amount of land they are spreading on to meet nutrient application standards if they are also required to reduce ammonia emissions. This can be particularly costly in a region where animal concentrations are high and cropland available for spreading manure is relatively scarce. In our analysis of the costs of spreading manure in the Chesapeake Bay watershed, nitrogen content of manure substantially increased when ammonia restrictions were introduced, increasing the costs of meeting nitrogen application standards. The higher cost of meeting water quality regulations might not be accounted for in an assessment of the cost of air quality regulations.

Second, a failure to coordinate water and air policies could lead to a loss of water quality benefits. If Clean Air Act or CERCLA requirements result in States requiring ammonia reductions on smaller farms as well as CAFOs, the water quality benefits of the CAFO regulations could be diluted by excess nutrient applications on the smaller farms. This was the case in both our regional and national analyses. Without regulations on spreading manure at agronomic rates, farms reducing ammonia emissions would be more likely to overapply manure, thus increasing nitrogen discharged to surrounding waters. It would be difficult to achieve ammonia emission reductions and still maintain water quality gains of the CAFO regulations if water quality regulations were not extended to smaller operations. Doing so would increase the costs to producers and consumers, but provide greater environmental improvements.

In our analyses, we have not assumed a relative value of air quality changes versus water quality changes. Monetary values associated with improved health and visibility from reduced ammonia emissions, and improved recreation and drinking water benefits from reduced nitrate runoff, have not been estimated at the national scale. These values would help policymakers respond appropriately to ammonia emissions and nitrogen runoff from animal feeding operations. For example, if water quality improvements are valued much less than air quality improvements, the “unintended consequence” of increased nitrogen runoff from an uncoordinated ammonia control policy may be of little concern.

Other Tradeoffs May Be Important

While we focus on the ammonia-nitrate tradeoffs, other interactions have a bearing on current environmental concerns. For example, animal operations are a primary source of the greenhouse gases methane and nitrous oxide. The former is not part of the nitrogen cycle. Its sources are the animal itself (enteric processes) and anaerobic storage. Nitrous oxide, which is part of the nitrogen cycle, is emitted primarily from fields where nitrogen is applied and from dry-waste-handling systems that have aerobic conditions. Commercial fertilizer is the primary source of agricultural nitrous oxide.

Policies that influence the number of animals, manure handling and storage systems, and the amount of nitrogen applied to land also influence greenhouse gas emissions. For example, if a nitrogen runoff-ammonia scenario reduces the number of beef cattle by 2 percent, methane emissions from beef cattle also decline 2 percent. Considering potential conflicts and synergies between policies aimed at visibility, health, water quality, and global climate change would be complex and costly, but could avoid unnecessary costs to the sector and to society as a whole.

Reducing Nitrogen at the Source Can Address Multiple Problems

Not creating pollution in the first place avoids the problems posed by conflicting policies. In the case of nitrogen and AFOs, increasing the efficiency of nutrient conversion to animal products can reduce nitrogen in waste. This would reduce the threats to air and water quality, and make

addressing either or both by managing manure less costly. Major advances are being made in feed efficiency through animal genetics, herd management, phase feeding, and feed formulation.

Another onfarm option involves technology for separating manure into liquid and solid wastes. Each component has a different nutrient content and may be handled differently so that the overall cost for meeting water quality and air quality goals may be reduced.

Another option is to remove manure as quickly as possible from the animal facility and to use it as an input elsewhere. Manure is currently being used to produce commercial fertilizer and energy, and research is underway to identify other potential uses. Atmospheric emissions may be more easily controlled in an industrial setting where contact with air and water can be minimized, and emissions from a ventilation system can be filtered. Current cost and demand conditions have not yet spurred wide-scale development of such industrial options. However, as environmental concerns increase and local, State, and Federal governments deal with manure issues, the costs of manure management are also likely to rise, making industrial options for manure more viable.

This report takes a stylized approach to mass balance, focusing on one set of compounds (nitrogen) and two environmental media (surface water and air quality). A more complete analysis would consider atmospheric deposition of nitrogen (bringing in nitrogen emissions from other sources), greenhouse gases, and groundwater contamination. A full accounting of all the controls necessary to meet additional environmental issues would likely increase the cost to producers, but the magnitude would depend on the interactions between the different pollutant flows, and the degree to which manure handling technologies can address multiple problems. However, the essential link between production and environmental quality, and the trade-offs between different policy approaches, would likely be similar to those suggested by these results.