

accidental discharges from lagoons and irrigation systems, or through intentional releases. Other reported causes of discharge to surface waters are overflows from containment systems following rainfall, catastrophic spills from failure of manure containment systems, and washouts from floodwaters when lagoons are sited on floodplains or from equipment malfunction, such as pump or irrigation gun failure, and breakage of pipes or retaining walls.

It is well established that in many agricultural areas shallow ground water can become contaminated with manure pollutants. This occurs as a result of water traveling through the soil to the ground water and taking with it pollutants such as nitrate from livestock and poultry wastes on the surface. Leaking lagoons are also a potential source of manure pollutants in ground water, based on findings reported in the scientific and technical literature.

Pollutants from CAFO wastes are released to air through volatilization of manure constituents and the products of manure decomposition. Other ways that manure pollutants can enter the air is from spray irrigation systems and as wind-borne particulates in dust. Once airborne, these pollutants can find their way into nearby streams, rivers, and lakes as they are subsequently redeposited on the landscape. More detailed information on the transport of animal wastes is presented in the *Benefits Analysis* and the record.

3. How Is Water Quality Impaired by Animal Wastes?

EPA has made significant progress in implementing Clean Water Act programs and in reducing water pollution. Despite such progress, however, serious water quality problems persist throughout the country. Sources of information on these problems include reports from States to EPA, documented in the *2000 Inventory*, and the U.S. Geological Survey's National Water Quality Assessment (NAWQA) Program.

a. EPA's national water quality inventory. Agricultural operations, including CAFOs, are a significant contributor to the remaining water pollution problems in the United States, as reported by the *2000 Inventory*. EPA's *2000 Inventory* data indicate that the agricultural sector—including crop production, pasture and range grazing, concentrated and confined animal feeding operations, and aquaculture—is the leading contributor to identified water quality impairments in the nation's rivers and streams, lakes, ponds, and reservoirs. Agriculture is also identified as the fifth leading

contributor to identified water quality impairments in the nation's estuaries. While the *2000 Inventory* does not generally separate effects of CAFOs from agriculture generally, EPA's data indicate that water quality concerns tend to be greatest in regions where crops are intensively cultivated and where livestock operations are concentrated.

The *2000 Inventory* data indicate that the agricultural sector contributes to the impairment of at least 129,000 river miles, 3.2 million lake acres, and more than 2,800 estuarine square miles. Forty-eight States and tribes identified agricultural sector activities contributing to water quality impacts on rivers; 40 States identified such impacts to lakes, ponds, and reservoirs; and 14 States reported such impacts on estuaries. AFOs are only a subset of the agriculture category, but 29 States specifically identified them as contributing to water quality impairment.

The leading pollutants impairing surface water quality in the United States as identified in the *2000 Inventory* data include nutrients, pathogens, sediment/siltation, and oxygen-depleting substances. These pollutants can originate from various sources, including the animal production industry. Animal production facilities may also discharge other pollutants, such as metals and pesticides, and can contribute to the growth of noxious aquatic plants due to the discharge of excess nutrients.

These data provide a general indication of national surface water quality, highlighting the magnitude of water quality impairment from agriculture and the relative contribution compared to other sources. Moreover, the findings of this report are corroborated by numerous reports and studies conducted by government and independent researchers that identify agriculture's predominance as an important contributor of surface water pollution, as summarized in the *Environmental Assessment of Revisions to the National Pollutant Discharge Elimination System Regulation and the Effluent Guidelines for Concentrated Animal Feeding Operations*, which is available in EPA's rulemaking record.

b. Other documented impacts on water quality. Data collected by NAWQA also identify agriculture among the leading contributor of nutrients to U.S. watersheds. A national water quality assessment program conducted by the U.S. Geologic Survey found that agricultural use of fertilizers, manure, and pesticides has degraded stream and shallow ground water

quality in agricultural areas and has resulted in high concentrations of nitrogen. Subsequent measurements in specific major river basins suggest that animal feeding operations may play a significant role in observed water quality degradation in those basins (*e.g.*, Kalkhoff *et al.*, 2000; Groschen *et al.*, 2000). Finally, a 1997 study by Smith *et al.* characterizing spatial and temporal patterns in water quality identified animal waste as a significant source of in-stream nutrient concentrations in many watershed outlets, relative to other local sources, particularly in the central and eastern United States. The findings of this report suggest that livestock waste contributes more than commercial fertilizer use to local total phosphorus yield, whereas the use of commercial fertilizer is the leading source of local total nitrogen yield.

Numerous local, regional, and national evaluations also indicate that animal manure can be a significant source of pollutants that contribute to water quality degradation. A literature survey conducted for the proposed rule identified more than 150 reports of discharges to surface waters from hog, poultry, dairy, and cattle operations. Over 30 separate incidents of discharges from swine operations between the years 1992 and 1997 in Iowa alone were reported by that State's Department of Natural Resources. The incidents resulted in fish kills ranging from about 500 to more than 500,000 fish killed per event. Fish kills or other environmental impacts have also been reported by agencies in other States, including Nebraska, Maryland, Ohio, Michigan, and North Carolina.

Runoff of nutrients and other contaminants in animal manure and wastewater also contributes to degradation of U.S. waters. For example, nutrients originating from livestock and poultry operations in the Mississippi River Basin have been identified as contributing to the largest hypoxic zone in U.S. coastal waters in the northern Gulf of Mexico. (Hypoxia is the condition in which dissolved oxygen is below the level necessary to sustain most animal life.) According to a report conducted by the National Science and Technology Council in 2000, adverse impacts of eutrophication might be of concern for ecologically and commercially important species in the Gulf, whose fishery resources generate \$2.8 billion annually. Animal manure also contributes to eutrophication, or nutrient overenrichment, which is also a serious concern for the Nation's coastal and estuarine resources.

More detailed information is presented in the 2001 proposal (66 FR