COSTS ASSOCIATED WITH DEVELOPMENT AND IMPLEMENTATION OF COMPREHENSIVE NUTRIENT MANAGEMENT PLANS (CNMP)

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Introduction

The Nation’s livestock sector has undergone dramatic change in recent decades. The substantial productivity increases in animal agriculture have fueled consolidation and geographic concentration. Correspondingly, the industry has seen marked declines in the number of livestock operations and an increase in the number of animals produced in confinement. The largest of animal feeding operations—concentrated animal feeding operations (CAFOs)—are defined as point sources and regulated under the authority of the Clean Water Act. However, all animal feeding operation (AFOs) are being scrutinized for their potential to contribute to non-point source pollution of the Nation’s water resources.

In 1999, the U.S. Department of Agriculture (USDA) and the U.S. Environmental Protection Agency (EPA) released a joint “Unified National Strategy for Animal Feeding Operations” (Strategy), which presented a plan for addressing the potential water quality and public health impacts associated with AFOs. The Strategy recognized the complementary roles to be played by voluntary and regulatory programs. Importantly, the Strategy articulated a national performance expectation that all AFOs should develop and implement technically sound, economically feasible, and site-specific comprehensive nutrient management plans (CNMPs) to minimize potential adverse impacts on water quality and public health, and to accomplish this within a 10-year implementation period.

The Strategy recognized the importance of understanding the costs of nationwide CNMP implementation and called upon EPA and USDA to evaluate costs and benefits. In September 2000, USDA initiated the first phase of an assessment of:

1. The cost of upgrading facilities and practices on AFOs nationwide to meet CNMP criteria,
2. The technical assistance needed to plan, design, implement, and follow-up on needed facilities and practices, and
3. The cost of alternatives to land application of manure, including feed management and alternative uses including treatment options.

This presentation today is a summary of the results from the report developed to address the first two components of the USDA assessment. At the end of this presentation I will provide information on where copies of the report can be obtained.

The cost estimates represent those associated with the animal feeding operation population as derived using the 1997 Census of Agriculture. The costs do not reflect any potential cost offsets that farmers and ranchers might receive, such as reductions in commercial fertilizer purchases, or government cost-share or incentive payments.

What is a CNMP?

A comprehensive nutrient management plan is a conservation system that is unique to confined animal feeding operations. In this study, an animal feeding operation is as defined by the EPA in its CAFO regulations. The CNMP can address six elements: Feed Management; Manure and Wastewater Handling and Storage, Land Treatment Practices, Nutrient Management, Recordkeeping, and Other Utilization Options. A CNMP is similar to
EPA’s “Nutrient Management Plan” as described by the CAFO Rule. This cost assessment did not address Feed Management and Other Utilization Options, as they will be addressed in a subsequent report.

### Comprehensive Nutrient Management Plan

A comprehensive nutrient management plan (CNMP) is a conservation system that is unique to animal feeding operations. It includes conservation practices and management activities which, when implemented as part of a conservation system, will help to ensure that production and natural resource protection goals are achieved. CNMPs may include the following six elements:

- **Manure and Wastewater Handling and Storage** – addresses components and activities associated with the production facility, feedlot, manure and wastewater storage and treatment structures and areas, and any areas used to facilitate transfer of manure and wastewater.

- **Land Treatment Practices** – addresses components and activities associated with the fields where manure and organic by-products are applied as beneficial nutrients. Generally, this includes identification of sensitive areas and implementation of conservation practices, such as residue management, contouring, and terraces to retain nutrient on-site and available for plant uptake.

- **Nutrient Management** – addresses components and activities associated with land application of all nutrients and organic by-products to meet crop needs and minimize potential adverse impacts to the environment and public health. Generally this includes planning and applying nutrients with consideration of form, timing, rate, and application method.

- **RecordKeeping** – addresses the need for AFO owners/operators to document management and implementation activities associated with their CNMP. Typically, this includes recording soil tests, manure tests, manure and wastewater field application dates and rates, manure transfers, and operations and maintenance activities.

- **Feed Management** – addresses activities that improve feed delivery, reduce feed wastage, or improve nutrient uptake efficiency.

- **Other Utilization Activities** – addresses AFO alternatives to land application of manure and organic by-products, such as energy production, nutrient stabilization and extraction for commercial fertilizers or other products, composting or palletizing, mixing or co-composting with other by-products to produce specialized use materials.

### AFO’s Potentially Needing CNMPs

The 1997 Census of Agriculture reported that there were 1.9 millions and ranches in the United States. Livestock are produced on nearly 1.3 million of these farms and ranches and in every state across the Nation. Operations that were estimated to need a CNMP were identified based on criteria involving size, recoverable manure, and livestock type. Essentially, the operations identified generated at least 200 pounds of recoverable manure nitrogen annually, that’s approximately 11 tons of manure. Based on these criteria, 257,201 operations in the 1997 Census of Agriculture were identified as needing a CNMP. (See PowerPoint Slide #3)

Overall, dairies accounted for the largest share of operations expected to need a CNMP, 79,000 farms (30 percent). However, ninety-six percent of dairy operations are small or medium sized. Conversely, fattened cattle represent only four percent of the operations, but twenty-three percent are large sized. Interestingly, the total number of animal units of fatten cattle and milk cows are almost the same. The large fatten cattle operations tend to be very large. (See PowerPoint Slide #4)

### Overall Costs

The total CNMP development and implementation cost over the 10-year implementation period was estimated to be $19.5 Billion, or about $76,000 for each of the 257,201 CNMPs.
CNMP development costs represent about 10 percent of the total cost (2.1 Billion), equivalent to 38.2 million hours of technical assistance at an average hourly cost of $55. The average CNMP development time was 149 hours per operation. The majority of technical assistance time—62 percent—is spent on activities related to manure and wastewater handling and storage because of the time needed for design and installation of structural practices. (See PowerPoint Slide #5)

CNMP implementation costs totaled $17.4 billion over the 10-year period, averaging $67,480 per operation. This reflects the cost to producers to modify practices and install needed upgrades. Costs varied substantially among operations; one percent of the farms had costs less than $2,000 per operation, while one percent of the farms had costs exceeding $670,000.

Implementation costs were estimated for five categories: nutrient management, off-farm export of manure, land treatment to control soil erosion on acres receiving manure, manure and wastewater handling and storage, and recordkeeping. On average, manure and wastewater handling and storage had the highest cost at $25,090 per operation. (See PowerPoint Slide #6)

Estimated development and implementation costs vary considerably, however, according to livestock type, the size of the operation, and production region.

**Costs by Livestock**

The average implementation cost per operation was highest for fattened cattle and turkey operations ($181,670 and $178,200 per operation, respectively), and lowest for pastured livestock and small operations with confined livestock types. These estimates, however, are heavily influenced by the number of livestock on the farm. For example, fattened cattle operations and turkey operations also had the most animal units per farm, on average. On a per-animal unit basis, dairies had the highest cost at $500 per animal unit, followed by layer operations at $450 per animal unit and swine farms at $440 per animal unit. Fatten cattle operations averaged only $140, the lowest of all farm groups except farms with pastured livestock types. The average cost per animal unit for all farms was $320. (See PowerPoint Slide #7)

**Costs by Operation Size**

Three size classes of operations were defined on the basis of the amount of manure phosphorus produced annually. Operations producing more than 10 tons of manure phosphorus annually were categorized as large operations; operations producing 4 to 10 tons of manure phosphorus annually were categorized as medium operations; and, operations producing less than 4 tons of manure phosphorus annually were categorized as small operations. These size categories correspond roughly to the size categories defined by EPA in the CAFO Rule, with large approximately 1000 animal units, medium 300 to 999 animal units, and small with less than 300 animal units.

As would be expected, costs were higher for large operations than for small operations. The average annual implementation cost for the large operations is about $305,000 per operation, compared to about $38,000 for the small operations. Large operations represent only 8 percent of all operations needing CNMPs, but account for about 35 percent of the total cost. Small operations potentially needing CNMPs represent 77 percent of the operations, while only accounting for 43 percent of the total costs. On a per-animal unit basis, however, the costs are lower for the large operations than for the small and medium-size operations, reflecting economies of scale for CNMP implementation. (See PowerPoint Slide #8)

**Costs by Production Region**

The 10 USDA farm production regions are used to represent geographic variability in CNMP development and implementation costs. Over one half of all operations that potentially need CNMPs are in the Corn Belt, Lake, and Northeast regions. However, these regions also account for almost 70 percent of all small operations. A
disproportionate number of large operations are in the Pacific, Southeast, Delta, and Mountain regions; the percentages of large operations in these regions are 2 to 3 times the national average.

Regionally, the highest average implementation cost is $194,000 per operation in the Pacific region, while the Lake States region has the lowest at $45,000, reflecting the differences in the mix of operation sizes among the regions. Off-site export had the most significant effect on cost variability among regions, reflecting regional differences in land availability relative to operation size. (See PowerPoint Slide #9)

**Limits to Land Application of Manure**

An essential element of CNMPs is managing the land application of manure nutrients based on a site specific evaluation of potential risk of nutrient transport to surface waters. Through nutrient management planning, it is determined if manure nutrients may be applied at a nitrogen rate (provides phosphorus in excess of crop needs), a phosphorus rate (provides phosphorus at or below crop needs depending on the risk level), or if manure application should be avoided. Because of the high phosphorus to nitrogen ratio in manure relative to crop needs, in most cases, CNMP implementation will result in additional acres being required to land apply manure nutrients in accordance with the nutrient management plan. In some cases, more land than is available to the operation.

About 3 billion pounds of recoverable manure nitrogen and about 1.4 billion pounds of recoverable manure phosphorus will be produced by the 257,201 operations that are expected to need a CNMP. Of this, approximately 35 percent will be applied on-farm on livestock operations and 49 percent will be exported for land application on non-livestock operations, leaving about 16 percent that cannot be land applied. In the USDA assessment, one of the assumptions of land availability used is that manure would not be transported out of the county in which it was produced. This excess manure is thus called “county-level excess manure.” Another assumption, only 50 percent of the crop and pasture land on non-livestock operations was available for land application of manure.

Most counties have sufficient acreage for off-farm land application of the manure produced in those counties, and therefore do not have any county-level excess manure after CNMPs are fully implemented. However, there 248 counties where the production of manure nutrients will exceed the capacity of the cropland and pastureland in those counties to assimilate the manure nutrients when applied at rates that meet nutrient management criteria. Complicating the management of these nutrient excesses is that most of these counties are co-located, reducing the opportunity to transport the manure to surrounding counties for land application. (See PowerPoint Slide #10)

**Concluding Remarks**

The costs presented in this assessment reflect the upgrades needed to bring existing operation up to a level of environmental performance characterized by a CNMP. Presently, CNMPs primarily address water quality concerns. Thus, cost could be affected as practices and treatments to address emerging environmental concerns—such as air quality, pathogens, and use of pharmaceuticals—are woven into CNMPS.