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Economic Analysis of the Final Revisions to the National Pollutant Discharge Elimination System Regulation and the Effluent Guidelines for Concentrated Animal Feeding Operations

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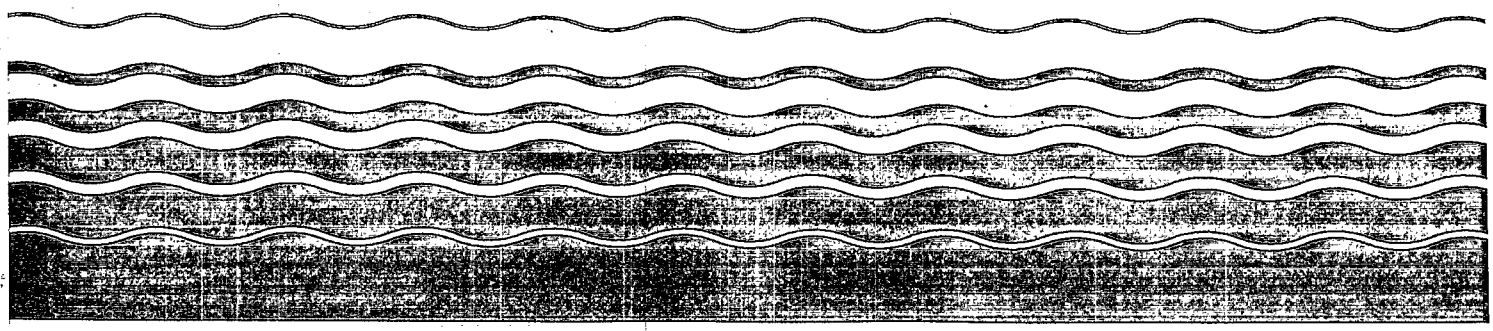

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Economic Analysis of the Final Revisions to the National Pollutant Discharge Elimination System Regulation and the Effluent Guidelines for Concentrated Animal Feeding Operations

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ACRONYMS

AFO	animal feeding operation
ARMS	Agricultural Resource Management Study
ASAE	American Society of Agricultural Engineers
AU	animal unit
BAT	Best Available Technology
BATEA	Best Available Technology Economically Achievable
BLS	Bureau of Labor Statistics
BMP	best management practice
BNR	biological nutrient removal
BOD	biological oxygen demand
BPJ	best professional judgment
C-E	cost-effectiveness
CAFO	concentrated animal feeding operation
CARD	Center for Agriculture and Rural Development
CC/Q	compliance costs per unit sold
CCI	Construction Cost Index
CE	Central
COD	chemical oxygen demand
CWA	Clean Water Act
DCF	discounted cash flow
EA	economic analysis
EBITDA	earnings before interest, taxes, depreciation, and amortization
ELG	effluent limitations guidelines
EMS	environmental management system
EO	Executive Order
EPA	Environmental Protection Agency
EQIP	Environmental Quality Incentives Program
ERS	Economic Research Service
FAPRI	Food and Agricultural Policy Research Institute
FF	farrow-finish and farrowing
FFSC	Farm Financial Standards Council
FRFA	final regulatory flexibility analysis
FTE	full-time equivalent
GDP	Gross Domestic Product
GF	grow-finish
ICR	Information Collection Request
IRFA	initial regulatory flexibility analysis
IRS	Internal Revenue Service
LCBP	Lake Champlain Basin Program
MA	Mid-Atlantic
MACRS	Modified Accelerated Cost Recovery System
MW	Midwest
NAICS	North American Industry Classification System
NASS	National Agricultural Statistics Service
NCBA	National Cattlemen's Beef Association
NCSU	North Carolina State University
NEWWT	Northeast Wisconsin Waters for Tomorrow, Inc.
NFI	net farm income
NMPF	National Milk Producers Federation
NOI	Notice of Intent
NPDES	National Pollutant Discharge Elimination System
NPPC	National Pork Producers Council
NRCS	Natural Resources Conservation Service
NRDC	Natural Resources Defense Council
NSPS	New Source Performance Standards
O&M	operation and maintenance
OSHA	Occupational Safety and Health Administration
PA	Pacific
POTW	publicly owned treatment works
RFA	Regulatory Flexibility Act

RIMS II	Regional Input-Output Modeling System
SBA	Small Business Administration
SBAR	Small Business Advisory Review
SBREFA	Small Business Regulatory Enforcement Fairness Act
SER	Small Entity Representative
SIC	Standard Industrial Classification
SO	South
TIAER	Texas Institute for Applied Environmental Research
TSS	total suspended solids
TWF	toxicity weighting factor
UMRA	Unfunded Mandates Reform Act
USDA	United States Department of Agriculture
WASDE	World Agricultural Supply and Demand Estimates
WWTP	wastewater treatment plant

EXECUTIVE SUMMARY

ES.1 INTRODUCTION

The U.S. Environmental Protection Agency (EPA) is revising and updating the two primary regulations that ensure that manure, wastewater, and other process waters generated by concentrated animal feeding operations (CAFOs) do not impair water quality. EPA's final regulatory changes affect the existing National Pollutant Discharge Elimination System (NPDES) provisions and the existing effluent limitations guidelines (ELG) for "feedlots." The NPDES provisions define and establish permit requirements for CAFOs, and the ELG establish the technology-based effluent discharge standard that is applied to CAFOs. Existing regulations were originally promulgated in the 1970s. EPA is revising the regulations to address changes that have occurred in the animal industry sectors over the past 25 years, to clarify and improve implementation of CAFO requirements, and to improve the environmental protection achieved under these regulations. Final revisions to the NPDES and ELG regulations are referred to in this report as the final CAFO regulations.

On January 12, 2001, EPA published a proposal to revise and update these regulations (66 FR 2959), referred to in this report as the "2001 Proposal." The Economic Analysis that supports the 2001 Proposal contains information on EPA's estimates of the cost, financial effects, and monetized benefits of the proposed revisions. That analysis, titled *Economic Analysis of the Proposed Revisions to the National Pollutant Discharge Elimination System Regulation and the Effluent Guidelines for Concentrated Animal Feeding Operations*, is referred to in this report as the "Proposal EA" (USEPA, 2001a). EPA also published two Notices of Data Availability in the Federal Register (66 FR 58556 and 67 FR 48099). These Notices present new data and information EPA has received since the 2001 Proposal, soliciting further public review and comment.

The revisions EPA is promulgating affect who must apply for a permit under the NPDES program, who is subject to the ELG, and what the ELG requires. A summary of the current, proposed, and final NPDES and ELG regulations for CAFOs is presented in Section 1 of this report. See Section 4 of the final rule preamble for a discussion of the final regulations.

This Economic Analysis (EA) summarizes EPA's analysis of the estimated annual compliance costs and the economic impacts that may be incurred by affected operations that are subject to the final revisions. Additional information on the regulatory alternatives considered by EPA for the 2001 Proposal are presented in the EA supporting the proposed regulations (USEPA, 2001a). The report covers financial impacts to CAFOs, potential impacts on processors of livestock and poultry products, and market and other secondary impacts such as impacts on prices, quantities, trade, employment, and output. It also responds to requirements for small business analyses under the Regulatory Flexibility Act (RFA) as amended by the Small Business Regulatory Enforcement Fairness Act (SBREFA) and for cost-benefit analyses under Executive Order 12866 and the Unfunded Mandates Reform Act (UMRA).

This EA summarizes EPA's analysis of the estimated annual compliance costs and the economic impacts that may be incurred by affected operations that are subject to the final revisions. EPA also provides additional material on the final CAFO regulations in the *Development Document for the Final Revisions to the National Pollutant Discharge Elimination System Regulation and the Effluent Guidelines for Concentrated Animal Feeding Operations*, which discusses how the Agency estimated the compliance costs of the final regulations. EPA's detailed benefit analysis, titled *Environmental and*

Economic Benefit Analysis of the Final Revisions to the National Pollutant Discharge Elimination System Regulation and the Effluent Guidelines for Concentrated Animal Feeding Operations, provides information about existing water quality impairments associated with animal production operations and estimates the extent to which these impairments might be mitigated by the final CAFO regulations.

ES.2 DATA AND METHODOLOGY

ES.2.1 Data Sources

EPA did not conduct an industry-wide survey of all CAFOs. Rather, the Agency is relying on existing data sources and expertise provided by numerous government agencies, state agricultural extension service agencies, and land grant universities, as well as information from industry trade associations, agricultural professionals, and environmental groups. This data collection effort is described in the 2001 Proposal (66 FR 2960) and detailed in the Proposal EA. Major data sources are discussed in detail where they are used to conduct the analyses presented in this report or reference other supporting documents in the rulemaking record.

For its engineering cost analysis, EPA uses industry and cost information from various sources, including USDA, the land grant universities, state agricultural extension agencies, and industry. EPA uses these data to develop its model CAFOs and to extrapolate CAFO level costs to all operations nationwide. A key source of data used to estimate compliance costs and economic impacts on the regulated community is the 1997 Census of Agriculture. The Census is conducted by the National Agricultural Statistical Service (NASS) every five years and provides information on the number of feedlots, their geographic distributions, the amount of cropland available to land apply animal manure generated from animal confinement operations, and other information. These data are compiled by NASS, with the assistance of personnel at USDA's Natural Resources Conservation Service (NRCS), who developed a methodology to identify information specific to animal confinement operations. All Census data provided to other government agencies, including EPA, are aggregated to preserve confidential business information. As detailed in the 2001 Notice, EPA has received additional data and information since proposal that have been incorporated into the Agency's analysis for the final regulations. EPA's *Development Document* supporting the proposed and final rule (USEPA, 2001 and 2002) presents the Census data used along with other USDA data and other source data that EPA uses for its cost analysis.

For EPA's economic impact analysis, the Agency obtained financial data for livestock and poultry operations from a variety of sources, including USDA, the land grant universities, and industry. EPA uses these data to depict baseline financial conditions at representative model CAFOs and to extrapolate CAFO level impacts to all operations nationwide. As detailed in both the 2001 Notice and the 2002 Notice, EPA received additional data and information since proposal that have been incorporated into the Agency's analysis for the final regulations. To assess broader market changes from the CAFO regulations, EPA compiled additional industry and market data from a wide range of USDA data and land grant university research. A detailed summary of the data and citations of the sources of these data are provided in the Proposal EA, supplemented by data and other information presented in this report.

A key source of financial data is USDA's Agricultural Resource Management Study (ARMS). This study is compiled by NASS and USDA's Economic Research Service (ERS) and provides complete

financial accounting data for U.S. farms for each of the major commodity sectors affected by the final CAFO regulations. These data are used to depict farm financial conditions and to evaluate regulatory impacts. ERS provided data for representative farms that were obtained through special tabulations of the available survey data, conducted by ERS, that differentiate the financial conditions among operations by commodity sector, facility size (number of animals onsite), and major farm producing region. As with the Census data, USDA aggregated these data in a manner that preserves both the statistical representativeness and confidentiality of the respondent survey data. EPA also obtained financial data from various land grant universities, including enterprise budgets that portray financial conditions for an operation's livestock or poultry enterprise. In particular, the University of Missouri's Food and Agricultural Policy Research Institute (FAPRI) submitted financial data for several sectors that had been collected as part of their evaluation of EPA's Proposal EA. EPA also obtained financial data from the National Cattlemen's Beef Association (NCBA) based on a survey of its membership to obtain financial statistics specific to cattle feeding operations. Section 2.3 and other sections of this report discuss these data in more detail and describe how these data sources contribute to EPA's analyses.

ES.2.2 Methodology

EPA assessed financial effects on regulated CAFOs based on predicted changes to select financial criteria. The economic model that EPA used to evaluate financial impacts on CAFOs uses a representative farm approach. Under this general framework, EPA constructed a series of model facilities ("model CAFOs") that reflect EPA's estimated compliance costs and readily available financial data. EPA used these model CAFOs to develop an average characterization for a group of operations based on certain distinguishing characteristics for each sector, such as facility size and production region, that can be shared across a broad range of facilities.

EPA developed two sets of models for determining economic impacts at animal confinement operations—cost models and financial models. EPA evaluated compliance costs based on more than 170 farm level cost models that were developed to depict conditions at and to evaluate compliance costs for select representative CAFOs. The cost models are differentiated by commodity sector, farm production region, facility size, and land availability for application of manure. EPA's cost models provide the estimated compliance costs, which are compared to corresponding financial models that characterize financial conditions across different types of operations. (Like the cost models, the financial models are also differentiated by sector, facility size, and production region.) Economic impacts under a post-regulatory scenario are approximated by extrapolating the average impacts for a given model CAFO across the larger number of operations that share similar production characteristics and are identified by that CAFO model. A summary of this overall approach is provided in Section 2.

For the purpose of estimating the costs that would be incurred by CAFOs to comply with the regulations, EPA estimated costs associated with four broad cost components: nutrient management planning, facility upgrades, land application, and technologies for balancing on-farm nutrients. Nutrient management planning costs include manure and soil testing, record-keeping, and plan development. Facility upgrades reflect costs for additional or improved manure storage, mortality handling, runoff controls, reduction of fresh water use where appropriate, and additional farm management practices. Land application costs address agricultural application of nutrients, including hauling of excess manure off-site and adjusting for changes in commercial fertilizer needs, and reflect differences among operations based on cropland availability for manure application.

EPA evaluated compliance costs using a representative facility approach based on approximately 1,600 farm level cost models to depict conditions and to evaluate compliance costs for select representative CAFOs. The major factors used to differentiate individual model CAFOs include the commodity sector, the farm production region, and the facility size (based on herd or flock size or the number of animals on-site). EPA's model CAFOs primarily reflect the major animal sector groups, including beef cattle, dairy, hog, broiler, turkey, and egg laying operations. Practices at other subsector operations are also reflected in the cost models, such as replacement heifer operations, veal operations, flushed-cage layers, and hog grow-finish and farrow-finish facilities.

Another key distinguishing factor incorporated into EPA's cost models is information on the availability of cropland and pastureland for land application of manure nutrients. For this analysis, nitrogen and phosphorus rates of land application were evaluated for three categories of cropland availability: (1) CAFOs with sufficient cropland for all manure generated on-site; (2) CAFOs with some, but not enough, cropland to accommodate all of the manure produced at the facility; and (3) CAFOs with no cropland. EPA used USDA data to determine the number of CAFOs within each of these categories. This information takes into account which nutrient (nitrogen or phosphorus) is used as the basis to assess land application and nutrient management costs. Additional information on this costing approach is provided in Section 2 of this report.

For the purpose of estimating costs and financial effects to CAFOs with between 300 and 1,000 AU, EPA assumes that costs that will be incurred by those sized operations to comply with BPJ-based limitations under the revised NPDES regulations are similar to the estimated costs that would be incurred if operations with between 300 and 1,000 AU had to comply with the ELG.

To estimate the impacts of the final regulations, EPA examined the economic effects on regulated CAFOs and national markets. Estimated financial impacts on regulated entities cover both existing and new CAFOs that will be affected by the final regulations. Results presented here focus on economic effects from the CAFO regulations affecting CAFOs with more than 1,000 AU because only large facilities will be subject to the effluent guidelines and NSPS. EPA's analysis also presents the estimated effects on existing operations that are small businesses.

EPA evaluated the economic achievability of the rule on existing operations based on changes in representative financial conditions across three financial criteria: (1) an initial screening comparing incremental post-tax costs to total gross revenue ("sales test"), (2) projected post-compliance cash flow over a 10-year period ("discounted cash flow analysis"), and (3) an assessment of an operation's debt-to-asset ratio under a post-compliance scenario ("debt-asset test").

EPA used the results from these analyses to divide affected CAFOs into three financial impact categories: Affordable, Moderate, and Stress. CAFOs experiencing affordable or moderate impacts are considered to have some financial impact on operations, but EPA does not expect the costs of complying with this rule to make these operations vulnerable to closure. EPA considers that for CAFOs in both the "Affordable" and "Moderate" impact categories the final requirements are likely to be economically achievable. Operations experiencing financial stress, however, are considered to be vulnerable to closure because of the costs of this rule. EPA considers that for CAFOs in the "Stress" impact category, the final requirements are likely not economically achievable. EPA believes that there may be mitigating factors that could reduce the number of facilities experiencing financial stress, such as the availability of cost-share assistance and long-run market adjustment.

EPA conducted its analysis first at the farm level based on data reflecting financial conditions for the entire farm operation (e.g., reflecting income and cost information spanning the entire operation, thus considering the operation's primary livestock production, along with other income sources such as secondary livestock and crop production, government payments, and other farm-related income). Based on the farm level results, EPA also assessed the financial effects on CAFOs at the enterprise level (e.g., limiting the scope of the assessment to the operation's livestock or poultry enterprise, and excluding other non CAFO-related sources of income from the analysis). By evaluating the financial criteria at both the farm level and the enterprise level, EPA's analyses address comments expressed by many commenters, including FAPRI, other land grant university researchers, and industry, as well as USDA.

Starting with the farm level analysis, EPA considers the regulations to be economically achievable for a representative model CAFO if the average operation has a post-compliance sales test estimate within an acceptable range, a positive post-compliance cash flow over a 10-year period, and a post-compliance debt-to-asset ratio not exceeding a benchmark value. Specifically, if the sales test shows that compliance costs are less than 3 percent of sales, or if post-compliance cash flow is positive and the post-compliance debt-to-asset ratio does not exceed a benchmark (depending on the baseline data) and compliance costs are less than 5 percent of sales, EPA considers the options to be "Affordable" for the representative CAFO group. (Although a sales test result of less than 3 percent does indicate "Affordable" in the farm level analysis, further analysis is conducted to determine the effects at the operation's livestock or poultry enterprise.) The benchmark values assumed for the debt-asset test are sector-specific. EPA assumes a 70 percent benchmark value for the debt-asset test to indicate financial stress in the hog and dairy sectors, and an 80 percent benchmark for the debt-asset test to indicate financial stress in the beef cattle sector. These benchmark values address public comment received and alternative debt and asset data submitted for the livestock sectors. For the poultry sectors, however, EPA did not obtain alternative debt and asset data and continues to evaluate data used for proposal against a 40 percent benchmark value.

A sales test of greater than 5 percent but less than 10 percent of sales with positive cash flow and a debt-to-asset ratio of less than these sector-specific debt-asset benchmark values is considered indicative of some impact at the CAFO level, but at a level not as severe as those indicative of financial distress or vulnerability to closure. These impacts are labeled "Moderate" for the representative CAFO group. EPA considers both the "Affordable" and "Moderate" impact categories to be economically achievable by the CAFO, subject to the enterprise analysis (see below). If, with a sales test of greater than 3 percent, post-compliance cash flow is negative or the post-compliance debt-to-asset ratio exceeds these sector-specific debt-asset benchmarks, or if the sales test shows costs equal to or exceeding 10 percent of sales, EPA considers the final regulations to be associated with potential financial stress for the entire representative CAFO group. In such cases, each of the operations represented by that group might be vulnerable to closure. For operations that are determined to experience financial "Stress" at the farm level, the final requirements are likely not economically achievable.

The enterprise level analysis builds on the farm level analysis, evaluating effects at a farm's livestock or poultry enterprise. If the farm level analysis shows that the regulations impose "Affordable" or "Moderate" effects on the operation, the enterprise level analysis is conducted to determine whether the enterprise's cash flow is able to cover the cost of regulations. This analysis uses a discounted cash flow approach similar to that used to assess the farm level effects, in which the net present value of cash flow is compared to the net present value of the total cost of the regulatory options over the 10-year time frame of the analysis. Over the analysis period, if an operation's livestock or poultry enterprise maintains a cash flow stream that both exceeds the cash costs of the rule (operating and maintenance

costs plus interest) and covers the net present value of the principal payments on the capital, EPA concludes that the enterprise will likely not close because of the CAFO rule. This analysis is conducted on a pass/fail basis. If the net present value of cash flow minus the net present value of the rule's costs is greater than zero, the enterprise passes the test and the enterprise is assumed to continue to operate. EPA considers these results to indicate that the final requirements are economically achievable. If the net present value of cash flow is not sufficient to cover the net present value of the cost of the rule, EPA assumes that the CAFO operator would consider shutting down the livestock or poultry enterprise. That is, if an operation fails the enterprise level analysis, these operations are determined to experience financial "Stress" and the final requirements are likely not economically achievable.

In response to comments, EPA conducted additional supplemental analysis to determine the effects of the regulation under two different scenarios. One scenario takes into consideration the effects of long-run market adjustment following implementation of the final regulations. This analysis is conducted using simulated changes in producer revenue given changes in market prices as depicted by EPA's market model, which uses estimates of price and quantity response in these markets. A second scenario takes into consideration potential cost share assistance under Federal and State conservation programs, assuming that a portion of costs are covered by cost sharing subject to programmatic constraints. Given the uncertainty of whether CAFO income will rise in response to long-run market adjustment or whether available cost share dollars will effectively offset compliance costs at regulated CAFOs, EPA's analysis to determine whether the regulation is "economically achievable" does not rely on such assumptions as part of its regulatory analysis and therefore reflects the highest level of impacts projected. However, EPA presents the results of this analysis assuming both some degree of cost passthrough and no cost passthrough, as well as some degree of cost share assistance and no cost share assistance, along with the results of its lead analysis. More information on this decision framework is provided in Section 2.

EPA's market analysis evaluates the effects of the final regulations on national markets. This analysis uses a linear partial equilibrium model adapted from the COSTBEN model developed by USDA's Economic Research Service. The modified EPA model provides a means to conduct a long-run static analysis to measure the market effects of the final regulations in terms of predicted changes in farm and retail prices and product quantities. Market data used as inputs to this model are from a wide range of USDA data and land grant university research. Once price and quantity changes are predicted by the model, EPA uses national multipliers that relate changes in sales to changes in total direct and indirect employment and also to national economic output. These estimated relationships are based on the Regional Input-Output Modeling System (RIMS II) from the U.S. Department of Commerce. The details of the market analysis are described in Section 2 and also in the Proposal EA.

Additional information on how EPA developed the cost models is provided in the *Development Document*. See also EPA's detailed responses to public comments received on proposal and both Notices of Data Availability published on this rule. These comments and the Agency's response are in the Comment Response Document that is available in the rulemaking record.

ES.3 REGULATED COMMUNITY

The animal sectors covered in this analysis include the cattle, veal, heifer, dairy, hog, broiler, egg layer, and turkey sectors. Not all confinement operations (animal feeding operations or AFOs) in these sectors may be CAFOs and thus subject to the final regulations. Table ES-1 presents the estimated

number of operations that would be defined or designated as a CAFO under the final revisions. CAFOs in the 300 to 1,000 animal units (AU)[1] size category that EPA expects would be defined as CAFOs under the existing NPDES regulation are labeled in table as "Status Quo."

Section 2 of the Proposal EA (USEPA, 2001a) presents more detailed information on the regulated community, including a profile of the various CAFO sectors and meat and poultry processors.

Table ES-1. Number of Potential Operations *Defined* or *Designated* as CAFOs (1997)

Sector	Total Operations Defined as CAFOs		
	>1,000 AU	300-1,000 AU "Status Quo"	Designated CAFOs <1,000 AU
	(number of operations)		
Cattle	1,766	174	15
Veal	12	230	0
Heifers	242	7	3
Dairy	1,450	1,949	30
Hogs	3,924	1,485	52
Broilers	1,632	520	52
Layers-dry	729	26	8
Layers-wet	383	24	2
Turkeys	388	37	10
Total CAFOs	**10,526**	**4,452**	**172**

Source: USEPA (see Section 3). "Layers: wet" are operations with liquid manure systems. "Layers: dry" are operations with dry systems. Number of designated facilities shown over 5 year period.

ES.4 ANNUAL INCREMENTAL COSTS

ES.4.1 Costs to Regulated CAFOs

EPA estimates the annual incremental costs of compliance using the capital and recurring costs derived in the *Development Document*. EPA converts these costs to incremental annualized costs, as described in Appendix A. Annualized costs better describe the actual compliance costs that a model

[1] As defined for the final CAFO regulations, one animal unit (AU) is equivalent to one slaughter or feeder cattle, calf or heifer; 0.7 mature dairy cattle; 2.5 hogs (over 55 pounds) or 5 nursery pigs; 55 turkeys; 30 egg-laying chickens (where a wet manure management system is used), and 125 broilers and 82 egg-laying chickens, regardless of the animal waste system used.

CAFO would incur, allowing for the effects of interest, depreciation, and taxes. EPA uses these annualized costs to estimate the total annual compliance costs and to assess the economic impacts of the final requirements to regulated CAFOs by taking the annualized costs for each CAFO model and aggregating them on the basis of the number of affected CAFOs represented by each model. Section 2 and Appendix A provide more details on the cost annualization methodology and results.

This EA presents the results of two technology options where EPA has estimated the cost of land application based on nitrogen-based application rates only (Option 1) and also the cost of land application based on nitrogen-based application rates, except in those instances where EPA believes that phosphorus-based rates are likely to be appropriate (Option 2). The final rule specifies that the determination of application rates is to be based on the technical standards established by the Director and EPA expects that these standards will require phosphorus-based application, where appropriate. The rule also provides for these standards to include appropriate flexibilities in the use of phosphorus-based rates, such as multi-year phosphorus application, but the potential costs savings resulting from these flexibilities are not reflected in the analysis. As a result, the cost and economic impacts of this rule may have been overestimated.

EPA evaluated the costs of these technology options for all operations defined as CAFOs with more than 1,000 AU and for those operations that are defined as CAFOs with between 300 and 1,000 AU. EPA calculates these costs using the data and approaches described in the *Development Document* (USEPA, 2002) and in Section 2 of this report. For the purpose of estimating total regulatory costs of the final CAFO regulations, EPA assumes that the individual per-CAFO costs to comply with the effluent guideline regulations are similar to the costs that will be incurred by operations with between 300 and 1,000 AU to comply with the revised NPDES requirements (although these smaller-sized operations will be subject to BPJ and not the ELG requirements). These cost estimates, therefore, may further be overstated for this size category.

Table ES-2 summarizes EPA's estimates of the total annualized costs to existing CAFOs due to the regulations. The table shows these costs broken out by sector and broad facility size category. Results are shown for both Option 1 and Option 2. As shown in the table, EPA estimates the total estimated costs to CAFOs range from $141 million (Option 1) to $326 million annually (Option 2), expressed as pre-tax, 2001 dollars. Roughly one-half of this cost is incurred by the dairy sector, with another roughly 30 percent incurred within the cattle sectors (including the beef, veal, and heifer sectors). (Total estimated social costs include an additional $9 million to Federal and State governments; see Section 5.)

Of this total, EPA estimates that the cost to operations with more than 1,000 AU range from $119 million (Option 1) to $273 million annually (Option 2). Total estimated costs to facilities defined as CAFOs with between 300 and 1,000 AU range from $19 million (Option 1) to $39 million annually (Option 2). EPA estimates that of the total cost to additional operations that may be designated as CAFOs ranges from about $3 million to $4 million annually, depending on the regulatory option. More information on these costs is provided in Section 3, along with cost information on alternative regulatory options EPA considered.

Table ES-2. Annual Pre-tax Cost of the Rule, $2001 (Option 1 & Option 2)

Sector	Number of Operations		Aggregate Incremental Costs			
	CAFOs >1,000 AU	CAFOs 300-1,000 AU	Total	CAFOs >1,000 AU	CAFOs 300-1,000 AU	Designated CAFOs
	(number)		($2001, millions, pre-tax)			
ELG Option 1						
Fed Cattle	1,766	174	$19.2	$17.8	$1.1	$0.3
Veal	12	230	<$0.1	<$0.1	<$0.1	$0.0
Heifer	242	7	$3.5	$1.3	$2.1	$0.1
Dairy	1,450	1,949	$71.5	$59.7	$11.3	$0.5
Hogs	3,924	1,485	$8.6	$6.4	$2.1	$0.1
Broilers	1,632	520	$18.5	$15.3	$2.1	$1.1
Layers - Dry	729	26	$6.6	$6.3	$0.1	$0.2
Layers - Wet	383	24	$6.4	$6.4	$0.0	<$0.1
Turkeys	388	37	$6.3	$5.9	$0.2	$0.2
Total	**10,526**	**4,452**	**$140.6**	**$119.1**	**$19.0**	**$2.5**
ELG Option 2						
Fed Cattle	1,766	174	$88.2	$85.8	$1.9	$0.5
Veal	12	230	$0.0	<$0.1	<$0.1	$0.0
Heifer	242	7	$6.3	$3.8	$2.4	$0.1
Dairy	1,450	1,949	$151.1	$128.2	$22.0	$0.9
Hogs	3,924	1,485	$34.8	$24.9	$9.5	$0.4
Broilers	1,632	520	$20.5	$16.8	$2.4	$1.3
Layers - Dry	729	26	$7.5	$7.2	$0.1	$0.2
Layers - Wet	383	24	$8.9	$8.4	$0.5	<$0.1
Turkeys	388	37	$8.7	$8.1	$0.3	$0.3
Total	**10,526**	**4,452**	**$326.0**	**$283.2**	**$39.1**	**$3.8**

May not add due to rounding. Number of operations do not include designated facilities. See notes Table 3-1.
"Layers: dry" are operations with dry manure systems. "Layers: wet" are operations with liquid manure systems.

These aggregated cost estimates reflect pre-tax costs. However, EPA's model calculates both pre-tax and post-tax costs (see Section 2.2.4). The post-tax costs reflect the fact that a CAFO would be able to depreciate or expense these costs, thereby generating a tax savings. Post-tax costs thus are the actual costs the CAFO would face. Pre-tax costs reflect the estimated total social cost of the regulations, including lost tax revenue to governments. Pre-tax dollars are used when comparing estimated costs to monetized benefits that are estimated to accrue under the final regulations (see Section 5). All costs presented in this section are presented in terms of pre-tax 1997 dollars and do not account for annual tax savings to CAFOs. However, post-tax costs are also used to evaluate impacts on regulated facilities using a discounted cash flow analysis, as presented in Section 3.3. EPA's estimated compliance costs presented in the *Development Document* are also estimated in 1997 dollars because 1997 is the base year of the analysis (USEPA, 2002). Estimated costs have been converted from 1997 dollars to 2001 dollars using the Construction Cost Index (ENR, 2002).

ES.4.2 Costs to the NPDES Permitting Authority

The NPDES permitting authority would incur additional costs to alter existing State programs and obtain EPA approval to develop new permits, review new permit applications, and issue revised permits that meet the final regulatory requirements. EPA expects that NPDES permitting authorities will incur administrative costs related to the development, issuance, and tracking of general or individual permits.

State and Federal administrative costs to issue a general permit include costs for permit development, public notice and response to comments, and public hearings. States and EPA might also incur costs each time a facility operator applies for coverage under a general permit due to the expenses associated with a NOI. These per-facility administrative costs include initial facility inspections and annual record-keeping expenses associated with tracking NOIs. Administrative costs for an individual permit include application review by a permit writer, public notice, and response to comments. An initial facility inspection might also be necessary.

EPA assumes that under the final regulations more than 15,500 CAFOs would be permitted. This estimate consists of about 15,000 CAFOs covered by State permits and about 500 CAFOs covered by Federal permits. Administrative costs incurred by State permitting authorities are expected to be $8.5 million. EPA permitting authorities will incur the remaining $0.3 million. EPA has expressed these costs in 2001 dollars, annualized over the 5-year permit term using a 7 percent discount rate. A summary of this analysis is available in section 10 of the preamble to the final rule. More information is is available in Section 5 of this report. See also the *NPDES Support Document* (USEPA, 2002n) and in the *Development Document* (USEPA, 2002).

ES.5 FINANCIAL EFFECTS

ES.5.1 Existing CAFOs

Table ES-3 presents the results of EPA's analysis of the estimated CAFO financial effects in terms of the number of operations that will experience affordable, moderate, or stress impact because of this rule. Results are shown by sector for CAFOs with more than 1,000 AU only. The analysis evaluates the regulatory impacts on existing CAFOs with more than 1,000 AU only because this size of operation

only would be subject to the ELG regulations (and, therefore, EPA has determined whether the final ELG requirements reflect Best Available Technologies Economically Achievable or BATEA. Operations with fewer than 1,000 AU would be subject to "Best Professional Judgement" [BPJ]).

EPA's analysis results are shown in Table ES-3. For Option 1, the analysis indicates that, among all CAFOs with more than 1,000 AU in the veal, heifer, dairy, hog, turkey, and egg-laying sectors, the impacts due to this rule can be characterized as "Affordable" or "Moderate." Therefore, EPA considers this option to be economically achievable for existing facilities in these animal sectors. EPA estimates that a total of 15 existing CAFOs (less than 1percent of all CAFOs with more than 1,000 AU) would experience financial stress and might be vulnerable to closure. By sector, EPA estimates that 12 beef operations (1 percent of affected beef CAFOs) and 3 broiler operations (less than 1 percent of affected broiler CAFOs) might close as a result of complying with the final regulations.

For Option 2, the analysis indicates that, among all CAFOs with more than 1,000 AU in the veal, dairy, turkey, and egg-laying sectors, the impacts due to this rule can be characterized as "Affordable" or "Moderate." Therefore, EPA considers this option to be economically achievable for existing facilities in these animal sectors. (Moderate impacts might be incurred by operations in some sectors, but these impacts are not considered to result in facility closure.) In the beef cattle, heifer, hog, and broiler sectors, however, EPA's analysis indicates that the final rule would cause some existing CAFOs to experience financial stress, making these operations vulnerable to facility closure. Across all sectors, EPA estimates that 285 existing CAFOs (about 3 percent of all all CAFOs with more than 1,000 AU) would experience financial stress and might be vulnerable to closure. By sector, EPA estimates that 49 beef operations (3 percent of affected beef CAFOs), 22 heifer operations (9 percent), 204 hog operations (5 percent of affected hog CAFOs), and 10 broiler operations (1 percent) might close as a result of complying with the final regulations. See Section 3 of this report for more information.

These estimates of the number of potential CAFO closures are cumulative and reflect the results of both the farm level analysis and the enterprise level analysis. These estimated closure rates are generally consistent with the findings of economic achievability of previous effluent guidelines for other industrial point source categories. Based on the results of this analysis, EPA concludes that both Option 1 and Option 2 would be considered economically achievable for existing CAFOs.

These results are based on an analysis that does not consider the longer term effects on market adjustment and also available cost-share assistance from Federal and State farm conservation programs. EPA believes that such adjustments could lessen the economic impacts of the final regulations over time. Sections 3.3.5 show the results of this analysis under assumptions of long-run market adjustment and cost-share assistance.

These results reflect estimated costs for two technology options where EPA has estimated the cost of land application based on nitrogen-based application rates only (Option 1) and also the cost of land application based on nitrogen-based application rates, except in those instances where EPA believes that phosphorus-based rates are likely to be appropriate (Option 2). Given that the final rule provides for appropriate flexibilities in the use of phosphorus-based rates, such as multi-year phosphorus application, EPA has not accounted for the potential costs savings resulting from these flexibilities in its analysis. As a result, the economic impacts presented here may be overestimated. Also, for the purpose of this analysis, EPA assumes that small business CAFOs with between 300 and 1,000 AU would incur costs similar to those estimated for CAFOs with more than 1,000 AU (although these smaller-sized operations will be subject to BPJ and not the ELG requirements under the revised NPDES requirements). These upper end cost estimates could, therefore, overstate the financial effects for this size category.

Table ES-3. Financial Effects of the ELG on CAFOs (>1,000 AU), Option 1 and Option 2

Sector	Number CAFOs (>1,000AU)	Affordable	Moderate	Stress	Affordable	Moderate	Stress
		(Number)			(Percent of Total Operations)		
ELG Option 1							
Fed Cattle	1,766	1,754	0	12	99%	0%	1%
Veal	12	12	0	0	100%	0%	0%
Heifer	242	242	0	0	100%	0%	0%
Dairy	1,450	1,232	218	0	85%	15%	0%
Hogs	3,924	3,924	0	0	100%	0%	0%
Broilers	1,632	1,334	294	3	82%	18%	0%
Layers - Dry	729	729	0	0	100%	0%	0%
Layers - Wet	383	383	0	0	100%	0%	0%
Turkeys	388	388	0	0	100%	0%	0%
Total	**10,526**	**9,998**	**512**	**15**	**95%**	**5%**	**0%**
ELG Option 2							
Fed Cattle	1,766	1,717	0	49	97%	0%	3%
Veal	12	12	0	0	100%	0%	0%
Heifer	242	220	0	22	91%	0%	9%
Dairy	1,450	1,019	431	0	70%	30%	0%
Hogs	3,924	3,249	470	204	83%	12%	5%
Broilers	1,632	1,032	590	10	63%	36%	1%
Layers - Dry	729	729	0	0	100%	0%	0%
Layers - Wet	383	383	0	0	100%	0%	0%
Turkeys	388	388	0	0	100%	0%	0%
Total	**10,526**	**8,749**	**1,491**	**285**	**83%**	**14%**	**3%**

Source: USEPA. May not add due to rounding.
"Layers: dry" are operations with dry manure systems. "Layers: wet" are operations with liquid manure systems.

Section 3 of this report also presents the results of alternative regulatory options considered in the 2001 Proposal. Also presented are potential closures assuming that operations with fewer than 1,000 AU might have been subject to the ELG, as was proposed by EPA.

ES.5.2 Small Business CAFOs

Table ES-4 shows EPA's estimate of the number of small businesses that would be affected by the final regulations. EPA's analysis indicates that the final rule could cause financial stress to some small businesses, making these businesses vulnerable to closure (assuming no cost passthrough and cost-share assistance). Section 4 of this report provides more detailed information.

The Small business Administration (SBA) defines a "small business" in the livestock and poultry sectors in terms of average annual receipts (or gross revenue). SBA size standards for these industries define a "small business" as one with average annual revenues over a 3-year period of less than $0.75 million for dairy, hog, broiler, and turkey operations; $1.5 million for beef feedlots; and $9.0 million for egg operations. EPA defines a "small" egg laying operation for purposes of its regulatory flexibility assessments as an operation that generates less than $1.5 million in annual revenue. EPA consulted with SBA on the use of this alternative definition. A summary of EPA's rationale and supporting analyses pertaining to this alternative definition is provided in the record and in Section 4.

Given these considerations, EPA defines a "small business" for this rule as an operation that houses or confines less than 1,400 fed beef cattle (includes fed beef, veal, and heifers); 300 mature dairy cattle; 2,100 market hogs; 37,500 turkeys; 61,000 layers; or 375,000 broilers. The approach used to derive these estimates is described in Section 4 and in the record.

EPA estimates that of the approximately 238,000 animal confinement facilities in 1997, roughly 95 percent are small businesses. Not all of these operations would be affected by the final rule. Table ES-4 shows EPA's estimates of the number of small business CAFOs that would be affected by this rule. For this analysis, EPA estimates that about 6,200 affected CAFOs across all size categories are small businesses, accounting for more than 40 percent of the estimated 14,515 affected facilities. EPA estimates that among CAFOs with more than 1,000 AU about 2,330 operations are small businesses (accounting for about one-fourth of all CAFOs in this size category). Most affected small businesses are in the broiler sector. Among CAFOs with between 300 and 1,000 AU, EPA estimates about 3,830 operations are small businesses (accounting for the majority of operations in this size category), and most of the affected small businesses are in the hog, dairy, and broiler sectors.[2]

For the 2001 proposal, EPA conducted a preliminary assessment of the potential impacts on small business CAFOs based on the results of a costs-to-sales test (66 FR 3101). This screen test indicated the need for additional analysis to characterize the nature and extent of impacts on small entities. Based on the results of this initial assessment, EPA projected that it would likely not certify that the proposal, if promulgated, would not impose a significant economic impact on a substantial number of entities. Therefore, EPA convened a SBAR Panel and prepared an Initial Regulatory Flexibility Analysis (IRFA) pursuant to §§609(b) and 603 of the RFA, respectively. The 2001 proposal provides more

[2] For reasons noted in the record, EPA believes that the number of small broiler operations is overestimated and might actually include a number of medium and large broiler operations that should not be considered small businesses.

information on EPA's small business outreach and the Panel activities during the development of this rulemaking (66 FR 3121). Section 10 of the preamble to the final rule summaries EPA's Final Regulatory Flexibility Analysis (FRFA), as required under §604 of the RFA. This analysis is provided in Section 4.

In examining the effects on small businesses for the final rule, EPA followed the same approach used to evaluate the impacts on existing CAFOs, as described in Section ES.2. For the purposes of this analysis, EPA assumes that small business CAFOs with between 300 and 1,000 AU would incur costs similar to those estimated for CAFOs with more than 1,000 AU (although these smaller-sized operations will be subject to BPJ and not the ELG requirements under the revised NPDES requirements). These upper end cost estimates could, therefore, overstate the financial effects for small businesses in this size category. For past regulations, EPA has often analyzed the potential impacts to small businesses by evaluating the results of a costs-to-sales test, measuring the number of operations that will incur compliance costs at varying threshold levels (including ratios where costs are less than 1 percent, between 1 and 3 percent, and greater than 3 percent of gross income). EPA conducted such an analysis at the time of the 2001 proposal, indicating that about 80 percent of the estimated number of small businesses directly subject to the rule as CAFOs might incur costs in excess of three percent of sales. EPA believes that its more refined analysis used for its general analysis (presented here) better reflects the potential impacts to regulated small businesses.

Using the approach used to evaluate the impacts on existing CAFOs, EPA's analysis indicates that the final rule could cause financial stress to some small businesses, making these businesses vulnerable to closure. These results are presented in Table ES-4.

For Option 1, the analysis indicates that, among all small business CAFOs in the veal, dairy, hog, turkey, and egg-laying sectors, the impacts due to this rule can be characterized as "Affordable" or "Moderate." EPA estimates that a total of 172 small businesses (3 percent of all small business CAFOs with more than 300 AU) would experience financial stress and might be vulnerable to closure. By sector, these closures are comprised of about 131 small businesses in the beef sector, 38 businesses in the heifer sector, and 3 businesses in the broiler sector. Most of these (nearly 90 percent) are operations with fewer than 1,000 AU. For Option 2, the analysis indicates that, among all small business CAFOs in the veal, dairy, hog, turkey, and egg-laying sectors, the impacts due to this rule can be characterized as "Affordable" or "Moderate." EPA estimates that a total of 262 small businesses (4 percent of all small business CAFOs with more than 300 AU) would experience financial stress and might be vulnerable to closure. By sector, these closures are comprised of about 183 small businesses in the beef sector, 50 businesses in the heifer sector, and 19 businesses in the broiler sector. Nearly 90 percent of these potential closures are operations with fewer than 1,000 AU. See Section 4 of this report for more information.

These estimates of the number of potential CAFO closures are cumulative and reflect the results of both the farm level analysis and the enterprise level analysis. These results are based on an analysis that does not consider the longer term effects on market adjustment and also available cost-share assistance from Federal and State farm conservation programs. EPA believes that such adjustments could lessen the economic impacts of the final regulations over time.

Table ES-4. Results of EPA's Small Business Analysis, Option 1 and Option 2

Sector	Number of Small Business CAFOs	Affordable	Moderate	Stress	Affordable	Moderate	Stress
		(Number)			(Percent of Total Operations)		
Option 1							
Fed Cattle	712	581	0	131	82%	0%	18%
Veal	12	12	0	0	100%	0%	0%
Heifer	327	289	0	38	88%	0%	12%
Dairy	1330	1330	0	0	100%	0%	0%
Hogs	1485	1485	0	0	100%	0%	0%
Broilers	1823	1395	424	3	77%	23%	0%
Layers: Dry	24	24	0	0	100%	0%	0%
Layers: Wet	407	407	0	0	100%	0%	0%
Turkeys	31	31	0	0	100%	0%	0%
Total	**6151**	**5554**	**424**	**172**	**90%**	**7%**	**3%**
Option 2							
Fed Cattle	712	529	0	183	74%	0%	26%
Veal	12	12	0	0	100%	0%	0%
Heifer	327	277	0	50	85%	0%	15%
Dairy	1330	1306	24	0	98%	2%	0%
Hogs	1485	1483	2	0	100%	0%	0%
Broilers	1823	1026	780	19	56%	43%	1%
Layers: Dry	24	24	0	0	100%	0%	0%
Layers: Wet	407	407	0	0	100%	0%	0%
Turkeys	31	31	0	0	100%	0%	0%
Total	**6151**	**5129**	**806**	**262**	**83%**	**13%**	**4%**

Source: USEPA. See Economic Analysis. May not add due to rounding. Does not includes the number of CAFOs includes designated facilities. Assumes that the costs that will be incurred by those sized operations to comply with BPJ-based limitations under the revised NPDES regulations are similar to the estimated costs that would be incurred if Medium CAFOs had to comply with the ELG.
"Layers: dry" are operations with dry manure systems. "Layers: wet" are operations with liquid manure systems.

ES.5.3 New CAFOs

EPA evaluated impacts on new source CAFOs by comparing the costs borne by new source CAFOs to those estimated for existing sources. That is, if the expected cost to new sources is similar to or less than the expected cost borne by existing sources (and that cost was considered economically achievable for existing sources), EPA considers that the regulations for new sources do not impose requirements that might grant existing operators a cost advantage over new CAFO operators and further determines that the NSPS requirements are affordable and do not present a barrier to entry for new facilities. In general, costs to new sources from NSPS requirements are lower than the costs for retrofitting the same technologies at existing sources since new sources are able to apply control technologies more efficiently than existing sources that might incur high retrofit cost. New sources will be able to avoid the retrofit costs that will be incurred by existing sources. Furthermore, new sources might be able to avoid the other various control costs facing some existing producers through careful site selection. The requirements promulgated in today's rule do not give existing operators a cost advantage over new CAFO operators; therefore, the NSPS do not present a barrier to entry for new facilities. Examples of avoided retrofit costs and costs of total containment systems and waste management, including land application, for both existing and new sources, are provided in Section 4 of the preamble to the final regulations. More detailed information is provided in the *Development Document* (USEPA, 2002) and related cost reports, as well as in Section 3.

ES.5.4 National Markets

EPA's market analysis evaluates the effects of the final regulations on commodity prices and quantities at the national level. The analysis also presents EPA's estimate of national and regional employment changes, net trade, and changes in economic output, among other supplemental analyses. Section 3 of this report provides more detailed information.

EPA expects that predicted changes in animal production might raise producer prices as the market adjusts to the final regulatory requirements. For most sectors, EPA estimates that producer price changes will rise by less than one percent compared to the pre-regulation baseline price. At the retail level, EPA estimates that poultry and red meat prices will rise about one cent per pound. EPA also estimates that egg prices will rise by about one cent per dozen and that milk prices will rise by about one cent per gallon. Trade and employment effects are also expected to be modest.

EPA also considered whether the final rule could have community level and/or regional impacts if it substantially altered the competitive position of livestock and poultry production across the nation, or led to growth or reduction in farm production (in- or out-migration) in different regions and communities. Ongoing structural and technological changes in these industries have influenced where farmers operate and have contributed to locational shifts between the traditional production regions and the emergent, nontraditional regions. Production is growing rapidly in the emergent regions because of competitive pressures and because specialized producers tend to have the advantage of lower per-unit costs of production. This is especially true in hog and dairy production.

To evaluate the potential for differential impacts among farm production regions, EPA examined employment impacts by region. EPA also evaluated whether the final requirements could result in substantial changes in volume of production, given predicted facility closures, within a particular production region. EPA concludes from these analyses that regional and community level effects are

estimated to be modest, but do tend to be concentrated within the more traditional agricultural regions. This analysis is discussed in Section 3.

EPA does not expect that this rule will have a significant impact on where animals are raised. On one hand, on-site improvements in waste management and disposal, as required by the final rule, could accelerate recent shifts in production to more nontraditional regions as higher-cost producers in some regions exit the market to avoid the relatively high retrofitting costs associated with bringing existing facilities into compliance. On the other hand, the final regulations might favor more traditional production systems where operators grow both livestock and crops, since these operations tend to have available cropland for land application of manure nutrients. These types of operations tend to be more diverse and less specialized and, generally, smaller in size. Long-standing farm services and input supply industries in these areas could likewise benefit from the final rule, given the need to support on-site improvements in manure management and disposal. Local and regional governments, as well as other nonagricultural enterprises, would also benefit.

ES.6 COST-BENEFIT ANALYSIS

As Table ES-5 shows, the economic value of the environmental benefits EPA is able to monetize (i.e., evaluate in dollar terms) is comparable to the estimated costs of the rule. EPA has estimated the monetized benefits of the final rule for all operations with more than 1,000 AU. For Option 1, total monetized benefits for CAFOs with more than 1,000 AU range from $141 million to $224 million. For Option 2, total monetized benefits for CAFOs with more than 1,000 AU range from $204 million to $340 million annually. These benefit estimates are expressed as pre-tax, 2001 dollars and have been calculated assuming a 7 percent discount rate. Monetized benefit categories are primarily in the areas of improved surface water quality (measured in terms of enhanced recreational value), reduced nitrates in private wells, reduced shellfish bed closures from pathogen contamination, and reduced fish kills from episodic events. EPA also identified a number of benefits categories that could not be monetized, including reduced euthrophication of estuaries, reduced pathogen contamination in private wells, reduced health and environmental risks associated with episodic pollutant discharge events, drinking water treatment cost savings, reduced odor and air emissions, and avoided loss in property value near CAFOs, among other benefits. These benefits are described in more detail the *Benefits Analysis* and other supporting documentation provided in the record.

These estimated benefits compare to EPA's estimate of the total social costs covering both industry and permit authority costs for operations with more than 1,000 AU only. These costs range from $125 million (Option 1) to $289 million (Option 2) annually for all CAFOs with more than 1,000 AU, as was estimated in the Agency's *Benefit Analysis*. These costs include compliance costs to all CAFOs, as well as administrative costs to Federal and State governments. EPA estimates of the administrative cost to Federal and State governments to implement this rule is $9 million per year. There may be additional social costs that have not been monetized. However, these costs are estimated based on the cost of land application based on nitrogen-based application rates, except in those instances where EPA believes that phosphorus-based rates are likely to be appropriate. As discussed previously, the final rule includes provisions for appropriate flexibilities in the use of phosphorus-based rates, such as multi-year phosphorus application, but the potential costs savings resulting from these flexibilities are not reflected in the analysis. Therefore, the costs of this rule may have been overestimated.

Table ES-5 Total Annual Monetized Social Costs and Benefits (millions $2001), CAFO >1,000 AU

Category	Option 1	Option 2
Total Monetized Social Costs		
Industry Compliance Costs (pre-tax):	$119	$283
State/Federal Administrative Costs:	$6	$6
Total Social Costs	*$125*	*$289*
Total Monetized Benefits		
Improved Surface Water Quality	$102.4 - $182.6	$166.2 - $298.6
Reduced Incidence of Fish Kills	$0.0 - $0.1	$0.1
Improved Commercial Shell Fishing	$0.1 - $2.0	$0.3 - $3.4
Reduced Contamination of Private Wells	$33.3	$30.9
Reduced Contamination of Animal Water Supplies	$4.7	$5.3
Reduced Eutrophication of Estuaries	$0.1	$0.2
Reduced Water Treatment Costs	$0.7 - $1.0	$1.1 - $1.7
Reduced eutrophication & pathogen contamination of coastal & estuarine waters	not monetized	not monetized
Reduced pathogen contamination of private & public underground sources of drinking water	not monetized	not monetized
Reduced human & ecological risks from antibiotics, hormones, metals, salts	not monetized	not monetized
Improved soil properties	not monetized	not monetized
Reduced cost of commercial fertilizers for non-CAFO operations	not monetized	not monetized
Total Benefits	**$141.3 + [B] - $223.8 + [B]**	**$204.1 + [B] - $340.2 +[B]**

Source: USEPA. May not add due to rounding. [B] represents the non-monetized benefits of the rule.

These cost and benefit estimates are also expressed as pre-tax, 2001 dollars and have been calculated assuming a 7 percent discount rate. See Section 5 for more information.

ES.7 OTHER INFORMATION

This report presents a summary of estimated per-animal and per-facility costs by animal sector (Section 3 and Appendices B and D). It also presents an overview of the cost annualization approach

(Appendix A), details on the model used to estimate changes in producer prices associated with the final regulations (Appendix C), and the results of a cost-effectiveness analysis (Appendix E).

Section 2 of the Proposal EA (USEPA, 2001a) provides a detailed industry profile of the affected regulated livestock and poultry sectors and meat and poultry processors. The Proposal EA also details the model used to estimate economic impacts on CAFOs and national level markets (Section 4 and Appendix B). Appendix D of the Proposal EA also shows the results of sensitivity analyses EPA conducted for the 2001 Proposal.

This report does not include a detailed presentation of the economic benefits that are expected to accrue as a result of the final CAFO regulations. That analysis is provided in the *Benefits Analysis* (USEPA, 2002k) that supports this rulemaking. The *Development Document* (USEPA, 2002) provides more detailed information on the farm level costs that EPA estimates for this analysis.

ES.8 ORGANIZATION OF THE REPORT

This report is organized to allow those interested in the impacts on a specific industry sector to find information easily. The sections of the report are as follows:

- Section 1 provides a summary of the existing, proposed, and final regulations affecting CAFOs.
- Section 2 describes the data and methodologies EPA uses to estimate the total annual incremental costs and the economic impacts that would be incurred by the livestock and poultry industry as a result of the final CAFO regulations, highlighting changes EPA has made since the 2001 Proposal in response to public comments.
- Section 3 presents a summary of the estimated national, annual costs and the economic impacts on regulated facilities of the final CAFO regulations.
- Section 4 presents the results of EPA's Final Regulatory Flexibility Analysis and describes the possible financial effects on small businesses.
- Section 5 presents a discussion of the regulatory costs and benefits pursuant to Executive Order 12866 and the Unfunded Mandates Reform Act (UMRA).
- Section 6 presents the references used throughout the report and its appendices.
- Appendix A presents a description of EPA's method to annualize costs and more detailed information on the annualized costs used as inputs to EPA's CAFO level economic analysis.
- Appendix B shows EPA's annualized compliance cost estimates for the ELG technology option chosen for the final regulations.
- Appendix C describes EPA's methodology for estimating changes in farm revenue based on predicted changes in market prices and quantities attributable to the final regulations.

- Appendix D shows EPA estimates of financial effects on operations with more than 300 AU for the ELG technology option chosen for the final regulations.

- Appendix E presents EPA's analysis of the cost-effectiveness of the final CAFO regulation, in terms of pollutant removal effectiveness for nutrients and other priority pollutants, and background information on the methods EPA used for the C-E analysis.

SECTION ONE

REQUIREMENTS OF THE FINAL CAFO REGULATIONS

The U.S. Environmental Protection Agency (EPA) is revising and updating the two primary regulations that ensure that manure, wastewater, and other process waters generated by concentrated animal feeding operations (CAFOs) do not impair water quality. EPA's final regulatory changes affect the existing National Pollutant Discharge Elimination System (NPDES) provisions and the existing effluent limitations guidelines (ELG) for "feedlots." The NPDES provisions define and establish permit requirements for CAFOs, and the ELG establish the technology-based effluent discharge standard that is applied to CAFOs. Existing regulations were originally promulgated in the 1970s. EPA is revising the regulations to address changes that have occurred in the animal industry sectors over the past 25 years, to clarify and improve implementation of CAFO requirements, and to improve the environmental protection achieved under these regulations. Final revisions to the NPDES and ELG regulations are referred to in this report as the final CAFO regulations.

On January 12, 2001, EPA published a proposal to revise and update these regulations (66 FR 2959), referred to in this report as the "2001 Proposal." The Economic Analysis that supports the 2001 Proposal contains information on EPA's estimates of the cost, financial effects, and monetized benefits of the proposed revisions. That analysis, titled *Economic Analysis of the Proposed Revisions to the National Pollutant Discharge Elimination System Regulation and the Effluent Guidelines for Concentrated Animal Feeding Operations*, is referred to in this report as the "Proposal EA" (USEPA, 2001a). EPA also published two Notices of Data Availability in the Federal Register (66 FR 58556 and 67 FR 48099). These Notices present new data and information EPA has received since the 2001 Proposal, soliciting further public review and comment.

This Economic Analysis (EA) summarizes EPA's analysis of the estimated annual compliance costs and the economic impacts that might be incurred by affected operations that are subject to the final revisions. Additional information on the regulatory alternatives that EPA considered for the 2001 Proposal is presented in the EA supporting the proposed regulations (USEPA, 2001a). The report covers financial impacts on CAFOs, potential impacts on processors of livestock and poultry products, and market and other secondary impacts such as impacts on prices, quantities, trade, employment, and output. It also responds to requirements for small business analyses under the Regulatory Flexibility Act (RFA), as amended by the Small Business Regulatory Enforcement Fairness Act (SBREFA), and for cost-benefit analyses under Executive Order 12866 and the Unfunded Mandates Reform Act (UMRA).

EPA also provides additional material on the final CAFO regulations in the *Development Document for the Final Revisions to the National Pollutant Discharge Elimination System Regulation and the Effluent Guidelines for Concentrated Animal Feeding Operations*, which discusses how EPA estimated compliance costs of the final regulations. EPA's detailed benefit analysis, titled *Environmental and Economic Benefit Analysis of the Final Revisions to the National Pollutant Discharge Elimination System Regulation and the Effluent Guidelines for Concentrated Animal Feeding Operations*, provides information about existing water quality impairments associated with animal production operations and estimates the extent to which these impairments might be mitigated by the final CAFO regulations.

This section begins with a discussion of the current regulatory framework. In the course of this discussion, the section also defines and describes animal feeding operations (AFOs) and CAFOs (Section 1.1). The reasons why EPA is revising these regulations are also discussed. Section 1.2 discusses EPA's proposed revisions to existing CAFO requirements in the 2001 Proposal (66 FR 2959). Section 1.3 reviews the final revisions promulgated by EPA.

1.1 SUMMARY OF EXISTING REGULATORY FRAMEWORK

In 1972 Congress passed the Federal Water Pollution Control Act, also known as the Clean Water Act (CWA), to "restore and maintain the chemical, physical, and biological integrity of the nation's waters." 33 U:S.C. [United States Code] § 1251(a). The CWA establishes a comprehensive program for protecting the nation's waters. Among its core provisions, the CWA prohibits the discharge of pollutants from a point source to waters of the United States except those authorized by an NPDES permit. The CWA also provides for the development of technology-based effluent limitations that are imposed through NPDES permits to control direct discharges of pollutants.

In response to the CWA, EPA established several regulatory programs, of which two pertain to livestock and poultry operations that confine animals (commonly referred to by EPA as animal feeding operations, or AFOs). These regulations include the requirements for discharge permits for CAFOs under the NPDES program (40 CFR Part 122.23) (see Section 1.1.1) and the ELG for animal feeding operations, of "feedlots" (40 CFR Part 412) (see Section 1.1.2).

1.1.1 NPDES Permit Regulation of CAFOs

The NPDES permit program controls pollution from identifiable discharge points or sources (e.g., discharge pipes or ditches). Under the NPDES permit program, all point sources that directly discharge pollutants to waters of the United States must apply for an NPDES permit and may discharge pollutants only under the terms of that permit. Such permits must include nationally established effluent discharge limitations. In the absence of national effluent limitations, NPDES permit writers must establish limitations and standards on a case-by-case basis, based on their "best professional judgment (BPJ)." Effluent limitations guidelines and BPJ provide the basis for technology-based effluent limits in NPDES permits.

Under the CWA, CAFOs are defined as point sources of pollution and are thus subject to NPDES permitting requirements (33 U.S.C. § 1362). The existing NPDES provisions that define which operations are CAFOs and establish permit requirements for CAFOs (40 CFR Part 122.23) were promulgated on March 18, 1976 (41 FR 11458).

Before an operation may be defined as a CAFO, it must first meet the definition of an AFO. AFOs are agricultural enterprises where animals are kept and raised in confined situations for a specified time during the year and where animals, feed, manure, dead animals, and production operations are congregated on a small land area. As defined by federal regulation, AFOs are lots or facilities 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 post-harvest

residues are not sustained in the normal growing period over any portion of the lot or facility. (40 CFR 122.23(b)(1)).

In 1976 EPA issued regulations defining which AFOs met the definition of a CAFO under the NPDES permit program. CAFOs are AFOs that confine a specified number of animals and in some cases meet specific discharge criteria. The specified number of animals is determined using the concept of an "animal unit" (AU). The term "animal unit" refers to a metric established in the 1970 regulations in an attempt to equate the characteristics of the wastes produced by different animal types. For each animal type, EPA's regulations identify the number of animals that is equivalent to 1 AU.

As defined in the existing regulation (40 CFR Part 122), 1 AU is equivalent to any of the following:

- 1 slaughter or feeder beef cattle.
- 0.7 mature dairy cows.
- 2.5 swine weighing more than 55 pounds.
- 55 turkeys.
- 100 laying hens or broilers (facility with continuous-flow watering system); 30 hens or broilers (facility with liquid manure handling system).
- 0.5 horses.
- 10 sheep or lambs.
- 5 ducks.

For the purpose of this analysis, the 1,000-AU threshold that EPA assumes for broiler and egg laying operations with dry manure systems (not covered under the existing regulations) is 125,000 meat chickens or broilers and 82,000 egg laying chickens. For veal and heifer operations, also not currently covered under the existing regulations, EPA assumes a 1,000-AU threshold consistent with that for cattle feeding operations (i.e., 1,000 AU equals 1,000 head).[1] EPA also assumes a 1,000-AU threshold for stand-alone nursery pig operations of 5,000 nursery pigs.

The existing NPDES regulation defines AFOs with 1,000 AU or more as CAFOs. These facilities are not CAFOs if they discharge only in the event of a 25-year, 24-hour storm. The existing regulation also states that AFOs with between 300 and 1000 AU are CAFOs if they meet certain conditions. These conditions include the discharge of pollutants into waters through a ditch, flushing system, or other man-made device. An AFO with between 300 and 1000 AU may also be defined as a CAFO if pollutants are discharged to waters that originate outside of and pass over, across, or through the facility or come into contact with confined animals. The state agency or other authority that issues NPDES permits may also designate AFOs with fewer than 1,000 AU as CAFOs if they are considered to have discharges that could

[1] The final rule preamble refers to operations in this size category as "Large" CAFOs.

significantly impair surface water. (Operations with between 300 AU and 1,000 AU are referred to in the final rule preamble as "Medium" CAFOs; operations with fewer than 300 AU are referred to as "Small" CAFOs.)

All NPDES permits for CAFOs with more than 1,000 AU must include requirements equivalent to or more stringent than the established ELG. As noted above, certain smaller operations can also be defined or designated as CAFOs, but the ELG does not apply to these CAFOs. In these cases, the permit writer must develop technology-based limitations based on BPJ for inclusion in the NPDES permit.

1.1.2 Effluent Limitations Guidelines for Feedlots

The CWA authorizes EPA to establish restrictions on the types and amounts of pollutants discharged from various industrial, commercial, and public sources of wastewater. Effluent guidelines define the types and amount of pollutants an NPDES permitted facility is allowed to discharge. Direct dischargers must comply with ELG and new source performance standards (NSPS). These limitations and standards are established by regulation for categories of industrial dischargers, and they are based on the degree of control that can be achieved using various levels of pollution control technology. These guidelines base the discharge (or effluent) amount on the best available technology that is economically achievable. Under the Clean Water Act, EPA has an obligation to promulgate effluent guidelines that achieve "best available technology economically achievable" (BATEA).

The existing national ELGs for the feedlots category, including the beef, dairy, swine, and poultry subcategories (40 CFR Part 412), were established on February 14, 1974 (39 FR 5704). The feedlot ELG allow for no discharge of process wastewater pollutants into the Nation's waters except when chronic or catastrophic storm events cause an overflow from a facility designed, constructed, and operated to hold process-generated wastewater plus runoff from a 25-year, 24-hour storm event. As a result, the current effluent guidelines for feedlots are usually referred to as "zero discharge" requirements. Many feedlots meet the "zero discharge" requirement by containing wet manure in lagoons and by land applying manure. The current ELG are applicable to NPDES permits issued to CAFOs with more than 1,000 AU. Discharge limits for facilities with fewer than 1,000 AU are established using BPJ.

1.1.3 Industries Affected by the Final CAFO Regulations

In this EA, information is organized by sector rather than by subcategory. This report focuses on the major livestock and poultry industries affected by the ELG and the NPDES program requirements. By North American Industry Classification System (NAICS)[2] code, these include:

- Cattle feedlots, NAICS 112112 [includes veal] (SIC 0211, beef cattle feedlots).
- Beef cattle ranching and farming, NAICS 112111 (SIC 0241, dairy heifer replacement farms).

[2] NAICS recently replaced the SIC (Standard Industrial Classification) system.

- Dairy cattle and milk production, NAICS 11212 (SIC 0241, dairy farms).
- Hog and pig farming, NAICS 11221 (SIC 0213, hogs).
- Broilers and other meat-type chickens, NAICS 11232 (SIC 0251, broiler, fryer, and roaster chickens).
- Turkey production, NAICS 11233 (SIC 0253, turkey and turkey eggs).
- Chicken egg production, NAICS 11231 (SIC 0252, chicken eggs).

In some cases, information is limited to analyze some sectors individually. For example, the analysis often aggregates information for the "cattle" sector presenting an aggregated review on fed cattle, heifer, and veal operations because sector-specific financial data and other industry information is limited. Under the regulations, however, beef cattle and heifer operations are covered under the same subcategory but veal operations are covered under a separate subcategory. Information on the types of operations in the poultry sector (broiler, egg layer, and turkey operations) is also presented together, in some cases depending on best available data. The dairy and swine subcategories are evaluated separately.

The ELG and NPDES permit requirements also affect other types of animal confinement operations, including operations that raise sheep, lambs, goats, horses, and other miscellaneous animal species. For some of these sectors (horses, ducks, etc.), EPA is updating the NPDES permit requirements as part of this rulemaking. Because EPA is not revising the ELG for these other sectors, however, these sectors are not covered in this analysis because EPA is not required to perform an economic achievability analysis for NPDES requirements (economic achievability analysis is only required for effluent guideline requirements). Also, EPA's cost and benefit analysis is focused only on those livestock and poultry operations that account for a majority of both number of animals produced and manure nutrients generated (cattle, dairy, hog and poultry sectors). EPA's national level analysis does not specifically account for other types of operations covered under the NPDES regulation since relatively few such operations exist. (See also response to comment DCN CAFONODA-600059-4.)

The U.S. Department of Agriculture (USDA) reports that there were 1.1 million livestock and poultry operations in the United States in 1997, corresponding to these affected industry sectors (USDA/NASS, 1999a). This number includes both confinement and non-confinement (grazing and rangefed) production, as well as both commercial and noncommercial operations. Of these operations, USDA estimates that there are about 240,000 operations raise animals in confinement (Kellogg, 2002). Table 1-1 summarizes the estimated total number of AFOs of all sizes in each of the four major livestock categories in 1997. EPA estimates that only a small subset of these AFOs would be regulated as CAFOs, because most would not meet the size definitions or other criteria. More information is provided in Section 3 of this report.

Table 1-1. Number of Total AFOs and AFOs *Defined* as CAFOs (1997)

Sector	Total AFOs	Defined CAFOs
Beef operations, including both cattle, veal, and heifer operations	21,807	2,431
Dairy operations (milk production operations only)	94,787	3,399
Hog operations, including both "farrow-finish" and "grow-finish" operations [a/]	51,772	5,409
Poultry operations, including broilers, layers (wet and dry operations), turkeys [b/]	27,530	3,739
Total AFOs	**237,821** [c/]	**14,978**

See Section 3.

[a/]Grow-finish operations finish more mature pigs while farrow-finish operations handle all stages of production from breeding to finishing.

[b/]Use either liquid or dry manure handling systems present at the facility.

[c/] USDA estimate of the total number of AFOs is adjusted for specialty cases. Specialty cases (estimated at 2,291 operations) are dairies that went out of business in 1997, swine operations with feeder pigs only, and egg-hatching operations.

1.2 SUMMARY OF THE PROPOSED RULEMAKING

1.2.1 The 2001 Proposal

On January 12, 2001 (66 FR 2959), EPA published proposed revisions to the existing effluent guidelines for CAFOs (40 CFR Part 412) and to certain provisions of the NPDES regulations applicable to CAFOs. Effluent guidelines and standards for CAFOs establish the technology-based effluent discharge and performance standards for both existing and new sources for each of the beef, dairy, swine, and poultry subcategories. The NPDES permit program for CAFOs defines which AFOs are CAFOs and need to obtain NPDES permits, and it establishes the specific requirements that must be complied with under a permit. These two existing interrelated regulations affecting CAFOs were originally promulgated in the 1970s.

An overview of the ELG options and NPDES scenarios is provided in Table 1-2. For more detailed information, see Sections 7 and 8 of the preamble to EPA's proposed rule (66 FR 2993-3061).

1.2.1.1 NPDES Permit Regulation

Under the current NPDES regulations for CAFOs, a three-tier structure is used to determine which AFOs also meet the criteria under which they are considered CAFOs. Under the current NPDES structure, (1) all AFOs with more than 1,000 AU are automatically defined as CAFOs; (2) AFOs with 301 to 1,000 AU are defined as CAFOs only if they meet certain conditions; and (3) AFOs with 301 to 1,000 AU that do not meet these conditions, and all AFOs with fewer than 300 AU are CAFOs only if they are designated as such by the permitting authority. (See 40 CFR 122.23 and Part 122, Appendix B).

EPA proposed several alternatives for revising the existing CAFO definition. Under one scenario, the current three-tier structure would be retained, but there would be certain changes to the conditions

that define an operation as a CAFO in the middle tier (300 AU to 1,000 AU). EPA also proposed an alternative regulatory approach that would replace the existing three-tier structure with a two-tier scenario for defining operations as CAFOs. Under the "two-tier" scenario, all AFOs with more than a specified number of animals would be defined as a CAFO. EPA considered several potential thresholds that could be set under the two-tier scenario.

EPA also proposed to revise the definition of a CAFO to expressly include chicken operations using dry litter management techniques, swine nurseries, and heifer operations. EPA proposed to explicitly address manure application on land under the control of a CAFO and considered alternatives for collecting information regarding manure transferred to off-site locations. The proposed rule included certain changes affecting which entities would be required to obtain NPDES permits. It also contained provisions requiring that a CAFOs that ceases operation must retain its NPDES permits until all wastes generated by the operation no longer have the potential to reach waters of the United States.

Table 1-2 summarizes the scope options that EPA considered during the development of the 2001 Proposal. For more information on the proposed changes to the NPDES regulations, see Section 7 of the proposed rule preamble (66 FR 2993-3050).

1.2.1.2 Effluent Limitations Guidelines and Standards

Under the current effluent guidelines regulations, CAFOs are prohibited from discharging process wastewater, except when rainfall events cause an overflow from a facility designed, constructed, and operated to contain all process-generated wastewater plus the runoff from a 25-year, 24-hour rainfall event.

EPA proposed requiring all existing and new CAFOs spreading manure on cropland to limit the application rate to the nitrogen needs of the crops and, for those fields where additional constraints are considered necessary, to ensure that the manure application rate would not exceed the phosphorus needs of the crops.

EPA also proposed requiring all existing beef and dairy operations to implement controls (retrofitting of lagoons and ponds with impervious liners) to minimize leaching to ground water if the ground water beneath the production area has a direct hydrologic connection to surface water. EPA proposed requiring all existing swine, veal, and poultry CAFOs to eliminate all discharges from the animal production area (thereby eliminating for these sectors the effluent guidelines provision that allows for certain overflows due to chronic or catastrophic rainfall).

EPA proposed that newly constructed CAFOs should meet the same requirements as those proposed for existing CAFOs, except that new swine, veal, and poultry operations also would need to implement ground water controls where there is a direct hydrologic connection to surface water.

Table 1-2 summarizes the ELG options that EPA considered for the 2001 Proposal. For more information on the proposed technology options, see section 8 of the proposed rule preamble (66 FR 3050-3070). Section 8 of the preamble also describes certain other technology options that EPA considered at proposal, such as prohibiting manure application on frozen, snow-covered, or saturated ground; requiring use of anaerobic digester systems; composting; and surface water monitoring requirements.

1.2.2 The 2001 Notice of Data Availability

On November 21, 2001, EPA published a Notice of Data Availability (referred to as the "2001 Notice") that presented a summary of new data and information submitted to EPA during the public comment period on the proposed CAFO regulations, including data received from the U.S. Department of Agriculture (66 FR 58556). There were four main components to the Notice: (1) discussion of new data and changes EPA was considering to refine its cost and economics model; (2) discussion of new data and changes EPA was considering to refine its nutrient loading and benefits analysis; (3) new data and changes EPA was considering to the proposed NPDES permit program regulations; and (4) new data and changes EPA was considering to the proposed ELG regulations. See USGPO, 2001b. The 2001 Notice also discussed options that the Agency considered to enhance flexibility for the use of State NPDES and non-NPDES CAFO programs, including implementation of environmental management systems (EMS).

1.2.3 The 2002 Notice of Data Availability

On July 23, 2002, EPA published a Notice of Data Availability (referred to in this report as the "2002 Notice") that presented a summary of new data and information submitted to EPA during the public comment period on the proposed CAFO regulations, including data received from the 2001 notice (67 FR 48099). There were three main components of the 2002 Notice: (1) establishing alternative regulatory thresholds for chicken operations using dry litter management practices; (2) the potential creation of alternative performance standards to encourage CAFOs to implement new technologies; and (3) financial data and changes EPA considered to refine its economic analysis models. See USGPO, 2002. The 2002 Notice made these data and potential changes available for public review and comment.

1.3 SUMMARY OF THE FINAL REVISIONS

Below is a brief summary of the major elements of this final rule and a brief index on where each of the requirements is located in the final regulations. Part 122 of the Code of Federal Regulations (Title 40) contains the regulations for the National Pollutant Discharge Elimination System (NPDES) permit program. These NPDES Regulations include requirements that apply to all point sources, including CAFOs. Part 412 is the location in the Code of Federal Regulations where the national effluent guidelines are located for CAFOs. This summary is not a replacement for the actual regulations and is not for interpretive purposes. More information is in the preamble to the final rule.

1.3.1 NPDES Permit Regulations

Overall, the final rule maintains many of the basic features and the overall structure of the 1976 NPDES regulations with some important exceptions. First, all CAFOs have a mandatory duty to apply for an NPDES permit, which removes the ambiguity of whether a facility needs an NPDES permit, even if it discharges only in the event of a large storm. In the event that a Large CAFO has no potential to discharge, the final rule provides a process for the CAFO to make such a demonstration in lieu of obtaining a permit. The second significant change is that large poultry operations are covered, regardless of the type of waste disposal system used or whether the litter is managed in wet or dry form. Third, under this final rule, all CAFOs covered by an NPDES permit are required to develop and implement a nutrient management plan. The plan would identify practices necessary to implement the ELG and any

other requirements in the permit and would include requirements to land apply manure, litter, and process wastewater consistent with site specific nutrient management practices that ensure appropriate agricultural utilization of the nutrients.

Table 1-2. Summary of Options and Scenarios Considered by EPA

Technology Options	
Option 1:	N-based land application controls and inspection and recordkeeping requirements for the production area
Option 2	Same as Option 1, but restricts the rate of manure application to a P-based rate where necessary (depending on specific soil conditions at the CAFO)
Option 3	Adds to Option 2 by requiring the operation to perform ground water monitoring and controls unless it can show that the ground water beneath manure storage areas or stockpiles does not have a direct hydrologic connection to surface waters
Option 4	Adds to Option 3 by requiring sampling of surface waters adjacent to the production area and/or land under control of the CAFO to which manure is applied
Option 5	Adds to Option 2 by establishing a zero discharge requirement that does not allow for an overflow from the production area under any circumstances
Option 6	Adds to Option 2 by requiring that large hog and dairy operations install and implement anaerobic digestion and gas combustion to treat their manure
Option 7	Adds to Option 2 by prohibiting manure application to frozen, snow-covered or saturated ground
Regulatory Scope Options	
Scenario 1	Retains existing 3-tier framework and establishes additional requirements
Scenario 2	Same as Scenario 1, except that operations with 300-1,000 AU would be subject to the regulations based on a revised set of conditions at the feedlot site
Scenario 3	Same as Scenario 2, but allows an operation with 300-1,000 AU to either apply for an NPDES permit or to certify to the permit authority that it does not meet any of the conditions and thus is not required to obtain a permit
Scenario 4a	Establishes 2-tier framework and applies ELG standard to all operations with more than 500 AU
Scenario 4b	Establishes 2-tier framework and applies ELG standard to all operations with more than 300 AU
Scenario 5	Establishes 2-tier framework and applies ELG standard to all operations with more than 750 AU
Scenario 6	Retains existing 3-tier framework and establishes a simplified certification process

1.3.2 Effluent Limitations Guidelines and Standards

The final ELGs will continue to apply to only CAFOs with more than 1,000 AU, although the requirements for existing sources and new sources are different for certain animal sectors. In the case of existing sources, the ELGs will continue to prohibit the discharge of manure and other process wastewater pollutants, except for allowing the discharge of process wastewater whenever rainfall events cause an overflow from a facility designed, constructed, and operated to contain all process wastewaters plus the runoff from a 25-year, 24-hour rainfall event. The ELGs also require land application at the CAFO must be at rates that minimize phosphorus and nitrogen transport from the field to surface waters in compliance with technical standards for nutrient management established by the Director. The ELGs also establish certain best management practice (BMP) requirements that apply to the production and land application areas.

For new large beef and dairy operations, the ELGs establish production area requirements that are the same as those for existing sources. In the case of large swine, veal, and poultry operations that are new sources, a new zero discharge standard is established. The rule also clarifies that where waste management and storage facilities are designed, constructed, operated and maintained to contain all manure, litter and process wastewater, including the runoff and direct precipitation from a 100-year, 24-hour rainfall event, and is operated in accordance with certain other requirements, this will satisfy the new standard. Land application requirements for both groups are identical to those established for existing sources.

SECTION TWO

DATA AND METHODOLOGY FOR ESTIMATING COMPLIANCE COSTS AND ECONOMIC EFFECTS

This section presents the data and methodology EPA uses to estimate the total annual incremental costs and the economic impacts that would be incurred by the livestock and poultry industry as a result of the final CAFO regulations. This analysis examines potential compliance costs and financial effects on regulated CAFOs (e.g., feedlots and feedyards) as well as effects on consumer markets.

Section 2.1 identifies the regulated industry sectors and provides an overview of EPA's data and model framework using a representative "model CAFO" approach. Section 2.2 describes the methods and assumptions used to estimate annual CAFO level compliance costs (described in greater detail in other rulemaking support documents). Section 2.3 summarizes the development and characterization of EPA's financial models for each sector, incorporating changes to EPA's model and input data used for the 2001 Proposal. These models provide the basis for calculating the total annual costs of the final regulations and are used to evaluate potential financial impacts on regulated CAFOs. This section also presents the financial data that EPA assumes to depict baseline conditions and assess regulatory changes. Section 2.4 describes the financial criteria and general approach that EPA assumes to evaluate regulatory effects on model CAFOs. Section 2.5 summarizes the methodology EPA uses to assess additional market impacts, including national level changes in prices and available quantities, as well as changes in national aggregate employment and economic output.

More detail on the data and model framework that EPA uses to evaluate economic effects of the rule is provided in EPA's *Economic Analysis* supporting the 2001 Proposal (see: USEPA, 2001a, referred to as the "Proposal EA"), with updates as documented in the two Notices of Data Availability presenting new data and information EPA has received since the 2001 Proposal (see: USGAO, 2001b, 66 FR 58556, and USGAO, 2002, 67 FR 48099; referred to as the "2001 Notice" and "2002 Notice," respectively). More information on EPA's compliance cost estimates is presented in EPA's *Development Document* supporting both the proposed and final rulemaking (USEPA, 2001b; 2002).

2.1 BACKGROUND AND OVERVIEW

2.1.1 Overview of Analytical Framework

As discussed in greater detail in the Proposal EA, EPA estimates incremental costs and regulatory impacts using a representative farm approach. For this analysis, EPA developed "model CAFOs" for each sector to assess the average costs and economic impacts of the revised regulations across differently sized, differently managed, and geographically distinct operations.

A representative farm approach is consistent with past research conducted by USDA and the land grant universities and their affiliated research organizations, including the Food and Agricultural Policy Research Institute (FAPRI), the Center for Agriculture and Rural Development (CARD), Texas A&M's Agriculture and Food Policy Center, the Texas Institute for Applied Environmental Research (TIAER), and the University of Missouri's Commercial Agriculture Program. These organizations and others have

widely adopted the representative farm approach to assess a broad range of policy issues, including changes in Federal agricultural policy and pricing programs, domestic food programs, environmental legislation, and international trade. This approach has been used to assess agricultural market changes for both livestock and crop commodities, as well as to evaluate the financial impact of implementing management measures and installing animal waste systems at livestock and poultry operations. More detailed information is provided in Section 4 of the Proposal EA. Since proposal, EPA has also conducted an in-depth literature review of the types of approaches used in the academic community to assess the economic effects of public policy on agricultural operations, which further validates use of this approach. This review is available in the rulemaking record (DPRA, 2001).

A representative approach provides a means to assess average impacts across numerous facilities by grouping facilities into broader categories to account for the multitude of differences among animal confinement operations. This approach allows a means to account for differences in performance among farming operations.

Using a representative farm approach, EPA constructs a series of model facilities that reflect the Agency's estimated compliance costs and available financial data. EPA uses these model CAFOs to develop an average characterization for a group of operations (described in Section 2.3 of this report). From these models, EPA estimates total annualized compliance costs by aggregating the average facility costs across all operations that are identified for a representative group. As with EPA's cost models, its financial models are grouped according to certain distinguishing characteristics for each sector, such as facility size and production region, that might be shared across a broad range of facilities. Economic impacts under a post-regulatory scenario are approximated by extrapolating the average impacts for a given model CAFO across the larger number of operations that share similar production characteristics and are identified by that CAFO model. EPA compares its estimated compliance costs at select model CAFOs to corresponding financial conditions at these model facilities (discussed in Section 2.4). Follow-up analysis assesses the broader market level effects of the final regulations (Section 2.5).

As detailed in the Proposal EA and in EPA's record, EPA presented its proposed methodological approach to USDA personnel and to researchers at various land grant universities for informal review and feedback at various stages in the development of these regulations.

2.1.2 Overview of Sources of Data

EPA has undertaken an expedited approach to this rulemaking effort and did not conduct an industry-wide survey of all CAFOs using a Clean Water Act Section 308 questionnaire. This decision is described in the 2001 Proposal (66 FR 3079) and detailed in the Proposal EA. EPA is relying on existing data sources and expertise provided by numerous government agencies, state agricultural extension agencies, land grant universities, industry trade associations, and agricultural professionals. Major data sources are discussed in detail where they are used to conduct the analyses presented in this report or reference other supporting documents in the rulemaking record.

The majority of the data EPA used to support development of the final CAFO regulations are from existing sources. As defined in the Office of Water 2002 Quality Management Plan, which is provided as part of the *Development Document* (USEPA 2002), existing (or secondary) data are data that were not directly generated by EPA to support the decision at hand.

In keeping with the graded approach to quality management embodied in the quality management plan, EPA must assess the quality of existing data relative to their intended use. The procedures EPA used to assess existing data for use in developing effluent guideline limitations for CAFOs varied with the specific type of data. In general, EPA's assessment included:

- Reviewing a description of the existing data that explains how the data were collected or produced (e.g., who collected the data, what data were collected; why were the data originally collected; when were the data collected; how were they collected; are the data part of a long-term collection effort, or was this a one-time effort; who else uses the data; what level of review by others have the data undergone, etc.)

- Specifying the intended use of the existing data relative to the CAFO final rule

- Developing a rationale for accepting data from this source, either as a set of acceptance criteria, or as a narrative discussion

- Describing any known limitations with the data and their impact on EPA's use of the data.

Brief descriptions of the data and their limitations are presented later in this document, as each data source is introduced.

In searching for existing data sources and determining their acceptability, EPA generally used a hierarchical approach designed to identify and utilize data with the broadest representation of the industry sector of interest. EPA began by searching for national-level data from surveys and studies by USDA and other federal agencies. When survey or study data do not exist, EPA considered other types of data from federal agencies.

Where national data do not exist, as the second tier, EPA searched for data from land grant universities. Such data are often local or regional in nature. EPA assessed the representativeness of the data relative to a national scale before deciding to use the data. When such data came from published sources, EPA gave greater consideration to publications in peer-reviewed professional journals compared to trade publications that do not have a formal review process.

The third tier was data supplied by industry. Prior to proposal, EPA requested data from a variety of industry sources, including trade associations and large producers. The level of review applied to data supplied by industry depended on the level of supporting detail that was provided. For example, if the industry supplied background information regarding how the data were collected, such as the number of respondents and the total number of potential respondents, EPA reviewed the results, compared them to data from other potential sources to determine their suitably for use in this rulemaking. If the data provided by industry originated from an identifiable non-industry source (e.g., a state government agency), EPA reviewed the original source before determining the acceptability of the data. In a limited number of instances, EPA conducted site visits to substantiate information supplied by industry. In contrast, data supplied by industry without any background information were given much less weight and generally were not used by EPA. Further, some data that were supplied by industry prior to the proposal were included in the proposal for comment. In the absence of any negative comments, such data were relied on to a greater extent than data submitted by industry during the comment period itself.

For its engineering cost analysis, EPA uses industry and cost information from various sources, including USDA, the land grant universities, state agricultural extension agencies, and industry. EPA uses these data to develop its model CAFOs and to extrapolate CAFO level costs to all operations nationwide. A key source of data used to estimate compliance costs and economic impacts on the regulated community is the 1997 Census of Agriculture. The Census is conducted by the National Agricultural Statistical Service (NASS) every five years. It provides information on the number of feedlots, their geographic distributions, the amount of cropland available to land apply animal manure generated from animal confinement operations, and other information. NASS compiles these data, with the assistance of personnel at USDA's Natural Resources Conservation Service (NRCS) who developed a methodology to identify information specific to animal confinement operations. All Census data provided to other government agencies, including EPA, are aggregated to preserve confidential business information. As detailed in the 2001 Notice, EPA has received additional data and information since proposal that have been incorporated into its analysis for the final regulations. EPA's *Development Document* supporting the proposed and final rule (USEPA, 2001, 2002) presents the Census data used along with other USDA data and other source data that EPA uses for its cost analysis.

For the economic impact analysis, EPA obtained financial data for livestock and poultry operations from a variety of sources, including USDA, the land grant universities, and industry. EPA uses these data to depict baseline financial conditions at representative model CAFOs and to extrapolate CAFO level impacts to all operations nationwide. As detailed in both the 2001 Notice and the 2002 Notice, EPA received additional data and information since proposal that have been incorporated into the analysis for the final regulations. To assess broader market changes from the CAFO regulations, EPA compiled additional industry and market data from a wide range of USDA data and land grant university research. A detailed summary of the data and citations of the sources of the data are provided in the Proposal EA, supplemented by data and other information presented in this report.

A key source of financial data is USDA's Agricultural Resource Management Study (ARMS). This study is compiled by NASS and USDA's Economic Research Service (ERS) and provides complete financial accounting data for U.S. farms for each of the major commodity sectors affected by the final CAFO regulations. These data are used to depict farm financial conditions and to evaluate regulatory impacts. ERS obtained data for representative farms through special tabulations of the ARMS data, conducted by ERS, that differentiate the financial conditions among operations by commodity sector, facility size (number of animals on site), and major farm producing region. As with the Census data, USDA aggregates these data in a manner to preserve both the statistical representativeness and confidentiality of the respondent survey data. EPA also obtained financial data from various land grant universities, including enterprise budgets that portray financial conditions for an operation's livestock or poultry enterprise. In particular, the University of Missouri's Food and Agricultural Policy Research Institute (FAPRI) submitted financial data for several sectors that were collected as part of its evaluation of EPA's Proposal EA. EPA also obtained financial data from the National Cattlemen's Beef Association (NCBA) based on a survey of its membership to obtain financial statistics specific to cattle feeding operations. Section 2.3 and other sections of this report discuss these data in more detail and describe how these data sources contribute to EPA's analyses.

2.1.3 Overview of EPA's Economic Model (2001 Proposal)

For the proposed rulemaking, EPA developed an economic model to assess financial impacts on regulated CAFOs based on predicted changes to select financial criteria. This approach is documented in

the 2001 Proposal (66 FR 3079-3103) and the Proposal EA (USEPA, 2001a). Additional information is available in the *Development Document* supporting the regulations (USEPA, 2001b, 2002).

To assess regulatory impacts on CAFOs, EPA developed an economic model to assess financial effects based on predicted changes to select financial criteria. This model consists of a series of representative model CAFOs that EPA used to evaluate estimated compliance costs against assumed baseline financial conditions. EPA evaluated the economic achievability of the proposed regulatory options at existing operations based on changes in representative financial conditions across three financial criteria: (1) an initial screening comparing incremental pre-tax costs to total gross revenue ("sales test"), (2) projected post-compliance cash flow over a 10-year period ("discounted cash flow analysis"), and (3) an assessment of an operation's debt-asset ratio under a post-compliance scenario ("debt-asset test"). These criteria were evaluated using 1997 data from USDA reflecting financial conditions at the whole-farm level (i.e., reflecting income and cost information spanning an operation's primary livestock production, as well as secondary livestock and crop production, government payments, and other farm-related income). Based on estimated changes to these select criteria, EPA divided the impacts of the proposed regulations into three financial impact categories: Affordable, Moderate, and Stress. Operations experiencing affordable or moderate impacts are considered to experience some financial impact on operations at the affected CAFOs, but EPA does not consider these operations to be vulnerable to closure as a result of compliance. Operations experiencing financial stress impacts are considered to be vulnerable to closure post-compliance. Section 4 of the Proposal EA provides more information about EPA's justification for using this approach and the assumptions in the model.

To assess economic effects on national markets, EPA used an approach adapted from a model developed by ERS to evaluate various policy scenarios in terms of changes in farm and retail prices and product quantities. Once price and quantity changes were predicted by the model, EPA used national multipliers that relate changes in sales to changes in total direct and indirect employment and also to national economic output. The approach and data used for this analysis are described in Section 4 and Appendix B of the Proposal EA.

2.1.4 Overview of Changes to EPA's Economic Model (Final Rule)

As detailed in the 2001 Notice (see 66 FR 58577-58591), EPA received many public comments on its economic analysis regarding the appropriateness of the financial data and the assessment criteria used for the analysis, as well as other aspects of EPA's model. The 2001 Notice details the major comments received on EPA's proposal, including recommendations that EPA (1) expand the range of cost estimates per representative farm to account for variability across operations (based on expected capital and management improvements needed); (2) add assessment criteria to measure changes in net farm income (profits) in addition to criteria considered in the analysis; (3) consider financial data to depict baseline conditions that consider revenue from an operation's livestock or poultry enterprise level only, rather than consider income available to an operation from all enterprises at that operation ("farm level" data); (4) revise the baseline data and the criteria threshold used to analyze the debt-asset test (which would reflect higher baseline debt levels in industry); (5) consider debt feasibility to evaluate an operation's ability to incur new debt; and (7) consider other available financial data for multiple years to supplement EPA's analysis based on a single year of data. Other comments include recommendations on EPA's assumptions on cost offsets, such as income from manure sales and cost-sharing and technical assistance. Additional information is presented in the 2002 Notice (see 67 FR 48110-48105).

Both Notices describe ways in which EPA would address these concerns and also present alternative financial data that the Agency is considering to perform its analysis. Comments received by EPA from industry and the land grant universities on both Notices largely support these efforts and provide additional recommendations. However, EPA also received comments that challenge the methodological changes presented in the 2001 Notice. These comments claim that EPA failed to consider societal costs and industry impacts accounting for various cost offsets, including cost savings of converting from confined to pasture-based systems as well as cost passthrough from farm to processor. See Waterkeepers Alliance, et al. (2001) and Sierra Club (2001), and other supporting comments (Ikerd, 2001; Weida, 2001).

The EA supporting the final regulations retains the general modeling framework that the Agency used to assess economic effects for the 2001 Proposal, with the modifications discussed in both EPA Notices. Section 2.3 of this report presents financial data that EPA uses for its final analysis. Section 2.4 describes changes to the approach EPA uses to assess financial effects to CAFOs.

2.2 ESTIMATES OF ANNUAL COMPLIANCE COSTS

2.2.1 Development of Representative Model CAFOs

To evaluate regulatory impacts on CAFOs, EPA has developed a series of model CAFOs to conform to a representative farm approach. This approach consists of two major modeling components: cost models and financial models. This section describes EPA's cost models; Section 2.3 describes EPA's financial models. Section 4 of the Proposal EA provides additional information on the development and interface of the cost and financial models.

Model CAFOs developed for EPA's analysis reflect average conditions for selected groups of livestock and poultry operations. Three factors are recognized to affect the way CAFOs operate: (1) commodity sector (beef, veal, heifers, dairy, hogs, broilers, layers, turkeys); (2) farm production region; and (3) facility size (based on herd or flock size or the number of animals on site). EPA's cost models and financial models are therefore differentiated by sector, select region, and size group.

The CAFO models EPA uses for this analysis represent the interface between a large number of cost models and a smaller number of financial models. Fewer financial models are developed because of data availability issues (as discussed in detail in Section 4 of the Proposal EA). The cost models are able to account for greater variability among operations, as compared to the financial models. This variability includes differences in production types, geographic conditions and production region, land availability, technology needs, and so forth. For example, EPA is able to account for individual costs to veal and heifer operations; however, financial data are not available for these individual sectors. Data are available to reflect cost differences between egg-laying operations that use liquid manure management systems and dry systems, but financial data do not capture these differences in cost and returns. The cost models can account for the type of animal production facility, the availability of cropland and pastureland to land apply manure nutrients, farmland geography, and existing state regulatory requirements. They can also reflect cost differences within sectors based on manure composition, bedding use, and process water volumes. For more detailed information, refer to the *Development Document* (USEPA, 2002). As discussed in Section 2.4, however, the financial models are able to account for certain other factors, such as business type and legal structure, which could affect an assessment of whether an operation is able to afford the estimated cost of compliance.

For its cost analysis, EPA has developed representative models that account for variability among the different types of operations, accounting for differences based on available cropland for manure application, differences by production region and by facility type, and an operation's current manure management practices and technology needs. As described in more detail in the *Development Document* (USEPA, 2002), estimated compliance costs distinguish between three categories of land availability: Category 1 CAFOs (sufficient cropland for all manure nutrients generated), Category 2 CAFOs (insufficient cropland), and Category 3 CAFOs (no cropland). EPA's estimated costs also distinguish between three categories of technology needs based on the types of manure management practices already in place: "Average Needs" (assumed for 50 percent of all operations), and "Least Needs" and "Most Needs" (assumed to account for 25 percent each of all operations). In addition, EPA's cost models account for production area differences in costs that are critical to an assessment of incremental compliance costs. See Section 2.2.3 of this report.

EPA's cost models aggregate USDA's regions into five broad production regions for the purposes of estimating costs: Midwest (MW); Central (CE); Pacific (PA); Mid-Atlantic (MA); and South (SO) (see USEPA, 2002). The financial models, however, are not distinguishable by this many regions because available financial data do not allow for aggregation at this level of detail. Where financial data are not available by region, national data are used. To match up with fewer regional models in the financial analysis, EPA collapses the total number of regions evaluated in some cases. To do this, estimated number of CAFOs in regions other than the major production regions are allocated to the major regions on an equally weighted basis. That is, within each sector, 50 percent of CAFOs in regions other than the two primary production regions are assigned to one major production region and the other 50 percent are assigned to the other.

Finally, EPA's cost models are developed across a broad range of facility size groups, including CAFOs with more than 1,000 AU[2] (Large 1 and Large 2 CAFOs) and operations with between 300 AU and 1,000 AU (Medium 1, 2, and 3 model CAFOs). Facility size categories vary by sector; the average number of animals represented by each model CAFO is based on typical inventory estimates that are common for that size range in a particular sector. Data limitations restrict the number of facility size categories available for EPA's financial models. In some cases, available financial data generally cover operations with more than 1,000 AU and operations with fewer than 1,000 AU. In cases where available data do not match this size breakout, EPA uses national average data. Because the cost and financial models are both expressed in terms of per-animal (inventory) basis, this approach allows EPA to link the available data on baseline financial conditions to estimated compliance costs across representative CAFOs, thus capturing differences in facility size. See the discussion in Section 2.4.

Table 2-1 shows the range of facility sizes and the average number of animals associated with each size range that EPA assumes for each model CAFO. See the *Development Document* (USEPA, 2002) for more information on the development of the model sizes shown in the table.

2.2.2 Compliance Assumption Under Existing Regulations

For the 2001 Proposal, EPA estimated only the costs of the new requirements attributable to the proposed regulations. All operations with more than 1,000 AU that are defined as CAFOs by the existing

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[2] As defined for the final regulations, one AU is equivalent to one slaughter or feeder cattle, calf, or heifer; 0.7 mature dairy cattle; 2.5 hogs (over 55 pounds) or 5 nursery pigs; 55 turkeys; 30 egg-laying chickens (wet manure systems); and 125 meat chickens and 82 egg-laying chickens (regardless of waste system used).

regulations are currently required to be in compliance with the existing regulatory program. As a result, all existing CAFOs with more than 1,000 AU—except poultry operations with dry manure management systems, which are not covered by the existing regulations—were costed for full compliance since they are covered by the existing regulations. This includes the NPDES regulations and the effluent limitations guidelines and standards for feedlots. For those operations with less than 1,000 AU, EPA used available data regarding current waste treatment practices under existing State laws and regulations to estimate the incremental cost they would incur to comply with the requirements of the proposed regulations.

EPA acknowledges comments claiming that many CAFOs do not have the necessary waste management components in place to comply with the existing CAFO regulations promulgated in 1974. Although the existing regulations were issued over 25 years ago, these commenters claim that many operations with 1,000 or more AU are not currently in compliance with these baseline requirements and would therefore incur substantial costs just to meet the 1974 requirements, in addition to any additional costs that would be incurred to comply with the new requirements of the proposed rule. Limited supporting data and information has been provided to EPA support these claims. However, EPA believes that it should consider only the costs attributable to the revised requirements and assume that existing CAFOs are in compliance with current requirements that were issued over 25 years ago. See also response to comment DCN CAFO400177-27 in EPA's COmment Response Document.

It is EPA's longstanding practice to attribute to a revised rule only the incremental cost of new requirements when revising existing regulations. EPA's methodology is authorized by the Clean Water Act (CWA). Under Section 301(b)(2)(B), EPA is required, when identifying BAT, to take into account a variety of factors, including the cost of achieving effluent reductions attainable through the application of BAT. The existing regulations identify BAT and require a certain level of effluent reduction. The effluent reductions attributable to the final revised regulation are those which are a result of new requirements. Therefore, EPA must evaluate the cost of achieving those additional reductions. The cost to implement Part 412 was considered when Part 412 was promulgated in 1974. If EPA were to now account for the cost to bring existing CAFOs into compliance with the 1974 requirements, the Agency would therefore bear the cost and impact of the 1974 regulation a second time. There should be no reward for non-compliance.

Not only is it statutorily required but reasonable to assume full compliance twenty-five (25) years after promulgation. The Clean Water Act (CWA), in Section 301(b)(3) states "for effluent limitations ... promulgated after January 1, 1982..., compliance as expeditiously as practicable but in no case later than three years after the date such limitations are promulgated (Part 412 was promulgated in 1974)...and in no case later than March 31, 1989..." Furthermore, the National Pollution Discharge Elimination System (NPDES) permits regulation at Part 122.47(a)(1) states, "Any schedules of compliance under this section shall require compliance as soon as possible, but not later than the applicable statutory deadlines under the CWA." 40 CFR 122.63(13) further states under compliance schedule "...In no case shall the compliance schedule be modified to extend beyond an applicable CWA statutory deadline for compliance." The statutory deadline for full compliance for Part 412 has long passed.

EPA believes that the Agency is well within any test of reasonableness to assume full compliance 25 years after the rule was promulgated. The practice of assuming compliance is consistent with EPA's published guidance for conducting regulatory analysis, outlined in EPA's "Guidelines for Preparing Economic Analyses, USEPA, 2000." EPA's guidance is available online at http://www.epa.gov/economics/. In accordance with EPA practice and guidance, EPA assumes that operations with 1,000 or more AU are in compliance with existing requirements promulgated in 1974;

these operations are assumed to have already incurred whatever costs were necessary to achieve compliance with these existing requirements.

As discussed in the 2001 Notice, guidance from the Office of Management and Budget (OMB), as outlined in "Economic Analysis of Federal Regulations Under Executive Order 12866," recommends that the baseline for assessing the costs and benefits of a regulation be, "... the best assessment of the way the world would look absent the proposed regulation." OMB's guidance goes on to discuss various factors that may be considered in choosing an appropriate baseline, including existing regulations and the likely degree of compliance with these regulations, and recommends that, "when more than one baseline appears reasonable or the baseline is very uncertain, and when the estimated benefits and costs of proposed rules are likely to vary significantly with the baseline selected, the agency may choose to measure benefits and costs against multiple alternative baselines as a form of sensitivity analysis." OMB's guidance is available online at http://www.whitehouse.gov/omb/inforeg/riaguide.html.

EPA did consider ways to evaluate the possibility that there may be noncompliance with the existing regulations and the additional potential costs of compliance as a supplement to its cost and economic analyses. To evaluate the cost of the existing regulations, EPA requested additional data and information on current rates of non-compliance in a 2001 Notice of Data Availability ("2001 Notice" at 66 FR 58556). Information was requested on the number or share of operations with more than 1,000 AU that are not in compliance with the existing regulations. During the development of the proposed CAFO rulemaking, EPA requested additional data and information to substantiate industry claims of widespread non-compliance with the existing regulations. In the 2001 Notice, EPA requested information on current rates of non-compliance with the existing regulation, differentiated to the extent possible by production type or facility size for each of the major livestock and poultry sectors. This information would be needed to account for animal waste management systems and practices that are already being implemented at the CAFO to manage manure and wastewater, including practices associated with various voluntary programs as well as practices to assist with basic day-to-day production needs at the facility.

EPA considered using any information submitted to conduct an evaluation of the combined additional cost to comply with the existing regulations plus the incremental costs of the proposed regulations. In the 2001 Notice, EPA also solicited comment on an approach that would be conducted in two stages, which is outlined as follows.

The first stage of this analysis would assess the cost to CAFOs to comply with current requirements—specified for the production area—promulgated under the existing 1970s regulations and further evaluate the expected financial impacts of these costs. Using a representative farm approach, where the Agency determines that compliance with the existing regulations would have resulted in financial stress and potential closure of a representative facility, this operation would be removed from the analysis under the assumptions that this operation would not have remained in business. This representative facility would now constitute a baseline closure for purposes of evaluating the proposed revisions to the existing rule. This approach by which baseline closures are removed from any subsequent analyses is consistent with longstanding Agency practice to assess only the incremental costs associated with a specific regulatory action.

The second stage of this analysis would evaluate costs and financial impacts to comply with the revised requirements. These costs and impacts would be assessed for operations within the assumed remaining CAFO universe based on the number of operations assumed to have remained in business

while complying with the existing regulations (i.e., excluding assumed baseline closures determined to close under the existing regulations in the first stage of this analysis). This alternative approach likely would have resulted in a reduced total CAFO population for the purposes of EPA's regulatory analysis, since those CAFOs determined to be unable to absorb the costs of the existing 1974 effluent guidelines requirements would have been eliminated from the analysis prior to assessing the financial effects of the final revised requirements. This alternative approach might have allowed EPA to consider more stringent and more costly requirements for this rulemaking had EPA been focusing primarily on those more financially secure CAFOs that have already been successful in absorbing the costs of the existing requirements.

EPA solicited comment on this approach and requested data and information in order to conduct this supplemental analysis. Subsequent to the proposal and the 2001 Notice, EPA received no substantive data to document the claim of substantial non-compliance and associated compliance cost in the CAFO industry. Minimal data was submitted for two segments of the industry but the basis of these data were not included. Neither stage of this assessment could be addressed; therefore, EPA was unable to calculate a reasonable alternative cost estimate because no substantive and useful information is available or was provided by commenters.

Due to the lack of substantiation of the baseline compliance claims, EPA's final analysis continues to assume that operations with 1,000 or more AU are in compliance with existing regulations (not including poultry operations with dry manure management systems). Accordingly, EPA's estimates of the incremental costs attributable to the final regulations take into account information regarding current Federal and State requirements for animal feeding operations and calculate compliance costs of the final requirements that exceed the current requirements. Operations located in states that currently have requirements that meet or exceed the proposed regulatory changes would already be in compliance with the final regulations and would not incur any additional cost.

EPA's final analysis also accounts for current structures and practices, assumed to be in place already at operations, that may contribute towards compliance with the regulations. However, EPA has made significant improvements to its analysis to better estimate the types of practices and controls at existing facilities. EPA's analysis now provides an expanded range of cost estimates that accounts for greater variability across operations based on expected capital and management improvements needed. This approach is discussed in the following section Section 2.2.3 of this report. More detailed information is provided in the *Development Documents* (USEPA, 2002, 2001b).

2.2.3 Method for Estimating CAFO Compliance Costs

Section 4 of the Proposal EA summarizes EPA's approach to estimate compliance costs to CAFOs and to non-CAFO recipients of manure generated at CAFOs. EPA's *Development Documents* for the proposed and final rule provide detailed information on EPA's cost analysis (USEPA, 2001b, 2002).

For the purpose of estimating total costs and economic impacts, EPA calculates the costs of compliance for CAFOs to implement the final regulatory options being promulgated. EPA estimates costs associated with four broad cost components: nutrient management planning, facility upgrades, land application, and technologies for balancing on-farm nutrients. Nutrient management planning costs

include manure and soil testing, record keeping, and plan development, among other costs. Facility upgrades reflect costs for manure storage, mortality handling, storm water and field runoff controls, reduction of fresh water use, and additional farm management practices. Land application costs address agricultural application of nutrients, including hauling of excess manure off-site and adjusting for changes in commercial fertilizer needs, and reflect differences among operations based on cropland availability for manure application at a representative CAFO. Specific information on the capital costs, annual operating and maintenance costs, start-up or first-year costs, and also recurring costs that EPA uses to estimate impacts of the final regulations is provided in the *Development Document* (USEPA, 2002). EPA also uses these model CAFOs to estimate total aggregate incremental costs to the CAFO industry.

EPA evaluates compliance costs using a representative facility approach based on about 1,600 farm level cost models to depict conditions and to estimate compliance costs for select representative CAFOs (USEPA, 2002). The major factors used to differentiate individual model CAFOs include the commodity sector, the farm production region, and the facility size (based on herd or flock size or the number of animals on-site). EPA's model CAFOs primarily reflect the major animal sector groups, including beef cattle, dairy, hog, broiler, turkey, and egg-laying operations. Practices at other subsector operations are also reflected in the cost models, such as replacement heifer operations, veal operations, operations with flushed caged layers, and grow-finish and farrow-finish hog operations (USEPA, 2002, 2001b).[3] EPA bases its analysis on results for model facilities with similar waste management and production practices to depict operations in regions that are not separately modeled.

Another key distinguishing factor incorporated into EPA's model CAFOs is information on the availability of cropland and pastureland for land application of manure nutrients. For this analysis, nitrogen and phosphorus rates of land application are evaluated for three categories of cropland availability: Category 1 CAFOs are assumed to have sufficient cropland for all on-farm nutrients generated, Category 2 CAFOs are assumed to have insufficient cropland, and Category 3 CAFOs are assumed to have no cropland (USEPA, 2002). EPA uses 1997 information from USDA to determine the number of CAFOs in each category. This information takes into account which nutrient (nitrogen or phosphorus) is used as the basis to assess land application and nutrient management costs.

For Category 2 and Category 3 CAFOs, EPA evaluates additional technologies that may be necessary to balance nutrients. Such technologies reduce off-site hauling costs associated with excess on-farm nutrients, as well as address ammonia redeposition, pathogens, trace metals, and antibiotic residuals. These technologies may include BMPs and various farm production technologies, such as feed management strategies, solid-liquid separation, composting, anaerobic digestion, and other retrofits to existing technologies. EPA considers all of these technologies for identification of "best available technologies economically achievable" (BATEA) under the various regulatory options described in the preamble for the final rulemaking.

For the proposal, EPA estimated compliance costs for a model CAFO facility by first estimating the total cost to an individual facility to employ a given technology including the full range of necessary capital, annual, start-up, and recurring costs. EPA then weights the average facility level cost to account for current use of the technology or management practice nationwide based on certain weighting factors,

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[3]Grow-finish operations finish more mature pigs, while farrow-finish operations handle all stages of production from breeding to finishing.

referred to in the analysis as "frequency factors," that the Agency assumes for each individual cost (each technology) and cost component (capital and annual costs) in each of its CAFO models (USEPA, 2002). Average costs were obtained by multiplying the total cost of a particular technology or practice by the frequency factor for that costing category, expressed as the percent of operations that are believed to use this particular technology or practice, to derive the average expected cost that could be incurred by a model CAFO. More information on how EPA developed and tested the frequency factors used for this analysis is provided in the *Development Documents* (USEPA, 2002, 2001b). These documents also provide additional information on the data and assumptions EPA uses for its cost models.

EPA received public comments that challenge this general approach because it fails to account for variability among operations. To address this concern, the 2001 Notice presents an alternative way to characterize the variability of costs that might be incurred by increasing the number of representative models used to assess compliance costs (66 FR 58572-58573). The 2001 Notice presents data and information from USDA that support this approach (see USEPA, 2002). This approach would first define a set of model CAFOs that represent typical or dominant production practices. Second, it would identify the expected compliance costs associated with the proposed CAFO rule requirements. Finally, it would adjust these costs according to how many CAFOs are expected to need upgrades to their facilities or practices to meet requirements. Compared to EPA's analysis for the 2001 Proposal, this approach further breaks out these costs into three categories of farms based on the "average" operation and also operations with "least needs" and "most needs." For the purpose of this analysis, EPA uses USDA's simplifying assumption for this approach: 50 percent of all operations within each representative farm group represent the average, while each representative group representing operations outside the average accounts for 25 percent of all operations. More information on this approach is presented in the 2001 Notice (66 FR 58556) and the *Development Document* supporting the final rule (USEPA, 2002).

EPA's cost models also account for other differences among operations, including soil type and other production factors, such as climate and farmland geography, land application and waste management practices, and other major production practices typically found in the key producing regions of the country. Model facilities reflect major production practices used by confinement operations with more than 300 AU. More information on EPA's cost models is provided in the *Development Document* (USEPA, 2002).

Where costs are not estimated for operations with fewer than 300 AU (e.g., for operations *designated* as CAFOs because they are determined to contribute to water quality impairment), EPA uses available compliance costs for other model CAFOs. EPA approximates costs to expected designated facilities using estimated costs for the smallest size model CAFO among operations with between 300 and 1,000 AU ("Medium 1" operations),[4] with the added assumption that these potential costs and effects are represented by costs developed to depict operations in the more traditional production regions (Midwest for the livestock and turkey operations and Southeast for the broiler and egg laying operations). For analysis purposes, EPA further assumes that these operations are characterized as having available land for land application of manure (Category 1 model facilities) and high technology needs ("most needs"). More detailed cost information is provided in the *Development Document* (USEPA, 2002) and related cost reports. See also EPA's Comment Response Document available in the rulemaking record.

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[4]The smallest model for wet layer is Medium 3, which were used for this analysis (see Tale 2-1).

2.2.4 Cost Annualization Methodology

EPA develops CAFO compliance costs from estimated start-up (first-year) costs, recurring 3-year and 5-year costs, and annual operating and maintenance costs. To compare estimated costs to available farm financial data in any one year, EPA annualizes these costs using the approach described below. A 1997 time frame is used for comparison with available USDA data on livestock and poultry farms, as reported in the 1997 Census of Agriculture and other related databases. The inputs and assumptions of the cost annualization model are summarized as follows.

Annualized costs account for the time value of money and reflect the annual repayment amount of an on-farm capital investment by spreading the initial costs over the expected life of the structure. EPA calculates both pre-tax and post-tax annual costs. Pre-tax costs are used to estimate the total cost of the final regulations to society (social costs). Post-tax costs are used to measure the economic impacts at CAFOs and to account for the reduction in a CAFO's tax liability. This reduction in taxes paid ("tax shield") offsets the expected compliance costs incurred by a facility. This portion of costs is borne by Federal and State governments through a reduction in tax revenue. Accordingly, the economic impacts of the final regulations are measured as the impact of the expected compliance cost incurred by a CAFO minus an appropriate tax shield.

The major inputs to and assumptions used in the cost annualization model are (1) the discount rate, (2) the life of the asset, and (3) tax rates. EPA uses the *discount rate* to calculate the present values of the cash flows. This rate is analogous to an interest rate used to compute a mortgage payment. The annualization model uses a real discount/interest rate of 7 percent, as recommended by the Office of Management and Budget (OMB, 1992), which does not have to be adjusted for inflation. EPA also evaluates costs assuming an alternative discount/interest rate of 3 percent to compare monetary benefit estimates using a range of rates (see the Benefits Analysis (USEPA, 2002k). Cost estimates assuming an alternative 3 percent discount rate are also presented in Section 5, comparing estimated costs and benefits assuming this rate.

The *life of the asset* is the time period over which the costs are to be annualized (like a mortgage time period) and is determined according to the Internal Revenue Code's classes of depreciable property. The time period over which the annualization is made depends on the serviceable life of the structure as well as on the depreciable life, which affects what portion of a capital cost can be used each year to reduce taxable income. The Internal Revenue Service (IRS) rules govern the designation of depreciable life, which is assigned on the basis of serviceable life. Most of the types of capital investments required under these regulations are typically depreciated over 10 years (IRS, 1999c).[5] The cost annualization model thus incorporates a 10-year annualization period to compute both pre-tax and post-tax annual costs. The equation EPA uses to calculate annual cost operates from mid-year to mid-year (mid-year convention); therefore, the entire time frame of the analysis begins in Year 1 and concludes in Year 11 but is discussed here as a 10-year time frame (see Appendix A).

The assumed *tax rates* are used to determine a facility's tax benefit or tax shield. Estimated tax savings are subtracted from the actual outlay in each year and are used to calculate the annual post-tax

[5]Many of the types of investments would best be classified as single-purpose agricultural structures, which IRS defines as enclosures or structures specifically designed, constructed, and used for housing, raising, and feeding a particular kind of livestock, including structures to contain produce or equipment necessary for housing, raising, and feeding livestock.

cost of compliance. The tax shield calculation uses three inputs: marginal tax rates (composed of Federal tax rates and an assumed State tax rate); an estimate of CAFO taxable income (net cash minus depreciation plus value of inventory change, assuming the CAFO is using the accrual method of accounting); and a depreciation schedule.

EPA calculates compliance costs to CAFOs under both pre-tax and post-tax scenarios. The pre-tax costs reflect the estimated total social cost of the final regulations, including lost tax revenue to governments. EPA uses calculated pre-tax dollars when comparing estimated costs to monetized benefits that are estimated to accrue under the final regulations. (EPA also uses pre-tax costs to conduct an initial screener of CAFO level financial effects; see Section 2.4.) Post-tax costs reflect the fact that a CAFO would be able to depreciate or expense these costs, thus generating a tax savings. Post-tax costs thus are the actual costs the CAFO would face. For this reason, EPA evaluates cash flow changes at CAFOs over time taking into account the tax savings to facilities, according to estimated post-tax costs, using available Federal and State tax information to compute the expected tax shield for a representative model facility (see Section 2.4).

Appendix A provides a description of how the tax rates are assigned to each model CAFO. The depreciation schedule is dictated by IRS rules, but there are several choices of depreciation schedule within those rules. For reasons outlined in Appendix A, EPA has chosen the Modified Accelerated Cost Recovery System (MACRS), which is a commonly used and generally advantageous depreciation schedule for tax minimization purposes. The tax shield is calculated using the depreciable capital cost in each year plus any recurring expenditures allowed to be expensed in each year. Each model CAFO is assigned a tax rate (marginal Federal rate plus an assumed State tax rate) based on the estimated amount of taxable income. The tax rate times the depreciated and expensed compliance cost in each year equals the estimated tax shield.

Appendix A of this report also provides more detailed information on the cost annualization approach used for this analysis and presents a sample spreadsheet that shows how all of the computations are made. The appendices also document all annualized incremental costs estimated by EPA (pre-tax, expressed in 1997 dollars) by model facility and by animal inventory (Appendix B) for each of the major livestock and poultry sectors. Section 3 presents the aggregated, national level annualized compliance costs (pre-tax, 2001 dollars) for the final regulations. Input costs used for this analysis are provided in the *Development Document* (USEPA, 2002).

2.3 BASELINE FINANCIAL DATA FOR EPA MODEL CAFOs

This section describes the data that EPA uses to depict baseline financial conditions at regulated CAFOs. Section 2.3.1 describes the sources of data used for the 2001 Proposal and alternative data that EPA received during the comment period to address public comments on the data and approach that the Agency uses to assess regulatory impacts for the final regulations. Section 2.3.2 discusses the process EPA uses to select among the available data to build baseline financial models for each of the affected sectors and also describes, in some cases, any adjustments that EPA made to these data. Section 2.3.3 briefly restates how EPA matches these financial models to the cost models developed to represent model CAFO facilities, which is described in more detail in the Proposal EA (USEPA, 2001a).

The financial data presented in this section reflect consideration of alternative data for use in EPA's analysis based on comments received during the public comment period. During this period, EPA received many comments on the financial data used to estimate CAFO level effects in the 2001 Proposal. In many cases, these comments were accompanied by alternative financial data for consideration by EPA. Among the principal comments that EPA received on its Proposal EA is the need to separately evaluate effects on an individual operation's livestock or poultry enterprise. This recommendation originated from USDA, various land grant universities, and some industry representatives. The comments recommend that EPA evaluate impacts using livestock enterprise level data that do not include revenue from other farm-related sources (e.g., secondary livestock, crops, government payments). This approach differs from the approach EPA used to evaluate effects for the 2001 Proposal, where only farm level financial data were used to evaluate regulatory impacts on CAFOs using financial data that include revenue from other farm-related sources. This change in the approach and underlying data for the analysis was presented in the 2001 Notice. This section describes these data for EPA's final analysis and describes additional adjustments that EPA made to respond to other public comments received on the 2001 Proposal, the 2001 Notice, and the 2002 Notice.

2.3.1 Sources of Data

To evaluate the regulatory impacts of the final regulations, EPA uses both farm level and enterprise level financial data compiled from a variety of sources, including USDA, various land grant universities and academic research organizations, as well as data provided by the regulated industry.

The financial data that EPA uses for its analysis of the final CAFO regulations depict baseline conditions at both the farm level and enterprise level. At the farm level, for most sectors, EPA will continue to use available 1997 farm level data from USDA, which EPA used for proposal. For the cattle feeding, dairy, and hog sectors, EPA substitutes the financial data used for proposal with alternative data obtained since proposal, as discussed later in this report. For the poultry sectors, EPA continues to use the 1997 USDA farm level data used for proposal, but also uses additional enterprise level data obtained from USDA and various land grant universities. All alternative data used by EPA were presented in both the 2001 Notice and the 2002 Notice. More information is provided in the rulemaking record.

2.3.1.1 USDA's Agricultural Resource Management Study

A key source of financial data used by EPA to evaluate the regulatory impacts of the final regulations is USDA's ARMS data. The ARMS is USDA's primary method for collecting data covering a broad range of issues about agricultural production practices and costs. These data provide the only national perspective on annual changes in the financial conditions of production agriculture (USDA/ERS, 2000a). The ARMS is an annual survey conducted using a probability sample, which in 1997 included information from 11,724 surveyed farms nationwide. The sample survey is hand-enumerated by trained personnel. USDA extrapolates the data from the sample survey to represent farming and ranching operations in the 48 contiguous states. These national level data are published in a series of annual and periodic reports, such as USDA ERS's annual compendiums on farm costs of production and on farm financial performance (data formerly identified as the Farm Costs and Returns Survey data).

Data on both family and nonfamily farms are included in the ARMS data (USDA/ERS, 2000b, 1999a). USDA's farm typology data also provide information on animal ownership based on the

percentage of animals raised at the farm site that are owned or not owned by the farmer (e.g., raised under contract for another business entity) (USDA/ERS, 1999a). This information is useful for understanding the average data, which include all the different farm structure types that are captured in the aggregated ARMS data for each livestock and poultry sector. The ARMS revenue data are separable by enterprise (livestock and crops), as well as by other farm-related income and government payments. Off-farm revenue is not included in the ARMS data used by EPA for this analysis, as described previously under revenue definitions for "Income Statement Information." However, the ARMS operating expense data are not separable by enterprise (e.g., buildings, labor and equipment for crop versus livestock production), but instead represent average production costs for an operation as a whole. This generally limits the types of analyses that EPA can conduct using these data for its economic impact analysis. Also, USDA information on off-farm revenue is not included in this analysis.

Aggregated ARMS data are readily available through periodic compendiums published by USDA. To depict financial conditions for selected representative farm groups, EPA requested that USDA provide these data on a more disaggregated basis than that found in the published data. As noted extensively throughout the 2001 Proposal and various support documents, USDA periodically publishes summary data from its farm level databases and provides customized analyses of the data to the public and other government agencies. The requested ARMS data summaries were compiled with the assistance of staff at USDA's ERS, who performed special tabulations of the data to differentiate the financial conditions among farms by selected facility size categories and by primary producing region for each sector. ERS developed a methodology for identifying farms likely to be CAFOs based on reported survey information, and developed estimates of animal units on these operations based on reported data. Given these estimates, farms were grouped into animal unit size categories and data were provided to EPA and other government agencies. All data provided to EPA are sufficiently aggregated to ensure the confidentiality of an individual farming operation and to maintain the statistical representativeness of the sample data.

In general, the published data provide financial information on a total, national basis across all farms for only four aggregated sectors: beef, dairy, hogs, and poultry. These data are reported across all production types and businesses, and in the poultry sector thus combine information across all broiler, turkey, and egg laying operations. However, the underlying ARMS database provides information on the financial conditions within individual sectors. These data can also be grouped to show differences among farms by facility size and production region, among other factors.

For the purposes of EPA's analysis, the Agency requested more detailed data from USDA for the poultry sector (1997 data), the hog sector (1998 data), and the dairy sector (2000 data). In some cases, USDA data are not available for each level of aggregation because of confidentiality and nondisclosure requirements, requiring that EPA use national level data. For the poultry sectors, the 1997 ARMS, which was conducted in conjunction with USDA efforts to collect the 1997 Census, contains more detailed information and allows for the breakout of financial conditions across the poultry category, including broiler, turkey, and egg-laying operations. EPA uses the farm level data to estimate financial effects on poultry operations for the 2001 Proposal. Since the 2001 Proposal, EPA has obtained additional financial data for the hog and dairy sectors from a special ARMS compilation of these sectors. These data provide a means for USDA to break out enterprise level operating revenues and costs to depict financial conditions at an operation's livestock or poultry enterprise separate from the revenues and costs for the whole facility. The 1997 ARMS operating expenses data are not distinguishable by business enterprise, but are the total for the business. For the hog sector, these data allow for greater breakout of financial conditions across the different production types (farrowing, farrow-finish, and grow-finish) as

well as across different business types (contract grower and independent owner-operator). The rulemaking record documents how EPA worked with USDA to obtain additional data since the 2001 Proposal (see: USEPA, 2002a, 2002b, 2002c, 2002d, 2002f, 2001c, and 2001d; USDA/ERS, 2002a, 2002b, 2002c, 2002d, 2001, 2001a, 2001b, 2001c, and 2001d; ERG, 2002c; ERG and DPRA, 2001). A detailed summary of how EPA uses the available hog data obtained from USDA is available in the record (ERG, 2002c—DCN 375083).

Financial data obtained by USDA from its ARMS and related databases are based on average end-of-year farm inventories. 1997 ARMS data obtained by USDA include information on the total number of farms and the total number of animals in the sample set. These data correspond exclusively to the average income statement and balance sheet information for representative farms compiled by ERS for each aggregated data grouping by commodity, production region, and facility size groups (USDA/ERS, 1999a). EPA uses these data to calculate financial data on a per-animal inventory. (See Section 4.2.4 of the Proposal EA [USEPA, 2001a], which also describes how EPA compiled its financial models using the 1997 ARMS data.) Data obtained from USDA by special compilation of recent hog and dairy financial data were translated on a per-animal inventory basis by USDA (USDA/ERS, 2002a, 2002b, 2002c).

2.3.1.2 Data from Various Land Grant Universities

To supplement EPA's farm level assessment of regulatory impacts conducted for the 2001 Proposal with an assessment of impacts at an operation's livestock or poultry enterprise, EPA obtained enterprise level financial data or "enterprise budgets" from a variety of land grant universities and academic research organizations.

Enterprise budgets are useful tools for examining the potential profitability of an enterprise before actually making an investment. To create an enterprise budget, an analyst gathers information on capital investments, variable costs (such as labor and feed), and fixed costs (e.g., interest and insurance), combined with price information and typical production yields, to estimate annual revenues, costs, and returns for a project. By varying different input parameters, enterprise budgets can be used to examine the relative importance of individual parameters to the financial return of the project or to identify break-even prices required to provide a positive return.

As part of EPA's public comment period, FAPRI submitted enterprise budgets developed by a panel of industry experts (FAPRI, 2001a). (See: DCN 235619.) For its study, FAPRI convened a panel of experts "to provide a snapshot of each enterprise at a given point in time" (FAPRI, 2001a, 2001b). These experts developed information on the financial characteristics of each model farm at the enterprise level for 2000. FAPRI did not provide corresponding revenue and cost data at the farm level, which would have allowed EPA to appropriately conduct its discounted cash flow analysis at the farm level. Enterprise data submitted are in the form of full financial statements and include other information such as beginning cash reserves, productivity measures, and feed efficiency. These data cover cattle, dairy, and hog (farrow-finish independent) operations, and they vary by select facility size grouping and production region for each sector (FAPRI, 2001a). Although the data are for a single year, other information provided by FAPRI allows for a more extensive analysis of expected changes over a 10-year period (2001 to 2011) based on FAPRI's projections, taking into account pricing cycles. Other available timeline data are from FAPRI's periodic *U.S. Baseline Briefing Book* (FAPRI, 2001c, 2001d). FAPRI's reports are provided in EPA's record and are also available at FAPRI's web site.

Since the publication of the 2001 Proposal, EPA has collected other published "enterprise budget" data from various land grant university sources to further evaluate the availability of usable enterprise level data and information. Given the lack of other available financial data for the poultry sectors, EPA uses published enterprise budgets to depict enterprise level financial conditions for broiler, egg, and turkey operations (as discussed in Section 2.4.2). As part of EPA's overall effort, however, enterprise budgets were compiled for beef feedlots (14 budgets), farrow-finish hog operations (10 budgets), grow-finish hog operations (5 budgets), dairy operations (7 budgets), heifer operations (4 budgets), and broiler operations (3 budgets). Since the publication of the 2001 Notice, EPA also obtained enterprise budgets for the egg and turkey sectors, which were provided when the 2002 Notice was published. The range of sources includes the University of Idaho, Iowa State University, Ohio State University, Oklahoma State University, Kansas State University, North Carolina State University, Ohio State University, Clemson University, and University of Arkansas. The enterprise budgets span a wide range of assumptions, including size and type of operation; type, age, or sex of animal raised; and feed and operating efficiency. The budgets vary greatly with respect to line items, which items were considered variable or fixed, whether depreciation and interest were reported separately, and whether a capital recovery item or building and equipment charge was reported. The years represented by data in these budgets varies, tending to be within the period from 1997 to 2000, with some exceptions. A summary of all the enterprise budget data collected for the purpose of identifying alternative financial data is provided in the record (see: ERG, 2001d), along with additional citations on poultry data used by EPA (see: DCN 175024, DCN 375036, DCN 375048, and DCN 375049).

2.3.1.3 Data from National Cattlemen's Beef Association

As discussed in the 2001 Notice, during the development of the proposed rulemaking EPA received alternative enterprise level data for the cattle feeding sector from NCBA based on a survey of its membership. For reasons described in the Proposal EA and the 2001 Notice, EPA decided not to base its economic analysis on NCBA's data for the proposal. Instead, given the lack of other statistically validated survey data for this sector, EPA used USDA's 1997 ARMS data for beef operations despite recognition of the limitations of these data for assessing cattle feeding operations. Both before EPA's proposal and during the comment period, NCBA expressed concern that the ARMS data are more reflective of cow-calf operations and represent few feedlots and, therefore, might not be representative of operations in this sector. USDA also indicated to EPA that the available ARMS data are more reflective of cow-calf operations and might not be suitable for evaluating impacts on cattle feeding operations. In public comments on the 2001 Proposal, researchers at Iowa State University also suggested that the use of ARMS data to represent beef feedlots is inappropriate (see: DCN 201602).

As part of EPA's public comment period, NCBA submitted additional financial data and information for cattle feeding operations (NCBA, 2001). (See: DCN 201165.) This new data submission addresses many of EPA's initial concerns about NCBA's previously submitted survey data. It provides additional details about how these data were collected and includes additional information that allows EPA to more fully evaluate these survey data. NCBA's data submission also includes projections by NCBA based on these baseline data over the time frame of EPA's analysis (NCBA, 2001, 2002).

The 2001 Notice presents data provided by NCBA, representing results of surveys of NCBA's membership. These data consist of a total of 66 surveys with 1997 financial data, 72 surveys with 1998 data, and 73 surveys with 1999 data returned by respondents. Of these, 54, 60, and 58, respectively, were used by NCBA to characterize the finances of the beef feedlots represented by these survey data. These

data are enterprise level data but include information on both company-owned cattle and cattle that are not owned by the feedlot but are fed on-site (e.g., custom operations). For the purpose of this analysis, EPA assumes that these data are representative of both the enterprise and farm because the data are more inclusive of a range of revenue sources. These data are used to depict conditions at larger beef operations based on NCBA survey results, which represent operations marketing an average of 52,000 cattle annually. Regional breakouts are not provided. NCBA presented gross receipts, total operating costs, interest payments and receipts, net cash income, depreciation, pre-tax net income, current assets, total assets, current liabilities, total liabilities, and total equity. NCBA also provided a variety of ratios, including debt-assets. These key parameters represent an average over a 3-year period from 1997 to 1999.

The next section of this report further describe the NCBA survey data submitted to EPA and discuss the Agency's rationale for choosing these data. These data are available in EPA's record (NCBA, 2001—DCN 201165), along with the an assessment comparing NCBA's data against information available from other sources (see ERG, 2001b). Also see EPA's response to comments on the data used to depict financial conditions at cattle feeding operations in the Comment Response Document available in the rulemaking record (see response to comment DCN CAFO 201602-22).

2.3.2 Data Selection and Modification for EPA's Financial Models

This section discusses EPA's process to select among the available data to build baseline financial models for each of the affected industry categories—cattle, dairy, hog, and poultry sectors—and also describes, in some cases, any adjustments made to these data by EPA. Data tables are presented at the end of this section. All financial variables used for EPA's analysis conform to established practices and standards for specifying commodity cost and returns, consistent with those used by USDA and set by American Agricultural Economics Association guidelines (AAEA, 2001).

For the some sectors, EPA continues to use available 1997 data from USDA reflecting financial conditions at the farm level, which the Agency used for proposal. For the livestock (cattle feeding, dairy, and hog) sectors, EPA has replaced the 1997 USDA data used for proposal with other farm level and enterprise level data, which were presented in both the 2001 Notice and 2002 Notice. For cattle operations, EPA uses financial data provided by NCBA and FAPRI. For dairy and hog operations, EPA uses alternative data from USDA. For the poultry (broiler, egg, and turkey) sectors, EPA continues to use USDA's farm level data used for proposal, but supplements these data with with limited available enterprise level data obtained since proposal.

As discussed in both the 2001 Notice and the 2002 Notice, among the principal comments that EPA received on its Proposal EA is the recommendation to separately evaluate effects on an individual operation's livestock or poultry enterprise. This recommendation originated from USDA, various land grant universities, and some industry representatives. It was suggested that EPA evaluate impacts using livestock enterprise level data that do not consider revenue from other farm-related sources (e.g., secondary livestock, crops, government payments). This approach differs from the 2001 Proposal, where only farm level financial data were used to evaluate regulatory impacts on CAFOs, using financial data that include revenue from other farm-related sources. To support this comment and to encourage EPA to use alternative data for its analysis, many commenters submitted enterprise level data to the Agency during the comment period, which are presented in the 2001 Notice.

To address comments that criticize EPA's use of a single year of financial data to reflect baseline conditions, the Agency adjusts financial data for the cattle, hog, and dairy sectors (using other available published data from USDA, FAPRI, and the land grant universities) to average out conditions over multiple years. This approach involves incorporating other available data into the analysis to obtain average conditions over a multiple year time frame, as discussed in the 2001 Notice (see 66 FR 58590-58591). Because of the lack of multiple years of financial data for the poultry sectors, EPA is not able to use this approach for those types of operations and is instead continuing to use a single year of data. Other recommended changes to the data that EPA uses for its analysis include the use of alternative data to project conditions over the time frame of the analysis (1997-2006), which is also discussed in both of EPA's published Notices.

For more information, see EPA's response to comments received during the public comment period regarding the financial data and the analytical approach that the Agency uses compile aggregate costs and to assess regulatory effects on CAFOs. These response to comments address alternative data and recommended changes to EPA's assessment approach. Relevant response to comments in the Comment Response Document include EPA's use of alternative data EPA uses (DCNs 201602-22, 400158-91, 400165-36, 202013-2, 201605-13 and 201352-108, 201352-136-4) and related adjustments using best available data to modify EPA's assessment approach (see, for example, 202402-35 regarding its enterprise analysis, 400158-92 regarding adjustment to average out single year of data, 201352-101 on projections used, and adjustments and clarification on the assessment criteria used in 201352-35, 201335-104, 201438-207-1, 201335-104, 210352-106, and 201438-207-1), among other Agency comment responses. The Comment Response Document available in the rulemaking record.

2.3.2.1 Cattle Sector

Because of USDA's concerns that the financial data for this sector might be more reflective of cow-calf operations and not suitable for evaluating impacts to cattle feeding operations (see: 2001 Notice, 66 FR 58585-58587), EPA is replacing the financial data for this sector used in the Proposal EA. Instead, for its final analysis of impacts on the cattle feeding sector, EPA uses financial data submitted by NCBA and FAPRI, along with available enterprise level data for heifers from the University of Idaho. A summary of the input data that EPA uses for its analysis is presented in Tables 2-2 and 2-3.

For operations with more than 1,000 AU, EPA uses data provided by NCBA for operations with an average of 52,000 head (see: DCN 175044). For operations with between 300 and 1,000 AU, EPA uses data submitted by FAPRI for a 500-head feedlot enterprise (DCN 175038). For the purposes of this analysis, and because of the lack of additional available data, EPA assumes that these data reflect baseline financial conditions for operations with fed cattle and veal. For operations rasing heifers, EPA uses enterprise budget data for heifer replacements given the availability of 1998 data from the University of Idaho (DCN 175033 and DCN 175034). EPA presented those data in the 2001 Notice (66 FR 58589). Each of these data sources represent enterprise level conditions. Farm level data are not available; therefore, EPA's analysis assumes that farm and enterprise conditions are the same.

EPA has evaluated the reasonableness of both the NCBA and FAPRI data (ERG, 2001a). Because of limited financial data on cattle feeding operations, little additional information is available for this sector to conduct an in-depth comparison. The use of these data is supported by information cited by Koontz et al. (2000), reporting average industry returns of $10 to $15 per head, along with high-end returns of $11 to $25 per head (assuming certain production equipment). Assuming returns reported

by Koontz et al. (2000) are primarily cash-based returns, they compare to the calculated midpoint of $10 to $12 per head based on the ranges assumed by EPA for its analysis (EPA assumes values for net cash income ranging from a $7 per head loss to earnings of $30 per head, depending on facility size). This information generally supports the level of net cash per head that EPA assumes for its discounted cash flow analysis for cattle feedlots. EPA selected the NCBA survey data for large feedlots because these data are more representative of larger operations. EPA has evaluated NCBA's financial data against those provided by FAPRI, and they compare closely. EPA also provided initial review and input to NCBA on each of its survey questionnaires developed for this rulemaking. For more information, see Section 8.1.3 of the Proposal EA.

EPA selected to use the alternative NCBA and FAPRI data over other more limited available data and information, including data submitted by Iowa State University (ISU, 2001) and enterprise budgets obtained from various land grant universities (see ERG , 2001d). EPA also chose NCBA and FAPRI data because all key data for the analysis were provided in one data source (revenues, net cash, total liabilities and total assets). Other advantages of these data are as follows.

Because nearly all operations responding to NCBA's survey are significantly larger than operations with fewer than 1,000 AU, EPA uses the FAPRI enterprise data for operations in this size category. FAPRI's data, which EPA uses for operations with fewer than 1,000 AU, were compiled using an "expert panel" approach. Some commenters object to the use of FAPRI-supplied financial data because these data were developed using a panel approach, which they perceive as potentially biasing the data. EPA disagrees with these comments. Use of an expert panel approach to obtain information about a representative facility's financial conditions is a longstanding and common practice used by FAPRI and other land grant university researchers to assess the implications of public policy on the agricultural sectors. Such an approach allows researchers to compile data and other information to address policy questions where other statistically valid data are not available. Even statistical survey data can vary, depending on what data are used (e.g., time period captured, sample size and representativeness, etc.). Although EPA recognizes that expert panel-generated data may be variable across different panels, statistical data are also variable, since each value generated by a statistical survey is subject to statistical variance and the same survey of a different group of respondents will not yield exactly the same results. In the past, the courts have upheld EPA's use of data, even though not perfect, as long as EPA uses the best data available in the best way the Agency can. Moreover, FAPRI data and analyses span decades of ongoing research work and are well-recognized within the agricultural research community and among land grant university researchers. Evidence of the community's regard for FAPRI's research contribution is shown by a 2002 nomination by the American Agricultural Economics Association (AAEA), the organization that publishes the leading agricultural economics research journal, for the AAEA Distinguished Policy Contribution Award—a nomination supported by the U.S. House of Representatives' Committee of Agriculture for FAPRI's contribution during the 2002 congressional farm bill debate (see AAEA, 2002—DCN 375112).

EPA decided to use available NCBA and FAPRI financial data instead of other available "enterprise budget" data that are have been developed by various land grant universities (see ERG, 2001d) for the following reasons. Enterprise budgets are developed to characterize possible revenues and costs that might be encountered by a farm that is interested in developing that enterprise. The revenues and costs are presented as examples, and typically the source indicates that the farmer should develop the budget using his or her best estimates of revenues and costs specific to that operation because, as many budgets note, "your costs or revenues may vary from those shown" (ERG, 2001d). Thus, farmers often use enterprise budgets as a template, not as the final word on whether to undertake the enterprise at a

specific operation. Enterprise budgets are very dependent on detailed assumptions and conditions, some of which are documented but some of which are not. Therefore, enterprise budgets might not truly represent conditions across a broad range of facilities. FAPRI's budgets are compiled using an "expert panel" approach to develop a representative financial model, which is a common and established practice in the field of agricultural policy research. Enterprise budget data are also not straightforward and easily interpreted because these data are not presented in terms of a standard income statement or balance sheet. Additional interpretation of line items is often required to determine whether they constitute actual cash items, opportunity costs, or noncash items (e.g., operating interest or labor). FAPRI data are more explicit and are presented in terms of a standard income statement or balance sheet line items. Furthermore, the FAPRI data explicitly provide asset and liability assumptions specific to the models, whereas many enterprise budgets do no explicitly provide such data.

As discussed in the 2001 Notice, to address recommendations that EPA average out baseline conditions to better account for year-to-year variability and pricing cycles (see 66 FR 58590), EPA uses the 3 years of survey data (1997 to 1999) provided by NCBA to calculate an average gross revenue value for its analysis using the sales test (NCBA, 2001). From the FAPRI data, which include a 2000 base year along with several years of projected data (2000 to 2011), EPA uses the first 3 years of reported revenue (2000 to 2002) to obtain an average total revenue value. EPA uses average values to address recommendations expressed during the public comment period. These comments suggest that EPA consider ways to depict financial conditions over multiple years, despite the availability of only a single year of data in some cases (see 66 FR 58590).

Tables 2-2 and 2-3 show the resultant average gross revenue values that EPA assumes for this analysis. At operations with more than 1,000 AU, the estimate is $475 per head revenue. This estimate compares to the average value of $945 per head assumed for operations with fewer than 1,000 AU. These average values reflect revenue per head sold (or, in the case of the NCBA data, revenue per head marketed, which includes the number of head sold plus the number of head fed under contract that were sent to market). The NCBA data highlight two distinct operations at large feedlots: custom feeding operations and company-owned cattle operations. The difference in revenue per head between these two size categories is attributable to the inclusion of information for custom cattle feeding operations in the NCBA data. The custom feeding portion of a feedlot operation has a different revenue and cost structure than the company-owned portion of the business because the feedlot does not buy or sell these cattle; rather, a price for keeping and feeding these cattle is paid, leading to lower revenues, but also lower costs. The NCBA revenue figure of $475 per head reflects the weighted average of per-head revenues for the company owned cattle enterprise and per-head revenues for the custom feeding enterprise. Because these data are for EPA's sales test, which is used principally as an initial screener to indicate the need for further analysis (see Section 2.4), the revenue data EPA uses for this analysis do not substantially affect the overall results of the Agency's analysis. Moreover, differences in the financial data among production types are less stark once revenues and costs are jointly considered, resulting in more comparable net cash income values.

EPA's discounted cash flow (DCF) analysis already accounts for variability and changing conditions over multiple years. This analysis spans a 10-year time frame (1997 to 2006) and uses time series projections. This approach is consistent with that used for the 2001 Proposal. For this analysis, EPA obtains net cash income estimates at both the farm and enterprise level for the base year (1997) from the available data. EPA uses NCBA data from 1997 for cattle operations with more than 1,000 AU (NCBA, 2001); EPA derives a base year estimate from available FAPRI data for 2000 (FAPRI, 2001), back-calculated to 1997 using the NCBA time series data (NCBA, 2001).

EPA projects out the 1997 baseline data using NCBA-reported data on costs and returns to feedlot enterprises, expressed as dollars per marketed head, to obtain a cash flow stream over the analysis period (1997 to 2006). NCBA's projection covers the 10-year analysis period, relying on historical data and pricing trends in the cattle cycle that correspond to the 3 years of data in the association's survey. EPA uses projected returns made by NCBA that were submitted to EPA (NCBA, 2001). See Table 2-4. Alternative projections by FAPRI and USDA report net returns to cow-calf operations only, which might not correspond to trends in the cattle feeding sector that will be subject to the revised regulations. The FAPRI projections for its 500-head feedlot model also do not cover the 1997 to 2006 time period used for EPA's analysis. The method EPA uses to project the baseline data follows the approach used to support the 2001 Proposal (see Section 4 of the Proposal EA). From this projected cash stream, EPA estimates the net present value estimates for use in its DCF analysis. Table 2-5 shows specific line item definitions. A summary of these values at both the farm level and enterprise level is presented in Tables 2-6 and 2-7.

For the debt-asset test, EPA uses both NCBA and FAPRI data on total assets and total liabilities for operations of similar size in this sector (FAPRI, 2001a), replacing the USDA asset and liability data used for proposal. As with the other financial data, EPA uses NCBA data for operations with more than 1,000 AU and FAPRI data for operations with between 300 and 1,000 AU.[6] See Table 2-2. Use of the alternative data addresses concerns expressed during the public comment period about EPA's assumptions of baseline debt and equity conditions at CAFOs and the data on debts and assets assumed for the proposed rulemaking (see: 2001 Notice, 66 FR 58582-58583). These data exclude smaller sized, typically older, operations that may carry less debt, and focus on larger sized facilities that are often more capital-intensive or might be seeking to expand, thus requiring additional capital investment. EPA uses these alternative debt and asset data for its debt-asset test—instead of USDA data—since these data are likely more representative of the debt load and size of operation affected by the final regulations.

For more information, refer to EPA's Comment Response Document available in the record for the Agency's response to comments on the financial data used to depict financial conditions for this sector, as well as other responses to comments about the financial tests used to evaluate this rule.

2.3.2.2 Dairy Sector

For dairy operations, EPA replaces the 1997 USDA farm level data that were used for the proposal analysis with alternative data provided by USDA based on a special USDA survey of the dairy sector in 2000 (USDA/ERS, 2002c—DCN 375085). A summary of the farm level and enterprise level input data that EPA uses for its analysis is presented in Tables 2-2 and 2-3.

The alternative 2000 USDA data for dairies have the advantage of providing both farm level and enterprise level data from a single data source. Another advantage of using USDA's data is that these data are based on an actual producer survey. As with all other data provided by USDA, these data were compiled by USDA's ERS for EPA's use and were sufficiently aggregated to mask any confidential business information. Given the availability of this single and up-to-date data source, EPA decided to use these data instead of a compilation of farm level data from the 1997 ARMS data set from USDA used

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[6] The resultant ratio using these alternative NCBA and FAPRI data provide an identical debt-asset ratio of 68 percent for use in EPA's debt-asset test, although the representative model debt and asset data may differ.

for the proposal analysis (USDA/ERS, 1999a), along with enterprise level data submitted by FAPRI (FAPRI, 2001a—DCN 175038) and/or enterprise budget data from various land grant universities (see ERG, 2001d). EPA's evaluation of each of these data sources, however, indicate that these data compare favorably to one another. The alternative FAPRI and enterprise budget data were presented in the 2001 Notice (66 FR 58588-58589), soliciting further public comment on their use for this analysis. The alternative 2000 USDA data were discussed in the 2002 Notice (see 67 FR 48108 and DCN 375084) and available for public review in the rulemaking record.

EPA conducted additional sensitivity analyses of these data by comparing the results of the Agency's main analysis using new farm level and enterprise level data from USDA for the year 2000 against the results of an alternative analysis using the 1997 USDA farm level data used for proposal and other enterprise data submitted by FAPRI. The results of this analysis indicate that EPA's analysis results are stable across a range of input data (ERG, 2002c—DCN 375111).

To address recommendations that EPA average out baseline conditions to better account for year-to-year variability and pricing cycles (see: 2001 Notice, 66 FR 58590), EPA adjusts the available 1997 gross income data prior to evaluating these data. This evaluation is done as part of EPA's sales test using published USDA cost and returns data for U.S. dairy operations, spanning 1993 to 2000. These national level data are used to create an index of 8 years of farm level financial data from which to project 1997 gross sales data, producing an average 8-year revenue value.

EPA's DCF analysis, which spans a 10-year time frame (1997 to 2006) and uses time series projections, already accounts for variability and changing conditions over multiple years. This approach is consistent with that used for the 2001 Proposal. For this analysis, EPA obtains net cash income estimates at both at the farm level and enterprise level for the base year (1997) from the available data. At the farm level, EPA projects the 1997 baseline data using USDA-reported net returns for the dairy sector to obtain a cash flow stream over the analysis period (1997 to 2006). At the enterprise level, EPA uses the 2000 net cash income for representative dairy operations submitted by FAPRI. The 2000 data are back calculated to 1997 and projected from 2000 to 2006 using the same USDA-reported net returns for the dairy sector that are used to adjust the farm level data. EPA continues to use the same USDA projections that were used for the 2001 Proposal (USDA/WAOB, 1999, 2000, 2002; see Table 2-4) because other available projections do not regularly report net returns per milk cow. They also do not cover the 1997 to 2006 time period for EPA's analysis. The method that EPA uses to project the baseline data follows the approach used for the Proposal EA. From this projected cash stream, EPA estimates the net present value for use in its DCF analysis. (Table 2-5 shows specific line item definitions.) A summary of these values at both the farm level and enterprise level is presented in Tables 2-6 and 2-7.

For the debt-asset test, EPA uses FAPRI data on total assets and total liabilities for operations of similar size in this sector (FAPRI, 2001a), replacing the USDA asset and liability data used for proposal. Use of the alternative data addresses concerns expressed during the public comment period about EPA's assumptions of baseline debt and equity conditions at CAFOs and the data on debts and assets assumed for the proposed rulemaking (see: 2001 Notice, 66 FR 58582-58583). These FAPRI data exclude smaller sized, typically older, operations that may carry less debt, and focus on larger sized facilities that are often more capital-intensive or might be seeking to expand, thus requiring additional capital investment. EPA uses the FAPRI debt and asset data for its debt-asset test, instead of USDA data, since FAPRI's data are likely more representative of the debt load and size of operation affected by the final regulations.

For more information, refer to EPA's Comment Response Document available in the record for the Agency's response to comments on the financial data used to depict financial conditions for this sector, as well as other responses to comments about the financial tests used to evaluate this rule.

2.3.2.3 Hog Sector

As discussed in the 2001 Notice, EPA is replacing the 1997 USDA data for hog operations used for proposal with other data obtained by the Agency since proposal (see 66 FR 58587-58588). For the hog sector, EPA is not using the financial data that it used for the proposal analysis because of concerns expressed by USDA and others through public comment on the 2001 Proposal. Such comments suggest that the 1997 data are not representative because they reflect conditions where hog prices were unusually high. For the final analysis, EPA uses alternative farm level and enterprise level data from USDA based on a special USDA survey of the hog sector in 1998 (USDA/ERS, 2002a—DCN 375064), with modifications by EPA as summarized here. A summary of the farm level and enterprise level input data that EPA uses for its analysis is presented in Tables 2-2 and 2-3.

The alternative 1998 USDA data for the hog sector have the advantage of providing both farm level and enterprise level data from a single data source. Another advantage of using USDA's data is that these data are based on an actual producer survey. As with all other data provided by USDA, these data were compiled by USDA's ERS for EPA's use and were sufficiently aggregated to mask any confidential business information. Given the availability of this single and up-to-date data source, EPA decided to use these data instead of a compilation of farm level data from the 1997 ARMS data set from USDA used for the proposal analysis (USDA/ERS, 1999a), along with enterprise level data submitted by FAPRI (FAPRI, 2001a—DCN 175038). The alternative USDA and FAPRI were presented in the 2001 Notice (66 FR 58588-58589), soliciting further public comment on their use for this analysis. The alternative 1998 USDA data were further discussed in the 2002 Notice (see 67 FR 48108 and DCN 375084) and available for public review in the rulemaking record.

The 1998 USDA data have the added advantage of providing broader coverage of the hog sector because these data cover a broader range of hog production types, including both farm and enterprise level conditions across three types of operations: independent owner-operator farrow-finish and farrowing operations, contract grow-finish operations, and independent grow-finish operations. (Financial data for farrow-finish contract operations are not available from USDA because of small sample size.) By contrast, the 1997 USDA hog data represent average conditions across all types of operations; the FAPRI reflect independent farrow-finish operations only. FAPRI's data also do not include farm level financial data. Although the USDA data reflect national and not regional conditions, other data from USDA are available to distribute the types of operations—contract versus independent operations—by major production region (USDA/ERS, 1999a). EPA is therefore able to provide region-specific model breakouts that account for the different proportions of contract versus independent operations across two of its CAFO model regions (Mid-Atlantic and Midwest).

As EPA had anticipated in its 2001 Notice, initial data obtained by the Agency from USDA could not be readily analyzed. Since the publication of the Notice, EPA has been working with USDA to resolve these issues and obtain additional data. Since the publication of the 2001 Notice, EPA has obtained data from USDA that report farm income excluding non-cash items, which USDA had included in the original submittal of these data. USDA's new submittal also includes corresponding farm level data. These data are available in the rulemaking record (USDA/ERS, 2002a—DCN 375064). The

rulemaking record also contains additional information documenting how EPA has worked with USDA to obtain alternative data since the 2001 Proposal (see: USEPA, 2002b, 2002c, 2002d, 2002f, 2001c, 2001d; USDA/ERS, 2002a, 2002b, 2002c, 2002d, 2001, 2001a, 2001b, 2001c, 2001d; ERG, 2002c; ERG and DPRA, 2001).

Because of persistently negative net cash income due to 1998 market conditions in the hog sector, EPA is unable to readily analyze these data for its analysis and considered additional modifications to the data obtained by USDA. Modifications to these data by EPA include (1) averaging conditions over 5 years using available USDA data on farm costs and returns at hog farms; (2) adjusting these data to reflect expected price rather than actual price for 1998 and 1999; and (3) making assumptions about farrow-finish operations in the Mid-Atlantic region that are counter to USDA's database. Other adjustments, consistent with those performed on data for each of the other livestock and poultry sectors analyzed, include projection of the base-year data across EPA's 10-year analysis period.

First, to average the available baseline farm level financial data over multiple years, EPA adjusts the 1998 data using published USDA cost and returns data for both farrow-finish and grow-finish operations. These data cover 1995 to 1999. For this analysis, EPA uses national level data to create an index to develop 5 years of farm level financial data from which to extrapolate the 1998 farm data. The 1998 data are extrapolated over the time frame by apportioning costs and revenues on the basis of changes in costs, revenues, and returns reported for 1995 through 1999. This type of adjustment is discussed in the 2001 Notice (66 FR 58590-58591) and it addresses comments received on the Proposal EA. This adjustment is made by averaging baseline conditions to better account for year-to-year variability and pricing cycles. Using this approach and USDA data, EPA obtains the average farm level revenue values that it uses for its sales test.

EPA's DCF analysis already incorporates changes over multiple years, spanning a 10-year time frame (1997 to 2006). This approach is consistent with that used for the 2001 Proposal. However, net cash income reported by USDA for hog enterprises in 1998 continues to be negative in some cases. When these 1998 values are extrapolated to the 1995 to 1999 time period, as is done for the farm level data, cash flow on average over this 5-year period continues to be negative for some representative facilities. The primary reason for these negative income values is that 1998 was a year in which hog prices dropped dramatically. At the farm level, USDA-reported net cash income is positive, although likely low when compared to other years.

Second, the principal modification to these enterprise data by EPA is the adjustment of the data to reflect expected price rather than actual price for 1998 and 1999. (EPA does not adjust USDA-reported farm level data since the Agency can analyze these data without adjustment.) EPA assumes this resultant expected price to adjust the 1998 data provided to the Agency by USDA. The method EPA uses is based on an approach recommended by USDA ERS personnel. This recommended approach uses price projections from USDA's World Agricultural Supply and Demand Estimates (WASDE) published in 1997 as an indicator of expected 1998 price levels in the hog sector (USDA, 2001). Applying this approach provides an expected price of about $47 per hundredweight (cwt.) across all hog operations for that year, compared to the actual price of less than $35 per hundredweight reported in 1998. Another approach suggested by USDA uses historical data to compile a ratio of hog prices to corn prices (see ERG, 2002c). This approach adjusts reported 1998 hog revenues upward by roughly 15 percent, but applying this approach results in consistently negative net cash income values for enterprises with fewer than 1,000 AU. A detailed summary of how EPA adjusts the available hog data obtained from USDA is available in the record (ERG, 2002a—DCN 375083).

EPA uses the resultant expected price for 1998 to adjust the enterprise level data provided by USDA. Once the 1998 enterprise level data are adjusted, EPA derives a base year estimate by back-calculating to 1997 using a 5-year index that EPA created based on the same USDA national level cost and returns data for farrow-finish and grow-finish operations from 1995 to 1999 as are used to extrapolate farm level revenues. EPA replaces the USDA-reported data for 1998 and 1999 with EPA-adjusted values based on the expected market prices during this period. The adjusted base-year enterprise level net cash income values are presented in Table 2-3 and are the data EPA assumes for its analysis. (Table 2-5 shows specific line item definitions.) EPA presented the results of these adjustments of the original data to USDA ERS personnel, who reviewed the approach and resultant adjustments to these data (USEPA, 2002f; USDA/ERS, 2002d).

EPA defends its decision to adjust the 1998 USDA hog financial data to reflect expected price rather than actual price for 1998 and 1999. As discussed in the Proposal EA, hog prices during this period were uncharacteristically low and the result of excess supplies due to overproduction and overcapacity in this sector. Since this time, hog prices have recovered to more closely reflect average historical price levels. Adjustments for "expected price" are also consistent with economic theory and are generally recognized as valid techniques among economists, and are commonly employed in applied research to obtain representative average and usable data for conducting policy analysis. The techniques employed by EPA are consistent with those employed by researchers at USDA, industry, and the land grant universities. In fact, the approaches used by EPA to adjust these data are precisely those recommended by researchers at USDA and were reviewed by USDA prior to use in the Agency's economic model (see DCN DCN 375083 AND DCN 375094). The approach used by EPA is consistent with previous data adjustments made by the Agency to adjust data for use in other regulatory analyses to make data reflect average and, in some cases, more realistic conditions, where other data are not available. Finally, adjustment of the original USDA data is necessary since without such adjustments, these data show persistently negative net cash income due to 1998 market conditions in the hog sector and EPA is unable to readily analyze these data for its analysis. No other data are available for EPA to conduct its analysis (see response to comment DCN CAFO400165-36). Without EPA's adjustments to these data, these data show persistently negative net cash income due to 1998 market conditions in the hog sector and EPA is unable to readily analyze these data for its analysis. Without these adjustments or other available data, this would require that EPA regard these operations as "baseline closures" and remove them from the analysis. As discussed in the 2001 Notice (66 FR 58579), where data show that a regulated facility would not normally be financially viable, it is EPA's longstanding practice to assume the operation is a baseline closure for purpose of its analysis and remove the facility from subsequent analysis. Because EPA is using a representative farm approach and grouping several operations under a certain representative model groupings, the Agency decided not to assume that any existing CAFOs would constitute baseline closures and thus be removed from the analysis.

EPA conducted two sensitivity analyses using alternative hog sector data and assumptions. One analysis compares the results of the Agency's main analysis using new farm and enterprise level data from USDA (as adjusted by EPA using WASDE data) against the results of an alternative analysis using other enterprise level data submitted by FAPRI. A second sensitivity analysis compares the results of its main analysis against USDA's data under alternative expected price adjustments based on the ratio of hog to corn prices (using the approach discussed previously; see also ERG, 2002a). The results of the analysis using alternative data for operations with more than 1,000 AU indicate that EPA's analysis results are stable across a range of input data. The results of the sensitivity analysis using alternative adjustments for expected price are indeterminate among operations with fewer than 1,000 AU since the baseline data for many of these operations indicate negative cash flow and would likely be considered as baseline closures by EPA (ERG, 2002c—DCN 375111).

EPA projects the 1997 baseline data using FAPRI timeline data of net returns for the hog sector to obtain a cash flow stream over the analysis period (1997 to 2006). See Table 2-4 (FAPRI, 2001c, 2001d). From these data, EPA estimates the net present value of expected cash flow for use in its DCF analysis. A summary of these values at both the farm level and enterprise level is presented in Tables 2-6 and 2-7.

Finally, USDA's financial data indicate that there are few (less than 4 percent) farrow-finish independent operations in the Mid-Atlantic region. This means that USDA is unable to provide financial data, given too small a sample size. Because these data are not available, EPA uses available national level data for farrow-finish independent operations to depict conditions for these types of operations in this region. However, EPA's interpretation of other USDA information, which the Agency uses to develop its engineering cost estimates, indicates that there is potentially a much greater share of farrow-finish operations in this region. Because this issue cannot be readily clarified, EPA uses the available financial data for farrow-finish independent operations, which is matched up against cost model data and information depicting the number of farrow-finish contract operations in this region.

For the debt-asset test, EPA uses FAPRI data on total assets and total liabilities for operations of similar size in this sector (FAPRI, 2001a), replacing the USDA asset and liability data used for proposal. Use of the alternative data addresses concerns expressed during the public comment period about EPA's assumptions of baseline debt and equity conditions at CAFOs and the data on debts and assets assumed for the proposed rulemaking (see: 2001 Notice, 66 FR 58582-58583). These FAPRI data exclude smaller sized, typically older, operations that may carry less debt, and focus on larger sized facilities that are often more capital-intensive or might be seeking to expand, thus requiring additional capital investment. EPA uses the FAPRI debt and asset data for its debt-asset test, instead of USDA data, since FAPRI's data are likely more representative of the debt load and size of operation affected by the final regulations.

For more information, refer to EPA's Comment Response Document available in the record for the Agency's response to comments on the financial data used to depict financial conditions for this sector, as well as other responses to comments about the financial tests used to evaluate this rule.

2.3.2.4 Poultry Sector

For the poultry sectors, EPA continues to use the 1997 USDA farm level data for broiler, egg-laying, and turkey operations, which the Agency used for the proposal analysis. Since proposal, additional farm level data for these sectors have not been made available. EPA also continues to use 1997 USDA data on total assets and total liabilities for the debt-asset test, which were used for proposal, since the Agency was unable to obtain alternative debt and asset data for these sectors. A summary of the farm level and enterprise level input data that EPA uses for its analysis is presented in Tables 2-2 and 2-3.

For the enterprise level analysis, EPA uses enterprise budget data compiled by various land grant universities. For broiler operations, EPA uses enterprise budgets reported by Oklahoma State University (1997), presented in the 2001 Notice (DCN 175024). These budgets reflect conditions at a contract grower operation. The data compare favorably to enterprise budget data published by other land grant universities for a contract broiler operation. See Georgia University (Cunningham, 2001), North Carolina State University (1993), and University of Arkansas (2000). EPA uses the 1997 data from Oklahoma State University because these data correspond to the base year of the Agency's analysis time frame (1997).

The 2001 Notice presented enterprise budget data for broiler operations. As anticipated by EPA in its 2001 Notice, the Agency compiled additional enterprise level data for egg-laying and turkey operations. Despite an extensive search of available land grant university data, EPA was able to locate only a single source for enterprise budgets for the egg-laying and turkey sectors. For turkey operations, EPA identified two enterprise budgets (one for hens and one for toms, which EPA averaged) for a contract grower operation (North Carolina State University, 1997). For egg-laying operations, EPA identified an enterprise budget for an independent-owner operation (Iowa State University, 1999). These data are available in the rulemaking record (see: DCN 375036, DCN 375048, and DCN 375049).

Available enterprise data do not capture each of the possible types of poultry operations, including whether an operation is independently-owned and operated or whether the operation raises animals under contract. Given that EPA has been unable to locate additional financial data for all types of operations, the Agency is unable to directly evaluate regulatory impacts at each type of operation. The enterprise data for broiler and turkey operations are for contract operations only; data are not available for independent owner-operators in these sectors. Enterprise data for layer operations are for an independent owner operations only; data are not available for operations that raise eggs under contract.

As noted in the Proposal EA, the overall financial conditions might differ depending on whether the operations raises animals independently or under contract. Gross farm revenues generated by contract growers tend to be lower than those of independent operators because the contract price is often lower than the market price received by independent operators; however, the contract grower typically faces lower production costs because the processor supplies much of the contract grower's production input. Also, a grower operation's current assets might be lower because these operations do not own the chickens they grow or produce crops requiring storage (Perry et al., 1999). Because production costs at contract operations are typically lower compared to independent operations, cash flow per bird is likely not substantially different. Therefore, EPA believes that the results of its cash flow analysis at either the farm level or the enterprise level will not be different in terms of number of number of business closures under a post-regulation scenario. Debt-to-asset ratios are also expected to be similar between contract and independent operations of similar size, since most contract operations own their own infrastructure.

EPA has further evaluated the potential implications of using the available data despite their limitations. EPA believes that lack of contract grower information for broiler and turkey operations does not substantially affect the results of its analysis of these sectors. First, the use of data for a contract operation to evaluate independent-owner operations may generally be considered a conservative source of data for assessing potential effects. Second, the available data reflect the dominant operation type in these sectors. USDA data indicate that nearly all broilers are raised under contract. This is based on data showing that 98 percent of birds produced are not owned by the farmer. Similar data for the turkey sector indicate that 70 percent of turkeys are produced under contract. Because EPA's analysis assumes that all (100 percent) broiler and turkey operations are contract grower operations, the results of EPA's analysis might be overstated. Because contract operations tend to have less available income to pay for compliance costs, as compared to independents, EPA's analysis might show a greater number of potential closures than is actually the case.

For the egg-laying sector, however, EPA uses enterprise budgets for independent operations across all operation, including contract grower operations, which could understate regulatory impacts to those operations that raise eggs under contract using the Agency's sales test (if these contract operations generate lower revenue per bird than independent operations). Information from USDA indicate that 87 percent of operations with more than 1,000 AU are independent operations and 60 percent of operations

with more than 300 AU are independent operations.[7] Although EPA believes that use of these data would not substantially affect its cash flow analysis results because production costs at contract operations are typically lower compared to independent operations (and, therefore, cash flow per bird might not be substantially different between independent and contract operations), the Agency has conducted further review of these data.

To evaluate how limited data in the egg-laying sector might influence the results of EPA's analysis, the Agency conducted additional sensitivity analyses of these data by comparing the results of its analysis using available data with adjustments to approximate conditions at contract grower operations (ERG, 2002c—DCN 375111). This sensitivity analysis uses enterprise budget data for independent-owner operations, which are adjusted by USDA information on the share of operations that are contract growers versus independents and by USDA information about the livestock portion of total farm revenue generated at egg operations (USDA/ERS, 1999a).

EPA conducts this analysis as follows. Among larger-sized operations with dry manure systems, EPA assumes that contract growers account for 13 percent of all operations and generate 10 percent of the reported livestock portion of total farm revenue for egg operations. Among smaller-sized operations with wet manure systems, EPA assumes that contract growers account for 40 percent of all operations and also generate 10 percent of the reported livestock portion of total farm revenue for egg operations. More information is available in the rulemaking record (see ERG, 2002c—DCN 375111). The results of this sensitivity analysis show that under these assumptions no egg operations would go out of business, which is consistent with the results of the main analysis (see Section 3.3 of this report). This analysis shows that use of these alternative data and assumptions should not affect the results of EPA's analysis. EPA believes that this finding would not change its assessment of the economic achievability of the CAFO regulations.

Because only limited poultry data are available, EPA has not been able to locate multiple years of financial data to average available data over a multiple year time frame. Therefore, EPA's analysis of the financial effects on broiler, egg, and turkey operations is based on a single year of input data. Using available data, EPA obtains net cash income estimates at both the farm and enterprise levels. EPA projects out the 1997 baseline data using FAPRI timeline data of net returns for the broiler, egg-laying, and turkey sectors to obtain a cash flow stream over the analysis period (1997 to 2006). See Table 2-4 (FAPRI, 2001c, 2001d). From these data, EPA estimates the net present value of expected cash flow for use in its DCF analysis. A summary of these values at both the farm level and enterprise level is presented in Tables 2-6 and 2-7.

For more information, refer to EPA's Comment Response Document available in the record for the Agency's response to comments on the financial data used to depict financial conditions for this sector, as well as other responses to comments about the financial tests used to evaluate this rule.

2.3.3 Matching of EPA Cost Models and EPA Financial Models

To facilitate the linking of the cost and financial models developed for this analysis, EPA expresses all cost model outputs and financial variable inputs on a per-animal (inventory) basis. This

[7] Assessed by USDA assuming 100,000 birds equals 1,000 AU.

allows EPA to compare estimated costs and baseline financial conditions across representative CAFO models that reflect varying facility sizes, producing regions, land availability, and facility types. This process is described in greater detail in the Proposal EA. EPA's cost models are described in Section 2.2, and more detail is provided in EPA's *Development Document* (USEPA, 2002).

To match up and establish consistency between the cost and financial models, EPA scales the financial data using the same number of animals assumed for each of the cost models, whose estimated compliance cost outputs also are expressed on a per-animal (inventory) basis. This intersection of financial models and cost models forms the basis for EPA's regulatory analysis using the representative farm approach. Table 2-1 shows the underlying assumptions of the average animal inventory for each CAFO model. Multiplying the average animal inventory estimates (shown in Table 2-1) by the financial data derived on a per-animal basis (shown in Tables 2-2 and 2-3) allows EPA to match up available cost and financial models for the purposes of this analysis. The baseline financial models that EPA uses for its analysis assume gross facility revenue and net present value of cash flow. This baseline depiction reflects the product of the average inventory assumptions and financial data derived on a per-animal basis shown in the tables.

This approach allows for greater accuracy by aligning the compliance costs incurred and revenues generated at a facility, allowing EPA to account for the single largest variable in its analysis—the number of animals raised at the facility. This approach also allows for greater flexibility because EPA can readily use available financial data for one CAFO model as a substitute for another where data are not available simply by adjusting the number of animals at a facility (assuming that per-unit costs and revenues between these representative facilities may be considered similar).

Agriculture sector research routinely expresses costs and revenues as a unit metric, such as dollars per animal or dollars on a unit weight basis. Expressing an increase in production costs on a per unit basis provides a quick assessment of the potential effects of such increases on a farming operation, often without further analysis. For example, to evaluate a range of technology options to regulate hog producers in North Carolina, researchers at North Carolina State University (NCSU) have established a cutoff of $3 to $5 per marketed hog as being "economically feasible," implying that per-head costs in excess of that threshold might be prohibitive (NCSU, 1999). EPA's estimates of per-animal costs for the final regulations are provided in Appendix B for each of the commodity sectors.

As noted in Section 2.2.1, the CAFO models EPA uses for this analysis represent the interface between a large number of cost models and a smaller number of financial models. The cost models are able to account for greater variability among operations, compared to the financial models, including differences by production types, geographic conditions and production region, land availability, technology needs, and the like. In some cases, available financial data do not match each possible permutation among all possible production cost structures (as discussed in Section 2.2.1).[8] Fewer financial models are developed because of limited data on financial conditions across all CAFOs. In other cases, however, the available financial data might more precisely reflect an operation's business type, including whether the operation is a contract grower or independent owner-operator, as well as (in more limited cases) whether the operation is reflective of a corporate structure. These types of

[8]In some cases, EPA decided to use national average available data despite limited available regional data, for reasons explained in Section 4 of the Proposal EA.

circumstances might have more bearing on the regulatory effects on an operation than the operation's cost structure.

Given that EPA has accounted for the single largest variable in its analysis—the number of animals raised at the facility—and given the use of available average financial data differentiated by sector and in some cases by size and business type, EPA believes that this approach reasonably approximates average financial conditions across all types of operations.

Alternative data obtained by EPA since proposal represent an important improvement to the economic analysis. EPA has obtained additional information differentiating between independent owner-operation and contract grower operations in the hog and poultry sectors. At proposal, EPA used available financial data for an entire sector that did not, in some cases, reflect differences in financial conditions across different business types, including whether the operation markets animals it owns (e.g., independently owned and operated farms) or raises animals on behalf of a corporate entity that typically retains ownership of the animals (e.g., contract grower). New data obtained for the hog sector also depict differing conditions among farrow-finish and grow-finish operations. Other new data depict enterprise budgets for replacement heifer operations. EPA's model still is unable to reflect conditions specific to veal operations. EPA's model also is not able to account for possible financial differences among egg laying operations (wet versus dry manure management systems). Other limitations regard the availability of data for the poultry sector to fully indicate all cases of whether the operation is an independent-owner operation or raises animals under contract (see discussion in Section 2.3.2.4).

As described in Section 2.4 of this report, EPA uses additional alternative data to expand upon its analysis to further evaluate regulatory effects at an operation's livestock or poultry enterprise. This approach builds upon the 2001 Proposal analysis, which evaluates financial effects at regulated CAFOs using financial data for an operation as a whole. That is, the analysis now includes revenue generated at a facility from other non-livestock and farm-related enterprises at the operation, and it counts among an operation's total farm income the revenue from the sale of livestock, crops, and other farm-related income, as well as government payments. Historically, most effluent guideline regulations have used broader facility level data, with the exception of only a limited number of cases (e.g., see USEPA, 1996). Given the availability of additional data that EPA has obtained since proposal, the Agency is able to account for potential facility closures as well as potential product line closures, as represented by the representative model CAFOs developed by EPA for this analysis.

Table 2-1. Model CAFO Assumptions by Sector, Size, and Region (Size Range and Average Inventory)

Sector	Region	Medium 1	Medium 2	Medium 3	Large 1	Large 2
		300-1000 AU			>1,000 AU	
Fed Cattle	MW,CE, PA,SO,MA	300-499 (370)	500-749 (552)	750-999 (766)	1,000-8,000 (1,839)	>8,000 (25,897)
Veal	MW,CE, PA,SO,MA	300-499 (400)	500-749 (540)	750-999 (1,080)	>=1,000 (1,080)	
Heifers	MW,CE, PA,SO,MA	300-499 (400)	500-749 (625)	750-999 (875)	>=1,000 (1,500)	
Dairy	MW,CE, PA,SO,MA	200-349 (250)	350-524 (425)	525-699 (600)	>=700 (1,430)	
Hog: FF	MA	750-1249 (940)	1250-1874 (1,439)	1875-2499 (2,004)	2500-5000 (3,686)	>5,000 (11,231)
	MW	750-1249 (921)	1250-1874 (1,415)	1875-2499 (1,987)	2500-5000 (3,280)	>5,000 (10,300)
Hog: GF	MA	750-1249 (940)	1250-1874 (1,439)	1875-2499 (2,004)	2500-5000 (3,686)	>5,000 (11,231)
	MW	750-1249 (921)	1250-1874 (1,415)	1875-2499 (1,987)	2500-5000 (3,280)	>5,000 (10,300)
Hog: FF	CE				2500-5000 (3,601)	>5,000 (16,946)
Hog: GF	CE				2500-5000 (3,601)	>5,000 (16,946)
Layers: Wet	SO			9,000-29,999 (19,500)	>= 30,000 (146,426)	
Layers: Dry	MW	30,000-49,999 (38,209)	50,000-74,999 (61,734)	75,000-99,999 (90,367)	100,000-600,000 (349,999)	>600,000 (856,367)
	SO	30,000-49,999 (38,209)	50,000-74,999 (61,734)	75,000-99,999 (90,367)	100,000-600,000 (349,999)	>600,000 (856,367)
Broilers	MA	30,000-49,999 (37,248)	50,000-74,999 (56,469)	75,000-99,999 (79,454)	100,000-180,000 (126,565)	>180,000 (254,390)
	SO	30,000-49,999 (36,792)	50,000-74,999 (56,130)	75,000-99,999 (79,364)	100,000-180,000 (124,448)	>180,000 (228,091)
Turkeys	MA	16,500-27,499 (22,246)	27,500-38,499 (34,640)	38,500-54,999 (47,534)	>=55,000 (127,396)	
	MW	16,500-27,499 (22,246)	27,500-38,499 (34,640)	38,500-54,999 (47,534)	>=55,000 (127,396)	

Source: USEPA, 2002. Values shown in parentheses are the average number of animals (inventory) assumed for each model CAFO. Values shown are averaged across all cost categories (based on land use and technology needs) for the P-based land application standard. See *Development Document* (USEPA, 2000). Shaded cells indicate model CAFO not developed. EPA's model regions: Midwest (MW); Central (CE); Pacific (PA); Mid-Atlantic (MA); South (SO) (vary by sector, see USEPA, 2002). FF: farrow-finish; GF: grow-finish.

Table 2-2. Financial Input Data, Farm Level

Sector Size (AU)	Reg.	Gross Revenue	Net Cash Income	Deprec.	Operating Cost	Debt-Asset	Source/ Description
		($ per head inventory)				(%)	
Beef, Veal, & Heifers Operations							
>1000	All	$475	$9	$5	$461	68%	NCBA 2001 (1997-1999) U.S. 52,000 head.
<1000	All	$945	$2	$5	$913	68%	FAPRI 2001a (2000-2002). Midwest 500-head.
Dairy Operations							
>1000	MW	$1,746	$269	$144	$1,319	64%	USDA 2002 (2000 data) Revenues avg. 1991-2000 using USDA/ERS 2002b. Debt/asset: FAPRI 2001 (2000).
	PA	$1,764	$230	$202	$1,374	64%	
<1000	MW	$2,492	$631	$158	$1,635	62%	
	PA	$1,841	$405	$117	$1,269	62%	
Hog Operations (GF/contract)							
>1000	All	$32	$9	$6	$20	65%	USDA 2002a (1998 data) U.S. >1,000AU; 300-1,000 AU. Averaged 1995-1999 using USDA ERS, 2002b Debt/asset: FAPRI 2001a (2000).
<1000	All	$244	$38	$15	$192	49%	
Hog Operations (GF/independent)							
>1000	All	$163	$29	$9	$124	65%	
<1000	All	$251	$42	$16	$194	49%	
Hog Operations (FF & farrowing/independent)							
>1000	All	$143	$18	$12	$112	65%	
<1000	All	$204	$42	$17	$141	49%	
Broiler Operations (average all operations, independent and contract)							
>1000	MA	$1.13	$0.50	$0.17	$0.44	30%	USDA 1999a (1997)
	SO	$1.16	$0.50	$0.17	$0.47	26%	
<1000	MA	$1.47	$0.60	$0.18	$0.67	21%	
	SO	$1.42	$0.60	$0.18	$0.64	19%	
Layer Operations (average all operations, independent and contract)							
All	All	$24.63	$4.10	$2.60	$16.74	11%	USDA 1999a (1997)
Turkey Operations (average all operations, independent and contract)							
>1000	All	$20.08	$1.80	$0.88	$17.29	15%	USDA 1999a (1997)
<1000	All	$11.24	$2.60	$0.90	$7.20	23%	

Table 2-3. Financial Input Data, Enterprise Level

Sector Size (AU)	Reg.	Net Cash Income	Depr./Cap. Recov.	Operating Cost	Source/ Description
		($ per head inventory)			
Beef & Veal Heifer Operations					
>1000	All	$9	$5	$461	Same as farm level (see Table 1)
<1000	All	$2	$5	$913	Same as farm level (see Table 1)
Heifer Operations					
All	All	$136	$63	$903	University of Idaho (1998 data) Average of Jersey and Holstein budgets.
Dairy Operations					
>1000	MW	$433	$171	$904	USDA 2002 (2000) Two regions: North (assumed for MW) & South (assumed for PA)
	PA	$295	$222	$1,136	
<1000	MW	$356	$525	$1,100	
	PA	$372	$232	$1,006	
Hog Operations (GF contract)					
>1000	All	$35	N/A	$86	USDA, 2002a (1998 data) U.S., >1,000AU and 300AU-1,000 AU (Adjusted–see text and ERG, 2002a)
<1000	All	$14	N/A	$94	
Hog (GF independent)			N/A		
>1000	All	$18	N/A	$104	
<1000	All	$6	N/A	$94	
Hog (FF/farrowing , independent)			N/A		
>1000	All	$33	N/A	$67	
<1000	All	$4	N/A	$73	
Broiler Operations (contract)					
All	All	$0.15	$0.05	$0.09	Oklahoma State University, 1997
Layer Operations (independent)					
All	All	$2.85	$0.60	$10.19	Iowa State University, 1999
Turkey Operations (contract)					
All	All	$0.57	$0.19	$0.14	NCSU, 1997 Average of turkey tom and hen budgets

Table 2-4. Baseline Projections, Returns Per Unit, 1997-2006

Sector/ Year	Beef	Dairy	Hogs	Broilers	Egg Layers	Turkeys
	($/cow)	($/cwt)	($/cwt)	(¢/lb)	(¢/doz)	(¢/lb)
1997	$21.78	$11.62	$10.62	5.81	9.10	(3.80)
1998	($4.48)	$12.41	$2.20	14.26	10.12	0.08
1999	$9.52	$9.85	$1.79	11.81	3.21	11.83
2000	$4.36	$9.83	$13.93	9.21	5.63	12.11
2001	$14.82	$10.46	$15.33	11.99	4.89	7.89
2002	$30.08	$10.89	$13.78	12.21	0.65	7.90
2003	($4.36)	$11.05	$9.06	11.87	3.61	8.49
2004	$26.59	$11.28	$10.93	11.68	5.45	8.98
2005	$29.20	$11.48	$12.09	11.54	6.94	8.87
2006	($6.54)	$11.69	$13.05	10.87	7.15	8.37

Sources: Cattle (NCBA, 2001); Dairy (USDA/WAOB, various years), and Hog/Poultry (FAPRI, 2001c, 2001d).

Table 2-5. Net Cash Income Components from Available Data

Data source	Sector	Data Type	Net Cash Income Components
1997 ARMS (USDA/ERS, 1999a)	Poultry sectors	Farm	Computed by USDA as gross cash income less variable and fixed cash expenses (see Proposal EA, USEPA, 2001a)
1998 ARMS (USDA/ERS, 2002a, 2002c)	Hog and dairy sector	Farm and enterprise	Farm net cash income computed by USDA as net cash farm income (gross cash income minus total cash expenses); enterprise net cash income computed as USDA-provided gross sales minus USDA-provided cash expenses (excl. operating interest, considered an opportunity cost by USDA).
FAPRI (2001a)	Cattle sectors (<1000 AU)	Enterprise	Computed by FAPRI using revenues minus operating costs, operating and fixed interest, and cash overhead items such as office supplies and property taxes.
NCBA (2001)	Cattle sectors (>1000 AU)	Enterprise	Computed by NCBA as revenues minus operating costs plus interest income minus interest expenses.
Enterprise budgets (various)	Heifer, broiler, layer, and turkey sectors	Enterprise	All cash items, both fixed and variable (including operating interest) identified and subtracted from revenues. Depreciation excluded.

Table 2-6. Projected Cash Stream for Farms (1997-2006) Based on Projections of Per-Unit Returns

Sector	Region	Size	Base Year Net Cash Income	Cash Stream (1997-2006)										NPV
				1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	
Beef	US	L	$22	$22	($4)	$10	$4	$15	$30	($4)	$27	$29	($7)	$83
Beef	US	M	$2	$19	($7)	$7	$2	$12	$28	($7)	$24	$27	($9)	$65
Dairy	MW	L	$269	$571	$704	$272	$269	$342	$369	$407	$441	$477	$370	$3,023
Dairy	PA	L	$230	$532	$665	$233	$230	$303	$330	$368	$402	$438	$331	$2,749
Dairy	MW	M	$631	$933	$1,066	$634	$631	$704	$731	$769	$803	$839	$732	$5,565
Dairy	PA	M	$405	$707	$840	$408	$405	$478	$505	$543	$577	$613	$506	$3,978
Hog FF	US	L	$18	$55	$18	$17	$48	$52	$48	$36	$41	$44	$46	$280
Hog FF	US	M	$42	$99	$42	$38	$70	$73	$69	$57	$62	$65	$67	$454
Hog GF Ind.	US	L	$29	$58	$29	$5	$36	$40	$36	$24	$29	$32	$34	$229
Hog GF Ind.	US	M	$42	$87	$42	$6	$37	$41	$37	$25	$30	$33	$35	$274
Hog GF Contr.	US	L	$9	$17	$9	$5	$36	$40	$36	$24	$28	$31	$34	$173
Hog GF Contr.	US	M	$38	$80	$38	$3	$34	$38	$34	$22	$27	$30	$32	$248
Broilers	US	L	$0.50	$0.50	$2.30	$1.78	$1.22	$1.81	$1.86	$1.79	$1.75	$1.72	$1.58	$11.25
Broilers	US	M	$0.60	$0.60	$2.40	$1.88	$1.32	$1.91	$1.96	$1.89	$1.85	$1.82	$1.68	$11.95
Broilers	SO	L	$0.50	$0.50	$2.30	$1.78	$1.22	$1.81	$1.86	$1.79	$1.75	$1.72	$1.58	$11.25
Broilers	SO	M	$0.60	$0.60	$2.40	$1.88	$1.32	$1.91	$1.96	$1.89	$1.85	$1.82	$1.68	$11.95
Layer	US	All	$4.1	$4.1	$4.3	$2.8	$3.4	$3.2	$2.3	$2.9	$3.3	$3.6	$3.7	$23.9
Turkey	US	L	$1.8	$1.8	$2.6	$5.1	$5.2	$4.3	$4.3	$4.4	$4.5	$4.5	$4.4	$28.1
Turkey	US	M	$2.6	$2.6	$3.4	$5.9	$6.0	$5.1	$5.1	$5.2	$5.3	$5.3	$5.2	$33.7

Source: Derived by EPA using cost and returns data from USDA (1999a, 2002a and 2002c), FAPRI (2001a), and NCBA (2001), along with projections from USDA/WAOB (various years), FAPRI (2001c, 201d), and NCBA (2001). Rounded to nearest dollar (beef, dairy, hogs), nearest 10 cents (layers and turkeys), or nearest cent (broilers). Base year of net cash income is either reported or projected to 1997.

Table 2-7. Projected Cash Stream for Enterprises (1997-2006) Based on Projections of Per-Unit Returns

Sector	Region	Size	Base Year Net Cash Income	Cash Stream (1997-2006)										NPV
				1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	
Beef	US	L	$22	$22	($4)	$10	$4	$15	$30	($4)	$27	$29	($7)	$83
Beef	US	M	$2	$19	($7)	$7	$2	$12	$28	($7)	$24	$27	($9)	$65
Heifer	US	All	$136	$162	$136	$150	$145	$155	$171	$136	$167	$170	$134	$1,070
Dairy	MW	L	$433	$735	$868	$436	$433	$506	$533	$571	$605	$641	$534	$4,174
Dairy	PA	L	$295	$597	$730	$298	$295	$368	$395	$433	$467	$503	$396	$3,205
Dairy	MW	M	$356	$658	$791	$359	$356	$429	$456	$494	$528	$564	$457	$3,634
Dairy	PA	M	$372	$674	$807	$375	$372	$445	$472	$510	$544	$580	$473	$3,746
Hog FF	US	L	$33	$69	$33	$18	$50	$53	$49	$37	$42	$45	$47	$313
Hog FF	US	M	$4	$31	$4	($5)	$26	$30	$26	$13	$18	$21	$24	$128
Hog GF Ind.	US	L	$18	$41	$18	$4	$35	$39	$35	$23	$28	$31	$33	$199
Hog GF Ind.	US	M	$6	$23	$6	($4)	$27	$31	$27	$15	$19	$22	$25	$129
Hog GF Contr.	US	L	$35	$63	$35	$19	$50	$53	$49	$37	$42	$45	$48	$310
Hog GF Contr.	US	M	$14	$35	$14	$2	$33	$37	$33	$20	$25	$28	$31	$177
Broilers	US	All	$0.15	$0.15	$1.95	$1.43	$0.87	$1.46	$1.51	$1.44	$1.40	$1.37	$1.23	$8.79
Layers	US	All	$2.9	$2.9	$3.1	$1.7	$2.2	$2.0	$1.1	$1.7	$2.1	$2.4	$2.5	$15.5
Turkeys	US	All	$0.6	$0.6	$1.4	$3.9	$4.0	$3.1	$3.1	$3.2	$3.3	$3.3	$3.2	$19.6

Source: Derived by EPA using cost and returns data from USDA (2002c), FAPRI (2001a), NCBA (2001), Oklahoma State University (1997), North Carolina State University (1997), and Iowa State University (1999), along with projections from USDA/WAOB (various years), FAPRI (2001c, 201d), and NCBA (2001). Rounded to nearest dollar (beef, dairy, hogs), nearest 10 cents (layers and turkeys), or nearest cent (broilers).

2.4 METHODOLOGY TO ASSESS IMPACTS ON MODEL CAFOs

For the 2001 Proposal, EPA developed a scheme to evaluate financial effects using 1997 USDA data based on a combination of farm's net income and debt-asset ratios to classify a representative farm's overall financial position based on annual earnings and solvency (USDA/ERS, 1997a, 1997e). See 66 FR 3079-3103. The analytical framework for the final rule retains the general modeling framework that EPA used to assess economic effects for proposal, with the modifications discussed in both the 2001 Notice and the 2002 Notice. Both Notices describe the range of methodological changes and financial data EPA has considered to improve its analysis.

This section describes the methodology that EPA uses to assess financial effects on regulated CAFOs, highlighting changes to this analysis since proposal. Section 2.4.1 presents the assessment criteria and key financial variables that EPA uses to assess post-compliance effects. Section 2.4.2 describes how EPA evaluates these assessment criteria to determine whether the estimated compliance costs are affordable, thus demonstrating the "economic achievability"[9] of the final regulations. Section 2.4.3 discusses additional analyses performed by EPA, including an assessment of the regulatory effects that takes into consideration long-run market price adjustments, Federal and State cost-share assistance, and other cost offsets.

2.4.1 Assessment Criteria and Financial Data Variables

EPA's choice of criteria in any economic assessment of a regulation is variable and highly dependent on the industry being regulated. EPA recognizes that each industry has its own special attributes and requires an individual assessment of appropriate financial criteria. Therefore, EPA does not advocate a "one size fits all" benchmark for all industries but instead assesses each industry's general conditions and uses generally accepted analytical approaches for identifying economic impacts in each industry, if available, among other factors. Where appropriate, these other factors include criteria that have been developed to analyze other industries.

Federal agencies like EPA and USDA have been analyzing the impacts of regulatory requirements on regulated communities for many years. For example, the CWA, with its requirement to assess economic achievability, has prompted EPA since the early 1970s to analyze the economic and financial impacts of effluent guidelines on affected industries. Generally, EPA measures impacts using a variety of approaches that attempt to assess post-compliance changes in key financial variables. In many cases a benchmark is developed. This benchmark may be based on, for example, the lowest quartile performance of firms in the industry (e.g., USEPA, 1998b) or on an assessment of what has been generally accepted in past analyses or by the financial community, tempered by any specifics of the industry. Usually EPA uses more than one financial variable in an assessment because a single variable is rarely sufficient to fully describe the relative financial health of an affected entity.

For this rulemaking, EPA has selected criteria based on those commonly used in the agricultural sector to measure financial stress, in conjunction with criteria that the Agency has used in the past to

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[9] The Clean Water Act requires EPA to establish effluent limitations for point sources based on the "best available technology economically achievable" (Sections 301(b)(2)(A) and 304(b)(2)). Factors that EPA shall consider in an assessment of best available technology include the cost of achieving effluent reductions, among other factors (Section 304(b)(2)(B)).

determine the affordability of effluent guidelines developed for other industries. This analysis focuses on three financial criteria to assess whether the final CAFO regulations are affordable to affected businesses: (1) an initial screening comparing incremental pre-tax costs to total gross revenue ("sales test"), (2) projected post-compliance cash flow over a 10-year period ("discounted cash flow" [DCF] analysis), and (3) an assessment of an operation's debt-asset ratio under a post-compliance scenario ("debt-asset test"). Financial data used for this assessment include total gross revenue for the sales test, net cash income for the DCF analysis, and debt-asset ratios for the debt-asset test. Each of these tests is conducted using available farm level financial data, with the exception of the DCF analysis, which is evaluated based on both farm level and enterprise level net cash income. Input data that EPA uses for this analysis are presented in Section 2.3 of this report.

For more information, see EPA's response to comments regarding the financial data and the analytical approach that the Agency uses compile aggregate costs and to assess regulatory effects on CAFOs. These response to comments address recommended changes to EPA's assessment approach, as well as the use of alternative data. Relevant response to comments in the Comment Response Document include adjustments to EPA's assessment approach (see, for example, 202402-35 regarding its enterprise analysis, 400158-92 regarding adjustment to average out single year of data, 201352-101 on projections used, and adjustments and clarification on the assessment criteria used in 201352-35, 201335-104, 201438-207-1, 201335-104, 210352-106, and 201438-207-1) and EPA's use of alternative best available data related to these adjustments (DCNs 201602-22, 400158-91, 400165-36, 202013-2, 201605-13 and 201352-108, 201352-136-4), among other Agency comment responses. The Comment Response Document available in the EPA's rulemaking record.

2.4.1.1 Sales Test Using Gross Cash Income

EPA uses *gross cash income* to measure the ratio of compliance costs to sales ("sales test"). EPA uses pre-tax costs to evaluate a sales test because this approach is more consistent with the majority of previous analyses that use the threshold values assumed for this analysis (although previous ELG analyses have evaluated cost-to-sales ratios using both post-tax and pre-tax costs).[10] The use of pre-tax revenue for the sales test represents a change from what EPA did for the Proposal EA, where post-tax revenues were analyzed for this criterion. This change addresses public comments received by EPA on the Proposal EA, as discussed in the 2001 Notice (see: 66 FR 58584-58585).

For this analysis, EPA uses average gross cash income expressed at the farm level. This measure includes total farm income from an operation's livestock business as well as income from other sources, such as sales of crops and other secondary livestock on-site. Other farm-related revenue and government payments are also included. Table 2-2 lists the farm level revenue values that EPA assumes for this analysis.

EPA has often used a sales test to evaluate post-compliance impacts in previous regulatory analyses (USEPA, 1987, 1994, 1995, 1996, 1997, 1998a, 1998b, 1999a, 1999b, 2000b, 2000c, 2002h,

[10]Effluent guideline regulations that have been evaluated using post-tax costs include the Landfills, Commercial Hazardous Waste Combustors, and Centralized Waste Treatment industries. Pre-tax costs were used to evaluate the Pulp, Paper, and Paperboard, the Pesticide Formulating, Packaging and Repackaging, and the Metal Products and Machinery industries. EPA used both pre- and post-tax costs to evaluate the Transportation Equipment Cleaning industry.

2002g, 2002i; DPRA, 1993, 1995; USGPO, 1999). EPA's use of a sales test is also common practice when evaluating small business impacts for most regulatory development. Other agencies, including the Occupational Safety and Health Administration, also use a sales test (e.g., OSHA, 1999). USDA has also considered cost-to-sales impacts to evaluate impacts on animal confinement operations (Heimlich and Barnard, 1995). As noted in the Proposal EA, however, the sales test is not widely used to measure impacts in the agricultural sector (Foster, 2000). During the comment period, several commenters claimed that the sales test is not a useful measure of whether producers can afford the regulations. They suggested that it should be replaced with a rate of return measure, such as return on assets, equity, or investment. One commenter suggested a criterion based on cost as a percent of profit margin (measured as revenue less cost of goods sold) or gross margin (measured as returns to labor and overhead before taxes) (Iowa State University, 2001). Another commenter recommended evaluating profits measured as earnings before interest, taxes, depreciation, and amortization (EBITDA) (NCBA, 2001). Others indicated that the sales test, if retained, should be measured against a lower threshold value due to the lower profit margins on sales in agriculture. In general, commenters asserted that potential impacts, even at lower cost-sales ratios, can result in proportionately large reductions in net returns and erode the attractiveness of reinvestment in animal agriculture (NPPC, 2001). The 2001 Notice solicited comment on these and other alternative assessment criteria. More information is available in the record (ERG, 2001b). Overall, commenters expressed a preference that EPA evaluate compliance cost impacts using other income and profitability measures instead of a sales test. In part, this is already part of EPA's overall analysis, which includes an analysis of changes in discounted cash flow. See Section 2.4.1.2.

The Proposal EA describes as an alternative and common metric the examination of earnings before taxes as a percentage of gross income or revenues ("profit test"), where the change in ratio post-compliance is used as an indicator of the impact that compliance costs might have on profits. USDA's analysis (Heimlich and Barnard, 1995) measured economic achievability by comparing estimated regulatory costs with gross cash income (a sales test) and net farm income (a profit test), as well as cash operating expenses. In recent years, however, EPA has tended to move away from using net income analysis and profit tests as an indicator of the financial strength of a regulated entity for a number of reasons. First, many financial analysts now acknowledge that a net income analysis is a less accurate measure of financial health than a cash flow analysis because net income includes depreciation as a cost even though depreciation is not a cash outlay (see, e.g., Brigham and Gapenski, 1997). Also, for valuing corporate loans, the Financial Analysis Standards Board considers discounted cash flow the best estimator for assessing fair value for enterprises lacking a quoted market price (Jarnagin, 1996l; FFSC, 1997, 2001). Second, profitability can be highly variable because a firm has a certain amount of leeway in calculating earnings in any given year to minimize tax liability. Privately held entities (which predominate in the livestock and poultry industries, for example) have few incentives to show large profits but every incentive to show minimal earnings for tax purposes. Third, if a large segment of an industry is showing negative net income, it is difficult to assess the impact of a regulation on profitability.

The problem with analyses based on profitability is especially important in the agricultural sector. Heimlich and Barnard (1995) point out that many farms "may be motivated by noneconomic considerations and should be considered hobby or recreational activities, rather than businesses, particularly when net farm income is negative." They further contend that most farm operators reporting negative net income have nonfarm sources of income and that they might be using the farm losses to offset off-farm income to reduce income tax liability. They also find, as does EPA, that when net farm income is

negative, costs as percentages of net income are difficult to interpret.[11] EPA, therefore, considers a sales test to be a more analytically useful tool than a profit test for assessing impacts in the livestock and poultry industries. First, EPA has concerns that profit-based measures might overstate vulnerability. Second, revenues are generally not as sensitive to incentives to show minimum values for tax purposes as profits and thus are not as likely as profits to be understated. Third, sales are never negative and thus a comparison between costs and sales can be adequately interpreted.

Given the boom and bust conditions common in the agricultural sectors, available financial data often show negative returns to risk, management, and unpaid labor. Consequently, the only way for EPA to conduct its analysis using these data is either to assume it is a baseline enterprise closure (i.e., it should not be considered in the regulatory analysis because the operation would be discontinued even without considering the impact of the regulations) or to determine that the operation cannot be analyzed at this level (i.e., the operation is remaining in business because of certain mitigating factors).[12] Information provided in the 2001 Notice indicates that some sectors would likely show large numbers of baseline closures given available data using a profit test with USDA definitions of net farm income (which includes depreciation and nonmoney expenses). Therefore, if the financial data for a certain representative group show negative returns under EPA's traditional approach, the Agency would need to consider all operations within a group as a baseline closure. For example, as discussed in the Notice, if EPA were to use alternative 1998 hog data from USDA, its traditional approach would assume that all operations in each of the representative groups are baseline closures. However, EPA recognizes that when available data show large numbers of baseline closures (including even whole sectors), this may indicate limitations with the underlying data or methodologies rather than a realistic picture of the industry. EPA is further aware that facilities identified as baseline closures under its traditional approach might be the very facilities likely to experience stress as a result of additional compliance costs and that it is therefore important to account for these facilities in the analysis.

For these reasons, EPA is maintaining use of the sales test and is not considering an alternative profitability measure for this criterion. However, to address comments on EPA's use of a sales test for the analysis, the Agency is clarifying that this test is primarily used as a first-level screen, indicating the need for further analysis, as discussed in more detail in Section 2.4.2.

EPA has made a number of changes in the way it evaluates this criterion. First, to address public comments on the use of financial data for this test, EPA uses alternative revenue data for the cattle and hog sectors (see Section 2.3). Second, EPA uses a sales test based on estimated pre-tax incremental cost, as opposed to costs that take into account potential tax savings (post-tax), which was assumed at proposal. More information is in EPA's response to comment DCN CAFO 201438-182. These pre-tax costs are

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[11]Typically, EPA considers that if a regulated entity is not profitable before pollution control investments are made, the entity "may not claim that substantial impacts would occur due to compliance..." (USEPA, 1995). In some cases EPA has used the concept of "baseline closure" if only a few entities have negative net income and cannot be analyzed (see, for example, USEPA, 2002h, 2001e, 2000c, 1998a, 1998b, 1997, and 1995). These entities might not necessarily close prior to implementation of a rule, but they cannot be analyzed within a profit test or net income analysis framework.

[12]Assumption of baseline closures is common practice in cases where EPA encounters such problems when analyzing certain multi-facility manufacturing or service firms using actual facility level data. In such cases the facility is removed from the analysis because it cannot be analyzed and is considered a baseline closure (see, for example, USEPA, 2002h, 2001e, 2000c, 1998a, 1998b, 1997, 1995).

compared to total farm level revenues, and that ratio is used as an initial screener to determine the need for additional analysis using EPA's discounted cash and debt-asset tests. Third, EPA's use of gross revenue now considers multiple years of data, where data are available, to derive a more representative average sales value for this test, rather than being based on a single year of data, as assumed at proposal. This approach uses available time series data from USDA to compile an index to project data over a longer time frame, linking up available financial data with other market and financial data for preceding and subsequent years (also for example, see: ERG and DPRA, 2001; ERG, 2002a). This approach, discussed in both of EPA's published Notices, is further discussed in Section 2.3 and documented in the record (ERG, 2002c; ERG and DPRA, 2001). More information is in EPA's response to comment DCN CAFO 400158-92. The DCF analysis spans a 10-year time frame (1997-2006) and uses time series projections, as discussed in Section 2.4.1.2, and thus already accounts for variability and changing conditions over multiple years. EPA is also expanding its DCF analysis to take into consideration enterprise level changes in profitability in addition to farm level effects (see Section 2.4.1.2).

For additional information about EPA's sales test, see response to comment DCN CAFO201352-35 in the Comment Response Document in the rulemaking record.

2.4.1.2 DCF Analysis Using Net Cash Income

The financial position of a farm can be calculated using either net cash income or net farm income. *Net farm income* is an effective measure of long-term profitability because it accounts for capital replacement costs and noncash business income (land, capital, and labor services). *Net cash income* reflects current or short-term cash earnings. For the purposes of this analysis, EPA uses cash-based measures (that is, the analysis is a net cash income-type analysis). The reported net cash income, or gross income less cash expenses, is used as an estimate of cash flow to construct a baseline per-animal annual cash flow. EPA conducts this analysis using both farm level and enterprise level financial data. Tables 2-2 and 2-3 list the baseline net cash income estimates for each sector that EPA assumes for this analysis. (See Table 2-5 for line item components assumed to define net cash income based on available data.)[13] Tables 2-6 and 2-7 present the discounted cash flow values computed for this analysis.

A net cash income-type analysis is consistent with current views on the use of cash flow analysis in preference to net income analysis among financial analysts (Brigham and Gapenski, 1997; Jarnagin, 1996). Net cash income corresponds to total farm cash revenues minus cash expenses; that is, it is the agricultural term corresponding to the financial term "cash flow." A net cash income-type analysis differs from an evaluation of net farm income, which includes both noncash income and noncash expenses (e.g., depreciation) and corresponds to the term "net income" in accounting. This methodology estimates the long-term reduction in earnings that results from the costs of complying with the final regulations. If the post-regulatory status is less than or equal to zero, it does not make economic sense for the owner to upgrade the farm. Under these circumstances, the average farm represented by that model might be vulnerable to closure. (As explained in the Proposal EA, unlike previous regulatory analyses conducted by EPA, this approach does not consider the salvage value of liquidated assets at a CAFO.)

To account for changes in an operation's cash flow post-compliance, EPA estimates the present value of projected farm earnings, measured as a future cash flow stream in 1997 dollars. The present

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[13] This analysis does not consider noncash income and depreciation.

value of cash flow, also known as the discounted cash flow, or DCF, represents the value (in terms of today's dollars) of a series of future receipts. EPA calculates baseline cash flow as the present value of a 10-year stream of farm cash flow.

EPA projects future earnings over the period of the analysis (1997 to 2006) using net cash flow values derived on a per-animal basis. These values are measured at both the farm level and the enterprise level using available data, along with available projections of enterprise level earnings from 1997 through 2006, and other market data to translate projected per-unit returns to per-animal returns. EPA approximates future earnings using FAPRI's, NCBA's, or USDA's projected changes (expressed in dollars per unit) by applying the equivalent incremental change (expressed in dollars per animal) for each year during the forecast period (as presented in Section 4.2). EPA uses the resultant time series data to calculate the present value of net cash income used for this analysis. This approach is outlined below.

EPA projects the available base year (1997) farm level and enterprise level data (Tables 2-2 and 2-3) using projections from USDA, FAPRI, and NCBA. To translate available projections in net returns by sector (Table 2-4) on a per-animal basis, EPA uses available market information, such as average per-animal yields reported by USDA and/or annual marketing cycles based on industry data. For dairy, the 1997 average output of 16,781 pounds of milk per cow is assumed (USDA/NASS, 1999c). An average weight of 257 pounds per finished hog is assumed, based on reported weights for "swine for slaughter" and "farrow-finish" (NPPC, 1998) averaged according to the market share of each (USDA/APHIS, 1995b). The average number of 255 eggs per egg-laying chicken in 1997 is assumed (USDA/NASS, 1998b, 1998f). An average broiler weight of 5.5 pounds per bird is assumed, derived from the total number of animals and pounds of production, reported in 1997 (USDA/NASS, 1999d). For turkeys, EPA assumes an average weight of 23.8 pounds per bird derived from weight estimates and market share information for turkey toms and hens (USEPA, 1999j; USDA/NASS, 1999d). No translation is needed for projections for the beef cattle sector because NCBA reports projected returns per occupancy, which EPA converts to per-marketed head using a ratio of occupancy to marketed head calculated using NCBA's data.

Once the available projections are expressed on a per-animal basis, future earnings are approximated by applying the incremental national average change (dollars per animal) between each year during the forecast period to the baseline financial data for each representative model CAFO. This is the same approach used for the Proposal EA. The revised cash streams over the forecast period for EPA's final analysis are shown in Tables 2-6 (farm level) and 2-7 (enterprise level).

Using these per-animal values, EPA calculates the net present value of future earnings for each model CAFO (also shown in Tables 2-6 and 2-7). This approach assumes a 7 percent discount rate over the 10-year period of the analysis (1997 to 2006). The equation EPA uses to calculate the net present value of cash flow is

$$NPV = v1 + \sum_{i=2}^{n} \frac{v_i}{(1+r)^{i-1}}$$

where:

$v_1 ... v_n$ = series of cash flows
r = interest rate
n = number of cash flow periods
i = current iteration

EPA's adjustment of the DCF analysis to represent post-compliance conditions for each model CAFO is measured based on present value of cash flow less present value of compliance costs.

EPA frequently uses negative post-compliance cash flow calculated over the period of the impact analysis to identify regulated entities that are vulnerable to closure. Several economic analyses for other effluent guidelines have used this measure as the only criterion or as part of a group of criteria for a closure analysis (see USEPA, 1995, 1996, 1997, 1998b, 1999a, 2000c, 2002h, 2002g). In these analyses, EPA has considered negative cash flow over the period of analysis as at least one indicator that a facility might be likely to close post-compliance.

To address public comments on EPA's proposal analysis, the Agency has made a number of changes in the way it evaluates this criterion. The changes EPA has made or considered to its general approach for this assessment criterion to address public comments are as follows. For more information, see EPA's response to comment DCN CAFO 201352-104 and other related comment responses (noted below) in the Comment Response Document in the rulemaking record.

First, EPA has expanded its DCF analysis, which now considers both farm level changes and enterprise level changes in cash flow—the latter which is based on an assessment of the financial effects on an operation's livestock or poultry enterprise. This change addresses comments expressed by many commenters, including FAPRI, other land grant university researchers, and industry, as well as USDA, to principally consider enterprise level effects for EPA's regulatory analysis. The analysis supporting the 2001 Proposal considers farm level effects only. This issue was discussed in the 2001 Notice (66 FR 58580-58582). It is also documented in the rulemaking record (see, for example, USEPA, 2001d; FAPRI, 2001a, 2001b; NPPC, 2001, NCBA, 2001, NMPF, 2001). Many of these comments were supported by alternative enterprise level data that were submitted to EPA since proposal and were presented in the 2001 Notice (USDA/ERA, 2002a and 2002c; FAPRI, 2001a; NCBA, 2001). An enterprise level analysis recognizes that a farm might be unwilling to cross-subsidize a continually failing livestock operation. Also, this approach recognizes that a failing enterprise with continuous cash flow problems would have limited access to financing for capital replacement and/or expansion, despite the health of the overall business. This analysis is conducted using the enterprise level financial data presented in Table 2-3 of this report. Section 2.4.2 provides more information and describes how EPA evaluates enterprise level changes in profitability. More information is in EPA's response to comment DCN CAFO 202402-35.

Second, EPA is using alternative time series data to project available financial data onto a 10-year time horizon for the discounted cash flow analysis. For the proposed rule, EPA used data projections developed by USDA (USDA/WAOB, various years). The 2001 Notice discussed comments that disagree with EPA's use of USDA's data series as the basis for projecting 1997 data, criticizing USDA projections on various grounds. Some comments suggested that EPA replace use of USDA's projections with alternative projections from FAPRI. In making the decision to use alternative projections for some sectors, EPA did not determine that USDA's projections were, in fact, inferior to projections compiled by other sources. EPA has reviewed the alternate projections recommended by commenters, comparing these to other published information. The data that EPA uses for the final analysis are based on a determination that these alternative data provide a better source from which to project out baseline financial conditions over the time period for some sectors. Based on this review, EPA is using alternative timeline data from FAPRI (hog and poultry sectors) and NCBA (cattle sector) to project future earnings from the baseline data. EPA justifies its decision to use alternative FAPRI projections given that FAPRI's publication of its annual projections are well-established and span

decades of ongoing research work; also, FAPRI's work is well-recognized within the agricultural research community and among land grant university researchers.[14] EPA was unable to use FAPRI projections for the cattle sector since these data do not cover the 1997 to 2006 time period of EPA's analysis. Other FAPRI and USDA projections report net returns to cow-calf operations only (and do not correspond to regulated cattle feeding operations). Therefore, EPA uses NCBA's projections for the cattle sector. Both FAPRI's and NCBA's projections compare well with USDA projections. For the dairy sector, EPA continues to use USDA's projections because alternative projections either do not regularly report net returns per milk cow or do not cover the 1997 to 2006 time period of EPA's analysis. Section 2.3 provides more detailed information on these data and EPA's selection process; see also EPA's response to comment DCN CAFO 201352-101. Projections that EPA uses for this analysis are shown in Table 2-4 and are expressed on a per-unit basis (i.e., cash returns per animal or per-unit output). The method EPA uses to project the baseline data follows the approach used for the proposal analysis, as discussed in the Proposal EA.

Third, the 2001 Notice discusses comments received by EPA that oppose the use of post-tax costs to assess financial impacts on the grounds that it is not appropriate to factor tax savings into the cost of compliance for producers. Commenters recommend that EPA not include expected tax offset in its financial tests because operations whose survival is in question would have no positive income against which to offset these "tax benefits." Instead, such operations would be forced to bear the full "pre-tax" costs of implementation. As discussed in the Notice, previous regulatory impact analyses conducted by EPA have evaluated compliance cost impacts on a post-tax basis using a standard cash flow model, incorporating an annualization approach that accounts for tax savings as well as depreciation at a business. This has been done because these costs are more reflective of the costs that are actually incurred by that business. Given this longstanding practice, which follows standard business and accounting practices, EPA continues to account for tax savings in its discounted cash flow analysis. As discussed in Section 2.4.1.1, however, EPA is using pre-tax costs instead of post-tax costs in the sales test for its final analysis. For more information, see EPA's comment-response document on this topic. More information is in EPA's response to comment DCN CAFO 201438-182.

Fourth, although other measures of farm earnings are discussed in the 2001 Notice, EPA decided not to use these other earnings measures, including EBITDA. This alternative measure of earnings would have been used to calculate return on assets and internal rate of return. However, EPA's analysis results using net cash income after taxes and a measure based on EBITDA for earnings are not substantially different for most sectors. Because EPA uses the present value of the total cost of the rule (the present value of operating expenses and capital), the Agency is able to determine whether cash flow is sufficient to cover the cash expenses of the regulations. This approach also provides for capital replacement at the end of the analysis period (or alternatively to cover the principal and interest payments over the period of the analysis). Although a "pass" result indicates that cash flow is positive over the 10-year period of the analysis, it also indicates that there is a cash flow cushion equal to the net present value of the capital expenditure (including the real cost of that capital) over that time frame. As discussed in the 2001 Notice, other possible financial indicators, such as return on assets or equity, were ultimately not used because those measures would involve 1 year of data or a single calculated average over a few years of data. EPA's use of discounted cash flow over the 10-year period of the analysis provides a better indication of whether an enterprise would be likely to remain viable. Indicators such as

[14] Evidence of the community's regard for FAPRI's research contribution is provided in the rulemaking record (see AAEA, 2002). See also EPA's response to comments on FAPRI's daat at DCN CAFO 201352-136-4.

return on assets are not ideal indicators of the financial health of an operation's enterprise because assets are rarely assessed at that level. More information is provided in EPA's record (see: ERG, 2001b) and in EPA's response to comment DCN CAFO 201352-104-182.

Some commenters (see, for example, NMPF, 2001) further recommended that EPA incorporate uncertainty into the analysis, pointing to FAPRI's parallel analyses of the 2001 Proposal (FAPRI, 2001a, 2001b). EPA did investigate the possibility of adopting a similar approach for its analysis that would incorporate a probabilistic approach (i.e., one that places probability distributions about available average data, similar to that adopted by FAPRI for its parallel analysis) and discontinue use of a deterministic approach (i.e., one that uses point estimates without any probability distributions, as EPA did for the proposed rule analysis). Information about FAPRI's baseline model is available in the rulemaking record at DCN 175038. EPA is not able to use a probabilistic approach because of data limitations and the challenges inherent to such an approach. For the 2001 Proposal, the financial data used were USDA's 1997 ARMS data, which are reported as average estimates from a statistical survey. Variance analysis of these data are limited. Strict confidentiality requirements on the outside use of USDA's databases also limited EPA's direct access to these and other USDA databases. Therefore, EPA uses average single point estimates for input into its models, as opposed to a broader range of data that would depict financial conditions at operations that are not necessarily represented by the average, such as operations at either end of the distribution (e.g., higher cost, less efficient operations at one end and lower cost, more efficient operations at the other end). Following the 2001 Proposal, EPA did evaluate the possibility of constructing probability distributions about the available financial data using uncertainty analysis techniques. Based on this investigation, EPA does not believe a probabilistic model would have best served the needs of its analysis for the CAFO rule. EPA's efforts demonstrate that such an approach may yield results that are overly dependent on a large number of critical assumptions that may be difficult or impossible to obtain. In general, EPA has concerns about probabilistic models based on its experience in trying to develop a such a model for another regulation of a farming sector (aquaculture or fish farming sectors). For that rulemaking, EPA decided not to pursue this approach, given the complexity and additional information needs to support such an approach. More information is available in the rulemaking record (ERG, 2001e—DCN 375013). See also EPA's response to comment DCN CAFO 201352-136-4.

Many commenters also criticize EPA for not considering impacts in a way that takes into account all of the cash outlays for an operation, including principal payments on loans to purchase the required technology. For reasons outlined in the 2001 Notice, EPA does not include a debt feasibility test as part of its analysis of the final rule because a down payment assumption is not necessary given the Agency's joint analysis of debt-asset ratios and cash flow (see 66 FR 58583-58584). More information is provided in the record (ERG, 2001c; USEPA, 2001c). See also response to comment DCN CAFO201352-104.

2.4.1.3 Debt Test Using Debt-Asset Ratios

The *debt-asset ratio* is a measure of a company's solvency and its ability to finance regulatory costs through additional debt. USDA calculates this measure as the ratio of business debt to business assets and considers it to reflect the share of assets owed to lenders (USDA/ERS, 1997a, 1997e).

To model the regulatory baseline for the representative model CAFOs, EPA uses available debt and asset data to compare changes in the ratio of baseline debt to assets under a postregulatory scenario. EPA calculates the postregulatory debt-asset ratio using the underlying data as follows:

$$\text{Postcompliance Debt-to-Asset Ratio} = \frac{\text{debt + capital compliance cost}}{\text{asset + capital compliance cost}}$$

For the 2001 Proposal, EPA used 1997 USDA-reported total farm assets and liabilities (USDA/ERS, 1999a) to evaluate changes in the debt-asset ratio for representative facilities. Changes in these ratios were evaluated based on USDA considerations that an operation facing potential financial stress were with debt-asset ratios exceeding 40 percent (USDA/ERS, 1997a, 1997e). More information is provided in Section 2.4.2.3; see also the discussion in Section 4 of the Proposal EA.

Comments received during the public comment period indicated general approval of EPA's use of debt-asset ratios in the economic analysis. However, many comments expressed concern about the baseline data assumptions and concern about the threshold value assumed to assess regulatory impacts. These comments noted that USDA's debt and asset data that EPA used for the proposal do not represent the current state of borrowing in many of these sectors, particularly among larger operation subject to EPA's regulations that tend to carry more debt than that reflected by USDA's data.

To address comments about the baseline data, EPA uses alternative debt and asset data for the livestock sectors (cattle, dairy, and hog). These data were submitted by FAPRI and NCBA. These alternative debt and asset data were presented in Section 2.3 and are available in the record (see: DCN 175044 and DCN 175038). These alternative data translate to the baseline debt-asset ratios shown in Table 2-2. These data indicate that confinement operations tend to have baseline debt-asset levels ranging from 60 percent to more than 70 percent in the beef, dairy and hog sectors, thus exceeding the USDA-recommended 40 percent threshold for indicating financial stress. The use of these alternative data for the livestock sectors has implications for the debt-asset benchmark for indicating financial stress as part of EPA's analysis. This issue is described in more detail in Section 2.4.2.3.

Because of data limitations, EPA continues to use USDA-reported average debt and asset data for the poultry sectors used for proposal. EPA also continues to evaluate these data using USDA recommendations that a 40 percent threshold indicates financial stress.

For more information, see EPA's response to comment DCN CAFO 210352-106 and also DCN CAFO 201438-207-1.

2.4.2 Criteria for Assessing Financial Effects

EPA uses its financial models, incorporating the data presented in Section 2.3 and the assessment criteria described in Section 2.4.1, to assess financial effects on select representative model CAFOs. The analysis for the final rule retains the general modeling framework that EPA used to assess economic effects for the 2001 Proposal (see 66 FR 3079-3103), with the modifications discussed in both the 2001 Notice and the 2002 Notice. Both Notices describe a range of methodological changes and financial data EPA considered for its analysis.

For the 2001 Proposal, the three assessment criteria described in Section 2.4.1 (sales test, discounted cash flow, and debt-asset ratios) were evaluated using USDA data reflecting financial conditions at the whole-farm level (reflecting income and cost information spanning an operation's

primary livestock production, as well as secondary livestock and crop production, government payments, and other farm-related income). For the final regulations, EPA conducts its discounted cash flow analysis using both farm level and enterprise level financial data. EPA still evaluates changes in the debt-asset levels using farm level data. EPA's sales test is also based on an evaluation of farm level revenue data, but it is primarily used as an initial screen of potential impacts that indicates the need for further evaluation.

2.4.2.1 Decision Matrix for "Economic Achievability"

For the 2001 Proposal, EPA's basis for determining economic achievability for the proposal was measured in terms of potential facility level (farm) closures and not potential product line (enterprise) closures. For the final regulations, economic achievability is determined based on an analysis measured both in terms of potential farm closures and potential enterprise closures.

The farm level analysis that supports the final rulemaking retains the same general framework used for the 2001 Proposal. Specifically, financial impacts are assessed using a sales test, discounted cash flow analysis, and debt-asset test. This evaluation is conducted using the farm level financial data presented in Table 2-2. These farm level data reflect income and cost information spanning an operation's primary livestock production, as well as secondary livestock and crop production, government payments, and other farm-related income.

As was done for the proposed rule, EPA divides the impacts of the final regulations into three financial impact categories: Affordable, Moderate, and Stress. The first category is the "Affordable" category, which means that the regulations have little or no financial impact on CAFO operations. The second category is the "Moderate" impact category, which means that the regulations would have some financial impact on operations at the affected CAFOs, but EPA does not consider these operations to be vulnerable to closure as a result of compliance. EPA considers that for CAFOs in both the "Affordable" and "Moderate" impact categories the final requirements are economically achievable. Operations experiencing financial stress, however, are considered to be vulnerable to closure because of the costs of this rule.[15] EPA considers the "Stress" impact category to indicate that the final requirements might not be economically achievable by the CAFO, subject to other considerations. Table 2-8 shows a summary of how EPA assesses these criteria using farm level data. Figure 2.1 illustrates the decision matrix graphically. Additional information on this approach is provided in the Proposal EA.

In general, EPA considers the regulations to be economically achievable for a representative model CAFO if the average operation has a post-compliance sales test estimate within an acceptable range, positive post-compliance cash flow over a 10-year period, and a post-compliance debt-asset ratio not exceeding a benchmark value. The benchmark value on the debt-asset test assumed for this analysis varies depending on the baseline conditions reported in the financial data used to conduct the analysis (discussed in Section 2.4.2.3) based on new data and recommendations submitted to EPA during the public comment period.

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[15] Commonly used measures of "farm financial stress" include bankruptcies, foreclosures, and net exits (Stam et al., 1991). Indicators of stress in agriculture as reported by farm banks include delinquent loans, discontinued financing, farm closures, liquidation, and bankruptcy (Stam et al., 1991, 2000).

EPA conducted its analysis first at the farm level based on data reflecting financial conditions for the entire farm operation (e.g., reflecting income and cost information spanning the entire operation, thus considering the operation's primary livestock production, along with other income sources such as secondary livestock and crop production, government payments, and other farm-related income). Based on the farm level results, EPA also assessed the financial effects on CAFOs at the enterprise level (e.g., limiting the scope of the assessment to the operation's livestock or poultry enterprise, and excluding other non CAFO-related sources of income from the analysis).

Starting with the farm level analysis, EPA considers the regulations to be economically achievable for a representative model CAFO if the average operation has a post-compliance sales test estimate within an acceptable range, a positive post-compliance cash flow over a 10-year period, and a post-compliance debt-to-asset ratio not exceeding a benchmark value. Specifically, if the sales test shows that compliance costs are less than 3 percent of sales, or if post-compliance cash flow is positive and the post-compliance debt-to-asset ratio does not exceed a benchmark (depending on the baseline data) and compliance costs are less than 5 percent of sales, EPA considers the options to be "Affordable" for the representative CAFO group. (Although a sales test result of less than 3 percent does indicate "Affordable" in the farm level analysis, further analysis is conducted to determine the effects at the operation's livestock or poultry enterprise.) The benchmark values assumed for the debt-asset test are sector-specific. EPA assumes a 70 percent benchmark value for the debt-asset test to indicate financial stress in the hog and dairy sectors, and an 80 percent benchmark for the debt-asset test to indicate financial stress in the beef cattle sector. These benchmark values address public comment received and alternative debt and asset data submitted for the livestock sectors. For the poultry sectors, however, EPA did not obtain alternative debt and asset data and continues to evaluate data used for proposal against a 40 percent benchmark value.

A sales test of greater than 5 percent but less than 10 percent of sales with positive cash flow and a debt-to-asset ratio of less than these sector-specific debt-asset benchmark values is considered indicative of some impact at the CAFO level, but at a level not as severe as those indicative of financial distress or vulnerability to closure. These impacts are labeled "Moderate" for the representative CAFO group. EPA considers both the "Affordable" and "Moderate" impact categories to be economically achievable by the CAFO, subject to the enterprise analysis (see below). If, with a sales test of greater than 3 percent, post-compliance cash flow is negative or the post-compliance debt-to-asset ratio exceeds these sector-specific debt-asset benchmarks, or if the sales test shows costs equal to or exceeding 10 percent of sales, EPA considers the final regulations to be associated with potential financial stress for the entire representative CAFO group. In such cases, each of the operations represented by that group might be vulnerable to closure. For operations that are determined to experience financial "Stress" at the farm level, the final requirements are likely not economically achievable.

The enterprise level analysis builds on the farm level analysis, evaluating effects at a farm's livestock or poultry enterprise. If the farm level analysis shows that the regulations impose "Affordable" or "Moderate" effects on the operation, the enterprise level analysis is conducted to determine whether the enterprise's cash flow is able to cover the cost of regulations. This analysis uses a discounted cash flow approach similar to that used to assess the farm level effects, in which the net present value of cash flow is compared to the net present value of the total cost of the regulatory options over the 10-year time frame of the analysis. Over the analysis period, if an operation's livestock or poultry enterprise maintains a cash flow stream that both exceeds the cash costs of the rule (operating and maintenance costs plus interest) and covers the net present value of the principal payments on the capital, EPA concludes that the enterprise will likely not close because of the CAFO rule. This analysis is conducted

on a pass/fail basis. If the net present value of cash flow minus the net present value of the rule's costs is greater than zero, the enterprise passes the test and the enterprise is assumed to continue to operate. EPA considers these results to indicate that the final requirements are economically achievable. If the net present value of cash flow is not sufficient to cover the net present value of the cost of the rule, EPA assumes that the CAFO operator would consider shutting down the livestock or poultry enterprise. That is, if an operation fails the enterprise level analysis, these operations are determined to experience financial "Stress" and the final requirements are likely not economically achievable.

The enterprise level analysis builds on the farm level analysis, evaluating effects at a farm's livestock or poultry enterprise. If the farm level analysis shows that the regulations impose "Affordable" or "Moderate" effects on the operation, the enterprise level analysis is conducted to determine whether the enterprise's cash flow is able to cover the cost of regulations. This analysis uses a discounted cash flow approach similar to that used to assess the farm level effects, where the net present value of cash flow is compared to the net present value of the total cost of the regulatory options over the 10-year time frame of the analysis. Over the analysis period, if an operation's livestock or poultry enterprise maintains a cash flow stream that both exceeds the cash costs of the rule (operation and maintenance costs plus interest) and covers the net present value of the principal payments on the capital, EPA concludes that the enterprise would likely not close because of the CAFO rule. This analysis is conducted on a pass/fail basis. If the net present value of cash flow minus the net present value of estimated compliance costs is greater than zero, the enterprise passes the test and is assumed to continue to operate. EPA considers these results to indicate that the final requirements are economically achievable. If the net present value of cash flow is not sufficient to cover the net present value of estimated compliance costs, EPA assumes that the CAFO operator would consider shutting down the livestock or poultry enterprise. In such cases, EPA conducts further analysis before making a final assessment of whether the final requirements are economically achievable.

Table 2-8 shows a summary of how EPA assesses these criteria using enterprise level data, providing additional analysis of the farm level assessment. Figure 2.1 illustrates the decision matrix graphically. The following section provides more information on the enterprise level analysis and how it builds on the farm level analysis.

In response to comments, EPA has conducted additional supplemental analysis to determine the effects of the regulation under two different scenarios. One scenario takes into consideration the effects of long-run market adjustment following implementation of the final regulations. This analysis is conducted using simulated changes in producer revenue given changes in market prices as depicted by EPA's market model, which uses estimates of price and quantity response in these markets. A second scenario takes into consideration potential cost share assistance under Federal and State conservation programs, assuming that a portion of costs are covered by cost sharing subject to programmatic constraints. Given the uncertainty of whether CAFO income will rise in response to long-run market adjustment or whether available cost share dollars will effectively offset compliance costs at regulated CAFOs, EPA's analysis to determine whether the regulation is "economically achievable" does not rely on such assumptions as part of its regulatory analysis and therefore reflects the highest level of impacts projected. EPA presents the results of this analysis assuming both some degree of cost passthrough and no cost passthrough, as well as some degree of cost share assistance and no cost share assistance, along with the results of its lead analysis. More information on these supplemental analyses is provided in Section 2.4.3 of this report. The results of this analysis are provided in Section 3.3.

Table 2-8. Economic Achievability Criteria for the Final CAFO Regulations

Criteria	Affordable	Moderate	Stress
Farm Level Analysis			
Sales test < 3%	X		
Sales test > 3% AND negative farm cash flow OR debt-asset ≥ benchmark value [1]			X
Sales test < 5% AND positive farm cash flow AND debt-asset < benchmark value [1]	X		
Sales test ≥ 5% but < 10% AND positive cash flow AND debt-asset < benchmark value [1]		X	
Sales test ≥ 10%			X
Enterprise Level Analysis			
"Affordable" farm level effects with negative enterprise cash flow			X
"Affordable" farm level effects with positive enterprise cash flow	X		
"Moderate" farm level effects with negative enterprise cash flow			X
"Moderate" farm level effects with positive enterprise cash flow		X	
Economically Achievable	**X**	**X**	

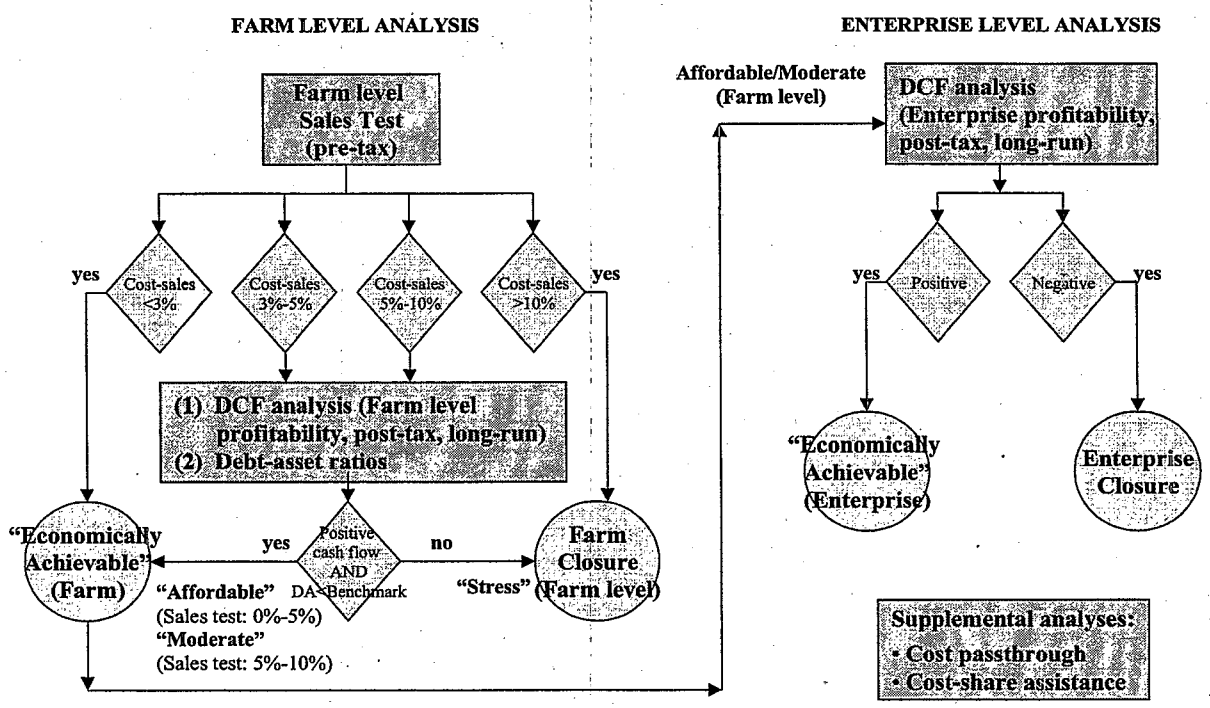

Figure 2-1. Schematic of EPA's Decision Matrix of "Economic Achievability"

2.4.2.2 Analysis of Effects at Multiple Business Levels

For the 2001 Proposal, EPA evaluated financial impacts using USDA data aggregated at the whole-farm level because data obtained from USDA did not allow for an enterprise level analysis. Therefore, EPA's basis for determining economic achievability for the proposal was measured in terms of potential farm closures and not potential enterprise closures.[16] Both of EPA's Notices present additional data received since proposal that EPA uses to assess financial impacts at multiple business levels within a representative facility (presented in Section 2.3 of this report). Using these data, EPA evaluates financial impacts both at the farm level and the enterprise level for the final regulations.

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[16] EPA typically conducts its analyses of regulated entities using data for a business as a whole as opposed to an individual product line because of data limitations. The only recent ELG regulation to evaluate product line closures is that for the Pesticide Formulating, Packaging and Repackaging industry, for which enterprise level financial data were collected through a CWA Section 308 survey (USEPA, 1996, or 61 FR 57518).

Perhaps the principal concern raised by researchers at various land grant universities and USDA is that EPA should evaluate financial impacts on regulated CAFOs using an enterprise level analysis only. As discussed in the 2001 Notice, many commenters claim that EPA's use of farm level financial data raises questions as to whether a CAFO would willingly subsidize one of an operation's enterprise with dollars from another enterprise at the business. These commenters question whether producers at more diversified operations would choose to cross-subsidize an unprofitable enterprise for long periods or whether they would instead shift assets toward other, more profitable enterprises at their operation; these producers might not quit farming but would remove the nonproductive enterprise from their farming mix (FAPRI, 2001a, 2001b; NPPC, 2001). This criticism was also raised before and after the 2001 Proposal (USEPA, 2001d). Other commenters point out that larger operations are normally enterprise-specific and tend to specialize. Therefore, an enterprise approach might be more appropriate for EPA's analysis. Other commenters also note that the use of enterprise level data in the form of "enterprise budgets" is more consistent with a representative farm approach, which was the general approach EPA adopted for evaluating financial impacts for the 2001 Proposal (NMPF, 2001). FAPRI (2001a) has also noted that although an evaluation of impacts at the farm level has merit, it is also prone to confounded results because enterprise-specific costs are spread over a larger share of the business (e.g., non-livestock enterprises bear the cost of regulations affecting the livestock portion of the operation). Some commenters, however, disagree with an approach that would consider an assessment at the enterprise level only (see, for example, Weida, 2002; Ikerd, 2002).

For the 2002 Proposal, EPA acknowledged many of the concerns expressed in public comments about the need to consider enterprise level financial effects. In the industry profile and data sections of the Proposal EA (see Section 2 and Section 4, respectively), EPA readily acknowledged limitations of these data stating that data were not available to evaluate an operation's livestock or poultry enterprise separate from the whole business operation. EPA also agrees with comments stating use of farm-level financial data raises questions of whether a CAFO would willingly subsidize one enterprise with dollars from other farm enterprises (e.g., whether producers at more diversified operations would choose to cross-subsidize an unprofitable enterprise for long periods or whether they would instead shift assets towards other, more profitable enterprises at their operation). Such producers might not quit farming but would only remove the non-productive enterprise from their farming mix. EPA recognizes that larger operations are normally enterprise specific and tend to specialize, focusing on a single enterprise; therefore, an enterprise approach may be more appropriate for EPA's analysis. EPA also recognizes that the use of enterprise level data in the form of "enterprise budgets" is more consistent with a representative farm approach, which was the general approach adopted by EPA for evaluating financial impacts for the 2001 Proposal. These concerns were noted by EPA in the 2001 Notice (66 FR 58580-58582). Because alternative enterprise level financial data were submitted to or obtained by EPA during the comment period, EPA has responded to these comments by including an analysis of the enterprise level effects as part of its overall assessment. Both of the Notices of Data Availability that EPA has published on this rule presented alternative enterprise level financial data and discussed options for evaluating enterprise level effects as part of the analysis, soliciting further review and comment on this issue. See: "2001 Notice" (November 21, 2001, 66 FR 58556) and the "2002 Notice" (July 23, 2002, 67 FR 48099), as well as DCN 375084 in the rulemaking record.

Although EPA agrees with comments that an evaluation of impacts at the farm level might be susceptible to confounded results because enterprise-specific costs are spread over a larger share of the business (including non-livestock enterprises), the Agency notes the merit in including an analysis of the fam level effects as well, since an analysis focused at the enterprise level only would ignore the interdependency among related enterprises at an operation. Comments by Ikerd (2002) noted that an enterprise level analysis would:

"ignore the fact that, on many diversified farming operations, the output of one enterprise becomes the input of another and the waste of one enterprise becomes a resource for another." Enterprise analysis treats separate enterprises as if they were 'independent,' whereas, on diversified farms enterprises are instead "interdependent." In addition, on well-managed, diversified farms, the different enterprises are complements, not substitutes—i.e. the enterprises 'cross-subsidize' each other by nature. Enterprise analysis quite simply is not appropriate to address issues where diversification is a logical management strategy —as is most clearly the case in dealing with environmental issues."

EPA recognizes the importance of considering financial impacts at multiple levels within a business because this is consistent with economic theory and is a technically sound approach. This approach is also consistent with how businesses make decisions because most businesses would be unwilling to cross-subsidize a failing enterprise over a long period rather than simply discontinuing it. Also, a failing enterprise might have limited access to available financing for capital replacement or expansion of the operation because lenders typically look at expected cash flow for an operation's enterprise in making loan decisions (ERG, 2001c). Focusing on the enterprise level further addresses changes in an operation's ability to diversify and manage risk, and it might also affect industry concentration and consolidation trends. Therefore, for the final rule analysis, although EPA's primary level for evaluating financial effects remains the farm level, the Agency has supplemented this approach with an assessment of the potential enterprise level effects of the regulation. EPA's final analysis approach using both farm level and enterprise level financial data for this effort.

EPA believes that both levels of analysis have merit in evaluating the financial effects of regulation in an industry. EPA has used this multi-level approach in other economic analyses it has performed for effluent guidelines. In the manufacturing sectors the key components of an impact analysis are the firm and the facility. EPA looks at whether a facility can absorb the costs of compliance while still remaining viable (typically, if cash flow is negative post-compliance, the facility is considered nonviable). The facility may be able to absorb the cost of compliance, but the firm may not be able to obtain the necessary capital to meet requirements or may fail as a result of incurring the costs of compliance at multiple facilities. Thus a firm level analysis is also performed. Impacts on both firms and facilities are considered in EPA's assessment of economic achievability. This approach supports observations noted in some comments on the CAFO rule, pointing out that farmers may support an enterprise because the output of one enterprise is used as input to another apply to analyses of firms and facilities. These facilities may be considered "captive" facilities, in that they are not stand-alone or the output of one is the input to another facility. Only an analysis at the firm level would reveal whether the firm can afford to keep going even if one or more facilities does not appear viable. Thus, EPA believes that an analysis covering both the farm level and the enterprise level is appropriate for this rulemaking.

For these reasons EPA is expanding its analysis to include an assessment of enterprise level effects. Other comments, however, challenge EPA's assessment of financial effects at the regulated entity, claiming that this assessment should be made for the "industry as a whole" and that economic factors be given only minimal consideration in setting effluent guidelines (Water Keepers Alliance, et al., 2001). Related comments presented by various groups during the development of the rulemaking further support conducting this analysis based on financial effects measured at the processor and consumer level (see, for example, USEPA, 2001f, and notes from other EPA meetings during the development of the rulemaking). As noted in the 2001 Notice, EPA has not modified its economic models to consider financial data for processing firms (66 FR 58581), as described below.

EPA continues to consider farm level impacts in addition to other assessed effects at the enterprise level because of concerns about evaluating impacts at the enterprise level only, as discussed in the 2001 Notice (see discussion starting at 66 FR 58580). As a practical matter, EPA recognizes that often the individual enterprises at an operation are highly interdependent, such as in the case of integrated production systems where there may be considerable cost savings due to shared production and labor costs among multiple enterprises. This is also true where one enterprise (e.g., grain crop production) serves as an input to another (e.g., livestock production). An analysis using enterprise level data might also fail to account for the range of assistance to the farming operation available through various government programs, which are often noted as a separate source of farm level income in USDA's data compendiums. Also, as pointed out by one lender questioned by EPA, lenders usually look at the debt-carrying capacity of the farm operation as a whole, except in the unusual instance when the lien is on only the enterprise (ERG, 2001c). Finally, farms are commonly noted to be motivated by noneconomic factors, which might influence an operation's decision to weather the boom and bust cycles that are commonplace in agricultural markets (USEPA, 2001, Heimlich and Barnard, 1995).

For additional information, EPA's response to comment DCN CAFO202402-35 in the Comment Response Document in the rulemaking record.

The issues described above raise questions about whether a decision to conduct EPA's analysis strictly at the enterprise level has merit. Also, previously published academic research by both the land grant universities and USDA has typically evaluated impacts using data and methods specified at the farm level or has, at least, taken into consideration information for the larger business concern (DPRA, 2001). This is all consistent with EPA's long-standing practice and consistent with Agency guidance to assess impacts on small businesses at the broader business level (USEPA, 1999i; SBA, 1998; USGPO, 2000).

Since the publication of the 2001 Notice, EPA has evaluated ways to incorporate an enterprise level analysis as part of its assessment. How EPA incorporates its enterprise level analysis into its overall decision-making framework was described in Section 2.4.2.1.

EPA conducts its enterprise level profitability test on a cash basis, which excludes both the noncash income and noncash expenses (depreciation). In agricultural accounting, net cash income measures the difference between gross cash income and cash expenses, including net rent to non-operator landlords. It does not include depreciation. This approach is consistent with Farm Financial Standards Council (FFSC) guidance. FFSC makes several recommendations concerning the role of unpaid labor and management in the income statement: "For analysis purposes, the FFSC recommends the following: (a) the general income statement should include a calculation of gross revenues and farm income, both on an accrual adjusted basis; (b) a charge for unpaid family labor and management should not [emphasis, as underlined, in the original] be included on the income statement;...." (FFSC, 1997, p. II-3). Other FFSC recommendations that support EPA's approach include the following: "For the purpose of analysis, the FFSC recommends the following on the issue of NFI (net farm income): NFI will continue to be defined as the return to operator and unpaid family labor, management and equity capital. No estimate of a charge for unpaid labor and management should be included on the income statement" (FFSC, 1997, p. II-22). Based on this guidance, EPA decided not to use net farm income as the profitability measure for this analysis. Net farm income is the difference between gross farm income and total production expenses, whereas gross farm income includes noncash income such as the value of home consumption and the rental value of dwellings. Also, in many cases the farm operation is also the owner-operators'

home; operator returns are calculated by excluding the income and expenses associated with farm operators' dwellings from net farm income.

2.4.2.3 Basis for Benchmark Values for Assessment Criteria

For the 2001 Proposal, the principal basis for EPA's economic achievability criteria for this rulemaking is USDA's financial classification of U.S. farms. In its analyses of the financial performance of U.S. commercial farms, USDA uses a combination of a farm's net income and debt-asset ratio to classify the overall financial position of a farm based on annual earnings and solvency (USDA/ERS, 1997e). Net farm income is an effective measure of long-term profitability; the debt-asset ratio is a useful measure of a farm's financial risk. Together these two measures provide an indicator of the farm's long-term financial health and viability (Sommer et al., 1998). For example, if a farm earns enough income to service debt and meet its other financial obligations, a high debt-asset ratio might be acceptable, while a farm carrying a low debt load might be able to weather periods of low or negative farm income (Sommer et al., 1998). USDA considers net income and debt-asset ratio jointly to classify farm performance by financial position, ranging from "favorable" to "unfavorable" (Sommer et al., 1998; USDA/ERS, 1997a, 1997e). USDA's classification scheme broadly identifies an operation with negative income and a debt-asset ratio in excess of 40 percent as "vulnerable." An operation with positive income and a debt-asset ratio of less than 40 percent is considered "favorable."

EPA adopts this scheme as part of its economic achievability criteria, using net cash flow to represent income and assuming a debt-asset threshold value of 40 percent. More information is presented in Section 4 of the Proposal EA.

As presented in the 2001 Proposal, USDA's debt-asset ratio threshold of 40 percent, which defines whether a farm is highly leveraged, is consistent with other recommendations (Ohio State University, 1999). Although a higher ratio usually indicates financial risk, debt-asset ratios tend to be higher for large farms and for those specializing in livestock feeding (Iowa State University, 1999b). For example, ratios of 30 to 40 percent are common among Iowa farms, although many operate with little or no debt (Iowa State University, 1999b). Another caution when considering debt-asset ratios is that a high debt load does not make farms less efficient; high-efficiency farms are able to service a higher debt load and maintain a higher debt-asset ratio with less risk than low-efficiency farms (Iowa State University, 1999b). As noted in the Proposal EA, the range of acceptable values for an operation's debt-asset ratio will vary depending on income variability, the proportion of owned land (or other assets) used in the farming operation, risks associated with normal production, and fluctuations in farm asset values that might occur due to changes in demand for agricultural assets (FFSC, 1997). For more information, see Section 4 of the Proposal EA.

EPA received several comments on the debt-asset test. Criticism of EPA's debt-asset test fall into two interrelated groupings, one criticizing the baseline data assumptions and the other criticizing the threshold value chosen to assess regulatory impacts. These comments noted that USDA's debt and asset data that EPA used for the proposal do not represent the current state of borrowing in many of these sectors, particularly for the size of operation subject to EPA's regulations which tend to carry more debt than that reflected by USDA's data. Comments challenging the baseline debt and asset data used for the 2001 proposal further raise questions the appropriateness of using USDA's recommended 40 percent benchmark value for assessing these larger-sized confinement operations. The 2001 Notice (November 21, 2001, 66 FR 58556) presented some of these concerns and described alternative data and approaches

that EPA was considering (see 66 FR 58585-58589). The 2002 Notice of Data Availability (July 23, 2002, 67 FR 48099) discussed additional considerations, providing further details and discussions of data pertaining to EPA's analysis for the final rule, thus soliciting further comment on this issue (see 67 FR 48105). Other information supporting the 2002 Notice was provided in DCN 375084 in the rulemaking record. For additional information, see EPA's comment-response document on this topic.

Commenters generally claimed that USDA's 40 percent threshold value, used by EPA in its baseline model to assess post-regulatory debt-asset ratios, does not reflect the financial reality of today's livestock or poultry industry. They also claimed that this debt level does not represent the current state of borrowing in many of these sectors (see, for example, NPPC, 2001; NMPF, 2001). These comments noted that the USDA 1997 data fail to account for the wide range of variability among farm operations, based on various factors, including facility size and the age of the farm operators. Alternative data submitted along with these comments support these claims.

To address comments about the baseline data, EPA uses alternative debt and asset data for several livestock sectors (cattle, dairy, and hog), which were submitted by FAPRI and NCBA.[17] These data indicate that larger, more intensive, or expanding operations tend to carry more debt than that reflected in data used by EPA for the proposal. This fact is supported by information EPA obtained from major agricultural lenders following the proposal; EPA's own discussions with farm lenders indicate a 60 percent debt level for "typical" operations (ERG, 2001c). See data presented in Table 2.2 in Section 2.3. By contrast, average USDA-reported data tend to cover a broader range of farm types and sizes, including small farms and non-confinement operations that are not subject to the regulations. EPA believes that alternative debt and asset data submitted by commenters and presented in both Notices are more appropriate for this analysis than data used for the proposal analysis. (EPA did not obtain alternative data for the poultry sectors; therefore, the Agency continues to use the same USDA-reported average debt and asset data and USDA's 40 percent threshold to indicate financial stress, as was done for proposal.)

The use of these alternative data, however, has implications for the debt-asset benchmark for indicating financial stress for these sectors. As shown in Table 2.2, these data translate to the baseline debt-asset ratios ranging from 60 percent to more than 70 percent and exceed the USDA-recommended 40 percent benchmark indicating financial stress. Therefore, USDA's recommended 40 percent benchmark is not suitable for assessing changes in debt at operations using these alternative debt and asset data. Use of alternative data submitted during the comment period (indicating that baseline debt-asset levels at some representative facilities exceed 40 percent and often exceed 70 percent) point to the need for EPA to consider an alternative benchmark to evaluate this test .

Since USDA's recommended 40 percent benchmark is not suitable for assessing operations using these alternative data, both of EPA's Notices and related supporting documentation requested information about alternative benchmark assumptions to evaluate changes in the baseline debt and asset data, soliciting further comment on this issue. In general, commenters claim that financial stress would occur at operations facing debt-asset ratios of roughly 60 percent to 80 percent. One commenter suggested that a ratio of more than 60 percent would be indicative of stress and that a ratio of more than 70 percent would result in bankruptcy (NMPF, 2001). The basis for this recommendation is farm credit information from the American Bankers Association's Farm Financial Standards Task Force suggesting

[17] These alternative debt and asset data are available in the record (see: DCN 175044 and DCN 175038)

that debt-asset levels in excess of 60 percent act as "red light" indicators to lenders (USEPA, 2001c; Cryan, 2001). The 2002 Notice solicited comment on an assumption of an 80 percent benchmark value to indicate financial stress for these sectors. This alternative benchmark is based on recommendations by NCBA (NCBA, 2002— DCN 375047). EPA's own discussions with farm lenders indicate a 60 percent debt level for "typical" operations (ERG, 2001c). Most lenders require an operation to retain a 40 percent equity base in the operation, although lower bases may be acceptable, particularly where the majority of debt is in short-term livestock loans or at very large operations. Therefore, debt-asset ratios of nearly 70 percent (reflecting a 30 percent equity stake) at very large operations represented in the NCBA survey may reflect both of these factors (NCBA, 2001).

In response to the 2002 Notice, EPA received comments recommending alternative benchmarks ranging from 50 percent to 70 percent for all sectors. One commenter representing the hog industry provided information from university researchers recommending a benchmark of 70 percent for larger hog operations and 50 percent for smaller hog operations; information provided suggests that an 80 percent benchmark is too high for a farrow finish operation since neither the animals or the facilities in this sector is as marketable as beef cattle (DCN 600031). EPA disagrees with the use of this lower bound benchmark given that the alternative debt-asset ratios that EPA presented in the 2002 Notice already exceed this level; however, EPA's "economic achievability" analysis is focused on larger-sized operations with more than 1,000 AU and therefore does not require that EPA establish an appropriate benchmark for smaller-sized operations. Other comments presented information from agricultural lenders supporting a benchmark of 70 percent for all sectors (DCN 600060 and DCN 400158). Because this recommendation originated from university staff and agricultural lenders, EPA generally recognizes that it should consider a lower benchmark for some sectors. Given these considerations and because USDA's recommended 40 percent benchmark is not suitable for evaluating the alternative debt and asset data that EPA is now using to reflect baseline conditions at regulated CAFOs, EPA is assuming for the final rule analysis a 70 percent benchmark value for the debt-asset test to indicate financial stress in the hog and dairy sectors and an 80 percent benchmark for the debt-asset test to indicate financial stress in the beef cattle sector.

To further evaluate these data and alternative benchmark values, and the implications for EPA's analysis, the Agency conducted additional sensitivity analyses. This analysis indicates that the use of the alternative 70 percent benchmark does not change the overall results of EPA's analysis for these sectors, compared to an analysis assuming an 80 percent threshold value for the debt-asset test. This finding holds for each of the cattle, dairy, or hog sectors. For each of the affected livestock sectors, EPA's sensitivity analysis compares the results of the economic analysis assuming two alternative benchmark values for its debt-asset test: one debt-asset benchmark assesses the results of this test assuming that financial "stress" occurs if the ratio of debt to assets exceeds 80 percent ("main" analysis); another debt-asset benchmark assesses the results of this test assuming that "stress" occurs if the ratio exceeds 70 percent ("alternative" analysis). This test is used in conjunction with EPA's two other assessment criterion for this analysis sales test and DCF analysis, with no change from the main analysis. The results of these analyses indicate that EPA's analysis results are stable across a range of input data (ERG, 2002c—DCN 375111). For more information, see EPA's response to comments DCN CAFO 210352-106 and DCN CAFO 201438-207-1.

The threshold values EPA uses for its sales test (3 percent, 5 percent, and 10 percent) are those the Agency has determined to be appropriate for this rulemaking and are consistent with threshold levels used by EPA to measure impacts of regulations for other point source dischargers. See Section 4 of the Proposal EA. EPA has used 1 percent and 3 percent sales test benchmarks to screen for potential impacts

in many small business analyses (e.g., USEPA, 2000c, 1999a). These benchmarks are only screening tools, but do support EPA's contention that a sales test of less than 3 percent generally indicates minimal impact (Snyder, 2000). Heimlich and Barnard (1995) do not define a threshold where the management measures would be considered economically achievable because "...there are no hard and fast guidelines for what is economically achievable, any appraisal of overall achievability... is subjective."

The 5 percent benchmark is consistent with threshold values established by EPA in previous regulations for other point source dischargers. Generally, EPA's analyses have assumed that sales tests less than 5 percent indicate compliance costs that are achievable (see, for example USEPA 1987 and 1994). Other analyses have assumed the same threshold but have further assumed that ratio values in excess of 5 percent may constitute moderate impacts, taking into consideration other factors (USEPA 2000b, 1999b, and 1996). This analysis adopts this framework to analyze regulatory impacts to CAFOs. In another analysis, a sales test result of greater than 5 percent was labeled a "sales impact" (USEPA, 1987). Sales impacts were assessed separately from those impacts that may make a facility vulnerable to closure.

EPA uses an upper limit for a sales test result of 10 percent (whereby this result alone indicates financial stress), rather than assuming that there is no upper limit on a sales test percentage if other financial variables are also analyzed (such as in USEPA, 1996). EPA believes, in this case, that if a sales impact is very high, this result should be considered a substantial impact and might make an operation vulnerable to closure in spite of positive cash flow and an adequate debt-asset ratio. EPA thus uses the 10 percent benchmark to ensure that potential vulnerability will not be underestimated. In fact, relatively few operations could incur costs greater than 10 percent of revenues while continuing to show positive cash flow.

Because EPA does not use a sales test alone as a measure of financial vulnerability, the sales test operates more as a screening tool. In most cases (results between 3 percent and 10 percent), a finding of financial stress is driven by cash flow and debt burden considerations. Thus, over the key range of sales impacts, EPA's methodology is consistent with many USDA analyses, which very frequently use net income and debt-asset ratios to assess impacts (e.g., USDA/ERS, 1997e). The exception is that EPA does not consider noncash income and depreciation (that is, EPA uses a *net cash income*-type analysis rather than a *net farm income* analysis). This is consistent with current views on the use of cash flow analysis, which is preferred over net income analysis among financial analysts (Brigham and Gapenski, 1997; Jarnagin, 1996).

Finally, as noted in the 2001 Notice, EPA has not modified its economic models to take into consideration financial data for processing firms (66 FR 58581). Such an approach has been suggested because of the affiliation between some CAFOs (e.g., contract growers) and processing firms through various contractual arrangements in some sectors. Data are not available to conduct such an analysis: EPA does not have market information on which processors and CAFOs participate in such contract agreements; financial data for processing firms that contract out the raising of animals to CAFOs are also not available. Consistent with how EPA conducted its analysis for the 2001 Proposal, EPA will continue to assume that an assessment of the regulatory impacts of the final regulations is more accurately conducted for the regulated CAFO that incurs the cost of the final requirements. EPA solicited comments on this approach and requested additional financial data to conduct such an analysis in its 2001 Proposal and Notice. EPA continues, however, to evaluate expected broader market level changes using the assumptions of cost passthrough that were developed for the proposal as a surrogate for more complex market level models that would take into account structural adjustment among farmers as well as market adjustment in the long run.

2.4.2 Supplemental Analyses

This section discusses supplemental analyses performed by EPA to evaluate financial effects on CAFOs. Section 2.4.3.1 describes how EPA evaluates the effects of long-run market adjustments under a post-compliance scenario, assuming that eventual higher prices and facility revenue might partially offset the estimated financial effects on regulated CAFOs. This analysis modifies a similar analysis conducted for the 2001 Proposal in which EPA assumed a portion of the costs are passed up through the food marketing chain under assumptions of long-run market adjustment. Section 2.4.3.2 describes how EPA evaluates the effects of the final regulations in conjunction with increased funding of available cost-share assistance programs, assuming that these program monies might partially offset the estimated compliance costs to regulated CAFOs. Section 2.4.3.3 describes other supplemental analyses considered by EPA.

Although EPA conducts various supplemental analyses of alternative assumptions in its analysis (for example, analyzing the potential CAFO closures assuming both no long-run market adjustment or cost passthrough, or assuming both some degree of cost share assistance and no cost share assistance), the Agency decided not to base its statutory analysis of "economic achievability" on such assumptions. The reason for this decision is continued uncertainty about how to incorporate such assumptions into its analysis. Therefore, EPA's analysis reflects the highest level of financial effects projected. The basis for EPA's decision is discussed in the Comment Response Document in the rulemaking record. Response to comment DCN CAFO201717-32 discusses how EPA addresses long-run market adjustment as part of its analysis, as well as the potential for operations to pass on costs incurred to comply with the final regulations. Response to comment DCN CAFO200139-4 discusses how EPA addresses available cost share assistance from Federal and State farm conservation programs as part of its economic analysis. Response to comment DCN CAFO202615-21 discusses how EPA's analysis accounts the nutrient value of manure and potential income from manure sales as part of its economic analysis.

2.4.3.1 Market Impacts on Facility Income

For the 2001 Proposal, EPA presented the results of its economic impact analysis both assuming no long-run market adjustment or cost passthrough (i.e., the highest level of financial effects projected) and some degree of cost passthrough. However, because of uncertainties regarding how and when much market adjustments would occur and whether this would actually offset estimated compliance costs incurred by CAFOs, EPA's determination of whether the regulation is "economically achievable" did not rely on assumptions of cost passthrough an offset to estimated compliance costs as part of its regulatory analysis and therefore reflects the highest level of impacts projected.

In general, EPA measures the financial effects of the final regulations on the basis of the estimated compliance costs incurred at the CAFO. However, other mitigating factors could influence what costs the CAFO ultimately incurs because a portion of these costs might eventually be passed on through the food marketing chain. Passthrough of compliance costs might occur in the long run through market adjustment (higher prices through changes in supply and demand) or in the shorter term as processors take steps to ensure a steady and continued supply of raw farm input (raise production prices for live animals or animal products produced by CAFOs). For the purpose of this analysis, EPA examines regulatory impacts on producers in the livestock and poultry sectors under the assumption that they will experience increased revenues due to long-run market adjustment and resultant higher market prices. This section presents an overview of this analysis.

Individual farms may be considered competitive and may not individually be able to raise prices. Collectively, however, if production costs rise across the industry as a whole, economic theory indicates that prices will rise. Essentially, if farmers cannot earn a sufficient return to cover all long-run costs of production, they will leave the market. This action, in turn, will force customers to pay a higher price to purchase the quantity of the product they desire. (This is illustrated in Figure C-1 of Appendix C of this report). As the final regulations result in an increase in production costs, the supply curve for the market shifts upward. The magnitude of this shift is equal to annualized compliance costs per unit sold (CC/Q). Because the supply curve reflects long-run production costs, this change represents the minimum price necessary to ensure adequate supply of the product. Market price will rise from P^0 to P^1 in the long run.[18] Intuitively, the effect of the final regulations on market prices can be measured (as shown in Figure C-1) as the increase in market price ($P^1 - P^0$) relative to compliance costs per unit of production (e.g., head of cattle):

$$\text{market price increase as percent of unit compliance costs} = \Delta P_{CC} = \frac{(P^1 - P^0)}{\frac{CC}{Q}}$$

Table 2-9 shows, for example, that the measured price increase as a percent of unit compliance costs equals 70.7 percent for beef cattle. That means if the final regulations cause farmers to incur compliance costs of $1.00 per head of cattle, then the resulting decrease in cattle supply causes the market price to increase by about $0.71 per head. In general, the magnitude of this effect will vary according to market-specific conditions.

EPA thoroughly examined this issue during the development of the proposed rulemaking, as documented in Section 10 of the proposed rule preamble as well as in the Proposal EA (Sections 2 and 4 and Appendices B and C). In the industry profile and data sections of the Proposal EA, EPA readily acknowledged limitations of incorporating assumptions of cost passthrough in the analysis, given existing dynamics in these industries. EPA's industry profile in the Proposal EA acknowledged many of the reasons why farmers may be limited from passing on higher operating costs, including the perception that farmers are price takers and have limited negotiating power to pass on costs or negotiate higher product prices, attributable in part to imperfect market conditions characterized by conditions of oligopsony/monopsony (i.e., few buyers, many sellers).

To further examine this issue, EPA conducted an extensive review of the agricultural literature on market power and price transmission in each of the livestock and poultry sectors and concluded that there is little evidence to suggest that markets will not adjust to at least partially offset increased production costs to producers. Although there is a potential for market power in each of the animal products industries, and although vertical integration has squeezed the rents out of many farming activities, EPA believes that the literature generally supports the conclusion that the degree of market power in these sectors is not sufficient to prevent increased production costs from being partially offset

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[18] Under highly unusual circumstances, market price will not rise in response to increased production costs. First, if demand for a product is perfectly elastic (the demand curve in Figure C-1 in Appendix C is horizontal), consumers, including processors or packers, are not willing to pay more for a product regardless of scarcity. Second, if the supply of a product is perfectly inelastic (the supply curve in Figure C-1 is vertical), the quantity supplied by the producer will not change regardless of price. In the real world, even nearly perfectly elastic demand or nearly perfectly inelastic supply at the sector or industry level for most products in the long run is rare.

by increased market prices for these products, particularly in the long-run, such that prices and quantities will adjust to a post-regulatory equilibrium. A summary of this research is in the rulemaking record (ERG, 2000c—DCN 70640).

Despite EPA's general conclusions based on the empirical research about long-run market adjustment, EPA presented the results of its economic impact analysis both assuming no long-run market adjustment or cost passthrough for the 2001 Proposal, and based its determination of whether the regulation is "economically achievable" without assuming cost passthrough of costs. As noted in the preamble and Proposal EA, many industry representatives opposed assumptions that producers will be able to pass on costs or that compliance costs would be partially offset by higher producer prices, including prices paid to contract growers who raise animals under contract with a meat packer or slaughtering/processing facility. Similar concerns were expressed by many small entity representatives during the Agency's small business outreach process and by members of the Small Business Advisory Review (SBAR) Panel.[19]

EPA received several comments on the 2001 Proposal recommending that the Agency not consider cost passthrough as part of its analysis, particularly for its analysis of whether the regulation is economically achievable. (See, for example, NPPC, 2002, NMPF, 2002, National Center, 2002) EPA acknowledges comments pointing out that individual farmers might be unable to influence market or producer prices. EPA also acknowledges, however, comments focused on the relationship between processing firms and producers that raise animals under contract for these firms, citing expectations that future contract negotiations would result in compliance costs will be fairly allocated over time (Wisconsin Department of Natural Resources, 2002). Some stakeholders support assumptions of cost passthrough. During the development of the rulemaking, the Natural Resources Defense Council (NRDC) and interest groups continually requested that EPA consider the financial ties linking processors and contract growers, and the ability within these markets to pass on costs to consumers (see: Weida, 2002; Ikerd, 2002; USEPA, 20021f, NRDC, 1999). Ikerd (2002) notes that "EPA CAFO regulations might logically result in more, smaller, and more-profitable farms" since the regulations "could cause price increases that would more than offset any increase in production costs."

In response to comments on this issue in the 2001 Proposal, the Agency's 2001 Notice of Data Availability (November 21, 2001, 66 FR 58556) EPA restated its intention to consider such analyses for the final regulations as part of its economic analysis, expecting to obtain additional comment on this issue (66 FR 58581). The 2002 Notice of Data Availability (July 23, 2002, 67 FR 48099) further discusses adjustments to the Agency's approach to conduct this analysis (67 FR 48107). The approach presented would alter the Agency's analysis from an approach that assumes costs are passed on by farmer through the marketing chain to an approach that would instead evaluate financial effects based on assumed changes in prices received by producers as a result of long-run market adjustment.

Appendix C of this report describes EPA's approach to evaluate the effects of long-run market adjustment and changes in facility level income under a post-compliance scenario for this analysis. To conduct this analysis, EPA estimates changes in farm level prices using its market model analysis (described in Section 2.5 of this report). EPA's market model uses baseline equilibrium price and quantity, as well as equations representing estimated supply and demand responses to changes in price.

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[19]These comments note that integrators have a bargaining advantage in negotiating contracts, which might ultimately allow them to force producers to incur all compliance costs, as well as allow them to pass down to growers any additional costs that might be incurred by the processing firm.

This model is specified for each livestock and poultry industry affected by the final regulations. The market model uses estimated compliance costs per unit of production for the final regulations to measure the vertical shift in the supply curve. Given the vertical shift in the supply curve, the model solves for the post-regulatory equilibrium price. Thus, all components of this supplemental analysis are baseline parameters, inputs, or outputs of EPA's market model. This approach reflects an adjustment to what was done for the 2001 Proposal by using predicted price changes from the market model analysis to calculate the effect of this change on the CAFO level financial analysis (focusing on the revenue rather than the cost side of the analysis). Such an approach is more consistent with previous regulatory analyses conducted by EPA's effluent guideline program (e.g.,USEPA, 1999a—65 FR 49686). This change was noted in the 2002 Notice (67 FR 48106-48107).

Table 2-9 shows the selected price elasticities of supply and demand that EPA assumes for each sector, along with the resultant estimate of the price increase as a percent of per unit compliance costs based on these estimates using the approach outlined in this section.

Section 4.4 and Appendix B of the Proposal EA describe EPA's market model for this analysis, providing a detailed overview of the data and the methodology underlying this approach. Section 4.2.6 and Appendix C of the Proposal EA provide additional information on the supply and demand elasticities compiled to evaluate long-run market conditions following promulgation of the final regulations.

Although many comments generally concurred with EPA that long-run market adjustment will occur, EPA agrees with concern expressed by these commenters about short-run impacts at regulated CAFOs and agrees that the results of a cost passthrough analysis must be interpreted cautiously. Given the uncertainty of whether CAFO level income will rise in response to long-run market adjustment, however, EPA presents the results of this analysis assuming both some degree of cost passthrough and no cost passthrough (the highest level of impacts projected).

EPA agrees that over the long-run the aggregate effect of many individual farmer's response to the regulations will cause market prices and quantities to adjust. This long-run market adjustment will lessen the economic impacts of the final regulations over time. EPA also agrees with comments that predict contract price negotiations between processing firms and their contract growers that will ensure continued and steady supply of animals for further processing. However, EPA decided not to base its statutory analysis of "economic achievability" on assumptions of long-run market adjustment because continued long-run changes are difficult to predict and therefore cannot be readily incorporated into EPA's regulatory analysis as an offset to estimated compliance costs at all regulated facilities. EPA also agrees with comments noting that an analysis that takes into account broader long-run market adjustments might mask severe financial effects at regulated CAFOs in the short-run. Accordingly, EPA has undertaken its main analysis as a short run analysis of the financial effects at regulated CAFOs. The results of this analysis are available in Section 3.3.2 of the Final EA and presents the results of EPA's economic achievability analysis before any longer-run revenue effects are realized. See Section 3.3 of this report. Although EPA's short-run model provides a reasonable means to approximate CAFO level effects taking into account market changes associated with long-run adjustment (when coupled with results from a market model analysis and other published information from various land grant universities), this model is not specifically designed to precisely capture such long-term effects.

To the extent that EPA's analysis considers assumptions of long-run market adjustment as part of a supplemental analysis, the Agency agrees with comments that the results of this analysis must be interpreted cautiously. Because long-run market adjustment will likely lessen the economic impacts of

the final regulations over time (in conjunction with offsetting cost share and technical assistance), EPA believes that the results of its analysis to determine "economic achievability" is sufficiently conservative and depicts the highest level of potential effects. The results of the Agency's supplemental analysis assuming some degree of long-run market adjustment is viewed as providing a realistic lower bound estimate of financial effects of the regulation. Section 2.4 of the Final EA discusses how EPA incorporates these assumptions in its analysis, while addressing the constraints of such an analysis. Appendix C of this report describes EPA's approach to evaluate the effects of long-run market adjustment and changes in facility level income under a post-compliance scenario.

EPA continues to present its analysis results both assuming no long-run market adjustment and some degree of long-run market adjustment. EPA also continues to base its determination of whether the regulation is "economically achievable" without relying on assumptions of long-run market adjustment as an offset to estimated compliance costs in the short-run.

Table 2-9. Selected Elasticity Estimates and Estimated Regulatory Price Effect

Animal Sector	Selected Price Elasticity of Supply [a/]	Selected Price Elasticity of Demand [a/]	Price Increase as Percent of per unit Compliance Costs
Beef	1.020	-0.621	70.7%
Dairy	1.527	-0.247	84.8%
Hogs	0.628	-0.728	69.7%
Broiler [b/]	0.200	-0.372	68.7%
Layer	0.942	-0.110	93.7%
Turkey	0.200	-0.535	49.5%

Sources: Various (ERG, 1999a, 199b); also see summary in Appendix C in Proposal EA (USEPA, 2001a)
[a/]Elasticities representing a consensus of expert opinion (Vukina, 2000; Foster, 2000a).
[b/]Includes elasticity estimates for both broilers and chickens because studies vary between the two terms when analyzing the markets for meat from chickens.

2.4.3.2 Cost-Share Assistance

For the 2001 Proposal, EPA presented the results of its economic impact analysis without considering the potential offsetting effects of cost-share and technical assistance from various Federal, State, and local farm conservation programs, due to uncertainties regarding who and how much cost share and technical assistance farmers receive and whether this would actually offset estimated compliance costs incurred by CAFOs. EPA's analysis to determine whether the regulation is "economically achievable" also did not rely on such assumptions as an offset to estimated compliance costs as part of its regulatory analysis and therefore reflects the highest level of impacts projected.

EPA thoroughly examined this issue during the development of the proposed rulemaking, as documented in Section 4.2 of the Proposal EA and in the rulemaking record (DCN 70130). Various State and Federal programs, such as the Environmental Quality Incentives Program (EQIP) administered by USDA, offer assistance to farmers for on-farm environmental improvements. For example, cost sharing

for eligible producers under EQIP may cover up to 75 percent of the costs of certain conservation practices, such as grassed waterways, filter strips, manure management facilities, capping of abandoned wells, and other practices important to improving and maintaining the health of natural resources in the area. Technical assistance is also available for formulating conservation plans. Previous regulatory analyses by the land grant universities and USDA have included cost-share program dollars as an offset to compliance costs associated with environmental regulation or at least consider available government assistance as part of an overall assessment (see literature review, DCN 175100). Also, a 1995 regulatory analysis of confined animal operations located in coastal zone areas, conducted by both USDA and EPA assumed a maximum cost sharing amount of $3,500 per year in government cost-sharing (Heimlich and Barnard, 1995; DPRA, 1995).

For reasons outlined in Section 4.2 of the Proposal EA (and detailed in DCN 70130), EPA decided not to consider cost share assistance as an offset to estimated compliance costs in determining whether the regulation is "economically achievable." Reasons for this include the following: (formerly) lower EQIP funding levels would be insufficient to cover all new applicants that might be affected by the final regulations, (formerly) strict eligibility requirements would limit larger-sized operations from participating in the program[20] and limiting the types of practices covered, waiting lists to participate in the program would be long and geographic priority areas were established, thus limiting access to some producers, among other factors limiting participation.

EPA received several comments on the 2001 Proposal supporting the Agency's decision not to consider include cost sharing to offset compliance costs faced by CAFOs (see, for example, DCN 201734, DCN 400158, DCN 400125, DCN 201717, DCN 400140, DCN 235769). EPA received few comments on the 2001 Proposal that support this assumption.

The 2001 Notice discussed the possibility that EPA would consider such analyses for the final regulations as part of its economic analysis (see: 66 FR 58585). The 2002 Notice presented additional information and discusses options for incorporating cost sharing in EPA's analysis due to increased appropriations and program changes broadening those eligible to participate in the program (67 FR 48106-48107). The 2002 Notice discusses new farm bill legislation passed by Congress in Spring 2002 that could significantly raise government expenditures for USDA conservation programs. Specifically, total EQIP authorization for FY 2002-2007 is $5.8 billion, ranging from $400 million to $1.3 billion per year over the period. The current authorized levels are about $200 million per year. The new legislation targets 60 percent of available EQIP funds to livestock and poultry producers, including confinement and grass-based systems (the latter accounting for about 70 percent of total livestock and poultry operations). The new legislation also removed the previous eligibility requirements under EQIP that restricted funding for certain structural practices to operations with fewer than 1,000 animal units (as measured by USDA), replacing this with an overall payment limitation of $450,000 per producer over the authorized life of the 2002 Farm Bill.

In response to the 2002 Notice, EPA received numerous comments recommending that the Agency account for the availability of cost-share and technical assistance in its regulatory analysis as an offset to estimated compliance costs as well as how producers might use these programs to help secure loans for capital investment associated with regulatory compliance. These comments noted that the debate surrounding these increased funding levels included a focus on assisting producers to comply with

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[20] Prior to new legislation passed in 2002, EQIP funds were not available to operations with more than 1,000 AU but only to operations with fewer than 1,000 AU (using USDA AU definitions). (See: DCN 70130).

environmental regulations (House Committee on Agriculture, 2002).[21] NRDC et al. (2002) also noted that industry representative, in their lobbying messages, industry told Congress that producers would need significant boosts in cost-share funds with no size restrictions on subsidy eligibility in order to comply with EPA's new CAFO regulations.[22] Despite these legislative changes, however, the majority of comments received by EPA on the cost-share issue continue to oppose the use of cost share assumptions as part of the analysis because of continued uncertainties about the availability and adequacy of funds, as well as administrative changes being considered in USDA's conservation programs. See comments by land grant universities (DCN 600046 and DCN 600038) and State governments and agriculture agencies (eg., DCN 600057, DCN 201716, DCN 400165, DCN 400249, and DCN 600049-7).

EPA agrees that program changes and increased funding in EQIP and other USDA conservation programs will benefit farmers and might offset compliance costs incurred by some facilities under the CAFO regulations. However, EPA disagrees that these legislative and program changes can be readily incorporated into EPA's regulatory analysis and will offset compliance costs at all regulated facilities.

EPA decided not to base its statutory analysis of "economic achievability" on assumptions of cost sharing because of continued uncertainty about how to incorporate such assumptions into its analysis. A number of uncertainties continue to constrain EPA's ability to simply incorporate cost share assumptions into its economic analysis. Such factors include uncertainty about actual funding levels, the share of program dollars allocated to confinement facilities (compared to all livestock and poultry operations, including non-confinement and grazing operations), the share of program dollars allocated to larger-sized operations (compared to smaller-sized operations), restrictions and eligibility requirements on the types of waste management practices covered, and availability of USDA technical personnel to implement the recent legislative changes in the near term. USDA is also considering administrative and programmatic changes to its conservation programs, making it difficult to know how the program will actually be implemented. For example, recent actions by USDA have sought to restrict cost share assistance to 50 percent of the capital expenditure on funding levels exceeding $100,000 per facility. Because EPA is unable to reasonably account for each of these factors and accurately incorporate assumptions of cost sharing addressing the uncertainty surrounding these factors, EPA decide not to base its statutory analysis of "economic achievability" on assumptions of cost sharing. EPA believes that the uncertainty regarding actual funding levels and implementation of the recent Farm Bill make less conservative assumptions more difficult to justify when economic achievability is assessed.

For these reasons, EPA continues to base its determination of whether the regulation is "economically achievable" without relying on assumptions of cost share assistance as an offset to estimated compliance costs. Because EPA recognizes that cost share assistance from Federal and State farm conservation programs will likely lessen the economic impacts of the final regulations over time (in conjunction with long-term market adjustment), however, the Agency now presents its analysis results

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[21] The Congressional record on the Farm Bill: "As legislation was developed to improve EQIP and provide additional resources to it, Congress was specifically concerned about how the U.S. livestock industry would meet the new Clean Water Act requirements on animal feeding operations" (Cong. Rec. at H1923, May 1, 2001).

[22] See letter from National Cattlemen's Beef Association, National Chicken Council, National Milk Producers Federation, National Pork Producers Council, National Turkey Federation, The Alliance of Western Milk Producers, and United Egg Producers to U.S. Senators (NCBA et al., 2001); testimony by National Pork Producers Council and National Cattlemen's Beef Association, Committee on Agriculture, Nutrition and Forestry, U.S. Senate (NPPC, 2001a; NCBA, 2001a).

both assuming some degree of cost share assistance and no cost share assistance (i.e., the highest level of financial effects projected). EPA believes that the results of its analysis to determine "economic achievability" is sufficiently conservative and depicts the highest level of potential effects. The results of EPA's supplemental analysis assuming some degree of cost sharing is viewed as providing a realistic probable alternative estimate of financial effects of the regulation among some operations. However, because EPA's supplemental analysis does not consider the maximum cost-share assistance possible ($450,000 per producer over the authorized life of the 2002 Farm Bill), this estimate should not be regarded as the potential low bound estimate among all operations.

2.4.3.3 Value of Manure as Cost Offsets

During the development of the 2001 Proposal, EPA considered whether to assume that beneficial uses of manure might offset incurred compliance costs as part of the Agency's economic analysis. This analysis consists of two components: (1) the nutrient value of manure for use as a fertilizer substitute of organic matter and (2) the potential income from manure or litter sales, particularly of relatively higher value dry poultry litter. Research conducted by the land grant universities and USDA often provide for some accounting of the benefits associated with efficient manure use (see a literature review conducted by EPA at DCN 175100 in the rulemaking docket). However, because there is not an established market for manure and the value of manure is uncertain or variable, EPA's determination of whether the regulation is "economically achievable" does not rely on assumptions of manure sales as part of its regulatory analysis and therefore reflects the highest level of impacts projected.

For both the proposal and final rule analysis, EPA's regulatory cost estimates take into account the nutrient value of manure for use as a fertilizer substitute to meet the nutrient needs of crops raised by the regulated CAFO. This analysis estimates the incremental cost of the land application requirements, accounting for various baseline practices of what farmers are doing currently in the absence of regulation. Because livestock and poultry operations currently use manure nutrients as a fertilizer source on crops grown on-site as a baseline practice, this analysis incorporates assumptions of the nutrient value of manure for use as a fertilizer substitute to meet the nutrient needs of crops raised by the regulated CAFO. The general approach used by EPA to assess the nutrient value of manure is consistent with approaches used by USDA (Kellogg et al., 2002; Kellogg et al., 2000). Information on EPA's approach to assess the nutrient content of manure for use as a fertilizer substitute is available in Section 21 of the rulemaking record and in the Development Documents and Cost Report (see: USEPA, 2002).

For the proposal, EPA also conducted a supplemental economic analysis that considered the potential income that might accrue to regulated CAFOs should that operation be able to sell any additional manure nutrients in excess of the nutrient needs of crops raised by the CAFO to other agricultural businesses. This supplemental analysis presented the results of its economic impact analysis both assuming no income from manure sales (i.e., the highest level of financial effects projected) and income from sales of manure in excess of the crop needs at the CAFO. For this analysis, EPA did not adjust or offset its estimated costs associated with managing, storing, hauling, processing, and distributing excess manure nutrients off-site as part of this analysis. This analysis evaluated only the income that might be generated from the sale of this excess manure based on the market value for nitrogen, phosphates, and potassium in commercial fertilizer. Also, EPA conducted this analysis for the poultry sectors only, because of the typically higher value of dry poultry manure and litter; e.g., in the broiler sector, EPA's supplemental analysis shows that sales of dry poultry manure could offset up to 50 percent of the estimated compliance costs (see Section 6 of the Proposal EA). Although EPA does

believe that the other livestock operations might also benefit from the sale of animal manure, the Agency chose not to evaluate such a scenario because of inadequate market indicators for the wetter manures that are common in the hog and dairy sectors and for dry manure collected at fed cattle operations. Because there is not an established market for manure, however, EPA's determination of whether the proposed regulation is "economically achievable" did not rely on assumptions of manure sales as part of its analysis. Information on EPA's supplemental economic analysis of the potential income that might accrue to regulated CAFOs should that operation be able to sell excess manure nutrients is available in Section 6 of the Proposal EA.

EPA received several comments that were generally opposed to EPA's consideration of the nutrient value manure, particularly about the Agency's monetary assessment of manure's value for consideration as an offset to estimated compliance costs of the rule. Few comments endorsed the concept of assuming the collateral benefit of considering manure as an offset the cost of compliance with this regulation. Following proposal, EPA further evaluated the potential income generated and/or cost savings to an operation from the sale or use of manure by the CAFO as a fertilizer substitute. EPA's 2001 Notice discusses options to include an analysis based on the volume of manure nutrients estimated for each representative CAFO model adjusted by the average value for these nutrients, according to, for example, market value for nitrogen, phosphates, and potassium. The 2001 Notice solicited public comment on these estimated values and data that EPA had considered for this analysis (see both 66 FR 58575 and 66 FR 58585), soliciting further comment on possible analytical approaches and assumptions.

EPA disagrees with comments that it should not consider the nutrient value of manure for use as a fertilizer substitute as part of its analysis of the compliance costs associated with the regulations. EPA's analysis estimates the incremental cost of the rule need by accounting for baseline practices based on what farmers are doing currently in the absence of EPA's regulation. Because livestock and poultry operations currently use manure nutrients as a fertilizer source on crops grown on-site as a baseline practice, this analysis incorporates assumptions of the nutrient value of manure for use as a fertilizer substitute to meet the nutrient needs of crops raised by the regulated CAFO. For this analysis, EPA assumes that CAFOs use manure generated as a fertilizer substitute on cropland under the control of the CAFO. This analysis fully considers all estimated costs associated with managing, storing, hauling, processing, and distributing excess manure nutrients off-site, and does not assume that these costs are offset by the nutrient value of the excess manure. Therefore, EPA disagrees with comments suggesting that the Agency has not considered the increased cost of using manure due to added costs attributable to the regulation. This analysis also accounts for the cost of additional fertilizer purchases, to the extent that it is needed to supplement manure that may need to be applied at different rates as a result of this rule (e.g., under a phosphorus standard, more commercial fertilizer may be needed to supply nitrogen needs to crops).

EPA acknowledges concerns expressed in comments about the possibility that the methodology used by the EPA for valuing manure nutrients might overstate the market value of manure. The approach that EPA uses to approximate the nutrient value of manure—based on the value of commercial fertilizer values of nitrogen, phosphorus, and potassium—is consistent with research conducted by USDA and land grant universities. Other market data and approaches for approximating the nutrient content of manure are not available and alternative data and approaches were not recommended to EPA during the public comment period. Information was also not submitted to EPA substantiating claims that the Agency has grossly overstated the nutrient value of manure for the purposes of its costing analysis. EPA also received no information to support claims that some farmers can obtain spread manure at no cost from other sources, and that therefore the CAFO's own supply of manure has zero value since it

substitutes for a free input. Finally, EPA disagrees with comments that it has not appropriately accounted for differences in the fertilizer value of manure based on the specific circumstances of each farm; such differences are accounted for using a representative farm approach that closely approximates the range of variability among farming operations. Use of such a representative farm approach to approximate a range of farming conditions is consistent with and research conducted by USDA and the land grant universities.

For more information on issues pertaining to the nutrient value of manure, see EPA's response to comment CAFO400112-52. Also see the response to comment CAFO 201141-2 for a discussion of how commercial fertilizer use is addressed by the nutrient management plan.

EPA agrees, however, with comments that caution against assuming that the nutrient value of manure will provide a source of income that will offset compliance costs, particularly as part of the Agency's analysis to assess regulatory impacts. Upon further review, EPA decided not to consider income from manure sales as part of its analysis because of uncertainty associated with incorporating such assumptions into the analysis. The main basis for this decision is the absence of established markets and a cash market price for spreading manure. Manure markets are presently functional, but remain largely under-developed and are not well established. In the absence of data under such market conditions, the true market value for manure and manure nutrients is uncertain or variable. Other marketing factors, such as distance from the source of manure to the application site and other site specific conditions, regional markets conditions, manure products applied, life cycle of the feeding operation in regards to the growing season, weather conditions, make such assumptions difficult to measure. Because true market value for manure is unknown, EPA assumes commercial fertilizer values (of nitrogen, phosphorus, and potassium) for approximating the nutrient value of manure. Although such an approach is consistent with practices used by researchers at USDA and the land grant universities, EPA recognizes that the value of manure might be misrepresented using this approach. In cases where there might be little or no positive cash market price for spreading manure, this approach would overstate its value. Use of this approach might also be inconsistent with the context in which manure is used; that is, some CAFOs may spread manure as a means of disposal, with the optimal application rate being that which satisfies crops needs at the lowest cost. Also, some operations may already be benefitting from manure as a potential income source; therefore, this income may already be reflected in the baseline financial data and any potential revenue from manure sales would not result in additional incremental income to a regulated CAFO.

Although EPA disagrees with comments suggesting that it has not considered the increased cost of using manure due to added costs associated with managing, storing, hauling, processing, and distributing excess manure nutrients off-site to comply with the regulation, it agrees with recommendations by USDA researchers that should EPA consider the revenue from the sale of manure as part of the analysis, then it should also consider any additional incurred costs (e.g., payments to crop growers to accept manure, in some cases). To date, EPA has not accounted for such additional costs. EPA also acknowledges comments noting that because the rule will not result in an (incremental) increase in the value of manure, it should not account for incremental offsetting costs.

Finally, EPA acknowledges concerns expressed by some commenters that the final rule might negatively affect the market for manure and manure nutrients. These commenters believe that the regulations will reduce or eliminate the inherent market value of manure by restricting the amount of manure that can be applied on available land, thus reducing the demand for manure nutrients and creating additional manure nutrient surpluses. These commenters claim that this might also increase the incentive

for CAFOs to subsidize the use of such manure, thus further increasing the CAFO's disposal costs. Many of these commenters claimed that such effects would be more pronounced under a phosphorus-based standard than under a nitrogen-based standard. Given the possibility that the value of manure may decline as a result of this rule, at least in the near term, EPA decided not to calculate the potential benefits from manure sales using current available data and approaches to approximate the potential market value of manure. Alternative market data and information to support an analysis assuming additional income from the sale of excess manure are not available and were not recommended to EPA during the public comment period.

Because of the inherent difficulties of conducting such an analysis and because of the possibility that the available data and analytical approaches might misrepresent the market value of manure nutrients, EPA's analysis of the final rule does not consider the potential income generated from the sale of manure as an offset to estimated compliance costs. Therefore, EPA continues to base its determination of whether the regulation is "economically achievable" does not rely on assumptions of manure sales as part of its regulatory analysis and therefore reflects the highest level of impacts projected. Despite this limitation of EPA's analysis, the Agency believes that some operations will benefit from the sale of excess manure and that the results of its analysis to determine "economic achievability" is sufficiently conservative and depicts the highest level of potential effects.

2.5 METHODOLOGY TO ASSESS BROADER MARKET LEVEL EFFECTS

EPA's CAFO level analysis measures the economic effects on regulated facilities. As these effects influence the decisions of farmers, processors, packers, and ultimately consumers, they translate into changes in the price and quantity of farm commodities and retail foods and generate changes throughout the national economy. To better understand the potential impacts, EPA conducts a market level analysis. Section 2.5.1 provides an overview of EPA's market model and input-output model to evaluate broader market level effects and it describes the input data and parameters for these models.

EPA did not receive comments that directly criticize the underlying data and modeling framework used to conduct this analysis. However, comments were submitted that question the appropriateness of EPA's modeling results, focusing on effects to regulated CAFOs and also regions and local communities. Section 2.5.2 discusses EPA's response to these comments. For more information see response to comments DCN CAFO 201438-186, DCN CAFO 400120-20, and DCN CAFO 201352-101 available in the Comment Response Document.

2.5.1 Market Model Methodology and Input Data

EPA's market analysis evaluates the effects of the final regulations on national markets based on the estimated total annual industry compliance costs (presented in Section 3.5 of this report). EPA's market model analysis predicts the effects of the final regulations on national markets in terms of the broader market changes that might result due to compliance with requirements. This analysis examines changes throughout the economy as impacts are absorbed at various stages of the food marketing chain. The analysis is intended as a long-run analysis to show impacts of the regulations on society, including effects on price and quantity. Other market changes examined by EPA include changes in regional employment and changes in U.S. livestock and poultry trade (imports and exports). This analysis uses national level production and employment impacts to approximate potential regional impacts at the community level effects.

The analysis uses a linear partial equilibrium model adapted from the COSTBEN model developed by the USDA's Economic Research Service (Hahn, 1996a, 1996b). The modified EPA model provides a means to conduct a long-run static analysis to measure the market effects of the final regulations in terms of predicted changes in farm and retail prices and product quantities. Appendix B of the Proposal EA provides a more detailed discussion of the market model's structure and operation. The market model assesses the estimated direct impacts associated with complying with the CAFO regulations, measured in terms of dollars of industry output per year. This approach allows EPA to compute market level changes in terms of changes in consumer and farm level prices for the selected products and changes in the amount of commodities produced and traded internationally (expressed as changes in U.S. product exports and imports).

Once the changes in output (price times quantity) are estimated using EPA's market model, EPA evaluates these changes using input-output multipliers to estimate the ripple effects as changes in one industry pass through its suppliers and the rest of the economy. Input-output analysis uses multipliers that forecast how much more or less output the whole economy would produce as a result of each dollar increase or decrease in spending by a given industry. For this analysis, EPA uses multipliers from the Regional Input-Output Modeling System, version 2 (RIMS II) (USDC, 1997, 1996) to estimate the impact on the national economy of changes in the animal products industry. Multiplying the original change by the multiplier gives a measure of the total direct effects (on immediate suppliers), indirect effects (on the suppliers' suppliers and all other industries), and induced effects (on households' spending and labor decisions). These estimates might be driven by an original change in final demand, output, earnings, or employment and yield results in terms of final demand, output, earnings, tax revenue, or employment changes. Estimated effects include changes in national employment (measured in terms of full-time equivalents) and changes in economic output (measured in terms of changes in Gross Domestic Product).

The data EPA collected to conduct this analysis span a wide range of primary and secondary data sources from USDA, the U.S. Department of Commerce's Bureau of Labor Statistics (BLS), various land grant universities, industry, and other sources, as documented in the Proposal EA. EPA uses 1997 as the base year, which is consistent with the engineering cost estimates that reflect 1997 conditions. The input data EPA uses for this analysis are presented in Tables 2-10 and 2-11 of this report. Detailed citations for each base year value appear in Section 4.4 and Appendix B of the Proposal EA (USEPA, 2001a). The Proposal EA provides additional detail on this approach, explaining EPA's justification for the approach as well as the theoretical concepts underlying the analysis.

Market data used as inputs to this model are from a wide range of USDA data and land grant university research. In keeping with the focus of this market analysis, the supply and demand elasticities used are long-run elasticities, rather than short-run elasticities. Short-run elasticities are not considered appropriate for this analysis (see response to comments DCN CAFO 400120-20 in the EPA's Comment Response Document). The approach used for EPA's market level analysis is discussed in greater detail in Section 4.4 of the Proposal EA (USEPA, 2001a). Section 4.4.1 of the Proposal EA presents an overview of the model and Section 4.4.2 presents the data sources used for the analysis.

In general, EPA also considered whether the final regulations could have community-level and/or regional impacts, e.g., if they substantially alter the competitive position of livestock and poultry production across the nation, or lead to growth or reduction in farm production (in- or out-migration) in different regions and communities. Ongoing structural and technological change in these industries has

influenced where farmers operate and has contributed to locational shifts between traditional production regions and the emergent, nontraditional regions. Production is growing rapidly in these regions because of competitive pressures from more specialized producers who face lower per-unit costs of production. This is especially true in hog and dairy production (El-Osta and Johnson, 1998; McBride, 1997; Iowa State University, 1998; Martinez, 1999). EPA believes that the regulations would not have a disproportionate effect on regions and communities.

The general market model framework EPA uses does provides a means to evaluate regional and community level effects. To do this, EPA distributes national employment estimates on a regional basis using state level production data for larger-sized livestock and poultry operations for each sector. The data EPA uses to allocate national employment impacts in the agriculture sectors are from the 1997 Census (USDA/NASS, 1999a) with imputed values to correct for omitted values (Westat, 2000), supplemented with other state level data from USDA (USDA/NASS, 1998b). The approach EPA used approximates changes in regional employment by disaggregating the national employment reductions (both direct and indirect) to indicate regions where impacts of the final regulations are most likely to occur. For each animal sector, EPA distributes the national direct employment impacts at the CAFO and processor/wholesale level onto a regional basis using state level data that reflect livestock and poultry production by the largest facilities in each state. These data include the 1997 Census (USDA/NASS, 1999a) and other USDA data (USDA/NASS, 1998b), with imputed values for omitted USDA data (Westat, 2000). EPA allocates total national indirect and induced employment changes onto a regional basis according to each state's share of 1997 total U.S. population as reported for 1997 from U.S. Census data (U.S. Census Bureau, 1999). The direct and indirect/induced results are summed to calculate the total impact for each state. EPA evaluates regional impacts from these state level estimates, aggregated to USDA's farm production regions, as shown in Figure 2-1 of the Proposal EA.

The available approach discussed in this EA and the best available data for EPA to evaluate these concerns, however, are not sufficient to more precisely assess community or regional impacts.

Nevertheless, EPA concludes from its broader-based analysis that regional and community level effects are estimated to be modest, but do tend to be concentrated within the more traditional agricultural regions. EPA does not expect that this rule will have a significant impact on where animals are raised. On one hand, on-site improvements in waste management and disposal, as required by the final rule, could accelerate recent shifts in production to more nontraditional regions as higher-cost producers in some regions exit the market to avoid the relatively high retrofitting costs associated with bringing existing facilities into compliance. On the other hand, the final regulations might favor more traditional production systems where operators grow both livestock and crops, since these operations tend to have available cropland for land application of manure nutrients. These types of operations tend to be more diverse and less specialized and, generally, smaller in size. Long-standing farm services and input supply industries in these areas could likewise benefit from the final rule, given the need to support on-site improvements in manure management and disposal. Local and regional governments, as well as other nonagricultural enterprises, would also benefit.

2.5.2 Public Comments on EPA's Market Analysis

EPA received public comments on its market model approach that question the appropriateness of EPA's market model. These comments focus mostly on the implications of the Agency's assessment of the potential effects to regulated CAFOs and also the broader effects of the regulations on regional markets (especially local communities and agricultural support industries). For more information, see

response to comments DCN CAFO 201438-186, DCN CAFO 400120-20, and DCN CAFO 201352-101 available in the Comment response Document.

Most commenters recognize the distinctions between prices as observed by individual farms and prices at the aggregate level and generally concurr with EPA that over the long run, prices and quantities will adjust to a post-regulatory equilibrium (see, for example, NMPF, 2001; FAPRI, 2001a; National Center, 2002). However, these commenters expressed concern about short-run impacts. (Short-run impacts on farms are assessed using the approach described in Section 2.3, which details the Agency's approach for determining economic achievability; see Section 3.3.) Some commenters recommended that EPA consider using a more complicated modeling approach (NMPF, 2001), such as that used by FAPRI in its parallel analysis conducted of the proposed CAFO regulations. Other commenters noted that EPA's model does not capture supply and demand shifts that might occur among species (e.g., NMPF, 2001a).

Another commenter requested that EPA perform a detailed assessment of impacts on individual communities and regions (National Center, 2002—DCN 400159). This commenter recommended that EPA further analyze and report results by geographic location based on the number of CAFO enterprises and their respective volumes of animal production that are expected to experience financial stress as a result of the final regulations. This commenter also pointed to FAPRI's analysis that indicates that financial stress would be clustered in some regions rather than spread uniformly across the country. The commenter recommended that EPA more closely evaluate the quantity of income, employment, and tax base lost on those farms that are determined to go out of business to calculate the multiplier effects in the surrounding community. See response to comment regarding EPA's analysis of the effects of the regulation on regional or community level effects (DCN CAFO400159-26).

EPA disagrees that using an alternative modeling approach is preferable to the model EPA's uses. Alternative modeling approaches—such as that used by FAPRI—do not produce results that are radically different from EPA results, as confirmed by FAPRI itself (see: DCN 235619). Although EPA uses a static model, rather than a dynamic model, this model was developed and used by USDA to evaluate the effects of changes in policy on the U.S. economy. This model is readily available and usable, provided at no charge by USDA, and is available in EPA's record for full public review and comment. FAPRI's model is proprietary and access to its use is restricted; also, FAPRI has not provided EPA the opportunity to submit their model for public review and comment in order to meet the Agency's administrative requirements for public notice. Finally, use of USDA's standing model has the added benefit of being simpler to operate, whereas FAPRI's model consists of a large scale econometric model of both U.S. and world agriculture containing roughly 5,000 behavioral equations and identities. See also response to comment DCN CAFO201352-136-4 regarding recommendations to use data and modeling techniques similar to FAPRI.

EPA believes that comments expressing concerns about the inability of EPA model to account for interspecies shifts in supply and demand (e.g., shifts in demand between products that might be considered close substitutes, such as beef and pork) are overstated. EPA readily acknowledged that its market model is not able to account for interspecies shifts in supply and demand in Section 2 and Appendix C of the Proposal EA. EPA decided not to account for inter-species shifts among different sectors in order to avoid making large-scale changes to USDA's COSTBEN-type framework. As a result, EPA's analysis may not fully capture cases where price or production costs changes in one sector may cause a shift in production from one commodity to another. However, EPA does not believe that such effects, though probable, are likely to be significant and substantially alter EPA's analysis of these

regulated sectors. Given the overall modest effects predicted for these final regulations (presented in Section 3 of the Final EA) such shifts would likely be very minimal. First, available USDA estimates of the cross-price elasticity of demand for these products tend to be small, even for close substitutes such as beef and pork (see DCN 70336), such that a change in the price of beef will have a relatively small impact on the demand for pork. Second, because EPA is regulating each of these sectors more or less equally, such that changes in production costs within one sector should not cause producers to shift from one sector to another. Also, because cross-price elasticities tend to be of similar magnitude across these food commodities, the net effect in shifts in demand between species will likely be minimal. Finally, because Americans are among the largest consumers of meat, dairy, and poultry products in the world, EPA believes that the strength and size of the U.S. market will cause markets to adjust over time and act to offset higher (short-term) costs. There have been ongoing changes in consumer demand trends, however, that are independent from EPA's regulation. For example, in the past few decades there has been a steady shift in the demand from the consumption of red meat to poultry products, and also shifts away from the demand for other products, such as eggs and some types of dairy foods. Accounting for these other factors affecting overall consumer demand—independent of the effects of EPA's regulation—are difficult to predict. The effects of the international demand for these products are also uncertain, given a wide range of market factors (e.g., relative prices and exchange rate effects, acceptance of U.S. foods abroad due to growing reluctance to U.S. hormone use and genetically modified foods, existing international trade restrictions, etc.).

In response to comments expressing concern over the time frame of the elasticity measure that were used to analyze market level effects, EPA disagrees with the comments that EPA should use short-run elasticities rather than long-run elasticities for EPA's market level analysis. EPA's market model is intended as a long-run analysis to assess potential changes in overall supply and demand conditions from EPA's regulations within the affected markets, including changes in prices and produced and traded quantities, as well as other market changes. Use of long-run elasticities are more appropriate to estimate market equilibrium effects on the U.S. economy. In the nearer term, the regulations should have little effect on prices and quantities. EPA believes that comments concerned about the short-run effects on regulated CAFOs and are more appropriately directed at EPA's CAFO level analysis. By contrast, EPA's market level analysis is intended to assess the market equilibrium effects and other effects on the economy as an additional aspect of the Agency's regulatory impact analysis.

EPA also disagrees that use of long-run elasticities distort EPA's cost estimates for this rule. For this rule, EPA calculates total costs by aggregating facility-level compliance costs estimated across all regulated CAFOs (which are then expressed on an annualized basis). These total costs are based on estimated engineering costs for select representative facilities (comprised of roughly individual 1,600 cost models). Elasticity measures and other market level parameters are not directly factored in this calculation. Also, EPA estimates of total social costs are calculated in terms of pre-tax costs and include broader social costs of the rule. Based on the results of EPA's but also FAPRI's market level analysis, the broader impact of these regulations of national markets are expected to be modest. These results indicate that any additional costs that might be incurred given changes in market conditions, but that are not directly accounted for by EPA's approach, are likely relatively small. Given that the majority of confinement operations (more than 90 percent of all animal feeding operations or AFOs) will not be directly affected by EPA's regulations, EPA believes that any eventual changes in market conditions resulting in higher prices over time might benefit non-regulated AFOs and also regulated CAFOs. See response to comment DCN CAFO 400120-20.

Regarding the Agency's analysis of the regional effects of the regulation, EPA disagrees with comments stating that this analysis does not adequately account for broad differential effects among the animal production regions. EPA acknowledges the merits of comments noting that the size of an operation that goes out of business—based on the number of animals raised at an operation and the resultant change in industry production—is relevant to an assessment of the effects of this regulation on communities and regions (see, for example, comment DCN 400159). However, the available data and the limitations of EPA modeling approach restrict the types of analyses the Agency is able to conduct. Instead, EPA's national level framework uses a representative farm approach to depict baseline financial conditions at representative model CAFOs and to extrapolate CAFO level impacts to all operations nationwide. This approach is not able to precisely measure changes in animal production in conjunction with model facilities that are predicted to close within a specific geographic location. Although EPA's approach may not appropriate to evaluate the potential effects at an individual affected CAFO or specific effects within a particular production region or farming community, such a broad-based approach is often consistent with other national level policy analyses conducted by researchers at USDA, the land grant universities, and industry analysts.

EPA believes that its analysis meets the Agency's obligation to perform a reasonable analysis with the best data EPA can obtain. A more in-depth and detailed study of these effects on individual communities and regions is not feasible given limited available data and information. Data necessary for a more detailed study would require a census or full survey of these industries, stratified by geographic location, indicating a full range of characteristics specific to an operation's production system, including financial status. This is the type of information that EPA gathers in its Section 308 survey. This information, along with an engineering assessment of what would be required under alternative regulatory options, would provide the basis to assess regional changes in income and employment (building its analysis from the bottom-up rather than using a top-down approach used by EPA). Because EPA did not undertake a Section 308 survey,[23] data were not available to implement such an approach for this rulemaking. The type of study this commenter recommends, however, is even more detailed and would require additional data, requiring that data be collected from all farming operations within a community—both regulated and non-regulated—as well as businesses and other institutions that might be affiliated with those farms. More focused analyses are sometimes conducted by academia to examine very narrowly-defined policy effects within a particular community or U.S. county; these analyses require a more detailed framework and the use of specific data collected from actual businesses in that community, including other farming and non-farming operations in that community. EPA typically does not conduct analyses conducted at this level of detail in developing national level regulations. Data and information were not available to support the more detailed analysis suggested by some commenters. EPA believes that the analysis it conducted using the best data available adequately informed the Agency's decision-making process for this rule. For more information see response to comment DCN CAFO400159-26.

[23] See discussion in the preamble to the 2001 Proposal at 66 FR 3079.

Table 2-10. Market Model Baseline Values (1997)

Variable	Beef [a/]	Dairy [b/]	Hog	Broiler [c/]	Turkey [c/]	Layer [d/]
Farm Products						
Price	$66.09/cwt	$13.38/cwt	$54.30/cwt	37¢/lb	40¢/lb	70¢/doz.
Quantity Produced	40,893 thous. head	156,100 mil. lbs	91,960 thous. head	--	--	6,473 mil. doz.
Quantity Exported	282 thous. head	0	55 thous. head	--	--	895 mil. doz.
Quantity Imported	2,046 thous. head	0	3,178 thous. head	--	--	0
Retail Products						
Price	$2.80/lb	145.5	$2.45/lb	151¢/lb	105¢/lb	106¢/doz.
Quantity Demanded	25,824 mil. lbs	156,100 mil. lbs	17,274 mil. lbs	27,551 mil. lbs	5,412 mil. lbs	5,578 mil. doz.
Quantity Exported	2,136 mil. lbs	5,244 mil. lbs	1,044 mil. lbs.	5,048 mil. lbs	598 mil. lbs	228 mil. doz.
Quantity Imported	2,343 mil. lbs	4,383 mil. lbs	633 mil. lbs	5 mil. lbs	0	7 mil. doz.
Elasticities						
Demand Elasticity	-0.621	-0.247	-0.728	-0.372	-0.535	-0.110
Supply Elasticity	1.020	1.527	0.628	0.200	0.200	0.942

Sources: See USEPA, 2001a.

[a/]Includes veal and heifer.

[b/] Consumer Price Index for Dairy Products as a composite good. Output is on a milk equivalent, total solids basis.

[c/]Includes various forms of chicken meat, such as broilers and mixed poultry meat. Because of coordination between the broiler feeding and processing sectors, it is not possible to determine prices per animal at the farm level. The chicken and turkey markets are modeled in terms of pounds of production.

[d/]Eggs (million dozen). Layer "exports" represent the number of eggs diverted to hatcheries (assumed as fixed).

Table 2-11. RIMS II Multipliers for Secondary Impact Analysis

Sector Name	Total Output	Total Employment[a/]	Own Industry Employment[a/]
Farm Products			
Poultry and Eggs	2.8217	26.3665	12.1043
Meat Animals	2.1692	20.8698	10.2072
Hogs	--	--	--
Cattle Feeding	--	--	--
Dairy Farm Products	2.3215	23.5130	11.5267
Food and Kindred Products[b/]			
Meat Packing Plants	2.4755	18.2332	3.3511
Meat/Egg Processing	--	--	--
Poultry Processing	2.1822	18.0150	6.1750
Fluid Milk Processing	2.3968	16.3311	2.6981
Dairy Processing	--	--	--
Other			
Construction	3.0851	32.4816	10.9000
Households	2.1642	23.8483	0.2823

Sources: See USDC, 1997, 1996.
[a/]Employment multipliers adjusted for inflation to 1997 values based on CPI-U.
[b/]Processing sector multipliers adjusted to eliminate CAFO level impacts.

SECTION THREE

TOTAL COSTS AND FINANCIAL EFFECTS OF THE FINAL CAFO REGULATIONS

This section presents the national level aggregate compliance costs and economic impacts on regulated facilities under the final CAFO regulations. Section 3.1 describes the regulated sectors and presents EPA's estimates of the number of affected facilities. Section 3.2 presents EPA's estimates of the expected pre-tax costs (2001 dollars) to industry as a result of the final CAFO regulations for both the NPDES and ELG revisions. (Section 5 of this report presents additional costs of the final regulations to Federal and State permitting authorities.) Section 3.3 and 3.4 present the results of EPA's analysis that evaluates the financial effects on CAFOs with more than 1,000 AU under the effluent guideline regulations. Section 3.3 examines the impact on existing facilities of complying with the final ELG requirements for Best Available Technologies Economically Achievable (BATEA); Section 3.4 examines the impact to new facilities on complying with the final ELG requirements for New Source Performance Standards (NSPS). Finally, Section 3.5 presents the results of EPA's market level analysis, focusing on the potential secondary impacts of the final NPDES and ELG regulations on both consumer and farm level prices and quantities, as well as changes in employment and economic output at the national level.

3.1 IDENTIFICATION AND NUMBER OF AFFECTED CAFOs

3.1.1 Identification of Affected Industry Sectors

3.1.1.1 Beef Subcategory

Cattle feedlots are identified under NAICS 112112 (SIC 0211, beef cattle feedlots) and NAICS 112111, beef cattle ranching and farming (SIC 0212, beef cattle, except feedlots). This sector comprises establishments primarily engaged in feeding cattle and calves for fattening, including beef cattle feedlots and feed yards (except stockyards for transportation).

The beef cattle industry can be divided into four separate producer segments:

- *Feedlot operations* fatten or "finish" feeder cattle before slaughter and constitute the final phase of fed cattle production. Calves usually begin the finishing stage after reaching 6 months of age or reaching at least 400 pounds. Cattle are typically held for 150 to 180 days and weigh 1,150 to 1,250 pounds (for steers) or 1,050 to 1,150 pounds (for heifers) at slaughter.

- *Veal operations* raise male dairy calves for slaughter. The majority of calves are "special fed" or raised on a low-fiber diet until about 16 to 20 weeks of age, when they weigh about 450 pounds.

- *Stocker or backgrounding operations* coordinate the flow of animals from breeding operations to feedlots by feeding calves after weaning and before they enter a feedlot. Calves are kept 60 days to 6 months or until they reach a weight of about 400 pounds.

- *Cow-calf producers* typically maintain a herd of mature cows, some replacement heifers, and a few bulls, and they breed and raise calves to prepare them for fattening at a feedlot. Calves typically reach maturity on pasture and hay and are usually sold at weaning. Cow-calf operators may also retain the calves and continue to raise them on pasture until they reach 600 to 800 pounds and are ready for the feedlot.

AFOs in this sector that might be affected by the final regulations include facilities that confine animals. More information on the types of facilities in this sector that might be covered by the final regulations is provided in the *Development Document* (USEPA, 2002) and the rulemaking record.

3.1.1.2 Dairy Subcategory

Operations that produce milk are identified under NAICS 11212, dairy cattle and milk production (SIC 0241, dairy farms). A dairy operation may have several types of animal groups present, including the following:

- *Calves* (0 to 5 months)
- *Heifers* (6 to 24 months)
- *Lactating dairy cows* (currently producing milk)
- *Cows close to calving and dry cows* (not currently producing milk)
- *Bulls*

AFOs in this sector that might be affected by the final regulations include facilities that confine animals. More information on the types of facilities in this sector that might be covered by the final regulations is provided in the *Development Document* (USEPA, 2002) and the rulemaking record.

3.1.1.3 Hog Subcategory

Hog operations that raise or feed hogs and pigs either independently or on a contract basis are identified under NAICS 11221, hog and pig farming (SIC 0213, hogs). Hog operations may be categorized by six facility types based on the life stage of the animal in which they specialize:

- *Farrow-to-wean* operations that breed pigs and ship 10- to 15-pound pigs to nursery operations.
- *Farrowing-nursery* operations that breed pigs and ship 40- to 60-pound "feeder" pigs to growing-finishing operations.
- *Nursery* operations that manage weaned pigs (more than 10 to 15 pounds) and ship 40- to 60-pound "feeder" pigs to growing-finishing operations.
- *Growing-finishing or feeder-to-finish* operations that handle 40- to 60-pound pigs and "finish" them to market weights of about 255 pounds.

- *Farrow-to-finish* operations that handle all stages of production from breeding through finishing.

- *Wean-to-finish* operations that handle all stages of production, except breeding, from weaning (10- to 15-pound pigs) through finishing.

AFOs in this sector that might be affected by the final regulations include facilities that confine animals. More information on the types of facilities in this sector that might be covered by the final regulations is provided in the *Development Document* (USEPA, 2002) and the rulemaking record.

3.1.1.4 Poultry Subcategory

Poultry operations can be classified into three individual sectors based on the type of commodity in which they specialize. These sectors include operations that breed and/or raise the following:

- *Broilers* or young meat chickens that are raised to a live weight of 4 to 4.5 pounds and other meat-type chickens, including roasters that are raised to 8 to 9 pounds. Classification: NAICS 11232, broilers and other meat-type chickens (SIC 0251, broiler, fryer, and roaster chickens).

- *Turkeys and turkey hens*, including whole turkey hens that range from 8 to 15 pounds at slaughter, depending on market, and also turkey "canners and cut-ups" that range from 22 to 40 pounds. Classification: NAICS 11233, turkey production (SIC 0253, turkey and turkey eggs).

- *Hens that lay shell eggs*, including eggs that are sold for human consumption and eggs that are produced for hatching purposes. Classification: NAICS 11231, Chicken egg production (SIC 0252, chicken eggs), and NAICS 11234, poultry hatcheries (SIC 0254, poultry hatcheries).

AFOs in this sector that might be affected by the final regulations include facilities that confine animals. More information on the types of facilities in this sector that might be covered by the final regulations is provided in the *Development Document* (USEPA, 2002) and the rulemaking record.

3.1.2 Estimated Number of AFOs and Regulated CAFOs

USDA reports that there were 1.1 million livestock and poultry farms in the United States in 1997 (USDA/NASS, 1999a). This number includes both confinement and non-confinement (grazing and rangefed) production, as well as both commercial and noncommercial operations. As shown in Table 3-1, USDA reports that about 240,000 operations raise animals in confinement (Kellogg, 2002). USDA estimates the number of operations with confined animals by focusing on those operations that meet certain minimum characteristics based on USDA assumptions in terms of the number of animals at an operation. This approach does not specifically focus on characteristics that meet the regulatory definition of an animal feeding operation, as codified at 40 CFR Part 122, according to the number of days animals are confined or the amount of vegetative cover at the production area. As stated in the 2001 Notice, EPA believes this is a reasonable approach to estimate the potential number of confinement operations, given best available data and other limited information.

To estimate the number of AFOs and "potential" CAFOs, USDA first defines "farms with confined livestock types" to be farms with 4 or more animal units of any combination of fattened cattle, milk cows, swine, chickens or turkeys (Kellogg, 2002). In USDA's analysis, the use of animal units is based on the USDA definitions of 1,000 pounds of liveweight and not EPA's regulatory definitions, which are expressed in terms of the number of animals on-site (codified in 40 CFR Part 122). USDA estimates of the number of "potential" CAFOs is based on EPA's regulatory definitions used for the proposed regulations. As defined for the proposed CAFO regulations, one animal unit (AU) is equivalent to one slaughter or feeder cattle, calf or heifer; 0.7 mature dairy cattle; 2.5 hogs (over 55 pounds) or 5 nursery pigs; 55 turkeys; 30 egg-laying chickens (where a wet manure management system is used), and 100 broilers and egg-laying chickens, regardless of the animal waste system used. (Note that the final regulation instead defines one AU as equivalent to 125 broilers and 82 egg-laying chickens; see the final rule preamble). The primary source of data for USDA's estimate is the 1997 Census of Agriculture (Census). More information on these data is provided in Kellogg (2002) and the 2001 Notice (66 FR 58556).

Table 3-1 shows EPA's estimates of the number of operations that would be defined as CAFOs under the final regulation (based on USDA's estimates). Size groups shown break out facilities by broad AU size groups (>1,000 AU and increments among operations with between 300 AU and 1,000 AU).[23] The data reflected in this table are adjusted from USDA's original estimates to account for layer facilities (800 operations) with wet manure management systems that have a different AU scale and that were not accounted for in USDA estimates of potential CAFOs. EPA's estimates also differ because other poultry sector data are assessed using a different AU scale—1,000 AU equals 125,000 broilers and 82,000 egg laying chickens—where a dry manure management system is used. EPA estimates further breakouts of the number of egg operations by the type of manure management systems, as well as among hog operations, by whether these are farrow-finish and farrowing operations (grouped under FF) or grow-finish (GF) operations. More information on EPA's estimates is provided in the *Development Document* (USEPA, 2002) and the rulemaking record.

As shown in Table 3-1, EPA estimates that there were about 10,500 operations that confine more than 1,000 AU in 1997, accounting for about 5 percent of all confinement operations. Total operations with between 300 and 1,000 AU are estimated at about 33,100 operations (Table 3-1). Table 5-2 in Section 5 of this report shows EPA's estimate of the number of CAFOs by State and EPA region.

To assess the number of operations with between 300 and 1,000 AU that are *defined* as CAFOs under the existing NPDES permit requirements, EPA uses available data to determine the share of all operations in this size group that are affected by the final regulations. EPA uses data and information from USDA, State extension service experts, and agricultural professionals to derive percentage estimates of the number of operations in each sector that meet the conditions of the existing rule for being defined as a CAFO. Table 3-2 shows the resultant number of operations with 300 to 1,000 AU that EPA expects will be defined as CAFOs based on the existing NPDES regulations (labeled in the table as "Status Quo"). More detailed information on EPA's estimates is in the *NPDES Support Document* available in the rulemaking record (USEPA, 2002n).

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[23]As defined for the final CAFO regulations, one animal unit (AU) is equivalent to one slaughter or feeder cattle, calf or heifer; 0.7 mature dairy cattle; 2.5 hogs (over 55 pounds) or 5 nursery pigs; 55 turkeys; 30 egg-laying chickens (where a wet manure management system is used), and 125 broilers and 82 egg-laying chickens, regardless of the animal waste system used.

Table 3-1. Number of AFOs and Potential CAFOs (1997)

Sector	Total AFOs	Total Operations by Size Group	
		>1,000 AU [a/]	300-1,000 AU
	(Number of Operations)		
Cattle	17,796	1,766	2,682
Heifers	3,843	242	724
Veal	168	12	57
Dairy	94,787	1,450	5,780
Hogs	51,772	3,924	9,901
Hogs-FF [b/]		1,939	6,112
Hogs-GF [b/]		1,985	3,789
Chickens	24,221	2,744	12,372
Broilers	17,776	1,632	10,402
Layers: dry [b/]	6,445	729	1,170
Layers: wet [b/]		383	800
Turkeys	3,309	388	1,615
Other Cattle [c/]	39,634	0	0
Total CAFOs	**237,821** [d/]	**10,526**	**33,131**

Source: Derived by EPA from USDA estimates (Kellogg, 2002). Rounded to nearest tenth. AFO totals include operations that raise more than a single animal type. Potential CAFOs adjusted for mixed operations. See *Development Document* (USEPA, 2002) for more detailed information.

[1/] As defined for the final CAFO regulations, one AU is equivalent to: one slaughter or feeder cattle, calf or heifer; 0.7 mature dairy cattle; 2.5 hogs (over 55 pounds) or 5 nursery pigs; 55 turkeys; 30 egg-laying chickens (where a wet manure management system is used), and 125 broilers and 82 egg-laying chickens (with a dry waste system).

[2/] Estimated by EPA to break out among production system types (farrowing and farrow-finish [FF] and grow-finish [GF], and laying operations with wet and dry manure management systems).

[3/] Cattle other than fattened cattle or milk cows.

[4/] USDA's estimate of the total number of AFOs is adjusted for specialty cases. Specialty cases (estimated at 2,291 operations) are dairies that went out of business in 1997, swine operations with feeder pigs only, and egg-hatching operations. USDA estimates of the total number of potential CAFOs adjusts for double counting of operations with animal populations in one or more sectors that qualify as potential CAFOs.

Table 3-3 shows estimates of the number of facilities that EPA expects will be *designated* as CAFOs by the permitting authority because they are significant contributors to water quality impairment. EPA does not anticipate that many AFOs with fewer than 1,000 AU will be designated by the permitting authority and subject to the final requirements. EPA is aware of very few AFOs that have been designated as CAFOs in the past 20 years. Based on available USDA analyses that measure excessive nutrient application on cropland in some production areas and other farm level data by sector, facility size, and region, EPA estimates that designation might add 172 operations, expressed over the term of a 5-year permit period nationwide (or, on average, about 35 operations each year). More information on EPA's estimates is available in the rulemaking record (USEPA, 2002n).

Table 3-2. Number of Potential Operations *Defined* as CAFOs (1997)

Sector	Total Operations Defined as CAFOs	
	>1,000 AU	300-1,000 AU
	(number of operations)	
Cattle	1,766	174
Heifers	242	230
Veal	12	7
Dairy	1,450	1,949
Hogs	3,924	1,485
Broilers	1,632	520
Layers - Dry	729	26
Layers - Wet	383	24
Turkeys	388	37
Total CAFOs	10,526	4,452

Source: EPA's *Development Document* (USEPA, 2002) and NPDES Support Document (USEPA, 2002n). See notes Table 3-1.

Table 3-3. Number of Potential Operations *Designated* as CAFOs (1997-2001)

Sector/Size Category	Total	Operations with	Operations with
	(number of operations)		
Cattle	15	13	2
Veal	0	0	0
Heifers	3	3	0
Dairy	30	28	2
Hogs	52	50	2
Broilers	52	50	2
Layers - Dry	2	1	1
Layers - Wet	8	7	1
Turkeys	10	8	2
Total	172	160	12

Source: EPA's *Development Document* (USEPA, 2002) and NPDES Support Document (USEPA, 2002n). See notes Table 3-1. Estimates are shown projected over a 5-year period.

3.2 ESTIMATED ANNUAL COSTS OF THE FINAL CAFO REGULATIONS

This section presents EPA's estimates of the compliance costs to regulated CAFOs for a range of technology options considered by the Agency during the development of these regulations. (Section 5 of this report presents costs of the final regulations to Federal and State permitting authorities.)

This EA presents the results of two technology options where EPA has estimated the cost of land application based on nitrogen-based application rates only (Option 1) and also the cost of land application based on nitrogen-based application rates, except in those instances where EPA believes that phosphorus-based rates are likely to be appropriate (Option 2). The final rule specifies that the determination of application rates is to be based on the technical standards established by the Director and EPA expects that these standards will require phosphorus-based application, where appropriate. The rule also provides for these standards to include appropriate flexibilities in the use of phosphorus-based rates, such as multi-year phosphorus application, but the potential costs savings resulting from these flexibilities are not reflected in the analysis. As a result, the cost and economic impacts of this rule may have been overestimated.

EPA evaluated the costs of these technology options for all operations defined as CAFOs with more than 1,000 AU and for those operations that are defined as CAFOs with between 300 and 1,000 AU. EPA calculates these costs using the data and approaches described in the *Development Document* (USEPA, 2002) and in Section 2 of this report. For the purpose of estimating total regulatory costs of the final CAFO regulations, EPA assumes that the individual per-CAFO costs to comply with the effluent guideline regulations are similar to the costs that will be incurred by operations with between 300 and 1,000 AU to comply with the revised NPDES requirements (although these smaller-sized operations will be subject to BPJ and not the ELG requirements). These cost estimates, therefore, may further be overstated for this size category.

3.2.1 Compliance Costs to CAFOs Under the Final Regulations

Table 3-4 summarizes the total annualized compliance costs to CAFOs. Results are shown as a range of estimates between Option 1 and Option 2. The table shows these costs broken out by sector and by broad facility size category. As shown in the table, EPA estimates the total estimated costs to CAFOs range from $141 million (Option 1) to $326 million annually (Option 2), expressed as pre-tax, 2001 dollars. Most of this cost (roughly 50 percent) is incurred by the dairy sector, with another roughly 30 percent incurred within the cattle sectors (including beef, veal, and heifer sectors).

Of this total, EPA estimates that the cost to operations with more than 1,000 AU ranges from $119 million (Option 1) to $283 million annually (Option 2). Total estimated costs to facilities defined as CAFOs with between 300 and 1,000 AU ranges from $19 million (Option 1) to $39 million annually (Option 2). EPA estimates that of the total cost to operations that may be designated as CAFOs ranges from about $3 million to $4 million annually, depending on the regulatory option.

These aggregated cost estimates reflect pre-tax costs. However, EPA's model calculates both pre-tax and post-tax costs (see Section 2.2.4). The post-tax costs reflect the fact that a CAFO would be able to depreciate or expense these costs, thus generating a tax savings. Post-tax costs thus are the actual costs the CAFO would face. Pre-tax costs reflect the estimated total social cost of the proposed regulations, including lost tax revenue to governments. Pre-tax dollars are used when comparing

estimated costs to monetized benefits that are estimated to accrue under the final regulations (see Section 5). All costs presented in this section are expressed in terms of pre-tax dollars and do not account for annual tax savings to CAFOs. However, post-tax costs are also used to evaluate impacts on regulated facilities using a discounted cash flow analysis, as presented in Section 3.3.

Estimated compliance costs are initially evaluated in 1997 dollars and then adjusted to 2001 dollars using *Engineering News Record's* Construction Cost Index (CCI) (ENR, 2002).[24] The base year for this analysis is 1997, corresponding with available data from USDA's 1997 Agriculture Census. Estimated compliance costs presented in the *Development Document* are estimated in 1997 dollars (USEPA, 2002).

Table 3-4. Annual Pre-tax Cost of the Rule, $2001 (Option 1 & Option 2)

Sector	Number of Operations		Aggregate Incremental Costs			
	CAFOs >1,000 AU	CAFOs 300-1,000 AU	Total	CAFOs >1,000 AU	CAFOs 300-1,000 AU	Designated CAFOs
	(number)		($2001, millions, pre-tax)			
ELG Option 1						
Fed Cattle	1,766	174	$19.2	$17.8	$1.1	$0.3
Veal	12	230	<$0.1	<$0.1	<$0.1	$0.0
Heifer	242	7	$3.5	$1.3	$2.1	$0.1
Dairy	1,450	1,949	$71.5	$59.7	$11.3	$0.5
Hogs	3,924	1,485	$8.6	$6.4	$2.1	$0.1
Broilers	1,632	520	$18.5	$15.3	$2.1	$1.1
Layers - Dry	729	26	$6.6	$6.3	$0.1	$0.2
Layers - Wet	383	24	$6.4	$6.4	$0.0	<$0.1
Turkeys	388	37	$6.3	$5.9	$0.2	$0.2
Total	**10,526**	**4,452**	**$140.6**	**$119.1**	**$19.0**	**$2.5**
ELG Option 2						
Fed Cattle	1,766	174	$88.2	$85.8	$1.9	$0.5
Veal	12	230	$0.0	<$0.1	<$0.1	$0.0
Heifer	242	7	$6.3	$3.8	$2.4	$0.1
Dairy	1,450	1,949	$151.1	$128.2	$22.0	$0.9
Hogs	3,924	1,485	$34.8	$24.9	$9.5	$0.4
Broilers	1,632	520	$20.5	$16.8	$2.4	$1.3
Layers - Dry	729	26	$7.5	$7.2	$0.1	$0.2
Layers - Wet	383	24	$8.9	$8.4	$0.5	<$0.1
Turkeys	388	37	$8.7	$8.1	$0.3	$0.3
Total	**10,526**	**4,452**	**$326.0**	**$283.2**	**$39.1**	**$3.8**

May not add due to rounding. Number of operations do not include designated facilities. See notes Table 3-1.

[24] Adjustment factor = (2001 CCI)/(1997 CCI) = 6342/5825 = 1.0888

3.2.2 Comparison with the Proposed Regulations

For the 2001 Proposal, EPA considered various alternative regulatory options, which are summarized in Table 1-2 in Section 1 of this report. The proposed CAFO regulations noted that EPA's "preferred BAT option" at the time of proposal required nitrogen-based and, where necessary, phosphorus-based land application controls at all livestock and poultry CAFOs (Option 2), along with the additional requirement that all cattle and dairy operations (except veal) must conduct ground water monitoring and implement controls if the ground water beneath the production area has a direct hydrologic connection to surface water (Option 3), and with the additional requirement that all hog, veal, and poultry CAFOs achieve zero discharge from the animal production area with no exception for storm events (Option 5). During the Agency's Option Selection process for the final regulations, EPA evaluated these and other options. The results of this analysis are presented in this section; see also USEPA, 20021 (DCN 375086) in the rulemaking record.[25] This comparison presents the results for five technology options (see also Table 1-2):

- Option 1 would require land application at the CAFO to be consistent with proper agricultural practices, including limiting manure application to the nitrogen needs of the crops grown

- Option 2 would require land application at the CAFO to be consistent with proper agricultural practices, including limiting manure application to the nitrogen needs of the crops grown, or where necessary, to the phosphorus needs of the crops

- Option 3 would add to Option 2 by requiring the operation to perform ground water monitoring and controls, unless it can show that the ground water beneath manure storage areas or stockpiles does not have a direct hydrologic connection to surface water

- Option 5 that would add to Option 2 by establishing a zero discharge requirement from the production area that does not allow for an overflow under any circumstances

- Option 7 that would add to Option 2 by prohibiting manure application to frozen, snow-covered or saturated ground.

Compared to the proposed requirements, EPA is promulgating a less costly regulatory option and is limiting the scope of the final revised regulations. See Section 4 of the final preamble for more details.

Table 3-5 summarizes the total annualized (pre-tax) costs of the alternative technology options for each of the ELG technology options that EPA considered in developing the final CAFO regulations. This comparison does not include estimated costs for designated facilities. As shown in the table, among operations with more than 1,000 AU, the total estimated costs across these options range from about $119 million and $640 million per year (pre-tax, 2001 dollars), not including the potential costs to designated CAFO facilities. Note that estimated costs for Option 3 and Option 7 are calculated using a previous set of engineering costs (April 4, 2002) and also assume an alternative AU thresholds for broiler and egg-laying operations (where 1,000 AU would equal 100,000 broiler and egg-laying operation with dry manure systems). Also, EPA did not estimate costs or financial impacts within the cattle and

[25] Costs for Option 3 and Option 7 are calculated using April 4, 2002 engineering costs and alternative AU thresholds for the broiler and egg-laying sector.

dairy sectors under Option 5 because the Agency does not consider housing of large animals under this option to be practicable in these sectors.

More cost information is provided in Tables 3-6(a) and 3-6(b). Table 3-6(a) shows estimated compliance costs on a per-animal (inventory) basis. Table 3-6(b) compares estimated per-animal costs to average operating costs for model CAFOs. Ranges are expressed across minimum and maximum values. Refer also to Appendix B and Appendix D for more detailed cost information.

Table 3-5. Pre-tax ELG Option Costs, by Sector and Size Group ($2001)

Sector	#CAFOs	Option 1	Option 2	Option 3	Option 5	Option 7
All Defined CAFOs >300 AU						
Beef	1,939	$19.0	$87.7	$87.7	N/A	$63.9
Veal	20	<$0.1	<$0.1	<$0.1	N/A	<$0.1
Heifer	472	$3.3	$6.2	$8.3	N/A	$7.7
Dairy	3,398	$71.0	$150.2	$203.5	N/A	$555.4
Hog	5,409	$8.6	$34.6	$148.6	$144.1	$75.3
Broiler	2,152	$17.4	$19.2	$53.2	$31.7	$43.2
Layer	1,162	$12.7	$16.2	$30.9	$17.3	$19.8
Turkey	425	$6.1	$8.4	$12.9	$8.4	$10.2
Total	**14,977**	**$138.2**	**$322.6**	**$545.3**	**$201.5**	**$775.5**
All Defined CAFOs >1,000 AU						
Beef	1,766	$17.8	$85.8	$83.1	N/A	$60.0
Veal	12	$0.0	<$0.1	<$0.1	N/A	<$0.1
Heifer	242	$1.3	$3.8	$4.9	N/A	$4.9
Dairy	1,450	$59.7	$128.2	$152.9	N/A	$442.6
Hog	3,924	$6.4	$24.9	$132.3	$114.5	$64.6
Broiler	2,945	$15.3	$16.8	$47.8	$28.2	$39.7
Layer	960	$12.7	$15.6	$29.3	$16.6	$18.5
Turkey	388	$5.9	$8.1	$12.5	$8.1	$9.9
Total	**10,526**	**$119.1**	**$283.3**	**$462.8**	**$167.4**	**$640.2**
All Defined CAFOs 300-1000 AU						
Beef	173	$1.1	$1.9	$4.6	N/A	$3.9
Veal	8	<$0.1	<$0.1	<$0.1	N/A	<$0.1
Heifer	230	$2.1	$2.4	$3.4	N/A	$2.8
Dairy	1,948	$11.3	$22.0	$50.6	N/A	$112.8
Hog	1,485	$2.1	$9.5	$16.3	$29.6	$10.7
Broiler	520	$2.1	$2.4	$5.4	$3.4	$3.5
Layer	50	$0.1	$0.6	$1.6	$0.7	$1.4
Turkey	37	$0.2	$0.3	$0.4	$0.3	$0.3
Total	**4,451**	**$19.0**	**$39.1**	**$82.5**	**$34.0**	**$135.3**

Source: USEPA. Costs for Option 3 and Option 7 are calculated using April 4, 2002 engineering costs and assume an alternative AU thresholds for broiler and egg-laying operations; see also USEPA, 2002l—DCN 375086). N/A = "not applicable" since EPA does not consider housing of large animals in some sectors to be practicable.

Table 3-6a. Per Head ELG Option Costs (Minimum and Maximum), by Sector and Size Group ($1997).

Sector/ Size Group	Option 1		Option 2		Option 3		Option 5		Option 7	
	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max
Beef										
>1000 AU	$0.1	$51.1	$2.2	$49.6	$0.8	$61.2	N/A	N/A	$0.8	$135.5
300-1000AU	$3.4	$54.6	$7.4	$69.3	$5.3	$108.2	N/A	N/A	$5.9	$117.0
Veal										
>1000 AU	$1.3	$1.7	$1.3	$1.7	$2.2	$3.2	N/A	N/A	$1.3	$1.8
300-1000AU	$1.3	$4.5	$1.3	$4.5	$1.7	$8.7	N/A	N/A	$1.3	$4.9
Heifer										
>1000 AU	$0.9	$17.1	$3.4	$50.3	$1.7	$63.4	N/A	N/A	$2.5	$124.8
300-1000AU	$3.0	$72.6	$6.7	$65.4	$4.8	$107.5	N/A	N/A	$5.7	$155.4
Dairy										
>1000 AU	$0.6	$92.7	$3.2	$144.0	$3.2	$281.0	N/A	N/A	$46.3	$1,018
300-1000AU	$2.8	$149.3	$6.2	$205.2	$8.9	$532.7	N/A	N/A	$54.8	$1,261
Hog: GF										
>1000 AU	$0.0	$0.7	$0.0	$6.2	$0.1	$9.4	$0.1	$11.2	$0.1	$6.6
300-1000AU	$0.4	$2.3	$0.7	$6.9	$5.4	$18.8	$0.5	$14.2	$1.6	$12.7
Hog: FF										
>1000 AU	$0.0	$0.7	$0.0	$6.2	$0.1	$9.4	$0.1	$11.1	$0.1	$9.0
300-1000AU	$0.4	$2.4	$0.7	$6.9	$5.3	$18.8	$0.5	$14.2	$1.5	$12.7
Broilers										
>1000 AU	$0.01	$0.12	$0.01	$0.17	$0.03	$0.21	$0.01	$0.17	$0.02	$0.17
300-1000AU	$0.01	$0.14	$0.01	$0.21	$0.05	$0.38	$0.01	$0.21	$0.04	$0.29
Layer Wet										
>1000 AU	$0.01	$0.38	$0.01	$0.35	$0.15	$0.49	$0.01	$0.35	$0.02	$0.30
300-1000AU	$0.04	$0.09	$0.04	$0.19	$0.37	$1.03	$0.42	$0.71	$0.10	$0.43
Layer Dry										
>1000 AU	$0.01	$0.06	$0.01	$0.12	$0.01	$0.19	$0.01	$0.12	$0.01	$0.18
300-1000AU	$0.02	$0.12	$0.02	$0.18	$0.04	$0.38	$0.02	$0.18	$0.03	$0.25
Turkeys										
>1000 AU	$0.03	$0.21	$0.03	$0.32	$0.00	$0.46	$0.03	$0.32	$0.06	$0.37
300-1000AU	$0.04	$0.25	$0.04	$0.48	$0.10	$0.85	$0.04	$0.48	$0.09	$0.57

Source: USEPA. Costs for Option 3 and Option 7 are calculated using April 4, 2002 engineering costs and assume an alternative AU thresholds for broiler and egg-laying operations; see also USEPA, 2002l—DCN 375086). N/A = "not applicable" since EPA does not consider housing of large animals in some sectors to be practicable.

Table 3-6b. Costs as a Share of Model CAFO Total Operating Costs (Minimum and Maximum), ($1997).

Sector/ Size Group	Option 1		Option 2		Option 3		Option 5		Option 7	
	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max
Beef										
>1000 AU	0.0%	11.1%	0.5%	10.8%	0.2%	13.3%	N/A	N/A	0.2%	29.4%
300-1000AU	0.4%	6.0%	0.8%	7.6%	0.6%	11.9%	N/A	N/A	0.7%	12.8%
Veal										
>1000 AU	0.1%	0.2%	0.1%	0.2%	0.2%	0.4%	N/A	N/A	0.1%	0.2%
300-1000AU	0.1%	0.5%	0.1%	0.5%	0.2%	1.0%	N/A	N/A	0.1%	0.5%
Heifer										
>1000 AU	0.2%	3.7%	0.7%	10.9%	0.4%	13.8%	N/A	N/A	0.5%	27.1%
300-1000AU	0.3%	8.0%	0.7%	7.2%	0.5%	11.8%	N/A	N/A	0.6%	17.0%
Dairy										
>1000 AU	0.0%	4.7%	0.2%	7.3%	0.2%	14.2%	N/A	N/A	2.3%	51.2%
300-1000AU	0.2%	7.8%	0.3%	12.0%	0.5%	31.2%	N/A	N/A	2.9%	66.2%
Hog: GF										
>1000 AU	0.0%	3.5%	0.0%	30.9%	0.1%	47.0%	0.1%	55.9%	0.1%	33.0%
300-1000AU	0.2%	1.2%	0.4%	3.6%	2.8%	9.8%	0.2%	7.4%	0.8%	6.6%
Hog: FF										
>1000 AU	0.0%	0.6%	0.0%	5.5%	0.1%	8.4%	0.1%	9.9%	0.1%	8.0%
300-1000AU	0.3%	1.7%	0.5%	4.9%	3.8%	13.3%	0.3%	10.0%	1.1%	9.0%
Broilers										
>1000 AU	1.1%	25.6%	1.1%	36.1%	5.5%	46.6%	1.8%	32.7%	5.1%	39.0%
300-1000AU	1.8%	22.2%	1.8%	32.7%	7.5%	59.2%	1.1%	36.1%	6.5%	42.6%
Layer Wet										
>1000 AU	0.1%	2.3%	0.1%	2.1%	0.9%	2.9%	0.1%	2.1%	0.1%	1.8%
300-1000AU	0.2%	0.5%	0.2%	1.1%	2.2%	6.2%	2.5%	4.2%	0.6%	2.6%
Layer Dry										
>1000 AU	0.1%	0.4%	0.1%	2.1%	0.1%	1.1%	0.1%	0.7%	0.1%	1.1%
300-1000AU	0.2%	0.5%	0.2%	1.1%	0.2%	2.3%	0.1%	1.1%	0.2%	1.5%
Turkeys										
>1000 AU	0.2%	1.2%	0.2%	1.9%	0.0%	2.7%	0.2%	1.9%	0.3%	2.1%
300-1000AU	0.6%	3.5%	0.6%	6.7%	1.4%	11.8%	0.6%	6.7%	1.3%	7.9%

Source: USEPA. Costs for Option 3 and Option 7 are calculated using April 4, 2002 engineering costs and assume an alternative AU thresholds for broiler and egg-laying operations; see also USEPA, 2002l—DCN 375086). N/A = "not applicable" since EPA does not consider housing of large animals in some sectors to be practicable.

3.3 ESTIMATED FINANCIAL EFFECTS ON EXISTING OPERATIONS (BAT ANALYSIS)

Following a brief review of the baseline financial conditions depicted in EPA's model CAFOs (Section 3.3.1), this section presents the financial effects of the regulations on CAFOs with more than 1,000 AU (Section 3.3.2). These results focus on two principal technology options (Option 1 and Option 2), as was done for estimated compliance costs in Section 3.2. Sections 3.3.3 and 3.3.4 show these results under alternative assumptions, including alternative cash flow calculations (Section 3.3.3) and estimates of CAFO closures under alternative assumptions of long-run market adjustment and cost-share assistance (Section 3.3.4). Section 3.3.5 provides additional information regarding other alternative regulatory options considered by the Agency during the development of the rule.

3.3.1 Baseline Financial Health of Model CAFOs

Based on financial data presented in Section 2 (see Tables 2-2 and 2-3), all representative model CAFOs, regardless of sector or size or production region, are considered to be financially healthy in the baseline before the impacts of the final regulations are considered. Using these data, all model CAFOs currently are estimated to have positive discounted cash flow and debt-to-asset ratios below the established benchmark value for this rule (depending on sector).[26] Post-regulatory impacts are measured against this baseline. EPA considers that negative cash flow or debt-to-asset ratios greater than the benchmark value in the impact analysis can be attributed to the compliance costs associated with the regulatory options considered.

3.3.2 Financial Effects on CAFOs under the Final Regulations

This section examines the impact on existing CAFOs with more than 1,000 AU to comply with the final ELG requirements for Best Available Technologies Economically Achievable (BATEA).

Table 3-7 presents the results of EPA's analysis of the estimated CAFO level financial effects in terms of the number of operations that will experience affordable, moderate, or stress impact due to the regulations. Results are shown both for Option 1 and Option 2. Results are shown by sector for operations with more than 1,000 AU only because these are the operations that would be subject to the ELG regulations. Operations with fewer than 1,000 AU would be instead subject to the BPJ of the permitting authority. Section 3.3.5 shows the results of alternative regulatory options assuming that operations with fewer than 1,000 AU would be subject to the ELG, which EPA considered in the 2001 Proposal.

For Option 1, the analysis indicates that, among all CAFOs with more than 1,000 AU in the veal, heifer, dairy, hog, turkey, and egg-laying sectors, the impacts due to this rule can be characterized as "Affordable" or "Moderate." Therefore, EPA considers this option to be economically achievable for existing facilities in these animal sectors. EPA estimates that a total of 15 existing CAFOs (less than 1percent of all CAFOs with more than 1,000 AU) would experience financial stress and might be

[26]As discussed in Section 2, EPA did adjust the available hog enterprise level data from USDA. Among the various reasons for this adjustment were concerns about how to assess impacts for this sector given that the reported data are unanalyzable in this framework (because of consistently negative cash flow calculations).

vulnerable to closure. By sector, EPA estimates that 12 beef operations (1 percent of affected beef CAFOs) and 3 broiler operations (less than 1 percent of affected broiler CAFOs) might close as a result of complying with the final regulations.

For Option 2, the analysis indicates that, among all CAFOs with more than 1,000 AU in the veal, dairy, turkey, and egg-laying sectors, the impacts due to this rule can be characterized as "Affordable" or "Moderate." Therefore, EPA considers this option to be economically achievable for existing facilities in these animal sectors. (Moderate impacts might be incurred by operations in some sectors, but these impacts are not considered to result in facility closure.) In the beef cattle, heifer, hog, and broiler sectors, however, EPA's analysis indicates that the final rule would cause some existing CAFOs to experience financial stress, making these operations vulnerable to facility closure. Across all sectors, EPA estimates that 285 existing CAFOs (about 4 percent of all all CAFOs with more than 1,000 AU) would experience financial stress and might be vulnerable to closure. By sector, EPA estimates that 49 beef operations (3 percent of affected beef CAFOs), 22 heifer operations (9 percent), 204 hog operations (5 percent), and 10 broiler operations (1 percent) might close as a result of complying with the final regulations.

These estimates of the number of potential CAFO closures are cumulative and reflect the results of both the farm level analysis and the enterprise level analysis. These estimated closure rates are generally consistent with the findings of economic achievability of previous effluent guidelines for other industrial point source categories. Based on the results of this analysis, EPA concludes that both Option 1 and Option 2 would be considered economically achievable for existing CAFOs.

These results are based on an analysis that does not consider the longer term effects on market adjustment and also available cost-share assistance from Federal and State farm conservation programs. EPA believes that such adjustments could lessen the economic impacts of the final regulations over time. Sections 3.3.5 show the results of this analysis under assumptions of long-run market adjustment and cost-share assistance.

As already discussed in Section 3.2, this report presents the results of two technology options where EPA has estimated the cost of land application based on nitrogen-based application rates only (Option 1) and also the cost of land application based on nitrogen-based application rates, except in those instances where EPA believes that phosphorus-based rates are likely to be appropriate (Option 2). Given that the final rule provides for appropriate flexibilities in the use of phosphorus-based rates, such as multi-year phosphorus application, EPA has not accounted for the potential costs savings resulting from these flexibilities in its analysis. As a result, the economic impacts presented here may be overestimated. Also, for the purpose of this analysis, EPA assumes that small business CAFOs with between 300 and 1,000 AU would incur costs similar to those estimated for CAFOs with more than 1,000 AU (although these smaller-sized operations will be subject to BPJ and not the ELG requirements under the revised NPDES requirements). These upper end cost estimates could, therefore, overstate the financial effects for this size category.

3.3.3 Sensitivity Analysis Under Alternative Cash Flow Calculations

This section presents the results of a separate sensitivity analysis where EPA calculates alternative cash flows based on the use of other accounting data as a proxy for capital replacement (discussed in more detail in Section 2.3.3).

Table 3-7. Financial Effects of the ELG on CAFOs (>1,000 AU), Option 1 and Option 2

Sector	Number CAFOs (>1,000AU)	Affordable	Moderate	Stress	Affordable	Moderate	Stress
		(Number)			(Percent of Total Operations)		
ELG Option 1							
Fed Cattle	1,766	1,754	0	12	99%	0%	1%
Veal	12	12	0	0	100%	0%	0%
Heifer	242	242	0	0	100%	0%	0%
Dairy	1,450	1,232	218	0	85%	15%	0%
Hogs	3,924	3,924	0	0	100%	0%	0%
Broilers	1,632	1,334	294	3	82%	18%	0%
Layers - Dry	729	729	0	0	100%	0%	0%
Layers - Wet	383	383	0	0	100%	0%	0%
Turkeys	388	388	0	0	100%	0%	0%
Total	**10,526**	**9,998**	**512**	**15**	**95%**	**5%**	**0%**
ELG Option 2							
Fed Cattle	1,766	1,717	0	49	97%	0%	3%
Veal	12	12	0	0	100%	0%	0%
Heifer	242	220	0	22	91%	0%	9%
Dairy	1,450	1,019	431	0	70%	30%	0%
Hogs	3,924	3,249	470	204	83%	12%	5%
Broilers	1,632	1,032	590	10	63%	36%	1%
Layers - Dry	729	729	0	0	100%	0%	0%
Layers - Wet	383	383	0	0	100%	0%	0%
Turkeys	388	388	0	0	100%	0%	0%
Total	**10,526**	**8,749**	**1,491**	**285**	**83%**	**14%**	**3%**

Source: USEPA. May not add due to rounding.

EPA's cash flow analysis uses net cash income estimates and does not consider noncash income and expenses. To address the question of whether EPA may have understated impacts because its discounted cash flow analysis does not include any allowance for depreciation or replacement of capital in its definition of cash flow, the Agency has conducted further sensitivity analysis using reported

accounting depreciation as a proxy for capital replacement to calculate alternative cash flow values for EPA's financial analysis.

For the purposes of this sensitivity analysis, EPA examines the sensitivity of the results of economic impact analysis under an alternative scenario where capital expenditures are set equal to accounting depreciation. These results are contrasted to results in EPA's main analysis, where capital replacement is not reflected as part of the Agency's cash flow calculation. This analysis is conducted at the farm level. Table 2-2 reflect reported depreciation amounts corresponding to financial data obtained for each model CAFO. These sources of financial data do not report estimated capital replacement.

Table 3-8 shows the results of this analysis. Based on this analysis, EPA has determined that the results of the economic impact analysis are not sensitive to the alternate assumptions regarding cash flow. The results of this analysis show that the number of estimated CAFO closures would not be substantially different if allowances for replacement of capital are made. Table 3-9 shows that under these alternative assumptions, the number of potential facility closures rises only slightly from 285 potential closures to 287 closures.

EPA recognizes that cash outlays for capital replacement and additions are required for a firm to remain in business and should be reflected in the cash flows used to assess economic impacts. However, EPA does not conclude from this analysis that accounting depreciation provides a reliable proxy for these continuing capital expenditures. Reported depreciation is a periodic accounting charge for capital assets acquired in the past, and it may be either larger or smaller than annual future capital expenditures for several reasons. Depreciation is based on historical cost, which might not equal the replacement cost of capital assets. Also, reported depreciation is based on various accounting and tax reporting conventions that might bear little resemblance to the actual economic life and consumption of capital assets. Finally, a firm's capital outlay decisions are influenced by the quality of its investment opportunities, the financial health of the enterprise, and general business conditions, which vary over time.

Table 3-8. Financial Effects on CAFOs: Changes to Cash Flow Calculations (Option 2)

Sector	Number of CAFOs	Affordable	Moderate	Stress	Affordable	Moderate	Stress
		Zero Depreciation			100% Depreciation		
		(Number of Affected Operations)					
Fed Cattle	1,766	1,717	0	49	1,715	0	51
Veal	12	12	0	0	12	0	0
Heifer	242	220	0	22	220	0	22
Dairy	1,450	1,019	431	0	1,019	431	0
Hogs	3,924	3,249	470	204	3,249	470	204
Broilers	1,632	1,032	590	10	1,032	590	10
Layers: Dry	729	729	0	0	729	0	0
Layers: Wet	383	383	0	0	383	0	0
Turkeys	388	388	0	0	388	0	0
Total	**10,526**	**8,749**	**1,491**	**285**	**8,747**	**1,491**	**287**

Source: USEPA. May not add due to rounding. See Table 2-8 for definitions: affordable, moderate, and stress.

3.3.4 Supplemental Analyses

Results presented in Section 3.3.1 do not consider the longer term effects on market adjustment and also available cost-share assistance from Federal and State farm conservation programs. EPA believes that such adjustments could lessen the economic impacts of the final regulations over time. To evaluate potential financial effects under such conditions, EPA has conducted further supplemental analysis to assess potential effects under two different scenarios. One scenario takes into consideration the effects of long-run market adjustment following implementation of the final regulations. This analysis is conducted using simulated changes in producer revenue given changes in market prices as depicted by EPA's market model, which uses estimates of price and quantity response in these markets. A second scenario takes into consideration potential cost-share assistance under Federal and State conservation programs, assuming that a portion of costs are covered by cost sharing subject to programmatic constraints. Given the uncertainty of whether CAFO income will rise in response to long-run market adjustment or whether available cost share dollars will effectively offset compliance costs at regulated CAFOs, EPA's analysis to determine whether the regulation is "economically achievable" does not rely on such assumptions as part of its regulatory analysis and therefore reflects the highest level of impacts projected. However, EPA presents the results of this analysis assuming both some degree of cost passthrough and no cost passthrough, as well as some degree of cost share assistance and no cost share assistance, along with the results of its lead analysis. Section 2.4.3 presents an overview of how EPA conducts these analyses and also discusses the Agency's decision not to incorporate such scenarios as part of its determination of economic achievability.

3.3.4.1 Market Impacts on Facility Income

For the purpose of this analysis, EPA examines regulatory impacts on producers in the livestock and poultry sectors under the assumption that they will experience increased revenues due to long-run market adjustment and resultant higher market prices. This analysis is conducted only for the beef, heifer, hog, and broiler sectors because these are the sectors where EPA's analysis shows there might be facility closures (under assumptions of no cost passthrough). Table 3-10 shows that, under assumptions of long-run market adjustment the number of potential facility closures is reduced from 210 closures (assuming no cost passthrough) to 1 closure in the beef sector (assuming partial cost passthrough).

In this analysis, EPA examines regulatory impacts on producers in the beef, heifer, and broiler sectors under the assumption that they will experience increased revenues due to the impact of the rule on market price. This revenue increase occurs because the effluent guideline increases production costs, shifting the supply curve for the market upward. Market price must then rise in the long run to ensure adequate supply; otherwise, producers will exit the market. The increase in unit price caused by the effluent guideline is illustrated in Figure C-1 in Appendix C of this report, where the shift in the supply curve is shown to equal to annualized compliance costs per unit sold (CC/Q) and the increase in market price is measured as $(P^1 - P^0)$.

In general, the magnitude of the price increase resulting from the revised regulations is largely determined by the price elasticities of supply and demand specified for the market model. Once the market model is specified, EPA can estimate the ratio of the change in price to the per unit compliance costs incurred: $(P^1 - P^0)/(CC/Q)$. In the beef and heifer sector, EPA found this ratio to be equal to 70.7 percent; in the broiler sector this ratio is equal to 68.7 percent. This means if the regulations cause farmers to incur compliance costs of $1.00 per head of cattle, for example, the resulting decrease in cattle supply causes the market price to increase by about $0.71 per head (see Section 2.4.3 for details).

Conceptually, applying this impact of the ELG on facility revenues to the DCF analysis is straightforward. In its DCF analysis, EPA (1) calculates the post-regulatory cash flow for each year of project life by subtracting operating expenses and compliance costs from operating revenues, (2) discounts the result according to project year, and then (3) sums the stream of post-regulatory discounted cash flows over the entire life of the project. Thus, for each year of the project's life, EPA calculates (in simplified form) post-regulatory cash flow as equal to market price multiplied by the number of units sold by the facility (facility revenues) minus operating costs and compliance costs. As a conservative estimate, EPA first performs its DCF analysis assuming that equilibrium market price is unchanged by the rule (i.e., market price is P^0 in Figure C-1). In this analysis, EPA adjusts facility revenues to reflect the increase in market price resulting from the ELG (market price is P^1 in Figure C-1 in Appendix C). See Appendix C of this report for more information.

Table 3-9 shows the results of the supplemental analysis assuming facility revenues reflect the increase in market price resulting from the final regulations. Only the fed cattle, heifer, hog, and broiler sectors are analyzed because CAFOs with more than 1,000 AU in the other sectors would be able to absorb costs associated with the final rule. As the table shows, the compliance costs would be affordable for virtually all CAFOs in these sectors. Only one beef operation would experience financial stress. All other operations in these sectors would be able to absorb the estimated compliance costs under an assumption that market prices would increase in response to regulatory revisions.

Table 3-9. Financial Effects to CAFOs: Partial Cost Passthrough (Option 2)

Sector	Number of CAFOs	Affordable	Moderate	Stress	Affordable	Moderate	Stress
		Zero Cost Passthrough			Partial Cost Passthrough		
		(Number of Affected Operations)					
Fed Cattle	1,766	1,717	0	49	1,765	0	1
Veal	12	12	0	0	ND	ND	ND
Heifer	242	220	0	22	242	0	0
Dairy	1,450	1,019	431	0	ND	ND	ND
Hogs	3,924	3,249	470	204	3,720	204	0
Broilers	1,632	1,032	590	10	1,632	0	0
Layers - Wet	383	729	0	0	ND	ND	ND
Layers - Dry	729	383	0	0	ND	ND	ND
Turkeys	388	388	0	0	ND	ND	ND
Total	**10,526**	**8,749**	**1,491**	**285**	**7,359**	**204**	**1**

Source: USEPA. May not add due to rounding. See Table 2-8 for definitions: affordable, moderate, and stress.

3.3.4.2 Cost-Share Assistance

For the purpose of this analysis, EPA examines regulatory impacts on producers in the livestock and poultry sectors assuming that some portion of the compliance costs will be incurred by Federal and/or State cost-share assistance. This analysis is conducted only for the beef, heifer, hog, and broiler sectors because these are the sectors where EPA's analysis shows there are potential facility closures (under assumptions of no cost sharing). Although other sectors may also receive cost share assistance, EPA has not modeled the effect of cost-share assistance on these types of operations because no stress impacts are measured in these sectors.

For this analysis, EPA assumes that 50 percent of the capital costs of compliance in these sectors would be covered by cost-share assistance. EPA reduced the capital cost of compliance by 50 percent for each of the representative model CAFOs and ran the same economic model as that used for the main analysis, with all other assumptions held constant.

Under an assumption that 50 percent of the capital costs are covered by cost-share assistance, EPA's analysis would assume that total cost sharing for operations with more than 1,000 AU in these four sectors would amount to roughly $20 million annually (1997 dollars). The majority of operations (about 90 percent) would receive less than $10,000 each per year, with a smaller share of operations receiving up to $30,000 each per year in the cattle and broiler sectors. Assuming changes under the 2002 Farm Bill legislation are implemented and there are resulting changes to USDA's farm conservation programs, EPA believes that these are reasonable assumptions for the purposes of conducting a sensitivity analysis.

Table 3-10 shows that, under assumptions of partial cost share assistance (assumed for this analysis to cover 50 percent of the capital expenditure to comply with the revised regulations), the number of potential facility closures is reduced only somewhat from 285 closures to 261 closures (assuming partial cost share assistance). These estimated closures are comprised of 43 beef, 11 heifer, 204 hog, and 3 broiler operations. Among the reasons why these closure results indicate little change assuming cost-share assistance is that EPA's approach applies cost-sharing to estimated capital costs only, whereas the bulk of incurred compliance costs are likely to be annual operating and maintenance costs associated with the land application requirements of the rule, including nutrient management and off-site hauling of excess manure.

3.3.5 Comparison with the Proposed Regulations

EPA considered various alternative regulatory options during the development of this rulemaking. For the Agency's Option Selection process for the final regulations, EPA evaluated these and other options. This section presents the results of these analyses.

Table 3-11 shows the results of EPA's analysis of these alternative options in terms of the number of operations estimated to experience financial stress under these options and that would be vulnerable to facility closure. These results are based on an analysis that does not consider the longer-term effects on market adjustment and also available cost-share assistance from Federal and State farm conservation programs. Note that estimated costs for Option 3 and Option 7 are calculated using a previous set of engineering costs (April 4, 2002) and also assume an alternative AU thresholds for broiler and egg-laying operations (where 1,000 AU would equal 100,000 broiler and egg-laying operation with dry manure systems). Also, EPA does not estimate costs or financial impacts on the cattle and dairy

Table 3-10. Financial Effects on CAFOs: Partial Cost-Share Assistance (Option 2)

Sector	Number of CAFOs	Affordable	Moderate	Stress	Affordable	Moderate	Stress
		Zero Cost Passthrough			50% Cost Share Assistance		
		(Number of Affected Operations)					
Fed Cattle	1,766	1,717	0	49	1,723	0	43
Veal	12	12	0	0	ND	ND	ND
Heifer	242	220	0	22	231	0	11
Dairy	1,450	1,019	431	0	ND	ND	ND
Hogs	3,924	3,249	470	204	3,257	463	204
Broilers	1,632	1,032	590	10	1,485	144	3
Layers - Wet	383	729	0	0	ND	ND	ND
Layers - Dry	729	383	0	0	ND	ND	ND
Turkeys	388	388	0	0	ND	ND	ND
Total	**10,526**	**8,749**	**1,491**	**285**	**6,696**	**607**	**261**

Source: USEPA. May not add due to rounding. See Table 2-8 for definitions: Affordable, Moderate, and Stress.

sectors under Option 5 because the Agency does not consider housing of large animals under this option to be practicable in these sectors).

Among operations with more than 1,000 AU, the expected potential CAFO closures range from about 20 operations to 1,700 operations, depending on the technology option

Table 3-11 also presents economic impacts on all operations with between 300 and 1,000 AU (more than 33,100 operations) and not just those operations that are expected to be *defined* as CAFOs under the regulations (about 4,500 operations). The reason EPA presents its analysis for all operations in this size category is that the Agency had considered extending the ELG regulations to operations in this size category in the 2001 Proposal. As shown in the table, applying these requirements to all operations with between 300 and 1,000 AU could potentially affect a large number of operations, ranging from about 200 operations[27] to nearly 11,000 operations, depending on the regulatory option.

Despite data and analytical changes made to EPA's financial analysis, as presented in both of EPA's Notices (see: USGAO, 2001b, 66 FR 58556 and USGAO, 2002, 67 FR 48099), the results of the Agency's analyses for these various regulatory options did not change much compared to that evaluated and presented for the 2001 Proposal. In particular, these results show that the inclusion of an enterprise level financial analysis does not significantly alter the results of EPA's overall analysis (since the enterprise level results do not always differ substantially from the farm level results across all sectors).

[27]Since EPA does not estimate costs or financial impacts on the cattle and dairy sectors under Option 5, EPA would assume total closures under either Option 1 or Option 2 for those sectors.

The use of alternative financial data overall in the beef and hog sectors, compared to that used for the proposal, does result in substantial changes to EPA's analysis results compared to that conducted for the proposed rule (although more beef operations but fewer hog operations are shown to experience financial stress from estimated compliance costs). EPA's economic results, however, are not driven solely by changes to EPA's financial models but are also driven by underlying changes to the Agency's engineering cost models. As discussed in the 2001 Notice, EPA has expanded the range of cost estimates per representative farm to account for variability across operations based on expected capital and management improvements needed (see 66 FR 58572-58573). The cumulative effect of each of these data and modeling refinements results in EPA's cost and financial models consistently showing that certain types of business operations in the baseline—namely, operations without sufficient land base for land application of manure that may incur high offsite transfer costs, high-technology and management needs, along with higher-cost, low-performing businesses—are more vulnerable to facility closure.

3.4 ESTIMATED FINANCIAL EFFECTS TO NEW OPERATIONS (NSPS ANALYSIS)

This section examines the impacts to new facilities to comply with the final ELG requirements for New Source Performance Standards (NSPS). For this analysis, EPA evaluated impacts on new source CAFOs by comparing the costs borne by new source CAFOs to those estimated for existing sources. That is, if the expected cost to new sources is similar to or less than the expected cost borne by existing sources (and that cost is considered economically achievable for existing sources), EPA considers that the regulations for new sources do not impose requirements that might grant existing operators a cost advantage over new CAFO operators and further determines that the NSPS is affordable and does not present a barrier to entry for new facilities. In general, the costs to new sources from NSPS requirements are lower than the costs for existing sources because new sources are able to apply control technologies more efficiently than existing sources, which may incur high retrofit costs. Not only will new sources be able to avoid the retrofit costs incurred by existing sources, new sources might also be able to avoid the other various control costs facing some existing producers through careful site selection. The requirements promulgated in the final regulation do not give existing operators a cost advantage over new CAFO operators; therefore, the new source performance standards do not present a barrier to entry for new facilities.

Examples of avoided retrofit costs and costs of total containment systems and waste management, including land application, for both existing and new sources, are provided in Section 4 of the preamble. As discussed in the preamble, EPA evaluated economic impacts to new source CAFOs by comparing the costs borne by new source CAFOs to those estimated for existing sources. That is, if the expected cost to new sources is similar to or less than the expected cost borne by existing sources (and that cost was considered economically achievable for existing sources), then EPA considers the regulations for new sources not to impose requirements that might grant existing operators a cost advantage over new CAFO operators and further determines that the NSPS is affordable and does not present a barrier to entry for new facilities. In general, costs to new sources for complying with a given set of regulatory requirements are lower than the costs for existing sources to comply with the same requirements since new sources are able to apply control technologies more efficiently than existing sources that may incur high retrofit cost. New source CAFOs will be able to avoid the retrofit costs that will be incurred by existing sources. For example, the cost of a model total containment system for swine that would meet the no discharge requirement (e.g., incremental cost of deep pit swine house, including land application) typically is less than the cost for an existing source to retrofit water intensive lagoon-based systems that are exposed to precipitation. Among the primary reasons for the capital cost

Table 3-11. Model CAFOs where Compliance Costs result in Financial Stress (Alternative Options)

Sector	Total No.	Option 1	Option 2	Option 3[1]	Option 5	Option 7[1]
All Defined CAFOs >300 AU						
Beef	4,448	133	216	2,885	N/A	2,535
Veal	736	0	0	0	N/A	0
Heifers	299	38	63	322	N/A	213
Dairy	7,230	0	0	504	N/A	1,888
Hogs	13,825	0	204	990	665	674
Broilers	12,034	3	19	8,293	108	2,732
Layers	3,082	0	0	0	0	0
Turkeys	2,003	0	0	0	0	0
Total	**43,657**	**174**	**502**	**12,994**	**773**	**8,042**
All Defined CAFOs >1,000 AU						
Beef	1,766	12	49	340	N/A	63
Veal	12	0	0	0	N/A	0
Heifers	242	0	22	71	N/A	58
Dairy	1,450	0	0	3	N/A	393
Hogs	3,924	0	204[1]	990	665	674
Broilers	1,632	3	10	699	84	541
Layers	1,112	0	0	0	0	0
Turkeys	388	0	0	0	0	0
Total	**10,526**	**15**	**285**	**2,103**	**749**	**1,729**
All Defined CAFOs 300-1000 AU						
Beef	2,682	121	167	2,545	N/A	2,472
Veal	57	0	0	0	N/A	0
Heifers	724	38	41	251	N/A	155
Dairy	5,780	0	0	502	N/A	1,495
Hogs	9,901	0	0	0	0	0
Broilers	10,402	0	10	7,594	24	2,191
Layers	1,970	0	0	0	0	0
Turkeys	1,615	0	0	0	0	0
Total	**33,131**	**159**	**218**	**10,892**	**24**	**6,313**

Source: USEPA. Costs for Option 3 and Option 7 are calculated using April 4, 2002 engineering costs and assume an alternative AU thresholds for broiler and egg-laying operations; see also USEPA, 2002l—DCN 375086).
N/A = "not applicable" since EPA does not consider housing of large animals in some sectors to be practicable.
This table also reflects impacts on all operations 300-1000 AU and not just operations *defined* as CAFOs only.

difference for a new source with total containment is that it does not include an impoundment lagoon, and it experiences reduced operating costs because it handles less waste with substantially lower water and higher solids content than a water-intensive lagoon-based system. New sources may be able to avoid many of the other control costs facing some existing producers through careful site selection, such as choosing to locate at a site with sufficient available land nearby for applying manure. Furthermore, other technologies are available to new sources, that have been implemented by existing sources, that are also capable of achieving the no discharge standard. The preamble of the final rule provides further discussion of these and other technologies. Since the new source requirements for beef and dairy operations are the same as the corresponding existing source requirements, EPA concludes that the NSPS requirements promulgated today do not present a barrier to entry for new facilities. For hog, poultry, and veal operations, where the new source requirements are more stringent than the existing source requirements, EPA concludes that the NSPS requirements do not pose a barrier to entry because of the currently widespread use of animal confinement practices and waste management technologies that can comply with the zero discharge standard, and because these total containment technologies and practices are less costly to implement than water-intensive systems (e.g., such as water flush waste management) that are exposed to precipitation.

As part of its preliminary analysis, EPA costed for zero discharge technologies and showed that these would pose no barrier to entry (see Section 3.4.1 and Section 3.4.2 below); now that operations can choose an alternative option that might be cheaper to implement, EPA believes there is even less likelihood that there is a barrier to entry. More information is provided in the *Development Document* and related cost supporting the final regulations (USEPA, 2002). All new source technologies are widely demonstrated and available in each animal sector.

3.4.1 Beef and Dairy Subcategories

As part of a preliminary analysis, EPA evaluated costs for new beef and dairy operations with more than 1,000 AU. These costs compare the cost of land application requirements for both new and existing source under similar technology requirements reflected by costs estimated for Option 2. The land application requirements for new sources would be identical to those established for existing sources.

EPA's analysis indicates that requiring Option 2 for new sources for the beef and dairy subcategories would not create a barrier to entry because the estimated costs for new sources are less expensive than the BAT costs for existing sources. This determination is based on a comparison of the costs of Option 2 BAT to the costs of Option 2 NSPS on a model-by-model basis. These results are shown in Table 3-12. Estimated Option 2 NSPS costs for new beef and dairy operations are lower than Option 2 BAT costs since they do not include retrofitting costs that would be incurred by existing sources. EPA's comparison of the estimated NSPS and BAT costs shows that the new source costs for some model facilities were estimated to be more than 20 percent lower than those for existing facilities. Furthermore, these requirements are "economically achievable" to existing facilities (see Section 3.3). Therefore, EPA concludes that the NSPS requirements should pose no barrier to entry to new business in these sectors. These cost estimates are available in the record.

3.4.2 Swine, Veal, and Poultry Subcategories

As part of a preliminary analysis, EPA evaluated costs for new swine, veal, and poultry operations with more than 1,000 AU. These costs would require that all discharges of process wastewater from the production area are prohibited and there is no allowance for discharges due to large rainfall events (Option 5). Land application requirements would be similar to those established for existing sources.

EPA's analysis indicates that requiring Option 5 for new sources for the hog, veal, and poultry subcategories would not create a barrier to entry since the estimated costs for new sources are the same as (for veal) or less expensive than the BAT costs for existing sources. This determination is based on a comparison of the costs of Option 2 BAT to the costs of Option 5 NSPS on a model-by-model basis. These results are shown in Table 3-13 (results are not shown for veal, since the costs are the same for NSPS and BAT). Estimated Option 5 NSPS costs for new swine and poultry operations are lower than Option 2 BAT costs since they do not include retrofitting costs that would be incurred by existing sources. EPA's comparison of the estimated NSPS and BAT costs shows that the new source costs for some model facilities were estimated to be more than 50 percent lower than those for existing facilities. Furthermore, these requirements are "economically achievable" to existing facilities (see Section 3.3). Therefore, EPA concludes that the NSPS requirements should pose no barrier to entry to new business in these sectors. These cost estimates are available in the record.

Table 3-12. Percent Difference in Costs between NSPS and BAT Costs, Beef and Dairy Sectors

Sector	Facility Size	Percent Difference
Fed Cattle	M1	-14% to -21%
	M2	-13% to -28%
	M3	-12% to -27%
	L1	-10% to -18%
	L2	-9% to -15%
Dairy	M1	-1% to -19%
	M2	-0.3% to -21%
	M3	-0.7% to -14%
	L1	-0.1% to -23%
Heifers	M1	-21% to -37%
	M2	-21% to -29%
	M3	-17% to -27%
	L1	-15% to -22%

Source: USEPA. Costs for BAT and NSPS Option 2 are calculated using April 4, 2002 engineering costs. Where percentages are negative, NSPS costs are less expensive than the BAT costs. See Table 2-1 for CAFO model definitions. Ranges shown are by region and reflect the average land availability and technology needs categories.

Table 3-13. Percent Difference between NSPS & BATCosts, Hog and Poultry Sectors

Sector	Facility Size	Percent Difference
Hog-GF	M1	-4% to -12%
	M2	-4% to -16%
	M3	-3% to -18%
	L1	-7% to -15%
	L2	-6% to -12%
Hog-FF	M1	-4% to -11%
	M2	-4% to -15%
	M3	-3% to -17%
	L1	-8% to -15%
	L2	-6% to -12%
Layers-Dry	M1	-42% to -43%
	M2	-44% to -46%
	M3	-34% to -36%
	L1	-55% to -58%
	L2	-58% to -63%
Layers-Wet	M3	-60%
	L1	-92%
Broilers	M1	-22% to -59%
	M2	-24% to -65%
	M3	-26% to -70%
	L1	-28% to -74%
	L2	-34% to -81%
Turkeys	M1	-33% to -36%
	M2	-41% to -45%
	M3	-40% to -44%
	L1	-50% to -56%

Source: USEPA. Costs for BAT and NSPS Option 2 are calculated using April 4, 2002 engineering costs. Where percentages are negative, NSPS costs are less expensive than the BAT costs. See Table 2-1 for CAFO model definitions. Ranges shown are by region and reflect the average land availability and technology needs categories.

3.4.1 Comparison with the Proposed Regulations

Table 3-14 compares the Agency's preliminary aggregate, average costs to new sources to those estimated for existing source, across a range of regulatory options considered by EPA. For the 2001 Proposal, these costs reflect new source requirements set forth in the proposal would have required phosphorous-based land application requirements with the added requirements of ground water controls where there is a direct hydrologic connection (Option 3, all sectors) and also total containment from the production area with no exception for a storm event (Option 5, hogs and poultry only). This proposed option is listed in Table 3-14 as the "Proposed Option 3/5 ." These proposed requirements would have applied both to new operations with more than 1,000 AU and to new operations with less than 1,000 AU that are defined as CAFOs. EPA did not consider a total containment option for the cattle and dairy sectors since this was deemed impracticable and not affordable.

As shown in the table, both alternative Option 1 and Option 2 would likely not pose a barrier to entry to new operations since the average NSPS cost is estimated to be less than or equivalent to the BAT costs (and these costs are determined to be economically achievable for existing operations; see Section 3.3). To determine "no barrier to entry" for the other alternative regulatory options that EPA considered for new sources (Option 3, Option 7, and Option 5 for some sectors), the Agency would need to conduct additional analysis before making such a determination. As shown, although the NSPS costs are generally lower than the estimated BAT costs, it is unclear whether imposing similar requirements for existing sources would be economically achievable for those operations or that these costs would not pose a barrier to entry to new operations.

Table 3-14: Facility Level Cost Comparison - New versus Existing Sources (>1000 AU)

Sector	Estimated NSPS Costs			Estimated BAT Costs		
	Proposal Option 3/5	P-based Standards Option 2	P-based & Timing Option 7	N-based Standards Option 1	P-based Standards Option 2	P-based & Timing Option 7
Cattle	$8,000	$5,500	$10,700	$4,700	$9,200	$16,500
Dairy	$15,400	$13,300	$109,100	$30,600	$44,900	$331,000
Hog	$5,700	$5,700	$5,700	$7,700	$18,200	$20,000
Broilers	$5,800	$5,700	$5,700	$11,900	$13,900	$13,900
Layers	$7,600	$7,600	$7,600	$14,200	$21,500	$21,500
Turkeys	$16,100	$16,100	$16,100	$20,900	$30,800	$30,800

Source: USEPA. Costs for BAT and NSPS Option 2 are calculated using April 4, 2002 engineering costs.

3.5 MARKET IMPACTS

This section the results of EPA's market model to predict impacts of the final regulations on consumer and farm level price and quantity. The market model results also form the basis for further projecting changes to national employment, national economic output, and regional employment. EPA

measures economic impacts on the livestock and poultry sectors (direct effects), on industries that provide goods and services to livestock and poultry producers (indirect effects) and from associated expenditures of income earned in direct and indirect activities (induced effects). EPA also predicts impacts on U.S. trade. Section 3.5.1 presents the results of EPA's analysis across all subcategories; Section 3.5.2 presents the results for each individual subcategory (cattle, dairy, hog, and poultry subcategories).

3.5.1 Market Analysis Results Across All Subcategories

This section presents the results of EPA's market model analysis across all subcategories. The results presented in this section are based on the aggregate compliance costs that EPA estimated for both CAFOs with more than 1,000 AU to comply with the effluent guideline revisions and for CAFOs with between 300 and 1,000 AU, if defined as a CAFO, to comply with the NPDES permitting requirements. Results are shown both for Option 1 and Option 2. These market effects are estimated based on estimated regulatory costs presented in Table 3-3.

3.5.1.1 Commodity Prices and Quantities

EPA's market model predicts that the final regulations will not result in significant industry-level changes in production and prices. Predicted changes in animal production might raise producer prices, as the market adjusts to the final regulatory requirements. For all sectors, EPA estimates that farm level prices will rise by less than one percent of pre-regulation baseline prices (Table 3-15). At the retail level, EPA expects that the final regulations will not have a substantial impact on overall production or consumer prices for value-added meat, eggs, and fluid milk and dairy products. EPA estimates that retail price increases resulting from these regulations will also be less than one percent of baseline prices in all sectors (Table 3-16). At the retail level, EPA expects that the final rule will not have a substantial impact on overall production or consumer prices for value-added meat, eggs, and fluid milk and dairy products. EPA estimates that retail price increases resulting from this rule will be less than one percent of baseline prices in all sectors, averaging below the rate of general price inflation for all foods. In terms of retail level price changes, EPA estimates that poultry and red meat prices will rise about one cent per pound. EPA also estimates that egg prices will rise by about one cent per dozen and that milk prices will rise by about one cent per gallon.

Tables 3-15 and 3-16 show predicted farm and retail price changes, as both absolute value and as a percentage of pre-regulation baseline price levels. These economic effects reflect changes to both the effluent guideline regulation and the NPDES permit regulation. For comparison purposes, the average annual percentage change in price from 1990 to 1998 is provided. In all cases, the percent change in price attributable to the regulation is well within the normal year-to-year variability of prices for these products.

Table 3-17 summarizes the forecast reductions in farm level production, following a shift in the supply curve caused by compliance. As shown, predicted quantity reductions are less than two-tenths of one percent of pre-regulation production levels for all sectors. Other than export and import changes, quantity changes at the retail level (not shown) are expected to be directly proportional to changes at the farm level because the model assumes a fixed-proportions production process.

Table 3-15. Post-Compliance Farm Level Price Changes

	Beef	Dairy	Hogs	Broilers	Layers	Turkeys
	($/hundredweight)			(cents/lb.)	(cents/doz.)	(cents/lb.)
Option 1						
1997 Price	66.09	13.38	54.30	37.00	69.80	40.10
Change in Price	0.03	0.05	0.02	0.04	0.17	0.05
Percent Change in Price	0.05	0.34	0.04	0.11	0.24	0.13
Avg. Annual Change (%) (1990-1998)	4.56	7.95	15.24	5.74	11.45	4.37
Option 2						
1997 Price	66.09	13.38	54.30	37.00	69.80	40.10
Change in Price	0.13	0.08	0.09	0.04	0.22	0.07
Percent Change in Price	0.19	0.61	0.17	0.12	0.31	0.18
Avg. Annual Change (%) (1990-1998)	4.56	7.95	15.24	5.74	11.45	4.37

Source: USEPA, except historical data (pre-regulatory average price and average annual change data) that are from USDA/ERS, 1999c, 1998b; USDA/WAOB, 1999, 2001; and NCBA, 2000.

Table 3-16. Post-Compliance Retail Level Price Changes

	Beef	Dairy	Hogs	Broilers	Layers	Turkeys
	($/lb.)	(index)	($/lb.)	(cents/lb.)	(cents/doz.)	(cents/lb.)
Option 1						
1997 Price	2.80	145.50	2.45	151.00	106.00	105.10
Change in Price	0.001	0.45	0.000	0.04	0.17	0.05
Percent Change in Price	0.02	0.31	0.01	0.03	0.16	0.05
Avg. Annual Change (%) (1990-1998)	2.30	2.43	5.07	2.99	7.17	2.39
Option 2						
1997 Price	2.80	145.50	2.45	151.00	106.00	105.10
Change in Price	0.002	0.81	0.001	0.04	0.22	0.07
Percent Change in Price	0.09	0.56	0.05	0.03	0.20	0.07
Avg. Annual Change (%) (1990-1998)	2.30	2.43	5.07	2.99	7.17	2.39

Source: USEPA, except historical data (pre-regulatory average price and average annual change data) that are from USDA/ERS, 1999c, 1998b; USDA/WAOB, 1999, 2001; and NCBA, 2000.

EPA uses the estimated production changes, multiplied by the appropriate per-unit market price, to compute the overall change in market value associated with complying with the final regulations. The overall change in market value is an input to EPA's input-output analysis framework, which allows EPA to compute changes in employment and economic output after compliance.

As demonstrated by the results in these tables, there are only very minor differences in the estimated results between the two regulatory options presented here (Option1 and Option 2).

Table 3-17. Post-Compliance Farm Production Changes

	Beef	Dairy	Hogs	Broilers	Layers	Turkeys
	(million pounds)				(mil. doz.)	(mil. lbs.)
Option 1						
1997 Quantity	47,967	156,100	23,542	27,551	6,473	5,412
Change in Quantity	9	145	3	3	1	1
Percent Change in Quantity	0.0	0.1	0.0	0.0	0.0	0.0
Option 2						
1997 Quantity	47,967	156,100	23,542	27,551	6,473	5,412
Change in Quantity	39	259	11	3	1	2
Percent Change in Quantity	0.1	0.2	0.0	0.0	0.0	0.0

Source: USEPA, except historical data (pre-regulatory quantity data) that are from USDA/ERS, 1998a, and 1998b; USDA/WAOB, 1999; and Putnam and Allshouse, 1999.

3.5.1.2 Aggregate Employment and National Economic Output

EPA does not expect the final regulations to cause significant changes in aggregate employment or national economic output as measured by Gross Domestic Product (GDP). EPA expects, however, that there will be losses in employment and economic output associated with decreases in animal production due to rising compliance costs. These losses are estimated throughout the entire economy, using available modeling approaches, and are not attributable to the regulated community only. This analysis also does not adjust for offsetting activity in other parts of the economy that may be stimulated as a result of the final regulations, such as the construction and farm services sectors.

Employment losses are measured in full-time equivalents (FTEs)[28] per year nationwide. These losses are associated with decreases in commodity production in response to higher compliance costs (Table 3-18). Predicted changes in aggregate employment are measured in terms of both direct and indirect/induced employment.[29].

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[28] One FTE is equivalent to 2,080 hours of labor.

[29] *Direct* employment measures the number of jobs related to production and processing, including workers engaged in the manufacture of agricultural inputs and their suppliers. Other *indirect* or *induced* employment provides a broader measure of industry-related employment and includes workers throughout the

Table 3-18. Post-Compliance Changes in Total National Employment (FTEs)

Option	Beef	Dairy	Hogs	Poultry	Total [a/]
Option 1					
Total Baseline Direct [a/] Farm Employment	336,700	483,800	195,900	71,800	1,088,200
Direct Employment	113	370	37	131	651
Direct Wholesale/ Processing Employment	16	15	10	20	60
Consumer/Indirect/ Induced Employment	528	2,020	207	666	3,421
Total Change	657	2,404	254	817	4,133
Option 2					
Total Baseline Direct [a/] Farm Employment	336,700	483,800	195,900	71,800	1,088,200
Direct Employment	476	660	149	159	1,444
Direct Wholesale/ Processing Employment	66	26	40	24	156
Consumer/Indirect/ Induced Employment	2,218	3,603	832	806	7,460
Total Change	2,759	4,289	1,021	990	9,059

Source: USEPA's market model results, in conjunction with RIMS II multipliers (USDC, 1997b). Totals may not add due to rounding and may include double counting because each sector is modeled separately.

[a/] Total farm employment is updated by EPA from 1990 estimates by Abel, Daft & Earley (1993) to account for changes between 1990 and 1997 (Council of Economic Advisors, 2000). Estimates are allocated by sector based on its share of annual farm revenue (USDA/NASS, 1999a) and exclude employment at cattle grazing operations. Processing sector employment is from the 1997 Census of Manufactures (USDC, 1999a) and is, in some cases, allocated to individual sectors based on farm sector employment proportions. See Section 2.5.3 of the Proposal EA USEPA, 2001a). Total employment in 1997 was 129.6 million (Council of Economic Advisors, 2000).

EPA estimates of the reduction in total employment across all sectors to range from about 4,100 jobs lost (Option 1) to about 9,100 jobs lost (Option 2). Table 3-18. This projected change is modest when compared to total national employment, estimated at about 129.6 million jobs in 1997. EPA estimates of the aggregate reduction in national economic output range from about $400 million (Option 1) to about $900 million (Option 2). Table 3-19. This projected change is also modest when compared to total GDP, estimated at $8.5 trillion in 1997 (Council of Economic Advisors, 2000).

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economy. More information is provided in Section 4.4 of the Proposal EA.

Table 3-19. Post-Compliance Changes in Total National Economic Output (GDP)

Option	Beef	Dairy	Hogs	Poultry	Total [a/]
	(millions in 1997 dollars)				
Option 1					
Baseline Total	---	---	---	---	8,318,400
Post-Regulation	65	222	26	80	394
Option 2					
Baseline Total	---	---	---	---	8,318,400
Post-Regulation	275	397	105	97	873

Source: USEPA's market model results, in conjunction with RIMS II multipliers (USDC, 1997b). Totals may not add due to rounding and may include double counting since each sector is modeled separately.
[a/] Council of Economic Advisors (2002).

3.5.1.3 Regional and Community Impacts

To evaluate the potential for differential impacts among farm production regions, EPA examined employment impacts by region. EPA also evaluated whether the final requirements could result in substantial changes in volume of production, given predicted facility closures, within a particular production region. EPA concludes from these analyses that regional and community level effects are estimated to be modest, but do tend to be concentrated within the more traditional agricultural regions.

EPA does not expect that this rule will have a significant impact on where animals are raised. On one hand, on-site improvements in waste management and disposal, as required by the final rule, could accelerate recent shifts in production to more nontraditional regions as higher-cost producers in some regions exit the market to avoid the relatively high retrofitting costs associated with bringing existing facilities into compliance. On the other hand, the final regulations might favor more traditional production systems where operators grow both livestock and crops, since these operations tend to have available cropland for land application of manure nutrients. These types of operations tend to be more diverse and less specialized and, generally, smaller in size. Long-standing farm services and input supply industries in these areas could likewise benefit from the final rule, given the need to support on-site improvements in manure management and disposal. Local and regional governments, as well as other nonagricultural enterprises, would also benefit.

Table 3-20 breaks out the estimated regional employment impacts between direct (farm and processing level) and indirect/induced (other economy-wide) job losses.[30] As shown, EPA estimates direct employment losses to be greatest in the Midwest region given the sheer volume of animal production in the region, which includes the Dakotas, Nebraska, and Kansas as well as the Corn Belt and Lake states. In the Midwest region, EPA estimated 300 to 700 direct job losses (depending on the

[30] Indirect effects are a result of changes in consumer spending and thus occur in areas with higher population densities regardless of the animal sectors affected.

option). These estimated job losses include CAFO owner-operator job losses due to business closure. Total estimated job losses, including indirect and induced employment impacts, are more evenly distributed among regions and are greatest in the Mid-Atlantic, which covers areas with both high consumer populations and concentrated hog and poultry operations in North Carolina, Virginia, and the Delmarva Peninsula.

Table 3-20. Regional Distribution of Predicted National Employment Reductions

Region [a]	Agricultural Sectors Direct	Indirect/ Induced	Total	Percent of Labor Force
	(FTEs)			
Option 1				
Pacific	102	547	649	0.003
Central	123	501	624	0.003
Midwest	268	800	1,068	0.003
South	78	510	588	0.003
Mid-Atlantic	140	1,063	1,203	0.003
Total	**712**	**3,421**	**4,133**	**0.003**
Option 2				
Pacific	192	1,194	1,386	0.006
Central	347	1,092	1,439	0.007
Midwest	700	1,745	2,444	0.007
South	108	1,111	1,219	0.006
Mid-Atlantic	253	2,318	2,571	0.006
Total	**1,599**	**7,460**	**9,059**	**0.007**

Source: USEPA's market model results, in conjunction with RIMS II multipliers (USDC, 1997b). State level employment data are from the U.S. Census Bureau (1999).
Totals may not add due to rounding and may include double counting since each sector is modeled separately.
[a]Regions are based on the USDA Farm Production Regions (see Figure 4-1in the Proposal EA): Pacific=Pacific, Central=Mountain and Southern Plains, Midwest=Corn Belt, Lake States, and Northern Plains, South=Delta and Southeast, Mid-Atlantic=Northeast and Appalachia.

To further evaluate regional impacts, EPA conducted the following additional assessment. The geography of impacts may be more clearly seen if the information is disaggregated further to the farm production region or state level. Table 3-21 shows the impact of the regulations at the farm production region level. The regions are ranked by the severity of agricultural impacts. The Northern Plains, Corn Belt, and Lake States dominate because of the regulation's focus on hog and cattle operations.

EPA believes that concerns about the potential regional and community effects are, in part, mitigated by changes to the final regulations, as compared to the 2001 Proposal. For the final rule,

Table 3-21. Farm Production Region Distribution of Predicted Changes in (Direct) National Employment

Farm Production Region [a/]	Agricultural Sectors Direct	Indirect/ Induced	Total	Percent of Labor Force
	(FTEs)			
Option 1				
Northern Plains	69	72	141	0.005%
Corn Belt	87	477	564	0.003%
Lake	112	251	363	0.003%
Pacific	102	547	649	0.003%
Southern Plains	63	290	353	0.003%
Mountain	60	211	271	0.003%
Northeast	85	740	825	0.003%
Appalachia	56	323	378	0.003%
Southeast	45	387	432	0.003%
Delta	33	123	156	0.003%
Total	**712**	**3,421**	**4,133**	**0.003%**
Option 2				
Northern Plains	257	157	414	0.014%
Corn Belt	225	1,040	1,264	0.006%
Lake	218	548	766	0.007%
Pacific	192	1,194	1,386	0.006%
Southern Plains	191	633	824	0.007%
Mountain	156	459	615	0.007%
Northeast	148	1,614	1,763	0.006%
Appalachia	104	704	808	0.006%
Southeast	63	844	906	0.006%
Delta	45	268	313	0.007%
Total	**1,599**	**7,460**	**9,059**	**0.007%**

Source: USEPA's market model results, in conjunction with RIMS II multipliers (USDC, 1997b). State level employment data are from the U.S. Census Bureau (1999). Totals may not add due to rounding and may include double counting since each sector is modeled separately.

[a/]USDA Farm Production Regions (see Figure 4-1 in the Proposal EA): Pacific=CA,OR,WA; Mountain= AZ,CO,ID,MT,NV,NM,UT,WY; Southern Plains= OK,TX; Northern Plains= KS,NE,ND,SD; Lake= MI,MN,WI; Corn Belt= IL,IA,IN,MO,OH; Delta= AR,LA,MS; Southeast= AL,FL,GA,SC; Appalachia= KY,NC,TN,VA,WV; Northeast= CT,DE,DC,ME,MD,MA,NH,NJ,NY,PA,RI,VT.

estimated market effects by region are considerably lower than those estimated for the proposal. For example, compared to the proposed rule where EPA estimated direct farm employment losses of more than 3,000 jobs, EPA estimates that the final rule could result in between 700 and 1,600 jobs lost. The Midwest, where EPA predicts the highest predicted job losses, is reduced from nearly 1,300 jobs lost estimated for proposal to between 300 and 700 jobs lost estimated for the final rule. Given these modest estimated effects on national and regional employment, employment effects are not expected to reach levels of concern in more finely drawn geographic regions.

3.5.1.4 Foreign Trade Impacts

Foreign trade impacts are difficult to predict because agricultural exports are determined by economic conditions in foreign markets and changes in the international exchange rate for the U.S. dollar. EPA predicts, however, that foreign trade impacts as a result of the final regulations will be minor given the relatively small projected changes in overall supply and demand for these products and the slight increase in market prices, as described Section 3.5.1.1. Measured as the percentage change in traded volumes, the increases in imports and decreases in exports estimated by EPA will each total less than 1 percent compared to baseline (pre-regulation) levels in each of the commodity sectors. Based on these results, EPA believes that any quantity and price changes resulting from the final regulations will not significantly alter the competitiveness of U.S. export markets for meat, dairy foods, and poultry.

Table 3-22 summarizes the impacts on retail level trade forecast by EPA's market model. By sector, the projected changes in imports compared to baseline trade levels range from a 0.01 percent increase in broiler imports to a 0.85 percent increase in dairy product imports. The predicted drops in U.S. exports range from a 0.01 percent reduction in broiler exports to a 0.14 percent reduction in dairy exports. Baseline information on U.S. imports and exports of livestock and poultry products is available in Section 2.5 of the Proposal EA. As shown in the table, there is little difference in the estimated results between the two regulatory options presented here (Option 1 and Option 2).

Table 3-22. Post-Compliance Retail Product Import and Export Changes

Option	Beef	Dairy	Hogs	Broilers	Layers	Turkeys
	(percent)					
Option 1						
Increase in Imports	0.02	0.48	0.01	0.01	0.15	NA
Decrease in Exports	0.01	0.08	0.01	0.01	0.02	0.03
Option 2						
Increase in Imports	0.09	0.85	0.03	0.01	0.19	NA
Decrease in Exports	0.05	0.14	0.04	0.01	0.02	0.04

Source: USEPA, except historical data that are from Putnam and Allshouse, 1999. NA = Not applicable.

3.5.2 Market Analysis Results across Individual Subcategories

This section presents the results of EPA's market model analysis for each individual subcategory (cattle, dairy, hog, and poultry subcategories). The results presented in this section are based on the

aggregate compliance costs that EPA estimated for both CAFOs with more than 1,000 AU to comply with the effluent guideline revisions and for CAFOs with between 300 and 1,000 AU, if defined as a CAFO, to comply with the NPDES permitting requirements. Results are shown both for Option 1 and Option 2. These market effects are estimated based on estimated regulatory costs presented in Table 3-3. The tables summarizing the results discussed in this section are provided at the end of the section.

Changes in employment and earnings can affect the vitality of local communities. Community impacts are usually determined by employment changes at individual facilities. As facility-specific information and analysis were not within the scope of this study, EPA is not able to speculate on community impacts. However, EPA does disaggregate the national employment results to examine the potential regional employment impacts of the final regulations. EPA allocates estimated national level impacts by production shares across states and does not take into account existing environmental practices or other production factors (see Section 4.4 of the Proposal EA).

3.5.2.1 Beef Sector

Compared to a baseline producer price of $66.09 per hundredweight, EPA's market model predicts that the final CAFO regulations would raise producer cattle prices by $0.03 per hundredweight (Option 1) to $0.13 per hundredweight (Option 2), or little more than 0.20 percent of the baseline producer price (Table 3-23). (All prices are in 1997 dollars.) At the retail level, consumer prices for beef products would rise less than half a cent per pound. At the retail commodity level, EPA's market model predicts that U.S. beef imports would rise by less than 0.1 percent, and U.S. beef exports would decrease by about 0.06 percent compared to baseline quantities.

Table 3-23 also presents EPA's estimates of both the direct (farm and processor level) and total (i.e., national level) reductions in employment for the beef sector. Overall, the decrease in national aggregate employment attributable to regulatory impacts on the beef sector range from about 700 FTE (Option 1) to about 2,800 FTE (Option 2). Projected job losses are estimated throughout the entire economy and are not attributable to the regulated community only. This analysis does not adjust for offsetting increases in other sectors of the economy that might be stimulated as a result of the final regulations. Estimated direct job losses include CAFO owner-operators, employed family members, and hired farm labor. Total farm level employment in the cattle sector was 336,700 FTEs in 1997 (Abel, Daft, and Earley, 1993, as updated by EPA; see Table 2-17 of the Proposal EA). More than 145,000 persons were employed in that sector's processing industries in 1997 (USDC, 1999a).

Table 3-23 shows that the traditional cattle production regions of the Midwest would be the most affected, followed closely by the Central region. None of the impacts represent a significant share of total employment in these regions. Compared to the baseline, EPA estimates the loss in beef agricultural employment at less than 0.02 percent of total regional employment; about half of the estimated agricultural job losses in the beef sector are expected in the Midwest region. Economy-wide employment losses are estimated at less than 0.02 percent of baseline employment.

3.5.2.2 Dairy Sector

Compared to a baseline producer price of $13.38 per hundredweight, EPA's market model predicts that as a result of the final regulations raw milk prices would rise compared to the baseline price

by $0.05 per hundredweight (Option 1) to $0.08 per hundredweight (Option 2). (All prices are in 1997 dollars.) The retail dairy product price index rises by up to 0.8, less than 0.6 percent of the baseline value (Option 2). These price increases are driven by slight changes in the amount produced at the farm level and thus available for consumption (Table 3-24). At the retail commodity level, EPA's market model predicts that U.S. dairy product imports would rise up to 0.9 percent, and U.S. dairy product exports would decrease by about 0.14 percent compared to baseline quantities (Option 2).

Table 3-24 also presents EPA's estimates of both the direct (farm and processor level) and total (national level) changes in employment for the dairy sector. EPA estimates total employment losses attributable to the impact of the regulations on the dairy sector range from about 2,400 FTE (Option 1) to about 4,400 FTE (Option 2). Projected job losses are estimated throughout the entire economy and are not attributable to the regulated community only. This analysis does not adjust for offsetting increases in other sectors of the economy that might be stimulated as a result of the final regulations. Estimated direct job losses include CAFO owner-operators, employed family members, and hired farm labor. Total farm level employment in the dairy sector was 483,800 FTEs in 1997 (Abel, Daft, and Earley, 1993, as updated by EPA). There were more than 141,000 FTE jobs in dairy processing in 1997 (USDC, 1999a).

Table 3-24 shows that the results of EPA's analysis indicate that dairy operations in the Midwest region would be most affected, followed by operations in the Mid-Atlantic and Pacific regions. The loss in dairy agricultural employment is estimated at less than 0.01 percent of total regional employment; about 35 percent of the estimated agricultural job losses in the dairy sector are expected in the Midwest region. Economy-wide employment losses are estimated at less than 0.02 percent of baseline employment for the sector.

3.5.2.3 Hog Sector

Compared to a baseline producer price of $54.30 per hundredweight (hundredweight), EPA's market model predicts that the final CAFO regulations would raise producer prices by by $0.02 per hundredweight (Option 1) to $0.10 per hundredweight (Option 2), or less than 0.2 percent of baseline producer price (Table 3-25). At the retail level, consumer prices for pork products would rise about one-tenth of one cent per pound. These price increases are driven by slight changes in the amount of pork products produced at the farm level and thus available for consumption. At the commodity level, EPA's market model predicts that U.S. pork imports would rise by about 0.03 percent and U.S. pork exports would decrease by about 0.04 percent compared to baseline quantities.

Table 3-25 also presents EPA's estimates of both the direct (i.e., farm and processor level) and total (i.e., national level) reductions in employment for the hog sector. Overall, EPA decreases in national aggregate employment in the hog sector by 300 FTE (Option 1) to about 1,000 FTE (Option 2). Projected job losses are estimated throughout the entire economy and are not attributable to the regulated community only. This analysis does not adjust for offsetting increases in other sectors of the economy that might be stimulated as a result of the final regulations. Estimated direct job losses include CAFO owner-operators, employed family members, and hired farm labor. Total farm level employment of 195,900 FTEs in the hog sector nationwide in 1997 (Abel, Daft, and Earley, 1993, as updated by EPA). Employment in the hog processing sector accounted for over 84,000 FTE jobs in 1997 (USDC, 1999a).

Table 3-25 shows that the traditional hog growing regions of the Midwest would be the most affected, followed by the Mid-Atlantic. None of the impacts represent a significant share of total employment in these regions. Compared to the baseline, EPA estimates the loss in hog agricultural

employment at under 0.01 percent; almost 70 percent of the estimated agricultural job losses in the hog sector are expected in the more traditional Midwest region. Economy-wide employment losses are estimated at under 0.01 percent compared to the baseline.

3.5.2.4 Poultry Sector

A summary of the key results of the market model for the broiler, layer, and turkey sectors is shown in Tables 3-26, 3-27, and 3-28. These tables indicate the predicted changes in farm and retail prices, quantities, national and regional employment, and national economic output.

Compared to a baseline producer price of 37 cents per pound (in 1997 dollars), EPA's market model predicts that the final CAFO regulations would raise broiler producer prices by about 0.05 cents per pound, or about 0.10 percent of the baseline producer price (Table 3-26). At the retail level, consumer prices for broiler products would also rise by about 0.05 cents per pound. Egg prices are projected to increase by under 0.2 cent per dozen under the final regulations, or less than 0.4 percent of the baseline producer price of 69.8 cents per dozen (Table 3-27). Consumer prices for eggs are also projected to rise by about 0.3 cents per dozen. For turkey, EPA's market model predicts that the final CAFO regulations would raise producer prices by under 0.1 cent per pound, less than 0.2 percent of the 40.1 cents per pound baseline producer price (Table 3-28). At the retail level, consumer prices for turkey products would also rise by about 0.2 cent per pound. In most cases, there is little differences between the estimated results for both Option 1 and Option 2.

These price increases are driven by slight changes in the amount of poultry products produced at the farm level and thus available for consumption. At the commodity level, EPA's market model predicts that U.S. egg imports would increase by about 0.20 percent and broiler imports would increase by 0.01 percent compared to baseline imports, but turkey imports would not change. U.S. broiler, turkey, and egg exports would all decrease by less than 0.04 percent relative to baseline exports.

Tables 3-26 through 3-28 also present EPA's estimates of both the direct (farm and processor level) and total (national level) reductions in employment for the poultry sector. Overall, national aggregate employment reductions attributable to the impact of the regulations on the broiler sector are estimated at 400 jobs to 500 jobs lost. National aggregate employment losses in the egg-laying sector would be 300 jobs to 400 jobs lost. In the turkey sector, the analysis shows that about 200 jobs would be lost. Projected job losses are estimated throughout the entire economy and are not attributable to the regulated community only. This analysis does not adjust for offsetting increases in other sectors of the economy that might be stimulated as a result of the final regulations. Estimated direct job losses include CAFO owner-operators, employed family members, and hired farm labor. Total farm level employment in the poultry sector was 71,800 FTEs nationwide 1997 (Abel, Daft, and Earley, 1993, as updated by EPA). More than 204,000 persons were employed in poultry processing in 1997 (USDC, 1999a).

Table 3-26 shows that the dominant broiler producing regions of the South would be the most affected, followed by the Mid-Atlantic. The largest impacts on turkey and egg production would be in the Midwest. None of the impacts represent a significant share of total employment in these regions. Compared to the baseline, EPA estimates the loss in broiler agricultural employment would be less than 0.04 percent; almost 60 percent of the estimated agricultural job losses in the broiler sector are expected in the South (Table 3-26). About 40 percent of egg and turkey industry job losses are expected in the Midwest (Tables 3-27 and 3-28). Again, economy-wide employment losses are estimated at under 0.01 percent compared to baseline employment.

Table 3-23. Summary of Market Model Results for the Beef Sector

Variable	Pre-Regulatory Value/Units	Post-Regulatory Value/Units	
		Option 1	Option 2
Farm Products			
Price	$66.09/cwt	$66.12/cwt	$66.22/cwt
Quantity [a/] Produced	47,967 mil. lbs.	47,958 mil. lbs.	47,927 mil. lbs.
Quantity Exported	331 mil. lbs.	331 mil. lbs.	330 mil. lbs.
Quantity Imported	2,400 mil. lbs.	2,401 mil. lbs.	2,405 mil. lbs.
Retail Products			
Price	$2.80/lb.	$2.801/lb.	$2.803/lb.
Quantity Demanded	26,031 mil. lbs.	26,028 mil. lbs.	26,016 mil. lbs.
Quantity Exported	2,136 mil. lbs.	2,136 mil. lbs.	2,135 mil. lbs.
Quantity Imported	2,343 mil. lbs.	2,344 mil. lbs.	2,345 mil. lbs.
Employment Reduction [b/]			
Direct Farm	336,700 FTEs	113 FTEs	487 FTEs
Direct Processor	145,617 FTEs	15 FTEs	67 FTEs
Total Economy	129.6 mil. FTEs	657 FTEs	2,827 FTEs
Output Reduction			
National	$8,478,600 million	$65 million	$282 million
Regional Farm and Processing Employment Reduction			
Pacific	23,869 FTEs	6 FTEs	27 FTEs
Central	195,434 FTEs	52 FTEs	225 FTEs
Midwest	254,929 FTEs	68 FTEs	293 FTEs
South	1,430 FTEs	0 FTEs	2 FTEs
Mid-Atlantic	6,656 FTEs	2 FTEs	8 FTEs
Total	482,317 FTEs	129 FTEs	554 FTEs

Source: Post-regulatory changes are estimated by USEPA. Pre-regulatory prices, quantities, and trade volumes, see Table 4-16 (Section 4 of the Proposal EA). Pre-regulatory employment, see Table 2-17 (Section 2 of the Proposal EA) allocated to regions based on production as are the post-regulatory values.

[a/] Includes veal and heifer.

[b/] 1 FTE = 2,080 hours of labor.

Table 3-24. Summary of Market Model Results for the Dairy Sector

Variable	Pre-Regulatory Value/Units	Post-Regulatory Value/Units	
		Option 1	Option 2
Farm Products			
Price	$13.38/cwt	$13.43/cwt	$13.46/cwt
Quantity Produced	156,100 mil. lbs.	155,955 mil. lbs.	155,835 mil. lbs.
Retail Products			
Price	145.50 Index	145.95 Index	146.33 Index
Quantity Demanded	155,239 mil. lbs.	155,119 mil. lbs.	155,020 mil. lbs.
Quantity Exported	5,244 mil. lbs.	5,240 mil. lbs.	5,237 mil. lbs.
Quantity Imported	4,383 mil. lbs.	4,404 mil. lbs.	4,421 mil. lbs.
Employment Reduction [a/]			
Direct Farm	483,800 FTEs	370 FTEs	675 FTEs
Direct Processor	141,400 FTEs	15 FTEs	26 FTEs
Total Economy	129.6 mil. FTEs	2,404 FTEs	4,387 FTEs
Output Reduction			
National	$8,478,600 million	$222 million	$406 million
Regional Farm and Processing Employment Reduction			
Pacific	138,725 FTEs	85 FTEs	156 FTEs
Central	91,963 FTEs	57 FTEs	103 FTEs
Midwest	225,389 FTEs	139 FTEs	253 FTEs
South	27,405 FTEs	17 FTEs	31 FTEs
Mid-Atlantic	141,718 FTEs	87 FTEs	159 FTEs
Total	625,200 FTEs	384 FTEs	701 FTEs

Source: Post-regulatory changes are estimated by USEPA. Pre-regulatory prices, quantities, and trade volumes, see Table 4-16 (Section 4 of the Proposal EA). Pre-regulatory employment, see Table 2-17 (Section 2 of the Proposal EA) allocated to regions based on production as are the post-regulatory values.

[a/] 1 FTE = 2,080 hours of labor.

Table 3-25. Summary of Market Model Results for the Hog Sector

Variable	Pre-Regulatory Value/Units	Post-Regulatory Value/Units	
		Option 1	Option 2
Farm Products			
Price	$54.30/cwt	$54.32/cwt	$54.40/cwt
Quantity Produced	23,542 mil. lbs.	23,539 mil. lbs.	23,530 mil. lbs.
Quantity Exported	14 mil. lbs.	14.1 mil. lbs.	14.1 mil. lbs.
Quantity Imported	814 mil. lbs.	813.8 mil. lbs.	814.5 mil. lbs.
Retail Products			
Price	$2.45/lb.	$2.45/lb.	$2.45/lb.
Quantity Demanded	16,863 mil. lbs.	16,862 mil. lbs.	16,857 mil. lbs.
Quantity Exported	1,044 mil. lbs.	1,043.5 mil. lbs.	1,043.2 mil. lbs.
Quantity Imported	633 mil. lbs.	633.1 mil. lbs.	633.2 mil. lbs.
Employment Reduction			
Direct Farm	195,900 FTEs [a/]	37 FTEs	153 FTEs
Direct Processor	84,723 FTEs	10 FTEs	40 FTEs
Total Economy	129.6 mil. FTEs	254 FTEs	1,047 FTEs
Output Reduction			
National	$8,478,600 million	$26 million	$108 million
Regional Farm and Processing Employment Reduction			
Pacific	1,507 FTEs	0 FTEs	1 FTEs
Central	20,128 FTEs	3 FTEs	14FTEs
Midwest	189,391 FTEs	32 FTEs	131 FTEs
South	12,129 FTEs	2 FTEs	8 FTEs
Mid-Atlantic	57,468FTEs	10 FTEs	40 FTEs
Total	280,623 FTEs	47 FTEs	194 FTEs

Source: Post-regulatory changes are estimated by USEPA. Pre-regulatory prices, quantities, and trade volumes, see Table 4-16 (Section 4 of the Proposal EA). Pre-regulatory employment, see Table 2-17 (Section 2 of the Proposal EA) allocated to regions based on production as are the post-regulatory values.

[a/] 1 FTE = 2,080 hours of labor.

Table 3-26. Summary of Market Model Results for the Broiler Sector

Variable	Pre-Regulatory Value/Units	Post-Regulatory Value/Units	
		Option 1	Option 2
Farm Products			
Price	37.00¢/lb.	37.04¢/lb.	37.05¢/lb.
Quantity Produced	27,551 mil. lbs.	27,548 mil. lbs.	27,548 mil. lbs.
Retail Products			
Price	151.00¢/lb.	151.04¢/lb.	151.05¢/lb.
Quantity Demanded	22,508 mil. lbs.	22,506 mil. lbs.	22,505 mil. lbs.
Quantity Exported	5,048 mil. lbs.	5,047.5 mil. lbs.	5,047.4 mil. lbs.
Quantity Imported	5 mil. lbs.	5 mil. lbs.	5 mil. lbs.
Employment Reduction [a/ b/]			
Direct Farm	71,800 FTEs	73 FTEs	88 FTEs
Direct Processor	204,200 FTEs	13 FTEs	15 FTEs
Total Economy	129.6 mil. FTEs	401 FTEs	487 FTEs
Output Reduction			
National	$8,478,600 million	$40 million	$48 million
Regional Farm and Processing Employment Reduction			
Pacific	11,764 FTEs	4 FTEs	4 FTEs
Central	22,826 FTEs	7 FTEs	9 FTEs
Midwest	13,077 FTEs	4 FTEs	5 FTEs
South	156,986 FTEs	48 FTEs	59 FTEs
Mid-Atlantic	71,347 FTEs	22 FTEs	27 FTEs
Total	276,000 FTEs	85 FTEs	103 FTEs

Source: Post-regulatory changes are estimated by USEPA. Pre-regulatory prices, quantities, and trade volumes, see Table 4-16 (Section 4 of the Proposal EA). Pre-regulatory employment, see Table 2-17 (Section 2 of the Proposal EA) allocated to regions based on production as are the post-regulatory values.

[a/] 1 FTE = 2,080 hours of labor.

[b/] Estimated employment across all poultry sectors (Table 2-17 of the Proposal EA).

Table 3-27. Summary of Market Model Results for the Egg-Laying Sector

Variable	Pre-Regulatory Value/Units	Post-Regulatory Value/Units	
		Option 1	Option 2
Farm Products			
Price	69.80¢/doz.	69.97¢/doz.	70.07¢/doz.
Quantity Produced	6,473 mil. doz.	6,472 mil. doz.	6,471 mil. doz.
Retail Products			
Price	106.00¢/doz	106.17¢/doz.	106.27¢/doz.
Quantity Demanded	5,357 mil. doz.	5,356 mil. doz.	5,356 mil. doz.
Quantity Exported	227.8 mil. doz.	227.8 mil. doz.	227.7 mil. doz.
Quantity Imported	7 mil. doz.	7 mil. doz.	7 mil. doz.
Employment Reduction [a/ b/]			
Direct Farm	71,800 FTEs	17 FTEs	27 FTEs
Direct Processor	204,200 FTEs	5 FTEs	7 FTEs
Total Economy	129.6 mil. FTEs	259 FTEs	408 FTEs
Output Reduction			
National	$8,478,600 million	$24 million	$38 million
Regional Farm and Processing Employment Reduction			
Pacific	11,764 FTEs	3 FTEs	4 FTEs
Central	22,826 FTEs	2 FTEs	3 FTEs
Midwest	13,077 FTEs	8 FTEs	13 FTEs
South	156,986 FTEs	5 FTEs	7 FTEs
Mid-Atlantic	71,347 FTEs	4 FTEs	7 FTEs
Total	276,000 FTEs	22 FTEs	34 FTEs

Source: Post-regulatory changes are estimated by USEPA. Pre-regulatory prices, quantities, and trade volumes, see Table 4-16 (Section 4 of the Proposal EA). Pre-regulatory employment, see Table 2-17 (Section 2 of the Proposal EA) allocated to regions based on production as are the post-regulatory values.

[a/] 1 FTE = 2,080 hours of labor.

[b/] Estimated employment across all poultry sectors (Table 2-17 of the Proposal EA).

Table 3-28. Summary of Market Model Results for the Turkey Sector

Variable	Pre-Regulatory Value/Units	Post-Regulatory Value/Units	
		Option 1	Option 2
Farm Products			
Price	40.10¢/lb.	40.15¢/lb.	40.17¢/lb.
Quantity Produced	5,412 mil. lbs.	5,410.6 mil. lbs.	5,410.0 mil. lbs.
Retail Products			
Price	105.10¢/lb	105.15¢/lb.	105.17¢/lb.
Quantity Demanded	4,814 mil. lbs.	4,813 mil. lbs.	4,812 mil. lbs.
Quantity Exported	598 mil. lbs.	597.8 mil. lbs.	597.8 mil. lbs.
Employment Reduction [a/ b/]			
Direct Farm	71,800 FTEs	41 FTEs	59 FTEs
Direct Processor	204,200 FTEs	3 FTEs	5 FTEs
Total Economy	129.6 mil. FTEs	157 FTEs	227 FTEs
Output Reduction			
National	$8,478,600 million	$16 million	$23 million
Regional Farm and Processing Employment Reduction			
Pacific	11,764 FTEs	4 FTEs	5 FTEs
Central	22,826 FTEs	2 FTEs	3 FTEs
Midwest	13,077 FTEs	17 FTEs	25 FTEs
South	156,986 FTEs	6 FTEs	9 FTEs
Mid-Atlantic	71,347 FTEs	15 FTEs	22 FTEs
Total	276,000 FTEs	45 FTEs	65 FTEs

Source: Post-regulatory changes are estimated by USEPA. Pre-regulatory prices, quantities, and trade volumes, see Table 4-16 (Section 4 of the Proposal EA). Pre-regulatory employment, see Table 2-17 (Section 2 of the Proposal EA) allocated to regions based on production as are the post-regulatory values.

[a/] 1 FTE = 2,080 hours of labor.

[b/] Estimated employment across all poultry sectors (Table 2-17 of the Proposal EA).

SECTION FOUR

FINAL REGULATORY FLEXIBILITY ANALYSIS

This section considers the effects of the CAFO regulations on small businesses in the livestock and poultry industries. Section 4.1 discusses EPA's requirements under the Regulatory Flexibility Act. Section 4.2 outlines EPA's initial assessment of small businesses in the sectors affected by the regulations. Section 4.3 presents EPA's final regulatory flexibility analysis and summarizes other steps taken by the Agency to comply with the RFA. Section 4.4 presents the data, methodology, and results of EPA's analysis of impacts on small businesses for this rulemaking.

4.1 THE REGULATORY FLEXIBILITY ACT AS AMENDED BY THE SMALL BUSINESS REGULATORY ENFORCEMENT FAIRNESS ACT

The Regulatory Flexibility Act (RFA, 5 U.S.C *et seq.*, Public Law 96-354), as amended by the Small Business Regulatory Enforcement Fairness Act of 1996 (SBREFA) generally requires an agency to prepare a regulatory flexibility analysis describing the impact of the regulatory action on small entities as part of the rulemaking. This analysis is required for any rule subject to notice-and-comment rulemaking requirements under the Administrative Procedure Act or any other statute unless the agency certifies that the rule will not have a "significant impact on a substantial number of small entities." Small entities include small businesses, small organizations, and governmental jurisdictions. Because the CAFO regulations could have a significant economic impact on a substantial number of small entities, EPA has prepared this final regulatory flexibility analysis (FRFA).

In addition to the preparation of an analysis, the RFA, as amended by SBREFA, imposes certain responsibilities on EPA when the Agency proposes rules that might have a significant impact on a substantial number of small entities. These include requirements to consult with representatives of small entities about the proposed rule. The statute requires that, where EPA has prepared an initial regulatory flexibility analysis (IRFA), the Agency must convene a Small Business Advocacy Review (SBAR) Panel for the proposed rule to seek the advice and recommendations of small entities concerning the rule. The panel is composed of employees from EPA, the Office of Information and Regulatory Affairs within the Office of Management and Budget, and the Office of Advocacy of the Small Business Administration (SBA).

4.2 INITIAL ASSESSMENT

Prior to the 2001 Proposal, EPA conducted an initial assessment according to Agency guidance on implementing RFA requirements (USEPA, 1999i). First, EPA must indicate whether the proposal is a rule subject to notice-and-comment rulemaking requirements. EPA determined that the proposed CAFO regulations were subject to notice-and-comment rulemaking requirements. Second, EPA should develop a profile of the affected small entities. EPA has developed such a profile of the livestock and poultry sectors, which includes all affected operations as well as small businesses. This information is provided in Section 2 and other sections of the Proposal EA (USEPA, 2001a). Third, EPA's assessment needs to

determine whether the rule would affect small entities and whether the rule would have an adverse economic impact on small entities.

For the proposed rulemaking, EPA could not conclude that costs are sufficiently low to justify "certification" that the regulations would not impose a significant economic impact on a substantial number of entities. Instead, EPA complied with all RFA provisions and conducted outreach to small businesses, convened an SBAR Panel, and prepared an IRFA. That analysis described EPA's assessment of the impacts of the proposed CAFO regulations on small businesses in the livestock and poultry sectors. A summary of this analysis was published in the *Federal Register* at the time of publication of the 2001 Proposal (66 FR 3099-3103, see: USGPO, 2001a). More detailed information on EPA's IRFA is provided in Section 9 of the Proposal EA. EPA's Proposal EA also describes other requirements of EPA's initial assessment of small businesses and summarizes the steps taken by EPA to comply with the RFA.

Since proposal, EPA has received new information and data related to small business in the livestock and poultry industries, including revisions to the SBA's definition of "small business" in these sectors and updates to EPA's estimate of the number of affected operations to reflect USDA estimates. This information was presented in the 2001 Notice (66 FR 58556; USGPO, 2001b). Section 4.2.1 of this report reviews SBA's revised definitions of small entities in the livestock and poultry industry and discusses a rationale for using an alternative definition of small business in one sector. Section 4.2.2 then uses the definitions of small entities laid out in Section 4.2.1 to estimate the number of operations that meet this small business definition. Section 4.2.3 presents the results of the initial assessment EPA conducted for the 2001 Proposal, which provides a first level screen of potential impacts on small business CAFOs and serves as a signal for additional analysis.

4.2.1 Definition of Small CAFO Businesses

The RFA defines a "small entity" as a small not-for-profit organization, small governmental jurisdiction, or small business. No small governmental operations operate CAFOs. A few not-for-profit organizations might operate CAFOs, but complete information is not available to warrant including not-for-profit organizations in this analysis. The analysis therefore focuses only on small businesses that are defined or designated as CAFOs. (Section 1 of this report describes the circumstances under which an AFO is defined or designated as a CAFO and is subject to the final regulations.)

The RFA requires, with some exceptions, that EPA define small businesses according to SBA's size standards. SBA sets size standards for defining small businesses by number of employees or amount of revenues for specific industries. These size standards vary by North American Industry Classification System (NAICS) code. CAFOs are listed under NAICS 112, Animal Production.[31]

Table 4-1 shows SBA size standards by SIC code for each of the six livestock and poultry sectors, which are expressed in terms of average "annual receipts" (revenue). With one exception,

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[31] In September 2000, SBA updated the basis for its size standard from Standard Industrial Classification (SIC) codes to NAICS codes (USGPO, 2000; U.S. Census Bureau, 2000). By SIC code, these industries are listed under SIC 02, Livestock and Animal Specialties. The actual size standards for each sector, specified as an annual revenue threshold, did not change as a result of this update.

current SBA standards define a "small business" within each of the main livestock and poultry sectors as an operation that generates average revenues ranging from less than $0.75 million per year (hog, dairy, broiler, and turkey sectors) to less than $1.5 million per year (beef feedlot sector), averaged over the three most recent fiscal years (USGPO, 2000; SBA, 1998). The exception is the revenue threshold for a small chicken egg operation, which SBA has defined as a business that generates up to $9 million annually. For reasons outlined in Section 9.2.1 of the Proposal EA, EPA believes that SBA's definition of small business for the egg laying sector (revenues of $9 million per year) does not truly characterize a small business in this sector. As discussed extensively in documentation supporting the 2001 Proposal, EPA is using an alternative definition of $1.5 million annually for this analysis. Refer to the Proposal EA (USEPA, 2001a) and docket materials cited in that document, and the proposal itself (USGPO, 2001a).

SBA's size standards differ from the revenue cutoff generally recognized by USDA, which has set $250,000 in gross sales as its cutoff between small and large family farms (USDA, 1998).

As discussed in the 2001 Notice (66 FR 58570-58571; see USGPO, 2001b), recent revisions to SBA's small business definitions for some sectors necessitate changes to EPA's estimate of the number of AFOs that are potentially defined as CAFOs and subject to the final requirements. Prior to June 2001, SBA defined a "small business" for the dairy, hog, broiler, and turkey sectors as an operation with annual sales of less than $0.5 million per year. On June 7, 2001, SBA raised the size standards for these four sectors to $0.75 million per year. SBA's notice of this change is at 66 FR 30646 (USGPO, 2001c). Although SBA did not revise its small business definition for the beef feedlot and egg laying sectors, updates to USDA estimates of the number of AFOs that are potentially defined as CAFOs also require changes to EPA's overall estimates of the number of small businesses affected by the rulemaking. EPA's revised estimates of the number of affected small businesses are presented in Section 4.2.2.

Table 4-1. SBA Revenue Size Standards for Small Livestock and Poultry Operations

NAICS Code (SIC Code)	NAICS Industry Description	SBA Size Standard [a/]	EPA-Assumed Revenue Cutoff
112112 (0211)	Beef Cattle Feedlots	$1.5 million	same as SBA
112111 (0241/0212)	Beef Cattle Ranching and Farming	$0.75 million	same as SBA
11221 (0213)	Hog and pig farming	$0.75 million	same as SBA
11212 (0241)	Dairy cattle and milk production	$0.75 million	same as SBA
11232 (0251)	Broilers and other meat-type chickens	$0.75 million	same as SBA
11231 (0252)	Chicken egg production	$9.0 million	$1.5 million
11233 0253	Turkey production	$0.75 million	same as SBA

Source: SBA, 1998; USGPO, 1991a, 1991b, 1996, 2000, 2001c; U.S. Census Bureau, 2000.
[a/]SBA Size Standards by NAICS code (13 CFR Part 121) correspond to classifications under SIC classification.

4.2.2 Number of Affected Small Businesses

EPA uses three steps to determine the number of small businesses that might be affected by the CAFO regulations. First, EPA identifies small businesses in the relevant livestock and poultry sectors by equating SBA's annual revenue definition with the number of animals at an operation. Second, EPA estimates the total number of small businesses in these sectors using farm size distribution data from USDA. Third, based on the regulatory thresholds being promulgated, EPA estimates the number of small businesses that would be subject to the final requirements. These steps are summarized below. More detailed information on this approach is presented in Section 9.2.2 of the Proposal EA.

In the absence of entity level revenue data, EPA identifies small businesses in the livestock and poultry sectors by equating SBA's annual revenue definitions of "small business" to the number of animals at these operations (step 1). This step produces a threshold based on the number of animals that EPA uses to define small livestock and poultry operations and reflects the average farm inventory (number of animals) that would be expected at an operation with annual revenues that define a small business. This initial conversion is necessary because USDA data by farm size are not available by business revenue. With the exception of egg laying operations, EPA uses SBA's small business definition to equate the revenue threshold with the number of animals raised onsite at an equivalent small business in each sector (shown in Table 4-1). For egg laying operations, EPA uses an alternative revenue definition of small business, discussed in Section 4.2.1.

EPA estimates the number of animals at an operation to match SBA's small business definitions based on annual revenue size standard (expressed as annual revenue per entity) and USDA-reported farm revenue data that are scaled on a per-animal basis (expressed as annual revenue per inventory animal for an average facility). Financial data used for this calculation are from USDA's 1997 ARMS database (USDA/ERS, 1999a). USDA's data report average national revenue for each sector, combining both livestock and nonlivestock farm revenue (income from crop sales and other farm-related income, including government payments). EPA uses the derived per-animal revenues shown in Table 4-2 to equate SBA's size standard (in revenues) with farm size based on the number of animals, as follows:

$$\frac{\textit{Average Number of Animals}}{\textit{Farm}} = \frac{\textit{SBA's small business definition (\$ per year per farm)}}{\textit{average total revenue per head (\$/animal)}}$$

The resultant number of animals represents the average animal inventory threshold for a small business. Estimated "small business" thresholds for each sector are shown in Table 4-2. Additional information on this approach and the data used for this calculation are outlined in Section 4.2.2 of the Proposal EA. The resultant size threshold represents an average animal inventory for a small business.

For the purpose of conducting its FRFA for this rulemaking, EPA is defining "small business" for these sectors as an operation that houses or confines less than the following: 1,400 fed beef cattle (includes fed beef, veal, and heifers); 300 mature dairy cattle; 2,100 market hogs; 37,500 turkeys; 61,000 layers; or 375,000 broilers (Table 4-2). As shown in Table 4-2, with the exception of dairy and some poultry operations, SBA's small business definition for these sectors more or less corresponds to operations with fewer than 1,000 AU being considered small businesses.

EPA then estimates the total number of small businesses in these sectors using facility size distribution data from USDA (step 2). Using the threshold sizes identified for small businesses in the

livestock and poultry sectors (Table 4-2), EPA matches these thresholds with the number of operations associated with the size thresholds, based on available USDA data, to estimate the total number of small animal confinement operations in these sectors. EPA's estimates of the number of potential CAFOs, derived from these USDA data (Kellogg, 2002), are presented in Section 3.1 of this report. This constitutes the primary data source that EPA uses to match the small business thresholds corresponding to SBA's definitions.

Because the USDA data are organized by broad AU groupings—operations with more than 1,000 AU, 750 AU, 500 AU and 300 AU—EPA has matched the animal thresholds above to the closest available AU grouping as follows. For hogs, EPA assumes that data reported for the 1,000 AU threshold (about 2,500 hogs) provide a close approximation of the 2,100 hog threshold to determine the number of small businesses in this sector. For dairies, EPA assumes that the 500 AU threshold (about 350 dairy cows) approximates the 300 dairy cow threshold. For turkey and egg laying operations with dry manure systems, EPA assumes that the 750 AU threshold (about 61,500 layers and 38,500 turkeys) approximates the 61,000 layers and 37,500 turkeys threshold. Because egg-laying operations with wet manure systems are regulated based on a different AU threshold (1,000 AU is equivalent to 30,000 birds), EPA assumes that all estimated operations for this category are small businesses. The resultant estimates of the number of small businesses in these sectors derived under these assumptions, in conjunction with available USDA data (Kellogg, 2002), are presented in Table 4-2.

For both cattle and broilers, EPA also relies on data on operations with more than 1,000 AU (corresponding to operations with 1,000 beef, veal, and heifers, and about 125,000 broilers), but uses these data as a starting point to assess the total number of small businesses in these sectors. To further determine the number of small businesses with more than 1,000 AU (corresponding to operations with less than 1,400 cattle and 375,000 broilers, as shown in Table 4-1), EPA assumes that, for cattle, about 40 percent of operations with more than 1,000 AU are potentially small businesses. This assumption is based on available USDA data on the share of feedlots with between 1,000 and 2,000 head, calculated as a share of all operations with more than 1,000 AU (Krause, 1991). For broilers, EPA assumes that nearly all operations are small businesses, with the exception of the largest 330 operations, which EPA assumes have more than 375,000 birds. This assumption is consistent with that assumed for the 2001 Proposal and is consistent with USDA broiler sales data and information (USDA/NASS, 2000a). The resultant estimates of the number of small businesses in these sectors using this approach, in conjunction with USDA data (Kellogg, 2002) are presented in Table 4-2.

USDA estimates that there were approximately 238,000 animal confinement facilities in 1997 (see Section 3). Table 4-2 presents EPA's estimates of the total number of small livestock and poultry operations that are potentially small businesses. Using the approach outlined in this section, EPA estimates that about 227,000 operations (95 percent of all operations)are small businesses. However, not all of these operations would be affected by the CAFO regulations.

EPA recognizes that this approach might not accurately portray actual small businesses in all cases across all sectors. On the one hand, the resulting small business estimate would suggest that a 15- to 20-house broiler operation with 375,000 birds would be a small business. Information from industry sources, however, suggests that a two-house broiler operation with roughly 50,000 birds is small (Madison, 1999; USEPA, 2000d). Therefore, it is likely that some medium- and large-size broiler operations are being considered small businesses (USEPA, 2000e).

On the other hand, it is possible that the resulting small business estimate might have failed to identify some small businesses in the other sectors as "small." For example, EPA's approach identifies

as a "small business" hog operations with fewer than 2,500 pigs and turkey operations with fewer than 41,250 turkeys, which account for less than 93 percent and 80 percent of all operations, respectively, and less than 40 percent of sales in these sectors (Kellogg, 2002). These proportions are below SBA's presumed coverage rates, which define as small about 99 percent of all operations and account for approximately 62 percent of sales (Perez, 2000). Therefore, it is likely that there are additional small hog and turkey businesses that are not captured under the revised methodology (USEPA, 2000e).

Table 4-2. Number of Small CAFOs That Might Be Affected by the CAFO Regulations

Sector	Total Annual ($million) Revenue [a] (x)	Revenue per Head [b] (Avg. U.S.) (y)	Number of Animals at Small CAFO Businesses (z = x/y)	Estimated Number of AFOs	Total "Small" AFOs	Small Business CAFOs [c]
Cattle [d]	$1.5	$1,060	1,400	21,800	20,430	**1,200**
Dairy	$0.75	$2,573	300	94,800	91,360	**1,294**
Hogs	$0.75	$363	2,100	51,800	47,850	**1,485**
Broilers	$0.75	$2	375,000	17,800	17,450	**1,822**
Egg Layers	$9.0	$25	365,000	ND	ND	**ND**
	$1.5		61,000	6,400	5,460	**486**
Turkeys	$0.75	$20	37,500	3,300	2,660	**27**
All AFOs	**NA**	**NA**	**NA**	**237,800** [e]	**227,120** [e]	**6,314**

NA=Not Applicable. ND = Not Determined. "AFOs" have confined animals on-site.

[a] SBA size standards are at 13 CFR Part 121. EPA assumes an alternative definition of $1.5 million in annual revenues for egg laying operations.

[b] Average revenue per head across all operations for each sector derived from data obtained from USDA's 1997 ARMS data (USDA/ERS, 1999a). For more information, see Section 4 of EPA's Proposal EA (USEPA, 2001a).

[c] Total small business CAFOs do not include estimates of designated CAFOs.

[d] Includes fed cattle, veal and heifers.

[e] USDA total include estimates of the number of operations with "cattle other than fattened cattle or milk cows" and also adjusts for double counting, accounting for roughly 42,000 operations (Kellogg, 2002). See Section 3. EPA's total for broilers and egg layers also differs because of differing 1,000 AU definitions (see Section 3).

The final step (step 3) in EPA's approach is to estimate the number of small businesses subject to the CAFO regulations based on the regulatory thresholds being promulgated, as discussed in Section 3 of this report. Not all small confinement operations would be subject to the CAFO regulations. The final regulations apply only to those operations that meet the regulatory definition of a CAFO or those that have been designated as CAFOs by the NPDES permitting authority because of risks posed to water quality and public health, as discussed in Section 1. The regulations *define* as a CAFO those operations that confine more than 1,000 AU, as well as a subset of operations with between 300 and 1,000 AU. The final regulations may also apply to an operation that is *designated* as a CAFO by the NPDES permitting authority on a case-by-case basis, based on an on-site inspection. As described in this section, EPA's estimates of the number of operations is based on USDA information for 1997 (Kellogg, 2002), which

constitutes the primary data source that EPA uses to determine the number of potential small businesses that might be subject to the regulations.

Table 4-3 presents the estimated number of livestock and poultry operations that might be subject to the CAFO regulations and are also small businesses ("small business CAFOs") by facility size category. EPA estimates that of the approximately 238,000 animal confinement facilities in 1997 roughly 95 percent are small businesses. Not all of these operations would be affected by the final rule. Table 4-3 shows EPA's estimates of the number of small business CAFOs that are expected to be affected by this rule. For this analysis, EPA estimates that about 6,200 affected CAFOs across all size categories are small businesses, accounting for more than 40 percent of the estimated 14,515 affected facilities. EPA estimates that among CAFOs with more than 1,000 AU about 2,330 operations are small businesses (accounting for about one-fourth of all CAFOs in this size category). Most affected small businesses are in the broiler sector. Among CAFOs with between 300 and 1,000 AU, EPA estimates about 3,830 operations are small businesses, with most of the affected small businesses are in the hog, dairy, and broiler sectors.

These estimates are based on USDA data for 1997. Because of continued consolidation and facility closure since 1997, EPA's estimates might overstate the actual number of small businesses in these sectors. Ongoing trends are causing some existing small and medium operations to expand their inventories to achieve economies of scale. Some of the CAFOs considered here as small businesses might no longer be counted as small businesses because they now have higher revenues. Furthermore, some CAFOs might now be owned by a larger, vertically integrated firm and might no longer be small businesses. EPA expects that there are few such operations, but it does not have data or information to reliably estimate the number of CAFOs that meet this description. In addition, for reasons noted in the record, EPA believes that the number of small broiler operations is overestimated and might actually include a number of medium and large broiler operations that should not be considered small businesses.

Table 4-3 also shows the expected number of small businesses that may be designated as CAFOs and subject to the rule. EPA estimates that about 172 operations will be designated as CAFOs. This estimate is expressed over the 5-year permit period (that is, assumes that roughly 35 operations will be designated annually). Among these, an estimated 160 operations are in the 300 to 1,000 AU size category; about 12 operations have fewer than 300 AU. (See Table 3-1.) EPA assumes that all of these operations are small businesses.[32] For analysis purposes, EPA also assumes that these operations are located in more traditional production regions and are characterized by operations with available land for land application of manure but also high technology needs (see discussion in Section 4.4).

[32]EPA expects that USDA will continue to provide voluntary assistance to those additional operations that are now defined as CAFOs under the current permitting requirements and are not covered by the final regulations.

Table 4-3. Total Number of Small Business CAFOs Subject to Regulation

Sector	All AFOs	Total Small Business AFOs	Small Business CAFOs >1,000 AU (Defined)	Small Business CAFOs 300-1000 AU (Defined)	Small Business CAFOs (Designated)
	(Number of operations)				
Fed Cattle	17,800	16,570	538	174	15
Veal	3,840	160	5	7	0
Heifers	170	3,700	97	230	3
Dairy	94,790	91,360	0	1,330	30
Hogs	51,770	47,850	0	1,485	52
Broilers	17,780	17,450	1,303	520	52
Layers	6,450	5,460	383	48	10
Turkeys	3,310	2,660	0	31	10
Total	**237,820** [a/]	**227,120** [b/]	**2,326**	**3,825**	**172** [b/]

Sources: Values presented in the table are EPA estimates, derived from published USDA data (Kellogg, 2002). All numbers are rounded to the nearest ten.

[a/] USDA total include estimates of the number of operations with "cattle other than fattened cattle or milk cows" and also adjusts for double counting, accounting for roughly 42,000 operations (Kellogg, 2002). See Section 3. EPA's total for broilers and egg layers also differs because of differing 1,000 AU definitions (see Section 3).

[b/] Number of designated facilities shown over 5-year permit period. EPA assumes all estimated designated facilities are small businesses.

4.2.3 Results of the Initial Assessment for the 2001 Proposal

For past regulations, EPA has often analyzed the potential impacts to small businesses by evaluating the results of a costs-to-sales test, measuring the number of operations that will incur compliance costs at varying threshold levels (including ratios where costs are less than 1 percent, between 1 and 3 percent, and greater than 3 percent of gross income).[33] EPA conducted such an analysis at the time of the 2001 proposal, indicating that about 80 percent of the estimated number of small businesses directly subject to the rule as CAFOs might incur costs in excess of three percent of sales. These results were based on an assessment of the potential impacts on small CAFO businesses based on the results of a sales test for all operations with more than 500 AU. This screening test indicated the

[33] EPA believes that its more refined analysis used for its general analysis (presented in Section 3 of this EA) better reflects the potential impacts to regulated small businesses.

need for additional analysis to characterize the nature and extent of impacts on small entities. This assessment is conducted for those CAFOs that are small businesses, as determined by EPA.

The results of this screening test for the 2001 Proposal indicate that, measured against all confinement operations with more than 500 AU, about 80 percent of the estimated number of small businesses could incur costs in excess of 3 percent of sales. Compared to the total number of all small animal confinement facilities estimated by EPA, operations that are estimated to incur costs in excess of three percent of sales constitute less than two percent of all small businesses in these sectors. The results of this analysis are presented in Section 9.2.3 of the Proposal EA.

Based on the results of this initial assessment, EPA projected that it would likely not certify that the regulations would not impose a significant impact on a substantial number of entities. This is because EPA's initial assessment indicates that the regulations could impose a significant economic impact on a substantial number of entities. Therefore, prior to the 2001 Proposal, EPA convened a SBAR Panel and prepared an initial regulatory flexibility analysis (IRFA) pursuant to Sections 609(b) and 603 of the RFA, respectively, and prepared an economic analysis. Sections 4.3 and 4.4 of this report present the results of EPA's final regulatory flexibility analysis (FRFA).

4.3 EPA COMPLIANCE WITH RFA REQUIREMENTS

4.3.1 Outreach and Small Business Advocacy Review

As required by Section 609(b) of the RFA, as amended by SBREFA, EPA convened a SBAR Panel for the proposed rule. See 66 FR 3121-3124; 3126-3128 (January 12, 2001). The Panel was convened in December 1999. Panel participants included representatives from EPA, the Office of Information and Regulatory Affairs within the Office of Management and Budget (OMB), and the Office of Advocacy of the Small Business Administration (SBA). "Small Entity Representatives" (SERs), who advised the Panel, included small livestock and poultry producers as well as representatives of the major commodity and agricultural trade associations. Throughout the development of these regulations, EPA conducted outreach to small businesses in the livestock and poultry sectors. EPA also consulted with SBA on the use of an alternative definition of small business for the egg laying sector.

Consistent with the RFA/SBREFA requirements, the Panel evaluated the assembled materials and small entity comments on issues related to the elements of the IRFA. The Panel's activities and recommendations are summarized in the *Final Report of the Small Business Advocacy Review Panel on EPA's Planned Proposed Rule on National Pollutant Discharge Elimination System (NPDES) and Effluent Limitations Guideline (ELG) Regulations for Concentrated Animal Feeding Operations* (April 7, 2000), or "Panel Report" (USEPA, 2000e). This document is included in the public record (DCN 93001). Section 12 of the preamble to the 2001 Proposal provides a summary of the Panel's activities and recommendations and describes the subsequent action taken by the Agency (see 66 FR 3121-3124). Section 12 of the preamble to the 2001 Proposal also details various outreach activities conducted by EPA, which include outreach to small businesses in these sectors.

For the 2001 Proposal, EPA prepared an economic analysis of the impacts on small businesses, which is provided in Section 9.4 of the Proposal EA. EPA's economic analysis supporting the final regulations is provided in Section 4.4 of this report.

For all final regulations for which an FRFA is prepared, Section 212 of the RFA requires that the Agency also issue a small entity compliance guide providing a plain language explanation of how to comply with the final regulations. EPA's small entity compliance guide for the CAFO regulations will be issued following promulgation.

4.3.2 EPA's Final Regulatory Flexibility Analysis

For the proposed regulations, EPA has conducted an IRFA, as required by Section 603 of the RFA, as amended by SBREFA. The IRFA must contain the following: (1) a description of the reasons why action by the agency is being considered; (2) a succinct statement of the objectives of, and legal basis for, the proposed rule; (3) a description of and, where feasible, an estimate of the number of small entities to which the proposed rule will apply; (4) a description of the projected reporting, recordkeeping, and other compliance requirements of the proposed rule, including an estimate of the classes of small entities that will be subject to the requirement and the type of professional skills necessary for preparation of the report or record; and (5) identification, to the extent practicable, of all relevant Federal rules that might duplicate, overlap or conflict with the proposed rule. The IRFA shall also contain a description of any significant alternatives to the proposed rule that accomplish the stated objectives of applicable statutes and that minimize any significant economic impact of the proposed rule on small entities. Sections 9.3.2.1 through 9.3.2.6 of the Proposal EA show how EPA addressed each of these requirements in the IRFA it prepared to support the 2001 Proposal. EPA also prepared an economic analysis of the impacts on small CAFO businesses, which is provided in Section 9.4 of the Proposal EA (USEPA, 2001a).

For the final regulations, EPA has conducted an FRFA, as required by Section 604 of the RFA, as amended by SBREFA. The FRFA addresses the issues raised by public comments on the IRFA, which was part of the proposal of this rule. The FRFA must contain: (1) a succinct statement of the need for, and objectives of, the rule; (2) a summary of the significant issues raised by the public comments in response to the initial regulatory flexibility analysis, a summary of the assessment of the agency of such issues, and a statement of any changes made in the proposed rule as a result of such comments; (3) a description of and an estimate of the number of small entities to which the rule will apply or an explanation of why no such estimate is available; (4) a description of the projected reporting, recordkeeping, and other compliance requirements of the rule, including an estimate of the classes of small entities that will be subject to the requirement and the type of professional skills necessary for preparation of the report or record; and (5) a description of the steps the agency has taken to minimize the significant economic impact on small entities consistent with the stated objectives of applicable statutes, including a statement of the factual, policy, and legal reasons for selecting the alternative adopted in the final rule and why each one of the other significant alternatives to the rule considered by the agency that affect the impact on small entities was rejected. Sections 4.3.2.1 through 4.3.2.5 of this report address each of these FRFA requirements.

4.3.2.1 Need for and Objectives of the CAFO Regulations

A detailed discussion of the need for the regulation is presented in Section 4 of the 2001 Proposal (66 FR 2293-2972-2976). A summary is also provided in Sections 1 and 10 of the Proposal EA. In summary, EPA's rationale for revising the existing regulations include the following: address reports of continued discharge and runoff from livestock and poultry operations in spite of the existing

requirements; update the existing regulations to reflect structural changes in these industries over the past few decades; and improve the effectiveness of the existing regulations.

Despite nearly 30 years of regulation, there are persistent reports of discharge and runoff of manure and manure nutrients from livestock and poultry operations. Revisions to the existing ELG and NPDES regulations for CAFOs are expected to mitigate future water quality impairment and the associated human health and ecological risks by reducing pollutant discharges from the animal production industries.

EPA's revisions also address the changes that have occurred in the animal production industries in the United States since the development of the existing regulations. The continued trend toward fewer but larger operations, coupled with greater emphasis on more intensive production methods and specialization, is concentrating more manure nutrients and other animal waste constituents within some geographic areas. This trend has coincided with increased reports of large-scale discharges from these facilities and continued runoff that is contributing to the significant increase in nutrients and resulting impairment of many U.S. waterways.

EPA's revisions to the existing regulations will make the regulations more effective in protecting or restoring water quality. The revisions will also make the regulations easier to understand and will clarify the conditions under which an AFO is a CAFO and, therefore, subject to the regulatory requirements.

A detailed discussion of the objectives and legal basis for these regulations is presented in Sections 1 and 3 of the preamble to the final rule and also the 2001 Proposal (see: 66 FR 2959 or USGPO, 2001a).

4.3.2.2 Significant Comments in Response to the IRFA

The significant issues raised by public comments on the IRFA address exemptions for small businesses, disagreement with SBA definitions and guidance on how to define small businesses for these sectors, and general concerns about EPA's financial analysis and whether the analysis adequately captures potential financial effects on small businesses.

Commenters generally recommend that EPA exempt all small businesses from regulation, arguing in some cases that regulating small businesses could affect competition in the marketplace, discourage innovation, restrict improvements in productivity, create entry barriers, and discourage potential entrepreneurs from introducing beneficial products and processes. Several commenters claimed that EPA had misrepresented the number of small businesses. In particular, several commenters objected to SBA's small business definition for dairy operations, claiming it understates the number of small businesses in this sector (see, for example, NMPF, 2001). One commenter claimed that EPA's estimate of the total number of operations is understated and therefore must understate the number of small businesses (Department of Agriculture, 2001). Some commenters objected to the consideration of total farm-level revenue to determine the number of small businesses because this approach understates the number of small businesses, despite SBA guidance that bases its definitions on total entity revenue for purposes of defining a small business (NCBA, 2001). Other commenters, however, claimed that EPA's approach does not truly capture operations that are, in fact, small businesses but reflect larger corporate operations (see, for example, Citizens Against Poultry Pollution, 2001). Another commenter

recommended that EPA simply consider any operation with fewer than 1,000 AU as small businesses (Wyoming Office of Federal Land Policy, 2001). EPA also received comments requesting that EPA consider use of regional-specific definitions of small business because of concerns that the revenue-based SBA definition might not be applicable to operations in Hawaii since producers in that State generally face higher cost of production and also higher producer prices relative to revenue and cost conditions at farms in the contiguous 48 States. Comments from SBA recommended that EPA adopt the Panel's recommendation not to consider changing the designation criteria for operations with fewer than 300 animal units as a means to provide relief to small businesses (SBA, 2001). SBA also recommends that EPA adopt the SBAR Panel's approach and allow permitting authorities to focus resources where there is greatest need (SBA, 2001). Finally, some commenters generally questioned the results of EPA's financial analysis, giving similarly stated concerns about EPA's financial data and models used for its main analysis (see, for example, NCBA, 2001).

In response, EPA notes that the projected impacts of today's final regulations on small businesses are lower than the projected impacts of the proposed rule. For example, the final rule does not extend the effluent guideline regulations to CAFOs with between 300 and 1,000 AU, as was proposed in the 2001 proposal. Instead, EPA is retaining the existing regulatory threshold, applying the effluent guideline to CAFOs with more than 1,000 AU only. Requirements for CAFOs with between 300 and 1,000 AU will continue to be subject to the BPJ requirements as determined by the permitting authority, thus requiring that fewer small businesses adopt the effluent guideline standards. More information on this topic is available in section IV of this preamble. Section 4 of the final rule preamble discusses other regulatory changes since the 2001 proposal, indicating greater alignment with SBAR Panel recommendations. Refer to Section 4 of the preamble for more information on the comments and EPA's responses to those comments, as well as EPA's justification for final decisions on these options.

EPA received two comments form one commenter requesting that EPA not use the alternative definition for egg-laying operations but instead consider regional-specific conditions for determining the number of small businesses. The commenter expressed concern that SBA's revenue-based definition might not be applicable to operations in Hawaii since producers in that State generally face higher cost of production and also higher producer prices relative to revenue and cost conditions at farms in the contiguous 48 States. There are a number of reasons why EPA did not use a regional-specific definition of small business for egg operations. First, as instructed under the Regulatory Flexibility Act (RFA), EPA uses small business definitions as defined by the Small Business Administration (SBA) for all sectors (except for the egg-laying sector). Since size standards set by the Small Business Administration (SBA) do not vary by region, EPA follows SBA's lead. Second, the regulations set requirements by the number of animal units at a farm, not the revenues associated with those animal units. A 1,000 AU egg-laying operation in the Midwest will be subject to the same effluent limitations guidelines as a 1,000 AU egg-laying operation in Hawaii and the territories. Third, the economic analysis, uses a representative farm approach. Only the broadest regional information could be obtained through USDA and other sources. Although some small subregions or localities might face unique issues, without performing a Section 308 survey of all regulated entities EPA must rely on the representative farm approach. (See also response to comment DCN CAFO201246C-6 regarding EPA's use of a representative farm approach, which is consistent with lonstanding practices at USDA and the land grant universities.) Fourth, very few impacts are seen in the egg-laying sector, regardless of size. Even if EPA had classified the majority of egg-laying operations with less than 1,000 AU as small businesses, this would not have changed the outcome of the Agency's small business analysis in any material way. Finally, even if EPA were to classify all operations as small businesses in areas outside the contiguous 48 States (including Hawaii and Alaska), this would only raise the total number of small business by less than 10 operations. See

response to comment DCN CAFO NODA600053-5 regarding EPA's consideration of regional-specific definition of small business for the regulated sectors.

Regarding EPA's estimate of the number of small businesses, the Agency continues to follow SBA guidance and SBA definitions on how to define small businesses for these sectors. However, EPA has made substantial changes to the financial data and models used for its main analysis, which is also used to evaluate financial effects on small businesses. Both the 2001 Notice (66 FR 58556) and the 2002 Notice (67 FR 48099) describe the public comments received by EPA on the baseline financial data and the methodological approach developed by the Agency to evaluate financial effects. These comments and how EPA has addressed them are discussed more fully throughout this report. EPA's detailed responses to comments, and the comments themselves, are contained in the Agency's comment response document (see, for example, DCN CAFO200179D-3).

4.3.2.3 Description and Estimate of Number of Small Entities Affected

The small entities subject to this rule are small businesses. No nonprofit organizations or small governmental operations operate CAFOs. As discussed in section 7 of the preamble to the final rule, to estimate the number of small businesses affected by this final rule, EPA relied on the SBA size standards for these sectors, with the exception of size definitions for the egg sector. SBA defines a "small business" in these sectors as an operation with average annual revenues of less than $0.75 million for dairy, hog, broiler, and turkey operations; $1.5 million in revenue for beef feedlots; and $9.0 million for egg operations. The definitions of small business for the livestock and poultry industries are in SBA's regulations at 13 CFR 121.201. For this rule, EPA proposed and solicited public comment on and is using an alternative defintion fo small business for the egg-laying operations. EPA defines a "small" egg laying operation for purposes of its regulatory flexibility assessments as an operation that generates less than $1.5 million in annual revenue. EPA consulted with SBA on the use of this alternative definition, as documented in the rulemaking record for the 2001 proposal. Given these considerations, EPA evaluates "small business" for this rule as an operation that houses or confines fewer than 1,400 fed beef cattle (includes fed beef, veal, and heifers); 300 mature dairy cattle; 2,100 market hogs; 37,500 turkeys; 61,000 layers; or 375,000 broilers. The approach used to derive these estimates is described in Section 4.2.

Using these definitions and available data from USDA and industry, EPA estimates that about 6,200 affected CAFOs across all size categories are small businesses. Among CAFOs with more than 1,000 AU, EPA estimates that about 2,330 operations are small businesses. Among CAFOs with between 300 and 1,000 AU, EPA estimates that about 3,870 operations are small businesses. Table 4.3 shows EPA's estimates of the number of regulated small businesses across all industry sectors. Table 4.4 provides this information by sector and by representative CAFO model.

Table 4-4. Numbers of Small CAFO Businesses by Sector, Size Grouping, and Region

Sector	Region	Total	CAFOs "Large 1"	CAFOs "Large 2"	CAFOs "Medium 3"	CAFOs "Medium 2"	CAFOs "Medium 1"
Fed Cattle	All	858	538		49	95	176
	CE	605	342		39	79	145
	MW	209	170		8	11	20
	PA	28	23		1	1	3
	SO	1	0		0	0	1
	MA	15	3		1	4	7
Veal	MW	12	5		1	2	4
Heifers	All	329	97		29	70	133
	MW	127	0		6	14	107
	CE	120	58		14	35	13	
	PA	82	39		9	21	13
Dairy	All	1,294					1,294
	CE	276					276
	MW	361					361
	PA	227					227
	SO	97					97
	MA	333					333
Hog: FF	All	916			123	252	541
	MA	811			105	216	490
	MW	105			18	36	51
Hog: GF	All	568			103	174	291
	MA	500			88	148	264
	MW	68			15	26	27
Broiler	All	1,822	1,034	269	184	197	138
	MA	1,223	698	182	120	133	90
	SO	599	336	87	64	64	48
Layer: Dry	All	59				21	38
	MW	29				10	19
	SO	30				11	19
Layer: Wet	SO	431	383		48		
Turkey	All	26				9	17
	MA	14				5	9
	MW	12				4	8

Source: USEPA. Preliminary based on estimates associated with the August 4, 2002, cost estimates. Size and region breakouts are based on an analysis of the 1997 Census data by USDA (Kellogg, 2002). Facility size and region definitions for model CAFOs are provided in Section 2, Table 2-1. Shaded cells indicate that there are no small CAFO businesses that will be affected by the regulations and that meet the SBA definition of a small business. Estimates do not include number of designated CAFOs.

4.3.2.4 Description of the Reporting, Recordkeeping, and Other Requirements

The final regulations would require all AFOs that meet the CAFO definition to apply for a permit, develop and implement a nutrient management plan, collect and maintain records required by applicable technology-based effluent discharge standards, and submit an annual report to the responsible NPDES permitting authority. (No nonprofit organizations or small governmental operations operate CAFOs.) All CAFOs would also be required to maintain records of off-site transfers of manure. Record-keeping and reporting burdens include the time to record and report animal inventories, manure generation, field application of manure (amount, method, date, weather conditions), manure and soil analysis results, crop yield goals, findings from visual inspections of feedlot areas, and corrective measures. Records may include manure spreader calibration worksheets, manure application worksheets, maintenance logs, and soil and manure test results. EPA believes the owner/operator has the skills necessary to keep these records and make reports to the permitting authority.

State permitting authorities will incur reporting burdens when they update their NPDES programs to incorporate the regulatory changes in the final rule. They will incur record keeping burdens as they implement the final rule. Data collection and record keeping activities include reviewing CAFO permit applications and periodic reports, and tracking compliance through on-site inspections.

EPA has estimated the burden and costs associated with information collection imposed on CAFOs, including small businesses, and also States as a result of the CAFO regulations. This analysis is provided in the Information Collection Request for the Final NPDES and ELG Regulatory Revisions for Concentrated Animal Feeding Operations (EPA ICR NO. 1989.02) prepared by EPA (USEPA, 2002j), which updates an analysis conducted for the 2001 Proposal (USEPA, 2000f).

For the purpose of this analysis, "burden" means the total time, effort, or financial resources expended by persons to generate, maintain, retain, or disclose or provide information to or for a federal agency. This includes the time needed to review instructions; develop, acquire, install, and utilize technology and systems for the purposes of collecting, validating, and verifying information, processing and maintaining information, and disclosing and providing information; adjust existing procedures to comply with any previously applicable instructions and requirements; train personnel to be able to respond to a collection of information request; search data sources; complete and review the collection of information; and transmit or otherwise disclose the information.

EPA's labor burden estimates for CAFO and State respondents are the hours of activity required to comply with changes to the NPDES CAFO program. For each activity, EPA estimates the burden in terms of the expected effort necessary to carry out these activities under normal conditions and reasonable labor efficiency. These activities and estimated burden and cost levels are described in more detail in the Supporting Statement for the ICR (USEPA, 2002j). The ICR also contains a summary of wage rate information from USDA and the Bureau of Labor Statistics, compiled by EPA for the purpose of this analysis. Additional information on the ICR is provided in the preamble supporting the final regulations. A summary of the analysis of impacts to CAFO operators is provided below. Additional information on the estimated burden and costs is provided in the ICR (USEPA, 2002j).

EPA identifies four burden categories to CAFO operators, including start-up activities, permit application, best available technology requirements, and NPDES record keeping and reporting requirements.

Start-up activities are steps that a CAFO owner or operator must take in preparation to comply with the information collection requirements of the final rule. Owners or operators that are potentially affected by the rule will need to familiarize themselves with the changes to the NPDES CAFO program to determine that they will need to apply for a permit.

Permit application activities include completing and submitting either an NOI to obtain coverage under a general permit or an application for an individual permit. These activities will be conducted once every five years. The final rule requires that the following information be provided on the application forms: the name of the owner or operator; facility address and mailing address; latitude and longitude of the production area; a topographic map; the type and number of animals in open confinement and housed under a roof; the type of containment and total capacity for manure, litter, and wastewater storage; the number of acres for land application; the estimated amount of manure generated per year; and estimated amount of manure transferred off site each year. As part of their record keeping responsibilities, CAFO operators will be required to keep the plan on site for inspections and make it available to the permitting authority on request. Nutrient management plans must be reviewed and rewritten at least every five years.

CAFO owners or operators will perform and record various activities to meet the BAT requirements such as visual inspections of the feedlot facilities, inspections of manure application equipment, collection of soil samples, and recording of volume of manure and process wastewater produced. CAFOs with more than 1,000 AU will also be required to record information for transfers of manure, litter, and process wastewater to other people.

In addition to the labor costs associated with these activities, EPA estimates the capital and operation and maintenance (O&M) costs incurred to collect data and keep records. A CAFO will incur capital costs when it purchases equipment or builds structures that are needed for compliance with the rule's reporting and record keeping requirements that the facility would not use otherwise. Consistent with the overall cost analysis for the final rule, capital costs are annualized assuming a 10-year amortization period and a 7 percent interest rate. Capital costs for the final rule include such items as purchasing a soil auger to collect soil samples and a manure sampler. Some facilities will also need to install depth markers in their lagoons. A facility incurs O&M costs when it regularly uses services, materials, or supplies needed to comply with the rule's reporting and record keeping requirements that the facility will not use otherwise. Any cost for the operation and upkeep of capital equipment is considered an O&M cost. O&M costs may also be incurred on a non-annual basis, such as every five years for a soil analysis. O&M costs include laboratory analysis of soil and manure.

EPA estimates that the public burden for this information collection request will require 1.6 million labor hours for all CAFO respondents to comply with the final regulations and 0.3 million labor hours for State permitting authority respondents (USEPA, 2002j). Information collection and reporting at a CAFO is associated with applying for permits, developing nutrient management plans, conducting site inspections, tracking land application and off-site manure transfers. These estimates include the time required to review instructions, search existing data sources, gather and maintain all necessary data, and complete and review the information collection. EPA estimates costs to regulated CAFOs at $29 million annually, which includes $25 million in labor costs and $4 million capital and O&M expenditures; annual State costs of $10 million include $8.6 million in labor costs and $1.6 million in O&M expenditures (USEPA, 2002j). This estimate excludes NPDES burden for CAFOs covered by other ICR estimates.

Under the final rule, EPA estimates that there will be an annual average of 11,712 CAFO respondents and an annual average of 82,705 CAFO responses, which includes multiple responses per CAFO. Thus, the annual average burden per CAFO respondent is 138 hours and the average burden per CAFO response is 19 hours. For this analysis, EPA assumes that the administrative burden assumptions are generally the same regardless of CAFO size. The annual average burden per State respondent is 10,152 and the average burden per response is 16 hours (USEPA, 2002j).

More detailed information on the burden and associated costs for each of the activities described above is provided in the ICR (USEPA, 2002j). Section 10 of the final rule preamble further summarizes the expected reporting and record-keeping requirements under the final regulations based on information compiled as part of the *Information Collection Request for the Final NPDES and ELG Regulatory Revisions for Concentrated Animal Feeding Operations* (OMB ICR NO. 2040-0250) prepared by EPA.

4.3.2.5 Steps Taken to Minimize Significant Economic Impacts on Small Entities

For the final regulations, EPA has adopted an approach for a regulatory program that mitigates impacts on small business, recognizes and promotes effective non-NPDES State programs, and works in partnership with USDA to promote environmental stewardship through voluntary programs, and financial and technical assistance. EPA's proposal included many options that were not finally adopted in deference to these principles.

Because of the estimated impacts on small entities EPA is not certifying that this rule will not impose a significant impact on a substantial number of small entities. EPA has complied with all RFA provisions and conducted outreach to small businesses, convened a SBAR panel, prepared an Initial Regulatory Flexibility Analysis (IRFA) and a Final Regulatory Flexibility Analysis (FRFA), and also prepared an economic analysis. The Agency's actions include the following efforts to minimize impacts on small businesses:

- Retained structure of existing regulations, which allows EPA and states to focus on the largest producers;
- Retained existing designation criteria and process;
- Retained existing definition of an AFO;
- Retained conditions for being defined as a Medium CAFO;
- Eliminated the "mixed" animal calculation for operations with more than a single animal type for determining which AFOs are CAFOs;
- Raised the duck threshold for dry manure handling duck operations; and
- Adopted a dry-litter chicken threshold higher than proposed.

EPA went to some length to explore and analyze a variety of ELG regulatory alternatives to minimize impacts on small businesses. The record for today's rule includes extensive discussions of the alternatives, EPA's analysis of those alternatives, and the rationale for the Agency's decisions. In large part, the Agency incorporated most of the alternative considerations to reduce the burden to small businesses. By way of example, today's regulations will affect fewer small businesses at significantly reduced costs, as compared to the estimates of the number of operations and expected costs to those affected entities based on the requirements set forth in the 2001 proposal. For more information on EPA's option selection rationale, see Section 4 of the preamble to the final rule.

4.4 EPA'S ANALYSIS OF SMALL BUSINESS IMPACTS

This section discusses the data and methodology EPA uses to assess economic impacts on small CAFO businesses (Section 4.4.1) and presents the results of this analysis (Section 4.4.2). This economic analysis supports the FRFA (Section 4.3) by quantifying the effects of the CAFO regulations. Based on the results of this analysis, EPA has determined that the CAFO regulations would result in financial stress to some affected small businesses, but not a substantial number of operations relative to the total number of affected small businesses in these sectors.

4.4.1 Data and Methodology

To examine the economic impacts of the final regulations on small CAFO businesses, EPA uses the same representative farm approach that is used to analyze impacts on all CAFOs (regardless of size), as described in Section 2 of this EA.[34] This approach evaluates impacts on select model CAFOs and extrapolates these results to the number of operations identified by each representative model, thus aggregating costs nationally across all sectors. Inputs for this analysis include the number of CAFOs represented by each model (see Section 4.3.3) and, for each model CAFO, the costs of the final regulations and selected financial characteristics (see Section 2).

EPA's analysis evaluates the economic achievability of the final regulatory options at small CAFO businesses based on financial criteria established for this analysis. These criteria reflect a combination of both farm level and enterprise level criteria. Three farm level criteria are assessed: (1) a comparison of incremental costs to total revenue (sales test), (2) projected post-compliance cash flow over a 10-year period, and (3) an assessment of an operation's debt-asset ratio under a post-compliance scenario. Projected post-compliance cash flow over a 10-year period is also assessed at the enterprise level in order to evaluate the potential effects at a facility's livestock or poultry enterprise, apart from the effects assessed for the entire facility.

EPA used the results from these analyses to divide affected CAFOs into three financial impact categories: Affordable, Moderate, and Stress. CAFOs experiencing affordable or moderate impacts are considered to experience some financial impact on operations, but EPA does not expect the costs of complying with this rule to make such operations vulnerable to closure. EPA considers that for CAFOs in both the "Affordable" and "Moderate" impact categories the final requirements are economically achievable. Operations experiencing financial stress, however, are considered to be vulnerable to closure because of the costs of this rule. EPA considers that for CAFOs in the "Stress" impact category, the final requirements might not be economically achievable, subject to other considerations. For more information on this decision framework, see Table 2-8 and Figure 2-1.

EPA conducted its analysis first at the farm level based on data reflecting financial conditions for the entire farm operation (e.g., reflecting income and cost information spanning the entire operation, thus

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[34] For past regulations, EPA has often analyzed the potential impacts to small businesses by evaluating the results of a costs-to-sales test, measuring the number of operations that will incur compliance costs at varying threshold levels. EPA conducted such an analysis at the time of the 2001 proposal, but believes that its more refined analysis used for its general analysis better reflects the potential impacts to regulated small businesses.

considering the operation's primary livestock production, along with other income sources such as secondary livestock and crop production, government payments, and other farm-related income). Based on the farm level results, EPA also assessed the financial effects on CAFOs at the enterprise level (e.g., limiting the scope of the assessment to the operation's livestock or poultry enterprise, and excluding other non CAFO-related sources of income from the analysis).

Starting with the farm level analysis, EPA considers the regulations to be economically achievable for a representative model CAFO if the average operation has a post-compliance sales test estimate within an acceptable range, a positive post-compliance cash flow over a 10-year period, and a post-compliance debt-to-asset ratio not exceeding a benchmark value. Specifically, if the sales test shows that compliance costs are less than 3 percent of sales, or if post-compliance cash flow is positive and the post-compliance debt-to-asset ratio does not exceed a benchmark (depending on the baseline data) and compliance costs are less than 5 percent of sales, EPA considers the options to be "Affordable" for the representative CAFO group. (Although a sales test result of less than 3 percent does indicate "Affordable" in the farm level analysis, further analysis is conducted to determine the effects at the operation's livestock or poultry enterprise.) The benchmark values assumed for the debt-asset test are sector-specific. EPA assumes a 70 percent benchmark value for the debt-asset test to indicate financial stress in the hog and dairy sectors, and an 80 percent benchmark for the debt-asset test to indicate financial stress in the beef cattle sector. These benchmark values address public comment received and alternative debt and asset data submitted for the livestock sectors. For the poultry sectors, however, EPA did not obtain alternative debt and asset data and continues to evaluate data used for proposal against a 40 percent benchmark value.

A sales test of greater than 5 percent but less than 10 percent of sales with positive cash flow and a debt-to-asset ratio of less than these sector-specific debt-asset benchmark values is considered indicative of some impact at the CAFO level, but at a level not as severe as those indicative of financial distress or vulnerability to closure. These impacts are labeled "Moderate" for the representative CAFO group. EPA considers both the "Affordable" and "Moderate" impact categories to be economically achievable by the CAFO, subject to the enterprise analysis (see below). If, with a sales test of greater than 3 percent, post-compliance cash flow is negative or the post-compliance debt-to-asset ratio exceeds these sector-specific debt-asset benchmarks, or if the sales test shows costs equal to or exceeding 10 percent of sales, EPA considers the final regulations to be associated with potential financial stress for the entire representative CAFO group. In such cases, each of the operations represented by that group might be vulnerable to closure. For operations that are determined to experience financial "Stress" at the farm level, the final requirements are likely not economically achievable.

The enterprise level analysis builds on the farm level analysis, evaluating effects at a farm's livestock or poultry enterprise. If the farm level analysis shows that the regulations impose "Affordable" or "Moderate" effects on the operation, the enterprise level analysis is conducted to determine whether the enterprise's cash flow is able to cover the cost of regulations. This analysis uses a discounted cash flow approach similar to that used to assess the farm level effects, in which the net present value of cash flow is compared to the net present value of the total cost of the regulatory options over the 10-year time frame of the analysis. Over the analysis period, if an operation's livestock or poultry enterprise maintains a cash flow stream that both exceeds the cash costs of the rule (operating and maintenance costs plus interest) and covers the net present value of the principal payments on the capital, EPA concludes that the enterprise will likely not close because of the CAFO rule. This analysis is conducted on a pass/fail basis. If the net present value of cash flow minus the net present value of the rule's costs is greater than zero, the enterprise passes the test and the enterprise is assumed to continue to operate. EPA

considers these results to indicate that the final requirements are economically achievable. If the net present value of cash flow is not sufficient to cover the net present value of the cost of the rule, EPA assumes that the CAFO operator would consider shutting down the livestock or poultry enterprise. That is, if an operation fails the enterprise level analysis, these operations are determined to experience financial "Stress" and the final requirements are likely not economically achievable.

More detail on the classification scheme established for this analysis, along with a discussion of the basis for EPA's use of these criteria, is provided in Section 2. Section 2.3. presents the baseline (farm and enterprise level) financial data that EPA uses to analyze impacts on small CAFO businesses.

Appendix B shows EPA's estimated compliance costs for selected model CAFOs under the final BAT Option. These costs reflect the range of facility level costs for model CAFOs based on estimated per-unit costs aggregated by the average number of animals assumed for each model. All costs shown are expressed on a per-animal basis and are differentiated by facility size, producing region, facility types, and other factors. Costs are reported in ranges across three types of land availability for manure application and also across three types of technology needs assumed for model CAFOs for the purpose of this analysis. The land availability types include: Category 1 farms, which have sufficient cropland for all on-farm nutrients generated; Category 2 farms, which have insufficient cropland; and Category 3 farms, which have no cropland. USDA data/information grouping facilities into the categories of technology adoption and use are: "least needs" and "most needs" operations (assumed to account for 25 percent each of all facilities) and also "average needs" (assumed to account for 50 percent of all operations). These groupings are based on available USDA data; detailed information is available in the *Development Document* supporting the proposed regulations (USEPA, 2002). Section 2 provides a summary on EPA's engineering cost models.

To estimate financial effects on operations with between 300 and 1,000 AU that may be defined as CAFOs under the NPDES permit regulations, EPA assumes that the estimated costs for CAFOs with between 300 and 1,000 AU to comply with the effluent guideline regulations are similar to the costs that will be incurred by sized operations of that size to comply with BPJ requirements under the revised NPDES regulations. Because the costs to comply with the effluent guideline represent the likely high end of the possible cost range, estimated impacts on operations in this size range might be overstated.

To estimate financial effects on expected designated facilities, EPA uses the same general approach described in Section 2 of this report to assess impacts on an estimated 344 designated facilities over a 10-year period.[35] For this analysis EPA uses estimated costs for the smallest size model CAFO among operations with between 300 and 1,000 AU ("Medium" operations)[36] for model CAFOs developed for operations located in the more traditional production regions (Midwest for the livestock and turkey operations and South for the broiler and egg-laying operations; Table 2-1 shows these definitions). For example, EPA assumes that operations characterized as having available land for land application of manure (Category 1 model facilities) and high technology needs ("most needs" or Category H) may be characterized as Category 1H models for purposes of costing across the range of

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[35] As shown in Table 3-3, EPA estimates 172 designated facilities over a 5-year permit period. For the purpose of this analysis, EPA assumes that half are expected to be designated during the first 5 years, and the other half, in the second 5 years.

[36] Medium 3 for wet layer operations.

land base and technology needs cost models. These cost estimates are shown in Appendix B. More detailed cost information is provided in the *Development Document* (USEPA, 2002).

For CAFOs with between 300 to 1,000 AU, operations are distributed in the key regions (Midwest or South) in the key category group (Category 1H) across the Medium 1, 2, and 3 model sizes. For all sectors excluding hog, the farm counts are distributed evenly across these three size groups. The hog models are more complex, because the engineering costs are divided by size, region, operation type (farrow finish and grow finish) and manure process (liquid and pit for Medium models), and the financial models are divided by size, region, and contract versus independent, and so forth, leading to a much larger matrix of models than those for other sectors. The designated counts were distributed in a ratio of NPDES farm counts over the Medium 1, 2, and 3 models for liquid and pit manure processes, by contract vs. independent and by farrow finish and grow finish in the Midwest 1H categories. For designated CAFOs with fewer than 300 AU, operations are placed in one model for each sector, with the exception of hog facilities. Hog operations are distributed evenly among the model types (manure process by grow finish or farrow finish and by contract versus independent). Costs for these "Small" models are developed using the Medium 1, Category 1H costs for each sector (or in the case of hog, each process and operation type). The cost per head for the Medium 1, 1H operation was applied to an assumed 300 AU number of head to estimate an annualized compliance cost per "small" facility. Because there was no Medium 1 size for wet layer, the Medium 3 size group per head cost was applied to the number of head associated with 300 AU.

4.4.2 Economic Analysis Results

Using the economic achievability criteria established for this analysis, discussed in Section 4.4.1, EPA's economic analysis indicates that the CAFO regulations will not impose financial stress on a substantial number of operations, relative to the total number of affected confinement operations in these sectors. The results of this analysis are presented in Table 4-5.

EPA estimates that about 6,200 small business CAFOs would be affected by this rule. For this analysis, EPA estimates that about 6,200 affected CAFOs are small businesses, consisting of about 2,330 operations with more than 1,000 AU and about 3,830 operations with between 300 and 1,000 AU. Most of these affected small businesses are in the hog, dairy, and broiler sectors.[37]

In examining the effects on small businesses for the final rule, EPA followed the same approach used to evaluate the impacts on existing CAFOs, as described in Section ES.2. For the purposes of this analysis, EPA assumes that small business CAFOs with between 300 and 1,000 AU would incur costs similar to those estimated for CAFOs with more than 1,000 AU (although these smaller-sized operations will be subject to BPJ and not the ELG requirements under the revised NPDES requirements). These upper end cost estimates could, therefore, overstate the financial effects for small businesses in this size category. For past regulations, EPA has often analyzed the potential impacts to small businesses by evaluating the results of a costs-to-sales test, measuring the number of operations that will incur compliance costs at varying threshold levels (including ratios where costs are less than 1 percent,

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[37] For reasons noted in the record, EPA believes that the number of small broiler operations is overestimated and might actually include a number of medium and large broiler operations that should not be considered small businesses.

between 1 and 3 percent, and greater than 3 percent of gross income). EPA conducted such an analysis at the time of the 2001 proposal, indicating that about 80 percent of the estimated number of small businesses directly subject to the rule as CAFOs might incur costs in excess of three percent of sales. EPA believes that its more refined analysis used for its general analysis (presented here) better reflects the potential impacts to regulated small businesses.

Using this approach, EPA's analysis indicates that the final rule could cause financial stress to some small businesses, making these businesses vulnerable to closure. These results are presented in Table 4-5a (Option 1) and Table 4-5b (Option 2).

For Option 1, the analysis indicates that, among all small business CAFOs in the veal, dairy, hog, turkey, and egg-laying sectors, the impacts due to this rule can be characterized as "Affordable" or "Moderate." EPA estimates that a total of 172 small businesses (3 percent of all small business CAFOs with more than 300 AU) would experience financial stress and might be vulnerable to closure. By sector, these closures are comprised of about 131 small businesses in the beef sector, 38 businesses in the heifer sector, and 3 businesses in the broiler sector. Most of these (nearly 90 percent) are operations with fewer than 1,000 AU. For Option 2, the analysis indicates that, among all small business CAFOs in the veal, dairy, hog, turkey, and egg-laying sectors, the impacts due to this rule can be characterized as "Affordable" or "Moderate." EPA estimates that a total of 262 small businesses (4 percent of all small business CAFOs with more than 300 AU) would experience financial stress and might be vulnerable to closure. By sector, these closures are comprised of about 183 small businesses in the beef sector, 50 businesses in the heifer sector, and 19 businesses in the broiler sector. Nearly 90 percent of these potential closures are operations with fewer than 1,000 AU.

These estimates of the number of potential CAFO closures are cumulative and reflect the results of both the farm level analysis and the enterprise level analysis. These results are based on an analysis that does not consider the longer term effects on market adjustment and also available cost-share assistance from Federal and State farm conservation programs. EPA believes that such adjustments could lessen the economic impacts of the final regulations over time.

Table 4-5 shows the results of this analysis aggregated across all estimated designated operations with less than 1,000 AU, indicating that nearly one-half of all designated operations may go out of business. Closures among designated operations are all in the broiler, beef, and heifer sectors.

Table 4-5a. Results of EPA's Small Business Analysis (Option 1)

Sector	Number of Small CAFOs	Affordable	Moderate	Stress	Affordable	Moderate	Stress
		(Number)			(Percent of Total Operations)		
CAFOs >1000 AU (excl. designated operations)							
Fed Cattle	712	581	0	131	82%	0%	18%
Veal	12	12	0	0	100%	0%	0%
Heifer	327	289	0	38	88%	0%	12%
Dairy	1,330	1,330	0	0	100%	0%	0%
Hogs	1,485	1,485	0	0	100%	0%	0%
Broilers	1,823	1,395	424	3	77%	23%	0%
Layers: Dry	24	24	0	0	100%	0%	0%
Layers: Wet	407	407	0	0	100%	0%	0%
Turkeys	31	31	0	0	100%	0%	0%
Total	**6,151**	**5,554**	**424**	**172**	**90%**	**7%**	**3%**
CAFOs >1,000 AU							
Fed Cattle	538	533	0	5	99%	0%	1%
Veal	5	5	0	0	100%	0%	0%
Heifer	97	97	0	0	100%	0%	0%
Dairy	0	--	--	--	--	--	--
Hogs	0	--	--	--	--	--	--
Broilers	1,303	1,065	234	3	82%	18%	0%
Layers: Dry	0	--	--	--	--	--	--
Layers: Wet	383	383	0	0	100%	0%	0%
Turkeys	0	--	--	--	--	--	--
Total	**2,326**	**2,083**	**234**	**8**	**90%**	**10%**	**0%**

Table 4-5a. Results of EPA's Small Business Analysis (Option 1)

Sector	Number of Small CAFOs	Affordable	Moderate	Stress	Affordable	Moderate	Stress
		(Number)			(Percent of Total Operations)		
Operations 300 - 1,000 AU (Defined as CAFOs)							
Fed Cattle	174	48	0	126	27%	0%	73%*
Veal	7	7	0	0	100%	0%	0%
Heifer	230	192	0	38	83%	0%	17%
Dairy	1,330	1,330	0	0	100%	0%	0%
Hogs	1,485	1,485	0	0	100%	0%	0%
Broilers	520	330	190	0	63%	37%	0%
Layers: Dry	24	24	0	0	100%	0%	0%
Layers: Wet	24	24	0	0	100%	0%	0%
Turkeys	31	31	0	0	100%	0%	0%
Total	**3,825**	**3,471**	**190**	**164**	**91%**	**5%**	**4%**
Operations <1,000 AU (Designated as CAFOs)							
Fed Cattle	30	4	0	26	13%	0%	87%
Veal	0	0	0	0	NA	NA	NA
Heifer	6	0	0	6	0%	0%	100%
Dairy	60	60	0	0	100%	0%	0%
Hogs	104	104	0	0	100%	0%	0%
Broilers	104	0	0	104	0%	0%	100%
Layers: Dry	4	4	0	0	100%	0%	0%
Layers: Wet	16	16	0	0	100%	0%	0%
Turkeys	20	20	0	0	100%	0%	0%
Total	**344**	**208**	**0**	**136**	**61%**	**0%**	**40%**

Source: USEPA. May not add due to rounding. Does not includes the number of CAFOs includes designated facilities. Assumes that the costs that will be incurred by those sized operations to comply with BPJ-based limitations under the revised NPDES regulations are similar to the estimated costs that would be incurred if Medium CAFOs had to comply with the ELG.
"Layers: dry" are operations with dry manure systems. "Layers: wet" are operations with liquid manure systems.

Table 4-5b. Results of EPA's Small Business Analysis (Option 2)

Sector	Number of Small CAFOs	Affordable	Moderate	Stress	Affordable	Moderate	Stress
		(Number)			(Percent of Total Operations)		
CAFOs >1000 AU (excl. designated operations)							
Fed Cattle	712	529	0	183	74%	0%	26%
Veal	12	12	0	0	100%	0%	0%
Heifer	327	277	0	50	85%	0%	15%
Dairy	1,330	1,306	24	0	98%	2%	0%
Hogs	1,485	1,483	2	0	100%	0%	0%
Broilers	1,823	1,026	780	19	56%	43%	1%
Layers: Dry	24	24	0	0	100%	0%	0%
Layers: Wet	407	407	0	0	100%	0%	0%
Turkeys	31	31	0	0	100%	0%	0%
Total	**6,151**	**5,129**	**806**	**262**	**83%**	**13%**	**4%**
CAFOs >1,000 AU							
Fed Cattle	538	522	0	16	97%	0%	3%
Veal	5	5	0	0	100%	0%	0%
Heifer	97	88	0	9	91%	0%	9%
Dairy	0	--	--	--	--	--	--
Hogs	0	--	--	--	--	--	--
Broilers	1,303	763	532	9	58%	41%	1%
Layers: Dry	0	--	--	--	--	--	--
Layers: Wet	383	383	0	0	100%	0%	0%
Turkeys	0	--	--	--	--	--	--
Total	**2,326**	**1,795**	**532**	**34**	**76%**	**23%**	**1%**

Table 4-5b. Results of EPA's Small Business Analysis (Option 2)

Sector	Number of Small CAFOs	Affordable	Moderate	Stress	Affordable	Moderate	Stress
		(Number)			(Percent of Total Operations)		
Operations 300 - 1,000 AU (Defined as CAFOs)							
Fed Cattle	174	7	0	167	4%	0%	96%
Veal	7	7	0	0	100%	0%	0%
Heifer	230	189	0	41	82%	0%	18%
Dairy	1,330	1,306	24	0	98%	2%	0%
Hogs	1,485	1,483	2	0	100%	0%	0%
Broilers	520	263	248	10	51%	48%	1%
Layers: Dry	24	24	0	0	100%	0%	0%
Layers: Wet	24	24	0	0	100%	0%	0%
Turkeys	31	31	0	0	100%	0%	0%
Total	**3,825**	**3,334**	**274**	**228**	**87%**	**7%**	**6%**
Operations <1,000 AU (Designated as CAFOs)							
Fed Cattle	30	4	0	26	13%	0%	87%
Veal	0	0	0	0	NA	NA	NA
Heifer	6	0	0	6	0%	0%	100%
Dairy	60	60	0	0	100%	0%	0%
Hogs	104	104	0	0	100%	0%	0%
Broilers	104	0	0	104	0%	0%	100%
Layers: Dry	4	4	0	0	100%	0%	0%
Layers: Wet	16	16	0	0	100%	0%	0%
Turkeys	20	20	0	0	100%	0%	0%
Total	**344**	**208**	**0**	**136**	**61%**	**0%**	**40%**

Source: USEPA. May not add due to rounding. Does not includes the number of CAFOs includes designated facilities. Assumes that the costs that will be incurred by those sized operations to comply with BPJ-based limitations under the revised NPDES regulations are similar to the estimated costs that would be incurred if Medium CAFOs had to comply with the ELG.
"Layers: dry" are operations with dry manure systems. "Layers: wet" are operations with liquid manure systems.

EPA believes that the estimated financial impacts shown in Tables 4-5(a) and 4.5(b) represent the worst case. The reasons are summarized below.

First, all results are estimated assuming no costs can be passed through between CAFOs and the processing sectors. As discussed in Section 3 of this report, if modest levels of cost passthrough are assumed in the broiler sectors, the BAT requirements are affordable to all small broiler operations. EPA did not evaluate economic impacts on cattle operations under a cost passthrough scenario; however, it is expected that long-run market and structural adjustment by producers in this sector will diminish the estimated impacts. Even without an assumption of cost passthrough, EPA's analysis shows that adverse impacts will not be experienced by a substantial number of operations, as compared to the number of affected operations in these sectors. EPA has conducted an extensive literature review of issues concerning cost passthrough. Based on the results of the available empirical research on market power and price transmission in these industries, EPA believes that there is little evidence to support the position that increased production costs may not be passed through the market levels. A summary of this literature review is provided in the rulemaking record (ERG, 2000c — DCN 70640).

Second, as noted in the SBAR Panel Report, EPA believes that the number of small broiler operations is overestimated. In the absence of business level revenue data, EPA estimates the number of "small businesses" using the approach described in Section 4.2. Using this approach, virtually all (>99.9 percent) broiler operations are considered "small" businesses. This categorization may not accurately portray actual small operations in this sector because it classifies a 15- to 20-house broiler operation with 375,000 birds as a small business. Information from industry sources suggests that a two-house broiler operation with roughly 50,000 birds is more appropriately characterized as a small business in this sector (Madison, 1999; Staples, 1998). Therefore, it is likely that the number of small broiler operations might include a number of medium and large size broiler operations being considered small entities. As discussed in Section 9.2.1 of the Proposal EA, EPA consulted with SBA on the use of an alternative definition for small businesses in all affected sectors based on animal inventory at an operation during the development of the rulemaking.

Third, EPA believes that a costs-to-sales comparison is a crude measure of impacts on small business in sectors where production contracting is commonly used, such as in the broiler sector (and also in the turkey, egg, and hog sectors, though to a lesser extent). As discussed in Section 4.2.4.5 of the Proposal EA, lower reported operating revenues in the broiler sector reflect the predominance of contract growers in this sector. Contract growers receive a prenegotiated contract price that is lower than the USDA-reported producer price, thus resulting in lower gross revenues at these operations (USDA/ERS, 1996b; Perry et al., 1999; Farm Journal, 1998). Lower producer prices among contract growers are often offset by lower overall production costs at these operations, because the affiliated processor firm pays for a substantial portion of the grower's annual variable cash expenses. Inputs supplied by the integrator may include feeder pigs or chicks, feed, veterinary services and medicines, technical support, and transportation of animals (USDA, 1996a). These variable cash costs compose a large component of annual operating costs, averaging more than 70 percent of total variable and fixed costs at livestock and poultry operations (USDA/ERS, 1999a). The contract grower also faces reduced risk because the integrator guarantees the grower a fixed output price (see Section 2 of the Proposal EA for more information on contracting in animal agriculture). Because production costs at a contract grower operation are lower than that at an independently owned operation, a profit test (costs-to-profit comparison) is a more accurate measure of impacts at grower operations. However, financial data are not available that differentiate between contract grower and independent operations.

Fourth, EPA's initial regulatory flexibility analysis also does not consider a range of potential cost offsets available to most farms. As discussed in Section 2.4 of this report, one source of potential cost offset is cost share and technical assistance available to farmers for on-farm improvements from various State and Federal programs, such as the Environmental Quality Incentives Program (EQIP) administered by USDA. Cost sharing for eligible producers under EQIP may cover up to 75 percent of the costs of certain conservation practices, such as grassed waterways, filter strips, manure management facilities, capping of abandoned wells, and other practices important to improving and maintaining the health of natural resources in the area. Technical assistance is also available for formulating conservation plans. In the Spring of 2002, new Farm Bill legislation passed by Congress might significantly raise government expenditures for this program. Total EQIP authorization for FY 2002 to FY 2007 is $5.8 billion, ranging from $400 million to $1.3 billion per year over the period. This compares to current authorized levels of about $200 million per year. The new legislation targets 60 percent of available EQIP funds to livestock and poultry producers, including confinement and grass-based systems. The new legislation also removed the previous EQIP eligibility requirements that restricted funding for certain structural practices to operations with fewer than 1,000 AU (as measured by USDA), replacing this restriction with an overall payment limitation of $450,000 per producer over the authorized life of the 2002 Farm Bill. Many other State and Federal cost share programs base eligibility not on size thresholds but on priority watersheds (e.g., USDA's Small Watershed Program; the New York City Watershed Program), priority contaminants (e.g., Kansas Non-Point Source Pollution Control Fund), or proposed waste management practices (e.g., Maryland, Minnesota, Missouri, Nebraska, and North Carolina state programs). However, technical assistance under most programs is available to all operations, regardless of watershed, contaminants, proposed practices, or size (ERG, 2000a). A review of cost-share and technical assistance programs available to AFOs is provided in the rulemaking record (ERG, 2000a—DCN 70130).

Section 2.4 also describes another source of potential cost offset, which is manure sales, particularly of relatively higher value dry poultry litter. EPA estimates that sales of dry poultry litter could offset the costs of meeting the regulatory requirements on the order of more than 50 percent. As illustrated in the Proposal EA, this reduction alone exceeds the level of cost passthrough (42 percent) assumed at proposal for the cost impact analysis of the broiler sector. Details on how EPA calculated these manure sale offsets and how they would reduce the economic impacts at poultry operations are presented in Section 6 of the Proposal EA.

Finally, this analysis does not take into account certain noneconomic factors that might influence an operation's decision to weather the boom and bust cycles that are commonplace in agricultural markets. Farm typology data from USDA indicate that a large share of farming operations (more than 90 percent) have annual sales of less than $250,000 and are considered "small family farms" by USDA (USDA/ERS, 2000d, 2000e). Of these, about 60 percent are "limited-resource," "retirement," or "residential" operations where farming is not the primary source of income (USDA/ERS, 2000e, 1999a). In many cases, these operations have negative annual income supplemented by sources of off-farm income that subsidize the farming operation (USDA/ERS, 2000d and 1996a).

USDA's ERS (1996a) reports that about 60 percent of farm operators reporting negative net income had nonfarm occupations. About 75 to 80 percent of farms rely on some nonfarm income, and even in the largest operations nonfarm income can be a significant portion of total household income (USDA/ERS, 1996a). More than 90 percent of farm operators with negative net income had nonfarm income averaging more than $35,700 per year; even farms with positive net income rely somewhat on nonfarm income (Heimlich and Barnard, 1995; USDA/ERS, 1996a).

When farm income is negative over a period of time, sales tests can be very difficult to interpret (Heimlich and Barnard, 1995). One reason that incomes can remain negative over several years is that operators can supplement farm income with nonfarm income, and these losses can be used to reduce total income tax liabilities while the real estate value of the farm property appreciates. Additional noneconomic factors might also include the satisfaction of working for oneself, the ability to employ family members, a sense of tradition and the ability to pass on that tradition to future generations, and the fact that the operation is both a home and a livelihood. These and other noneconomic factors might influence the decision to close a livestock or poultry operation cannot be adequately addressed in an economic model. To the extent that these factors play a role in that decision, EPA's economic model might overstate the possibility of closure among small businesses.

USDA's farm financial data include operations where farming is part-time and not the primary occupation, but exclude sources of nonfarm income at these operations. As noted in Section 4.2 of the Proposal EA, the inclusion of these operations may result in lower average data values than would be the case if these operations were excluded from the analysis. EPA believes that including of these operations might tend to overstate impacts. Previous analyses by USDA and EPA have also noted the potential effect on average farm data of including these operations and have regarded these part-time business more as "hobbies or recreational activities" (Heimlich and Barnard, 1995; DPRA, 1995). Heimlich and Barnard (1995) further indicate that considering non-farm income in addition to farm income may provide a more appropriate comparison to the costs of required measures where the motivation for staying in business is not necessarily purely economic.

Overall, EPA expects that the CAFO regulations will benefit the smallest businesses in these sectors, because the regulations might create a comparative advantage for small operations that are not subject to the regulations. Except for the few AFOs that are designated as CAFOs, these small operations will not incur costs associated with the final requirements and may benefit from eventual higher producer prices as these markets adjust to higher production costs in the long term.

SECTION FIVE

OTHER REGULATORY ANALYSIS REQUIREMENTS

This section addresses the requirements to comply with Executive Order (EO) 12866 and the Unfunded Mandates Reform Act (UMRA), both which require Federal agencies to assess the costs and benefits of each significant rule they propose or promulgate.

This section is organized as follows. Section 5.1 describes the administrative requirements of both EO 12866 and UMRA. Section 5.2 identifies the reasons why EPA has determined that the existing regulations need to be revised. Section 5.3 provides a summary of the total social costs of the final CAFO regulations. Section 5.4 briefly summarizes the expected pollutant reductions. Section 5.5 summarizes the estimated monetized benefits for regulatory Options 1 and 2.

Much of the information provided in this section is summarized from, and extensively references, other documents that support this rulemaking, as well as other sections of this report that present more detailed accounts of EPA's supporting analyses.

5.1 ADDITIONAL ADMINISTRATIVE AND REGULATORY ANALYSES

5.1.1 Requirements of Executive Order 12866

Under Executive Order 12866 (58 FR 51735, October 4, 1993), the Agency must determine whether a regulatory action is "significant" and therefore subject to Off cie of management and Budget (OMB) review and the requirements of the Executive Order. The Order defines a "significant regulatory action" as one that is likely to result in a rule that may:

- have an annual effect on the economy of $100 million or more or adversely affect in a material way the economy, a sector of the economy, productivity, competition, jobs, the environment, public health or safety, or state, local, or tribal governments or communities;
- create a serious inconsistency or otherwise interfere with an action taken or planned by another agency;
- materially alter the budgetary impact of entitlements, grants, user fees, or loan programs or the rights and obligations of recipients thereof; or
- raise novel legal or policy issues arising out of legal mandates, the President's priorities, or the principles set forth in the Executive Order.

EPA has determined that the final CAFO rulemaking is a "significant regulatory action" under the terms of Executive Order 12866. As such, this action was submitted to OMB for review. Changes made in response to OMB's suggestions or recommendations will be documented in the public record.

In addition to submission of the action to OMB, the principal requirements of the Executive Order are that the Agency perform an analysis comparing the benefits of the regulation to the costs that

the regulation imposes, that the Agency analyze alternative approaches to the rule, and that the need for the rule be identified. Wherever possible, the costs and benefits of the rule are to be expressed in monetary terms. To address the analytical requirements, as specified by the Executive Order, Section 5.2 describes the reasons why EPA is revising the existing regulations, and Sections 5.3 through 5.6 present the estimated social costs, pollutant reductions, and monetary benefits of the proposed CAFO regulations. An in-depth profile of these industry sectors is presented in Section 2 of the Proposal EA and additional information for each affected industry subcategory is provided in Sections 6, 7, and 8 of the Proposal EA. The preamble to the final CAFO regulations describes revisions to the existing regulations, which are briefly summarized in Section 1 of this report).

5.1.2 Requirements of the Unfunded Mandates Reform Act (UMRA)

Title II of the UMRA Public.Law 104-4, establishes requirements for Federal agencies to assess the effects of their regulatory actions on State, Tribal, local, governments and the private sector. Under Section 202 of the UMRA, EPA generally must prepare a written statement, including a cost-benefit analysis, for proposed and final rules with "Federal mandates" that may result in expenditures to State, Tribal, and local governments, in the aggregate, or to the private sector, of $100 million or more in any one year.

This final rule is anticipated to cost the private sector more than $100 million per year for the time period analyzed. In particular, this section addresses the following:

- Section 202(a)(1): authorizing language (also see Section 10 of the preamble to the final rule)
- Section 202(a)(2): a qualitative and quantitative assessment of the anticipated costs and benefits of the regulation
- Section 202(a)(3)(A): accurate estimates of future compliance costs (as reasonably feasible)
- Section 202(a)(3)(B): disproportionate effects on particular segments of the private sector
- Section 202(a)(3)(B): disproportionate effects on local communities (this rule is not expected to have disproportionate effects on local communities.)
- Section 205(a): least burdensome option or explanation required (also see Section 4 of the preamble to the final rule)

EPA has determined that the final CAFO regulations contain a Federal mandate that may result in expenditures of $100 million or more for the private sector in any one year (see Section 3.3). Accordingly, EPA has prepared the written statement required by section 202 of the UMRA. This and previous sections of the EA constitute this statement: Sections 5 through 8 of the EA identify costs and impacts (burdens) on CAFOs that are subject to the final regulations, as well as impacts on processors in these industries and other market affects. Appendix E of the Proposal EA (USEPA, 2001a) presents

information comparing the cost-effectiveness of the proposed regulatory alternatives; Appendix E of this report presents EPA's cost-effectiveness for the final regulations. Additionally, EPA's *Benefits Analysis* (USEPA, 2002k) presents estimated monetary benefits that might accrue under the proposed regulations, as required under UMRA when costs of a federal mandate exceed $100 million in any one year.

Before promulgating an EPA rule for which a written statement is needed, Section 205 of the UMRA generally requires EPA to identify and consider a reasonable number of regulatory alternatives and adopt the least costly, most cost-effective or least burdensome alternative that achieves the objectives of the rule. The provisions of section 205 do not apply when they are inconsistent with applicable law. In this rule, the Clean Water Act requires EPA to establish effluent limitations for point sources based on the "best available technology economically achievable" (Sections 301(b)(2)(A) and 304(b)(2)). Factors that EPA shall consider in an assessment of best available technology include the cost of achieving effluent reductions, among other factors (Section 304(b)(2)(B)). Pursuant to section 205(a)(1)-(2), EPA selected the least expensive option that also meets the requirement that EPA select the "best available technology economically achievable." More information is provided in Section 4 of the preamble supporting the final regulations.

EPA has also determined that the final CAFO regulations do not include a Federal mandate that may result in estimated costs of $100 million or more to State, Tribal, or local governments in the aggregate. Accordingly, the regulations contain no regulatory requirements that might significantly or uniquely affect small governments and therefore are not subject to the requirement of Section 203 of the UMRA. Costs incurred by Federal or State governments under the final regulations are presented in Section 5.3. Tribal governments may also incur compliance costs; however, these costs are expected to be modest and have not been estimated. EPA has determined that the regulations do not include requirements that might significantly or uniquely affect local governments; therefore, this rule does not affect small governments as outlined in Section 203. Therefore a small governments agency plan has not been developed. (If EPA establishes any regulatory requirements that may significantly or uniquely affect small governments, including Tribal governments, it must have developed under Section 203 of the UMRA a small government agency plan. The plan must provide for notifying potentially affected small governments, thus enabling officials of affected small governments to have meaningful and timely input in the development of EPA regulatory proposals with significant Federal intergovernmental mandates, and informing, educating, and advising small governments on compliance with the regulatory requirements.)

5.2 NEED FOR THE REGULATIONS

Executive Order 12866 requires that the Agency identify the need for the regulation or regulations being proposed. A detailed discussion of the need for the regulations is presented in Section 4 of the 2001 Proposal (66 FR 2293-2972-2976). A summary may also be found in Sections 1 and 10 of the Proposal EA. These reasons are summarized briefly below:

- In spite of existing regulatory controls, there is continued discharge and runoff of manure and nutrients from livestock and poultry operations. The proposed regulations are expected to address the impairment of many U.S. waterways and the associated human health and ecological risks by reducing nutrient contributions from animal agriculture.

- Periodic review and revision of existing regulations is envisioned in the CWA. The existing regulations need to be updated to reflect structural changes in these industries over the past few decades. The continued trend toward fewer but larger operations, coupled with greater emphasis on more intensive production methods and specialization, is concentrating more manure nutrients and other animal waste constituents within some geographic areas. This trend has coincided with increased reports of large-scale discharges from these facilities.

- The existing regulation needs to be more effective at protecting or restoring water quality. The revisions will make the regulations easier to understand and better clarify the conditions under which an AFO is a CAFO and, therefore, subject to the regulatory requirements. Currently, few livestock and poultry operations have NPDES permits.

Both UMRA and EO 12866 require the statutory authority for the rule to be cited. A detailed discussion of the objectives and legal basis for these regulations is presented in Sections 1 and 3 of the preamble to the final rule and also the 2001 Proposal (see: 66 FR 2959 or USGPO, 2001a).

5.3 TOTAL SOCIAL COSTS

EPA estimates the total social costs of Option 2 at $335 million annually in 2001 dollars. These costs include compliance costs borne by CAFOs and administrative costs to States and the Federal government. Costs to regulated CAFOs constitute the bulk of this total cost, estimated by EPA at $326 million annually. EPA estimates that the administrative cost to Federal and State governments to implement this rule is $9 million per year. (For purposes of discussing EPA's analysis supporting UMRA, this section discusses results for Option 2 only; see Table 5-1).

5.3.1 Costs to Regulated CAFOs

The largest component of social cost is the cost to industry of complying with the regulation. Costs to industry include annualized capital costs, operating and maintenance costs, start-up and recurring costs, and also record-keeping costs. Estimated costs cover four broad categories, including nutrient management planning, facility upgrades, land application, and technologies for balancing on-farm nutrients. All capital costs are depreciated over a 10-year recovery period, based on the Internal Revenue Code's guidance for single-purpose agricultural or horticultural structures. More detail on how EPA estimates compliance costs for this rulemaking is in the *Development Document* (USEPA, 2002).

Table 5-1 shows the total annualized compliance costs to CAFOs. EPA estimates that of the total estimated social cost of Option 2 ($335 million annually), compliance costs borne by CAFOs constitute the bulk of this total cost and are estimated by EPA at $326 million annually. Of this total, compliance cost to operations with more than 1,000 AU are estimated at$283 million per year. Costs to operations with between 300 and 1,000 AU are estimated at $39 million per year. Cost to operations that may be designated as CAFOs is estimated at $4 million annually under Option 2. Information on these costs, along with a comparison of cost estimates for other regulatory options considered by EPA, is provided in Section 3.

These costs are pre-tax and do not reflect tax savings of incurred compliance costs.[38] For the purpose of this analysis, estimated pre-tax compliance costs can be viewed as an estimate of the net output loss to the economy, plus consumer and producer surplus losses. EPA does not use an estimate of net output loss because the Agency would then need to compute output gains and consumer and producer surplus losses associated with the proposed regulations. Because the pre-tax costs include no cost passthrough assumptions, no consumer surplus is lost. Additionally, the pre-tax cost will incorporate the loss in producers' surplus. The pre-tax costs of compliance thus serve as an estimate for the net output loss to the economy plus losses in consumer and producer surplus.

EPA assumes that all confinement operations that are defined or designated as CAFOs will incur these costs. Cost estimates include costs to facilities that are projected to experience financial stress that could lead to facility closure. In some cases, it is possible that a CAFO might be liquidated instead of incurring these costs. EPA considers the compliance costs assigned to these model CAFO to be a reasonable upper estimate of the costs to liquidate such operations.[39] An operation will choose to liquidate (to the extent that the choice is theirs to make) only when the costs of liquidating are less than the costs of installing and implementing pollution control.

5.3.2 Costs to the Permitting Authority (Federal and State Governments)

As discussed in Section 5.3.1, the overwhelming majority (more than 95 percent) of the estimated total regulatory costs will accrue to industry and to Federal and State governments in the form of foregone tax revenues. However, additional costs will be incurred by the NPDES permitting authority to alter existing state programs and obtain EPA approval to develop new permits, review new permit applications and issue revised permits that meet the final regulatory requirements.

Under the final rule, Federal and State National Pollutant Discharge Elimination System (NPDES) permitting authorities will incur administration costs related to the development, issuance, and tracking of general and individual permits. State NPDES permitting authorities would also incur costs to modify existing State NPDES programs for CAFOs and obtain EPA approval of the modifications. EPA estimates that under the final regulations an estimated 15,400 CAFOs would be permitted. This estimate consists of about 14,920 CAFOs covered by State permits and about 480 CAFOs covered by Federal permits. Administrative costs incurred by State permitting authorities are expected to be $8.5 million. EPA permitting authorities would incur the remaining $0.3 million (Table 5-1). These costs are expressed in 2001 dollars and are annualized over the 5-year permit life using a 7 percent discount rate. This analysis is available in the record and in the *Development Document* (USEPA, 2002). This analysis was conducted to evaluate the costs of the proposed rule to governments, as required under the Unfunded Mandates Reform Act (UMRA), as discussed in the preamble to the final regulations.

There are several ways that issuance of general permits will result in administrative costs to State and federal permitting authorities. First, State permitting authorities will need to revise their programs to incorporate changes in the final rule. Second, States will need to revise existing general permits; those

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[38]The tax shield is the cost to the Federal and State governments of subsidizing, in effect, the cost of the final regulations. Tax shields are also a cost to society and must be included in the estimate of social costs.

[39]These liquidation costs include legal fees, broker fees, and so forth.

that do not currently use them may choose to develop a general permit. The permitting authority is required to give public notice announcing the development of a draft permit and allow an opportunity for public comments. Often permitting authorities issue a response to the public comments received and, occasionally, hold public hearings on the draft general permit. Following the issuance of the final general permit, States and EPA may begin to incur administrative costs per facility. For example, each time a facility operator files a Notice of Intent (NOI) to obtain coverage under a general permit, the permitting authority will incur costs to review the application, file the NOI, or enter permittee information into a permit tracking system. Per-facility administrative costs might also include facility inspections to ensure compliance with permit conditions or to ensure a facility qualifies for coverage under the general permit. Finally, State and federal NPDES permitting authorities will need to review the annual reports submitted by each facility covered by a general permit.

When a facility submits an application for an individual permit, the permitting authority incurs administrative costs for review of the individual permit application and development of the individual permit by a permit writer. Additionally, public notice must be given about the development of the draft permit, and the authority may respond to any comments received and conduct public hearings as needed. Facility inspections might also be necessary prior to issuing a permit or to ensure compliance with permit conditions. As with general permits, permitting authorities will incur expenses for record-keeping, associated filing and tracking of individual permit applications and review of annual reports submitted by each facility covered by an individual permit.

EPA assumes that under the final regulations an estimated 15,400 CAFOs would be permitted. This estimate consists of 14,920 State permits (10,440 general and 4,480 individual permits) and 480 Federal permits (340 general and 140 individual permits). Table 5-2 shows EPA's estimate of the number of CAFO permits by State and EPA Region. More information on EPA's estimates is provided in the *Development Document* (USEPA, 2002) and rulemaking record.

The unit permit costs EPA assumed for this analysis are based on information obtained from State and EPA Regional permitting personnel. The cost assumptions used to develop, review, and approve permits and inspect facilities, as well as the estimate of annual administrative costs is presented in the *Development Document* (USEPA, 2002). These documents also provide detailed discussions on EPA's assumptions for the state and federal wage rates used to estimate costs.

5.3.3 Other Social Costs

An estimate of total social costs of the proposed regulations comprises costs that go beyond the compliance costs of constructing and implementing pollution control procedures. Some of these additional costs are monetary, but many are nonmonetary or not easily monetized (i.e., a dollar value cannot be attributed or is difficult to attribute to the items).

Additional monetary costs include the cost of Federal and State subsidies in the form of a tax shield (or lost tax revenue) and costs of administering a regulation (permitting costs). These costs are presented in Sections 5.3.1 and 5.3.2. Other costs, however, might also be incurred under the proposed regulations and constitute the full range of total social costs. For example, costs might be incurred as a result of worker dislocations. These costs comprise the value to workers of avoiding unemployment and the costs of administering unemployment, including the costs of relocating workers, and the inconvenience, discomfort, and time loss associated with unemployment (the unemployment benefits

themselves are generally considered transfer payments, not costs). Other potential social costs include the cost associated with a slowdown in the rate of innovation. In theory, there might be some impact on the rate of innovation to the extent that farms might invest in newer technologies if they did not have to allocate resources to meeting the requirements of the proposed regulations. Generally, however, unless an industry is highly technical, with major investments in research and development, impacts on the rate of innovation are likely to be minimal.

Monetizing such social costs is difficult. EPA does not evaluate these other potential social costs but expects that such costs that are not specifically addressed by the analyses presented in this report will be modest.

Table 5-1 Annual Pre-tax Cost of the Rule, $2001 (Option 2)

Sector	#Operations/Permittees		Aggregate Incremental Costs			
	>1,000 AU	300-1,000 AU	Total	>1,000 AU	300-1,000 AU	Designated CAFOs
	(number)		($2001, millions, pre-tax)			
Regulated CAFOs [a/]						
Fed Cattle	1,766	174	$88.2	$85.8	$1.9	$0.5
Veal	12	230	$0.0	<$0.1	<$0.1	$0.0
Heifer	242	7	$6.3	$3.8	$2.4	$0.1
Dairy	1,450	1,949	$151.1	$128.2	$22.0	$0.9
Hogs	3,924	1,485	$34.8	$24.9	$9.5	$0.4
Broilers	1,632	520	$20.5	$16.8	$2.4	$1.3
Layers - Dry	729	26	$7.5	$7.2	$0.1	$0.2
Layers - Wet	383	24	$8.9	$8.4	$0.5	<$0.1
Turkeys	388	37	$8.7	$8.1	$0.3	$0.3
Total	**10,526**	**4,452**	**$326.0**	**$283.2**	**$39.1**	**$3.8**
Permitting Authority [b/]						
States	NA	NA	$8.7	NA	NA	ND
Federal	NA	NA	$0.3	NA	NA	ND
Subtotal	**10,526**	**4,452**	**$9.0**	**$6.0**	**$3.0**	**ND**
Total Social Costs						
TOTAL	**10,526**	**4,452**	**$335.0**	**$289.2**	**$42.1**	**$3.8**

Source: USEPA. May not add due to rounding. Number of operations and total costs shown do not include designated facilities. "Layers: dry" are operations with dry manure systems. "Layers: wet" use liquid systems.

[a/]See Section 3 of this report for more information on the number and cost to affected CAFOs.

[b/]Number of permits includes permits for designated facilities on an annualized basis. Table 5-2 provides additional information on estimated number of permits.

Table 5-2. Medium and Large CAFOs by Region, State, and Sector

Region and State	Beef	Veal	Dairy	Heifer	Swine	Broiler	Turkey	Layer
Region 1	**0**	**0**	**137**	**0**	**1**	**0**	**14**	**17**
Connecticut	0	0	18	0	0	0	1	7
Maine	0	0	18	0	0	0	5	5
Massachusetts	0	0	13	0	1	0	3	3
New Hampshire	0	0	8	0	0	0	2	0
Rhode Island	0	0	1	0	0	0	0	0
Vermont	0	0	79	0	0	0	3	2
Region 2	**2**	**0**	**352**	**0**	**10**	**0**	**9**	**20**
New Jersey	0	0	6	0	1	0	2	3
New York	2	0	346	0	9	0	7	17
Region 3	**10**	**0**	**245**	**0**	**170**	**284**	**37**	**147**
Delaware	2	0	6	0	4	58	0	0
Maryland	0	0	31	0	11	67	2	15
Pennsylvania	6	0	135	0	135	50	14	122
Virginia	2	0	65	0	19	89	18	10
West Virginia	0	0	8	0	1	20	3	0
Region 4	**4**	**0**	**354**	**0**	**1292**	**1226**	**78**	**318**
Alabama	0	0	17	0	16	290	3	45
Florida	0	0	99	0	4	37	7	45
Georgia	0	0	61	0	54	372	3	137
Kentucky	1	0	31	0	61	30	1	6
Mississippi	0	0	17	0	17	214	1	10
North Carolina	2	0	56	0	1076	197	39	27
South Carolina	1	0	17	0	27	39	22	46
Tennessee	0	0	56	0	37	47	2	2
Region 5	**105**	**16**	**622**	**121**	**1742**	**34**	**102**	**214**
Illinois	31	0	27	9	442	0	8	11
Indiana	5	2	31	7	403	1	18	63
Michigan	20	1	127	2	84	0	17	20
Minnesota	39	3	112	46	595	19	26	27
Ohio	7	3	58	8	142	4	20	82
Wisconsin	3	7	267	49	76	10	13	11
Region 6	**330**	**0**	**337**	**69**	**171**	**542**	**59**	**192**
Arkansas	0	0	8	0	106	277	40	55
Louisiana	0	0	22	0	1	66	2	5
New Mexico	21	0	103	27	0	0	1	2
Oklahoma	45	0	15	13	48	75	4	18
Texas	264	0	189	29	16	124	12	112
Region 7	**1072**	**0**	**117**	**46**	**1809**	**42**	**53**	**99**
Iowa	166	0	43	17	1236	3	15	65
Kansas	294	0	22	8	130	0	4	5
Missouri	21	0	31	11	195	39	30	16
Nebraska	591	0	21	10	248	0	4	13

Table 5-2. Medium and Large CAFOs by Region, State, and Sector

Region and State	Beef	Veal	Dairy	Heifer	Swine	Broiler	Turkey	Layer
Region 8	**273**	**0**	**121**	**65**	**188**	**0**	**22**	**20**
Colorado	153	0	42	23	16	0	5	7
Montana	15	0	3	0	13	0	3	0
North Dakota	6	0	6	1	20	0	2	0
South Dakota	72	0	28	10	133	0	3	6
Utah	12	0	40	27	5	0	7	7
Wyoming	15	0	2	4	1	0	2	0
Region 9	**64**	**0**	**851**	**72**	**16**	**9**	**28**	**102**
Arizona	16	0	70	13	3	0	1	1
California	43	0	763	59	11	9	26	98
Hawaii	2	0	6	0	2	0	0	3
Nevada	3	0	12	0	0	0	1	0
Region 10	**80**	**0**	**263**	**99**	**10**	**15**	**23**	**33**
Alaska	0	0	0	0	0	0	0	0
Idaho	46	0	132	48	3	0	2	4
Oregon	13	0	28	19	3	7	13	7
Washington	21	0	103	32	4	8	8	22

Source: USEPA, 2002, 2002n. May not add due to rounding.

5.4 POLLUTANT REDUCTIONS

EPA's analysis of pollutant discharges under the final rule addresses changes in pollutant discharges occurring at the production area, and also changes in the quantity of pollutants in runoff from land on which manure has been applied. Estimates of pollutant discharges from these manure application sites, or "edge-of-field" loadings, include nutrients, metals, pathogens, and sediment for both pre-rule conditions (baseline) and post-rule conditions.

Table 5.2 provides estimates for combined total (all animal sectors) baseline and post-regulation edge of field loading reductions for CAFOs with more than 1,000 AU only for Option 2.

Table 5.3 Edge of Field Loading Reductions for CAFOs (Option 2, >1,000AU), All Sectors

Parameter/Units	Baseline Pollutant Loading (Pre-regulation)	Post-regulation Pollutant Loading	Pollutant Reduction	
			Units	Percent
Nutrients (million lb.)	658	503	155	24
Metals (million lb.)	20	19	1	5
Pathogens (10^{19} cfu)	5,784	3,129	2,655	46
Sediment (million lb.)	35,493	33,434	2,059	6

Source: USEPA; see Development Document (2002).

EPA estimates edge-of-field loadings using a simulation modeling approach based on representative model CAFOs used to estimate compliance costs of the final regulations, as described in *Development Document* (USEPA, 2000a, 2002). This model uses estimates of manure generation and information on cropping systems specific to animal operations under various pre- and post-regulation model simulation conditions. Model CAFOs take into account differing conditions at representative operations. These conditions include animal type, production region, facility size, current management systems and practices, and regionally based physiographic conditions regarding soil, rainfall, hydrology, crop rotation, and other factors. Reductions in pollutant discharges using the Groundwater Loading Effects of Agricultural Management Systems (GLEAMS) model, which uses information on soil characteristics and climate, along with characteristics of the applied manure and commercial fertilizers, to estimate losses of nutrients, metals, pathogens, and sediment in surface runoff, sediment, and ground water leachate. EPA used GLEAMS to quantify the reduction of nitrogen and phosphorus loads, and reductions of discharges of zinc, copper, cadmium, nickel, lead, and arsenic. Fecal coliform and Fecal streptococcus were used as surrogates to estimate pathogen reductions that would likely be achieved by this rule.

Edge-of-field loadings are differentiated by broad animal sector categories (cattle, dairy, hog, and poultry). More details on these models and a summary of the estimated loadings and post-compliance reductions are provided in the *Development Document* (USEPA, 2000a, 2002).

Edge-of-field loading estimates are used as inputs to EPA's water quality modeling framework that simulates the potential amount of pollutant loadings that reach U.S. waterways (measured as rivers and streams). The resultant loading estimates are referred to in EPA's analysis as "at-stream" loadings. Information on EPA's fate and transport model and a comparison of edge-of-field loadings and pollutants that reach U.S. waters is provided in the *Benefits Analysis* (USEPA, 2000d, 2002k). This analysis indicates that roughly 80 percent of all land applied manure runoff of nitrogen, phosphorous, and sediments (edge-of-field) reach U.S. waters (at-stream) (USEPA, 2000d, 2002k). The level of nutrients reaching U.S. waters can be explained by differing assumptions on a variety of levels, including manure generation by animal species, the share of animals in confinement, and losses due to volatization and management practice, as well as other factors, including rounding and truncation error and assumptions regarding background levels.

Tables 5.4 through 5.6 provide a more in-depth presentation of edge of field loading reductions for all contributors by pollutant, option, sector size, and sector.

5.5 COMPARISON OF COST AND BENEFITS ESTIMATES

This section compares the estimated costs and benefits attributable to the final rule for both Option 1 and Option 2 for CAFOs with more than 1,000 AU only. Tables 5-7 and 5-8 present the annualized estimated costs and benefits in 2001 dollars (pre-tax) assuming both a 7-percent and a 3-percent discount rate, respectively. This section provides only a summary of EPA's analysis of the estimated monetized benefits of the final regulations, which is based on the more detailed assessment available in the Agency's *Benefits Analysis* (USEPA, 2002k).

These tables show that the economic value of the environmental benefits EPA is able to monetize (i.e., evaluate in dollar terms) is comparable to the estimated costs of the rule. EPA has estimated the monetized benefits of the final rule for all operations with more than 1,000 AU. Assuming a 7-percent

Table 5-4 Edge-of-Field Loading Reductions (All Contributions) Nitrogen

Sector	Option 1	Option 2	Option 3	Option 5
	million lbs./year			
All Operations CAFOs >1000 AU				
Cattle	45.2	47.9	54.3	47.9
Dairy	14.1	14.7	17.9	14.7
Hogs	0.3	4.0	13.6	(21.3)
Poultry	29.9	36.4	38.1	41.6
Total	**89.6**	**103.0**	**123.8**	**82.9**
Operations Defined as CAFOs 300- 1,000 AU				
Cattle	0.17	0.22	0.22	0.22
Dairy	4.59	5.03	7.34	5.03
Hogs	0.03	0.98	3.11	(0.59)
Poultry	0.81	0.88	0.90	0.95
Total	**5.60**	**7.10**	**11.56**	**5.60**

Source: USEPA (USEPA, 2002)

Table 5-5 Edge-of-Field Loading Reductions (All Contributions) Phosphorous

Sector	Option 1	Option 2	Option 3	Option 5
	million lbs./year			
All Operations CAFOs >1000 AU				
Cattle	15.6	23.1	23.1	23.1
Dairy	3.2	5.0	5.0	5.1
Hogs	0.1	4.7	4.7	8.1
Poultry	8.5	19.2	19.2	20.4
Total	**27.4**	**52.1**	**52.1**	**56.5**
Operations Defined as CAFOs 300-1,000 AU				
Cattle	0.05	0.27	0.27	0.27
Dairy	1.33	2.55	2.55	2.55
Hogs	0.01	0.70	0.70	1.50
Poultry	0.26	0.72	0.72	0.73
Total	**1.66**	**4.24**	**4.24**	**5.05**

Source: USEPA (USEPA, 2002)

Table 5-6 Edge-of-Field Loading Reductions (All Contributions) Sediment

Sector	Option 1	Option 2	Option 3	Option 5
	million lbs./year			
All Operations CAFOs >1000 AU				
Cattle	1,523.5	1,523.5	1,523.5	1,523.5
Dairy	126.0	126.1	126.1	126.1
Hogs	0.0	143.5	143.5	(584.7)
Poultry	31.2	265.9	265.9	310.7
Total	**1,680.8**	**2,059.0**	**2,059.0**	**1,375.6**
Operations Defined as CAFOs 300-1,000 AU				
Cattle	1.4	20.1	20.1	20.1
Dairy	2.6	57.5	57.5	57.5
Hogs	0.0	20.0	20.0	12.1
Poultry	2.2	6.0	6.0	6.6
Total	**6.3**	**103.6**	**103.6**	**96.3**

Source: USEPA (USEPA, 2002)

discount rate, under Option 1, total monetized benefits for CAFOs with more than 1,000 AU range from $141 million to $224 million. For Option 2 (assuming a 7-percent rate), total monetized benefits for CAFOs with more than 1,000 AU range from $204 million to $340 million annually. Assuming a 3-percent discount rate, under Option 1, total monetized benefits for CAFOs with more than 1,000 AU range from $157 million to $240 million. For Option 2 (assuming a 3-percent rate), total monetized benefits for CAFOs with more than 1,000 AU range from $219 million to $255 million annually. See Table 5-7 and Table 5-8.

Monetized benefit categories are primarily in the areas of improved surface water quality (measured in terms of enhanced recreational value), reduced nitrates in private wells, reduced shellfish bed closures from pathogen contamination, and reduced fish kills from episodic events. EPA also identified a number of benefits categories that could not be monetized, including reduced euthrophication of estuaries, reduced pathogen contamination in private wells, reduced health and environmental risks associated with episodic pollutant discharge events, drinking water treatment cost savings, reduced odor and air emissions, and avoided loss in property value near CAFOs, among other benefits. These benefits are listed in Tables 5-7 and 5-8, and are described in more detail the *Benefits Analysis* and other supporting documentation provided in the record.

These estimated benefits compare to EPA's estimate of the total social costs covering both industry and permit authority costs for operations with more than 1,000 AU only. Assuming a 7-percent discount rate, these costs range from $125 million (Option 1) to $289 million (Option 2) annually for all CAFOs with more than 1,000 AU, as was estimated in the Agency's *Benefit Analysis*. Assuming a 3-percent discount rate, these costs range from $132 million (Option 1) to $285 million (Option 2) annually for all CAFOs with more than 1,000 AU. See Table 5-7 and Table 5-8. These costs include compliance costs to all CAFOs, as well as administrative costs to Federal and State governments. EPA estimates of the administrative cost to Federal and State governments to implement this rule is $9 million per year.

There may be additional social costs that have not been monetized. However, these costs are estimated based on the cost of land application based on nitrogen-based application rates, except in those instances where EPA believes that phosphorus-based rates are likely to be appropriate. As discussed previously, the final rule includes provisions for appropriate flexibilities in the use of phosphorus-based rates, such as multi-year phosphorus application, but the potential costs savings resulting from these flexibilities are not reflected in the analysis. Therefore, the costs of this rule may have been overestimated.

Table 5-7 Total Annual Monetized Social Costs and Benefits (7% Rate): CAFOs >1,000AU

Category	Option 1	Option 2
	millions $2001	
Total Monetized Social Costs		
Industry Compliance Costs (pre-tax):	$119	$283
State/Federal Administrative Costs:	$6	$6
Total Social Costs	*$125*	*$289*
Total Monetized Benefits		
Improved Surface Water Quality$166.2 to $298.6	$102.4 - $182.6	$166.2 - $298.6
Reduced Incidence of Fish Kills$0.1	$0.0 - $0.1	$0.1
Improved Commercial Shell Fishing$0.3 to $3.4	$0.1 - $2.0	$0.3 - $3.4
Reduced Contamination of Private Wells$30.9	$33.3	$30.9
Reduced Contamination of Animal Water Supplies	$4.7	$5.3
Reduced Eutrophication of Estuaries$1.1 to $1.7	$0.1	$0.2
Reduced Water Treatment Costs	$0.7 - $1.0	$1.1 - $1.7
Reduced eutrophication & pathogen contamination of coastal & estuarine waters	not monetized	not monetized
Reduced pathogen contamination of private & public underground sources of drinking water	not monetized	not monetized
Reduced human & ecological risks from antibiotics, hormones, metals, salts	not monetized	not monetized
Improved soil properties	not monetized	not monetized
Reduced cost of commercial fertilizers for non-CAFO operations	not monetized	not monetized
Total Benefits	**$141.3 + [B] - $223.8 + [B]**	**$204.1 + [B] - $340.2 +[B]**

Source: USEPA. May not add due to rounding. [B] represents the non-monetized benefits of the rule.

Table 5-8 Total Annual Monetized Social Costs and Benefits (3% Rate): CAFOs >1,000AU

Category	Option 1	Option 2
	millions $2001	
Total Monetized Social Costs		
Industry Compliance Costs (pre-tax):	$279	$122
State/Federal Administrative Costs:	$6	$6
Total Social Costs	*$285*	*$132*
Total Monetized Benefits		
Improved Surface Water Quality	$102.4 - $182.6	$166.2 - $298.6
Reduced Incidence of Fish Kills	$0.0 - $0.1	$0.1
Improved Commercial Shell Fishing	$0.1 - $2.0	$0.3 - $3.4
Reduced Contamination of Private Wells	$49.3	$45.7
Reduced Contamination of Animal Water Supplies	$4.7	$5.3
Reduced Eutrophication of Estuaries	$0.1	$0.2
Reduced Water Treatment Costs	$0.7 - $1.0	$1.1 - $1.7
Reduced eutrophication & pathogen contamination of coastal & estuarine waters	not monetized	not monetized
Reduced pathogen contamination of private & public underground sources of drinking water	not monetized	not monetized
Reduced human & ecological risks from antibiotics, hormones, metals, salts	not monetized	not monetized
Improved soil properties	not monetized	not monetized
Reduced cost of commercial fertilizers for non-CAFO operations	not monetized	not monetized
Total Benefits	**$157.3 + [B] - $239.8 + [B]**	**$218.9 + [B] - $355.0 + [B]**

Source: USEPA. May not add due to rounding. [B] represents the non-monetized benefits of the rule.

SECTION SIX

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APPENDIX A

COST ANNUALIZATION MODEL

This appendix provides an overview of the cost annualization model used by EPA. This model calculates four types of compliance costs for a model CAFO:

- Present value of expenditures—before-tax basis
- Present value of expenditures—after-tax basis
- Annualized cost—before-tax basis
- Annualized cost—after-tax basis

The following sections present the input data and assumptions (Section A.1) and provide details about the workings of the model (Section A.2). All supporting tables are provided at the end of this section.

A.1 INPUT DATA SOURCES

The cost annualization model requires four key data inputs:

- Capital and O&M costs (including startup, recurring, and annual O&M costs)
- Depreciable life of the asset
- Discount rate
- Marginal tax rate

The *capital and O&M* costs that EPA uses in the cost annualization model are developed by the Agency. The capital cost is the initial investment needed to purchase and install the structure; it is a one-time cost. The O&M cost is the annual cost of operating and maintaining the structure. O&M costs can be incurred in the first year (start-up O&M costs), at periodic intervals (recurring O&M costs), or every year of the structure's operation (annual O&M costs).

The *depreciable life of the asset* refers to EPA's assumption of the time period used to depreciate capital improvements that are made because of the proposed CAFO regulations.

EPA's annualization model uses a real *discount rate* of 7 percent, as recommended by the Office of Management and Budget (OMB) (OMB, 1992). EPA assumes this input to be a real interest rate, and therefore it is not adjusted for inflation.

The *marginal tax rate* (used to compute the tax shield) depends on the amount of taxable earnings (estimated as net cash income minus depreciation plus value of inventory) at the model CAFO. Inputs to the cost annualization model to calculate an average operation's tax shield include both federal and state tax rates.

Additional information about compliance cost estimates and development of the model CAFOs is provided in Section 2.2 of this report. Detailed information about the costs used as inputs to the annualization model is provided in the *Development Document* (USEPA, 2002). Section A.1.1 presents the tax rates EPA assumes; Section A.1.2 discusses the depreciation method in more detail.

A.1.1 Marginal Tax Rate

EPA conducts its financial analysis at the CAFO level using representative average models. The cost annualization model uses both federal and state tax rates as inputs to calculate an average operation's tax shield (see Table A-3 for sample worksheet). For this analysis, EPA uses federal and state corporate income tax rates because it is not possible to definitively identify whether CAFOs represented by each model pay taxes at the corporate or the individual rate.

Table A-1 lists the range of federal tax rates that EPA assumes for this analysis and attributes to model CAFOs based on estimated taxable earnings. As shown, federal tax rates range from 15 percent to 34 percent, depending on the amount of taxable income at a facility (CCH, 1999b). As an example, using these rates, model CAFOs with earnings g, eater than or equal to $335,000 would be assigned the federal tax rate of 34 percent; model CAFOs with earnings greater than or equal to $100,000 but less than $335,000 would be assigned a tax rate of 28.3 percent.

Table A-1 (provided at the end of this section) lists each state's top corporate tax rates and rates on individual income (CCH, 1999a, 1995). The cost annualization model refers to reported average state tax rates; however, because of the uncertainty over which state tax rate to apply to a given model CAFO, EPA uses the national average across all states. Table A-1 lists the national average values EPA assumes for this analysis (CCH, 1999a, 1995). As shown, the average national rates are 6.6 percent (corporate income) and 5.8 percent (personal income). EPA uses the higher corporate income tax rate for this analysis.

The cost annualization model can incorporate variable tax rates according to the level of income to address differences between small and large model CAFOs. For example, a large model CAFO might have a combined tax rate of 40.6 percent (34 percent federal rate plus 6.6 percent state rate). After tax shields, this model CAFO would pay 59.4 cents for every dollar of incremental animal waste management costs. A small model CAFO might be in the 21.6 percent tax rate (15 percent federal rate plus 6.6 percent state rate). After tax shields, the small model CAFO would pay 78.4 cents for every dollar of incremental animal waste management costs. For the DCF analysis, EPA uses the net present value of after-tax cost because it reflects the impact the business would actually see in its net income. [1]

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[1]The cost annualization model does not consider tax shields on interest paid to finance animal waste management investments. The cost annualization model assumes a cost to the operation to use the money (the discount/interest rate), whether the money is paid as interest or is the opportunity cost of internal funding. Tax shields on interest payments are not included in the cost annualization model because it is not known what mix of debt and capital an operation will use to finance the cost of incremental animal waste management investments and to maintain a conservative estimate of the after-tax annualized cost.

A.1.2 Depreciation Method

After examining three alternatives to depreciate capital investments, including Modified Accelerated Cost Recovery System (MACRS) , straight-line depreciation, and section 179 of the Internal Revenue Code, EPA chose to use the MACRS. MACRS allows businesses to depreciate a higher percentage of an investment in the early years and a lower percentage in the later years. In contrast, straight-line depreciation writes off a constant percentage of the investment each year. MACRS offers companies a financial advantage over the straight-line method because a model CAFO's taxable income may be reduced under MACRS by a greater amount in the early years when the time value of money is greater. EPA also considered using the Internal Revenue Code section 179 provision to elect to expense up to $17,500 in the year the investment is placed in service, assuming that the investment costs do not exceed $200,000 (IRS, 1999a). EPA assumes, however, that this provision is already applied to other investments at the CAFO.

To determine the recovery period of depreciable property, IRS identifies asset classes based on the activity in which the property is being used. If no activity matches the use, IRS provides classes for specific depreciable assets that are used across multiple business activities such as office furniture, information systems, and automobiles. Under MACRS, the cost of property is recovered over a set period. The recovery period is based on the property class to which your property is assigned. If the property of interest is not identified by the IRS, it usually has a recovery period of 7 years (IRS, 1999b).

The capital costs required by this regulation fall across three IRS asset classes: land improvements (15-year recovery period), agriculture (7-year recovery period), and single-purpose agricultural or horticultural structures (10-year recovery period). Table A-2 (also provided at the end of this section) presents these IRS asset classes as well as the capital costs associated with them. EPA has identified the appropriate class for each type of cost and has judged that a 10-year time frame is appropriate for this analysis for the following reasons:

- A 10-year depreciation time frame is consistent with the 10-year property classification of a single-purpose livestock structure, which is defined under section(i)(13)(B) as any enclosure or structure specifically designed, constructed and used for housing, raising, and feeding a particular kind of livestock, including their produce, or for housing the equipment necessary for the housing, rasing, and feeding of livestock (IRS, 1999a).

- A 10-year depreciation time frame is a fairly conservative assumption considering that some assets, such as land improvements, have a longer 15-year time frame whereas others, such as agricultural equipment, have a shorter 7-year time frame.

- This assumption provides a uniform time frame for use in the annualization model and prevents the use of separate annualization calculations for individual capital costs.

- A 10-year time frame is consistent with the practice of cost-share programs, which typically organize contracts over 5- to 10-year periods.

EPA conducted initial sensitivity analyses of the annualization model using initial cost estimates and determined that the differences between using a 7-, 10-, or 15-year time frame for depreciation did not result in large changes in annualized costs.

A.2 SAMPLE COST ANNUALIZATION SPREADSHEET

Table A-3 shows a sample cost annualization worksheet. The top of the spreadsheet shows the data inputs described in Section A.1. The spreadsheet contains numbered columns that calculate the before- and after-tax annualized cost of the investment to the CAFO. Column 1 of Table A-3 lists each year of the investment's life span, from its installation through its 10-year depreciable lifetime (shown over years 1 through 11, because a mid-year convention is used).

Column 2 of Table A-3 represents the percentage of the capital costs that can be written off or depreciated each year. These rates are based on the MACRS and are taken from the *2000 U.S. Master Tax Guide* (CCH, 1999b). Multiplying these depreciation rates by the capital cost gives the annual amount the model CAFO may depreciate, which is listed in Column 3. EPA uses depreciation expense to offset annual income for tax purposes; Column 4 shows the tax shield provided from the depreciation expense—the overall tax rate times the depreciation amount for the year.

Column 5 of Table A-3 is the annual O&M expense. Because of the mid-year convention assumption for depreciation, Year 1 and Year 11 show only 6 months of annual O&M costs. Year 1 O&M also includes the startup O&M cost. Years 2 through 10 include annual O&M plus recurring O&M costs for every third and fifth year. Column 6 is the tax shield or benefit provided from expensing the O&M costs.

Columns 7 and 8 represent any negative costs that should be evaluated when considering compliance costs for model CAFOs. This example includes a scenario where EPA considers payments from Federal, State, or local cost-share programs as well as other offsets measured in terms of cost savings from use of manure as a fertilizer substitute. (These two examples are shown for illustrative purposes only and do not necessarily reflect assumptions for EPA's final analysis.)

Column 9 lists a model CAFO's annual cash outflow, or total expenses, associated with the additional animal waste management, under the analysis assumptions presented here. Total expenses include capital costs, assumed to be incurred during the first year when the structure is installed, plus each year's O&M expense.

Column 10 lists the annual cash outflow less the tax shields from the O&M expenses and depreciation; a model CAFO will recover these costs in the form of reduced income taxes. The sum of the 11 years of after-tax expenses is $106,546 (1997 dollars). The equation EPA uses to calculate the present value of cash flow is :

$$NPV = v1 + \sum_{i=2}^{n} \frac{v_i}{(1+r)^{i-1}}$$

where:

$v_1 ... v_n$ = series of cash flows
r = interest rate
n = number of cash flow periods
i = current iteration

EPA uses the present value of the after-tax cash outflow in the CAFO level impact analysis to calculate the post-regulatory present value of future earnings for a model CAFO.

EPA transforms the present value of the cash outflow into a constant annual payment for use as the annualized model CAFO's compliance cost. Column 9 calculates the annualized cost as a 10-year annuity that has the same present value as the total cash outflow. The annualized cost represents the annual payment required to finance the cash outflow after tax shields. In essence, paying the annualized cost each year and paying the amounts listed in Column 8 for each year are equivalent. EPA calculates the annualized cost as follows (where n is the number of payment periods):

$$\text{Annualized Cost} = \text{present value of cash outflows} * \frac{\text{real discount rate}}{1 - (\text{real discount rate} + 1)^{-n}}$$

In the example used in Table A-3 (provided at the end of this section), based on the capital investment of $100,000, start-up O&M costs of $1,000, 3-year recurring O&M costs of $500, 5-year recurring O&M costs of $1,500, annual O&M costs of $10,000 per year, a tax rate of 40.6 percent, and a real discount rate of 7 percent, the model CAFO's annualized cost is $20,591 on a pre-tax basis and $12,729 on a post-tax basis.[2]

EPA uses the pre-tax annualized cost to calculate the total social cost of the regulation (presented in Section 10). This approach incorporates the cost to industry for the purchase, installation, and operation of additional animal waste management structures, as well as the cost to Federal and State government from lost tax revenues. (Every tax dollar that a business does not pay due to a tax shield is a tax dollar lost to the government.)

EPA uses the post-tax annualized cost to reflect what a business actually pays to comply with incremental animal waste management requirements. The post-tax present value of incremental animal waste management expenditures is used in the CAFO level impact analysis.

Appendix B of this report shows post-tax annualized costs to regulated CAFOs to comply with the proposed revisions to the CAFO regulations. Annualized costs are shown in 1997 dollars and are expressed on a per-facility and a per-animal (inventory) basis. Costs are shown for the BAT option only.

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[2] There are two ways to calculate post-tax annualized cost. One is to calculate the annualized cost as the difference between the annuity value of the cash flows (Column 9) and the tax shields (Columns 4 and 6). The second is to calculate the annuity value of the cash flows after tax shields (Column 10). Both methods yield the same result.

Table A-1. State Income Tax Rates

State	Corporate Income Tax Rate	Basis for States With Graduated Tax Tables	Personal Income Tax Upper Rate	Basis for States With Graduated Tax Tables
Alabama	5.00%		5.00%	$3,000+
Alaska	9.40	$90,000+	0.00%	
Arizona	9.00%		6.90%	$150,000+
Arkansas	6.50%	$100,000+	7.00%	$25,000+
California	9.30%		11.00%	$215,000+
Colorado	5.00%		5.00%	
Connecticut	11.50%		4.50%	
Delaware	8.70%		7.70%	$40,000+
Florida	5.50%		0.00%	
Georgia	6.00%		6.00%	$7,000+
Hawaii	6.40%	$100,000+	10.00%	$21,000+
Idaho	8.00%		8.20%	$20,000+
Illinois	4.80%		3.00%	
Indiana	3.40%		3.40%	
Iowa	12.00%	$250,000+	9.98%	$47,000+
Kansas	4.00%	$50,000+	7.75%	$30,000+
Kentucky	8.25%	$250,000+	6.00%	$8,000+
Louisiana	8.00%	$200,000+	6.00%	$50,000+
Maine	8.93%	$250,000+	8.50%	$33,000+
Maryland	7.00%		6.00%	$100,000+
Massachusetts	9.50%		5.95%	
Michigan	2.30%		4.40%	
Minnesota	9.80%		8.50%	$50,000+
Mississippi	5.00%	$10,000+	5.00%	$10,000+
Missouri	6.25%		6.00%	$9,000+
Montana	6.75%		11.00%	$63,000+
Nebraska	7.81%	$50,000+	6.99%	$27,000+
Nevada	0.00%		0.00%	

Table A-1. State Income Tax Rates

State	Corporate Income Tax Rate	Basis for States With Graduated Tax Tables	Personal Income Tax Upper Rate	Basis for States With Graduated Tax Tables
New Hampshire	7.00%		0.00%	
New Jersey	7.25%		6.65%	$75,000+
New Mexico	7.60%	$1 Million+	8.50%	$42,000+
New York	9.00%		7.88%	$13,000+
North Carolina	7.75%		7.75%	$60,000+
North Dakota	10.50%	$50,000+	12.00%	$50,000+
Ohio	8.90%	Based on stock value	7.50%	$200,000+
Oklahoma	6.00%		7.00%	$10,000+
Oregon	6.60%		9.00%	$5,000+
Pennsylvania	9.90%	1997 and thereafter	2.80%	
Rhode Island	9.00%		10.40%	$250,000+
South Carolina	5.00%		7.00%	$11,000+
South Dakota	0.00%		0.00%	
Tennessee	6.00%		0.00%	
Texas	0.00%		0.00%	
Utah	5.00%		7.20%	$4,000+
Vermont	8.25%	$250,000+	9.45%	$250,000+
Virginia	6.00%		5.75%	$17,000+
Washington	0.00%		0.00%	
West Virginia	9.00%		6.50%	$60,000+
Wisconsin	7.90%		6.93%	$20,000+
Wyoming	0.00%		0.00%	
Average:	6.61%		5.84%	

Source: CCH, 1999a, 1995.

Basis for rates is reported to nearest $1,000. Personal income tax rates for Rhode Island and Vermont based on federal tax (not taxable income). Tax rates given here are equivalents for highest personal federal tax rate.

Table A-2. IRS Asset Class Lives and Recovery Periods for the Annualization of Capital Costs

Asset Class	Description of Assets Included	Recovery Period (in years)		Sample Capital Costs (Beef/Dairy Facilities)	Sample Capital Costs (Beef/Dairy Facilities)
		Class Life	MACRS		
00.3	**Land Improvements:** Includes improvements directly to or added to land, whether such improvements are section 1245 property[a] or section 1250 property[b], provided such improvements are depreciable. Examples of such assets might include sidewalks, roads, canals, waterways, drainage facilities, sewers (not including municipal sewers in Class 51), wharves and docks, bridges, fences, landscaping shrubbery, or radio and television transmitting towers. Does not include land improvements that are explicitly included in any other class, and buildings and structural components as defined in section 1.48-1(e) of the regulations. Excludes public utility initial clearing and grading land improvements as specified in Rev. Rul. 72-403, 1972-2 C.B. 102.	20	15	- Earthen settling basin - Concrete settling basin - Storage pond ("regular" and clay-lined) - Vegetated filter strip (including wastewater distribution system) - Concrete pad to store dry manure	- Trenching to divert storm water around structures - Lagoon liner - Groundwater monitoring well
01.1	**Agriculture:** Includes machinery and equipment, grain bins, and fences (but no other land improvements), that are used in the production of crops or plants, vines, and trees; livestock; the operation of farm dairies, nurseries, greenhouses, sod farms, mushroom cellars, cranberry bogs, apiaries, and fur farms; and the performance of agriculture, animal husbandry, and horticultural services.	10	7	- Windrow turning equipment (composting) - Long-stem dial thermometer (composting) - Lagoon marker - Scale for manure spreader calibration - Irrigation center pivot device - Truck (solid waste/ slurry waste transport options)	- Soil auger/sampler - Manure sampler - Scale for manure spreader calibration - Lagoon marker - Disk harrow for surface incorporation - Manure injector - Center pivot for irrigation - Truck to transport manure - Storage for poultry litter
01.4	**Single -purpose agricultural or horticultural structures (within the meaning of section 168(l)(13) of the code)**	15	10		- Mortality composting facility

Source: IRS, 1999b. [a] Section 1245 property: Property that is or has been subject to an allowance for depreciation or amortization. Section 1245 property includes personal property, single-purpose agricultural and horticultural structures, storage facilities used in connection with the distribution of petroleum or primary products of petroleum, and railroad grading or tunnel bores. [b] Section 1250 property: Real property (other than section 1245 property) that is or has been subject to an allowance for depreciation.

Table A-3. Cost Annualization Model Inputs

Initial capital cost	$100,000	
Annual O&M Cost	$10,000	
Startup O&M Cost	$1,000	
Recurring O&M Cost	$500 (3 year)	$1,500 (5-yr)
Real discount rate	7.0%	
Taxable income	$400,000	
Marginal income tax rate		
Federal	34.0%	
State	6.6%	
Combined	40.6%	

Federal Corp. Tax Table:

If Taxable Earnings			then tax rate is:	Average Effective Tax Rate
>= $0	and	< $50,000	→	15.0%
>= $50,000	and	< $75,000	→	16.7%
>= $75,000	and	< $100,000	→	20.4%
>= $100,000	and	< $335,000	→	28.3%
>= $335,000			→	34.0%

1 Year	2 Depreciation Rate	3 Depreciation for Year	4 Tax Shield from Dep.	5 O&M Cost	6 O&M Tax Shield	7 Cost-Share	8 Manure Offset	9 Cash	10 Cash After Tax
1	10.00%	$10,000	$3,491	$5,000	$2,095	$0	$0	$106,000	$100,414
2	18.00%	$18,000	$6,284	$10,000	$3,491	$0	$0	$10,000	$225
3	14.40%	$14,400	$5,027	$12,189	$4,255	$0	$0	$12,189	$2,907
4	11.52%	$11,520	$4,022	$10,000	$3,491	$0	$0	$10,000	$2,487
5	9.22%	$9,220	$3,219	$10,180	$3,554	$0	$0	$10,180	$3,407
6	7.37%	$7,370	$2,573	$12,189	$4,255	$0	$0	$12,189	$5,361
7	6.55%	$6,550	$2,287	$10,000	$3,491	$0	$0	$10,000	$4,222
8	6.55%	$6,550	$2,287	$10,000	$3,491	$0	$0	$10,000	$4,222
9	6.56%	$6,560	$2,290	$12,189	$4,255	$0	$0	$12,189	$5,644
10	6.55%	$6,550	$2,287	$10,180	$3,554	$0	$0	$10,180	$4,340
11	3.28%	$3,280	$1,145	$5,000	$1,746	$0	$0	$5,000	$2,109
Sum	100.00%	$100,000	$34,910	$106,927	$37,677	$0	$0	$207,927	$135,340
Present value		$73,443	$25,639	$72,594	$25,669	$0	$0	$166,987	$115,679
								Before Tax	After Tax
Present value of annualized cost								$166,987	$115,679
								$22,269	$15,427

Notes: This spreadsheet assumes that a modified accelerated cost recovery system (MACRS) is used to depreciate capital expenditures. Depreciation rates are from 2000 U.S. Master Tax Guide for 10-year property and mid-year convention (CCH, 1999b).

APPENDIX B

SUMMARY TABLES: ANNUALIZED COSTS PER FACILITY AND PER ANIMAL

This appendix shows EPA's annualized compliance cost estimates for two technology options evaluated for this rulemaking. The first option (Option 1) will require land application at the CAFO to be consistent with proper agricultural practices, including limiting manure application to the nitrogen needs of the crops grown. The second option (Option 2) will require land application at the CAFO to be consistent with proper agricultural practices, including limiting manure application to the nitrogen needs of the crops grown or where necessary, to the phosphorus needs of the crops.

Costs presented in this section are annualized using the methods described in Appendix A. Annualized costs presented in this appendix include representative model CAFO costs by facility (Table B-1) and by per-animal inventory (Table B-2). Costs are expressed in 1997 dollars.

Compliance costs are estimated for each representative model CAFO and are broken out by animal sector, production region, and facility size, as well as groupings based on land availability and the technology needs of the facility:

- **Production region**: Midwest (MW); Central (CE); Pacific (PA); Mid-Atlantic (MA); and South (SO). For more information, see Table 2-1 in Section 2 of this report.
- **Facility size**: Varies by sector. See Table 2-1 in Section 2 of this report.
- **Land availability**: Category 1 CAFOs (sufficient cropland for all manure nutrients generated), Category 2 CAFOs (insufficient cropland), and Category 3 CAFOs (no available cropland for land application).
- **Technology needs**: Medium (average needs); Low (least needs); High (most needs).

More detailed cost information is available in the *Development Document* (USEPA, 2002).

Table B-1(a)
Total Estimated Annualized Compliance Costs, Option 1

Sector	Model	Head	Cat. 1L	Cat 2L	Cat. 3L	Cat. 1M	Cat. 2M	Cat. 3M	Cat. 1H	Cat. 2H	Cat. 3H
Beef											
	MW Region										
	Medium 1	370	$4,298	$4,383	$2,388	$6,114	$6,189	$2,676	$7,698	$7,765	$2,867
	Medium 2	552	$4,630	$4,715	$2,604	$6,442	$6,518	$2,944	$8,045	$8,111	$3,148
	Medium 3	766	$4,915	$5,002	$2,885	$6,828	$6,907	$3,260	$8,460	$8,531	$3,489
	Large 1	1,839	$3,848	$5,114	$1,363	$5,902	$7,121	$1,984	$7,639	$8,812	$2,288
	Large 2	25,897	$19,994	$14,775	$3,621	$30,765	$25,003	$7,314	$39,479	$33,175	$8,951
	CE Region										
	Medium 1	370	$3,980	$4,101	$2,230	$5,980	$6,087	$2,460	$7,577	$7,671	$2,658
	Medium 2	552	$4,269	$4,388	$2,381	$6,264	$6,370	$2,642	$7,881	$7,974	$2,852
	Medium 3	766	$4,139	$4,642	$2,573	$5,741	$6,695	$2,850	$7,024	$8,328	$3,080
	Large 1	1,839	$4,025	$3,411	$1,415	$6,173	$5,485	$1,838	$7,930	$7,168	$2,126
	Large 2	25,897	$23,423	$16,366	$2,000	$32,826	$24,920	$4,074	$40,983	$32,229	$4,900
	PA Region										
	Medium 1	370	$4,984	$6,943	$2,956	$6,673	$8,626	$3,254	$8,241	$10,187	$3,430
	Medium 2	552	$5,479	$5,773	$3,405	$7,213	$7,501	$3,745	$8,799	$9,081	$3,935
	Medium 3	766	$6,021	$6,316	$3,892	$7,805	$8,093	$4,275	$9,410	$9,691	$4,481
	Large 1	1,839	$5,324	$81,099	$1,317	$8,526	$83,064	$1,892	$11,434	$84,734	$2,173
	Large 2	25,897	$21,149	$40,082	$2,972	$33,372	$51,885	$6,018	$43,861	$61,955	$7,332
	SO Region										
	Medium 1	370	$4,415	$16,355	$3,055	$6,720	$18,643	$3,361	$8,297	$20,212	$3,551
	Medium 2	552	$5,287	$5,045	$3,529	$8,225	$7,388	$3,878	$10,242	$8,990	$4,096
	Medium 3	766	$6,337	$6,420	$4,040	$10,145	$10,212	$4,439	$12,764	$12,823	$4,689
	Large 1	1,839	$5,403	$89,641	$1,796	$11,044	$92,266	$2,436	$14,912	$94,044	$2,831
	Large 2	25,897	$30,374	$257,633	$6,436	$59,834	$280,277	$11,277	$79,486	$295,331	$13,960
	MA Region										
	Medium 1	370	$4,131	$9,679	$2,742	$5,854	$11,390	$3,037	$7,245	$12,776	$3,322
	Medium 2	552	$4,919	$4,615	$3,120	$7,105	$6,358	$3,442	$8,889	$7,800	$3,780
	Medium 3	766	$5,993	$5,086	$3,535	$8,925	$6,868	$3,885	$11,324	$8,367	$4,277
	Large 1	1,839	$5,208	$27,085	$1,513	$9,457	$29,011	$2,020	$12,963	$30,724	$2,630
	Large 2	25,897	$27,815	$54,186	$4,357	$51,354	$66,159	$7,491	$69,907	$76,019	$10,532
Veal											
	MW Region										
	Medium 1	400	$1,813	$1,535	$1,400	$1,813	$1,535	$1,400	$1,813	$1,535	$1,400
	Medium 2	540	$1,813	$1,535	$1,400	$1,813	$1,535	$1,400	$1,813	$1,535	$1,400
	Medium 3	1,080	$1,813	$1,535	$1,400	$1,813	$1,535	$1,400	$1,813	$1,535	$1,400
	Large 1	1,080	$1,813	$1,535	$1,400	$1,813	$1,535	$1,400	$1,813	$1,535	$1,400
	CE Region										
	Medium 1	400	$1,813	$1,535	$1,400	$1,813	$1,535	$1,400	$1,813	$1,535	$1,400
	Medium 2	540	$1,813	$1,535	$1,400	$1,813	$1,535	$1,400	$1,813	$1,535	$1,400
	Medium 3	1,080	$1,813	$1,535	$1,400	$1,813	$1,535	$1,400	$1,813	$1,535	$1,400
	Large 1	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	PA Region										
	Medium 1	400	$1,813	$1,535	$1,400	$1,813	$1,535	$1,400	$1,813	$1,535	$1,400
	Medium 2	540	$1,813	$1,535	$1,400	$1,813	$1,535	$1,400	$1,813	$1,535	$1,400
	Medium 3	1,080	$1,813	$1,535	$1,400	$1,813	$1,535	$1,400	$1,813	$1,535	$1,400
	Large 1	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	SO Region										
	Medium 1	400	$1,813	$1,535	$1,400	$1,813	$1,535	$1,400	$1,813	$1,535	$1,400
	Medium 2	540	$1,813	$1,535	$1,400	$1,813	$1,535	$1,400	$1,813	$1,535	$1,400
	Medium 3	1,080	$1,813	$1,535	$1,400	$1,813	$1,535	$1,400	$1,813	$1,535	$1,400
	Large 1	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	MA Region										
	Medium 1	400	$1,813	$1,535	$1,400	$1,813	$1,535	$1,400	$1,813	$1,535	$1,400
	Medium 2	540	$1,813	$1,535	$1,400	$1,813	$1,535	$1,400	$1,813	$1,535	$1,400
	Medium 3	1,080	$1,813	$1,535	$1,400	$1,813	$1,535	$1,400	$1,813	$1,535	$1,400
	Large 1	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

Table B-1(a)
Total Estimated Annualized Compliance Costs, Option 1

Sector	Model	Head	Cat. 1L	Cat 2L	Cat. 3L	Cat. 1M	Cat. 2M	Cat. 3M	Cat. 1H	Cat. 2H	Cat. 3H
Heifers											
	MW Region										
	Medium 1	400	$6,044	$6,145	$2,507	$9,358	$9,457	$2,795	$12,306	$12,402	$2,988
	Medium 2	625	$4,579	$4,683	$2,645	$6,389	$6,492	$2,992	$7,986	$8,087	$3,200
	Medium 3	875	$4,852	$4,871	$2,947	$6,764	$6,782	$3,332	$8,390	$8,405	$3,566
	Large 1	1,500	$3,440	$3,545	$1,322	$5,382	$5,485	$1,866	$7,056	$7,157	$2,140
	CE Region										
	Medium 1	400	$5,379	$5,498	$2,301	$9,108	$9,223	$2,533	$12,061	$12,175	$2,730
	Medium 2	625	$4,111	$4,230	$2,408	$6,094	$6,210	$2,674	$7,697	$7,811	$2,886
	Medium 3	875	$4,317	$4,360	$2,625	$6,365	$6,405	$2,908	$7,992	$8,031	$3,141
	Large 1	1,500	$3,282	$3,401	$1,380	$5,324	$5,441	$1,763	$6,994	$7,108	$2,030
	PA Region										
	Medium 1	400	$6,988	$23,067	$3,202	$10,041	$26,118	$3,501	$12,972	$29,049	$3,679
	Medium 2	625	$7,544	$15,577	$3,491	$10,832	$17,309	$3,838	$13,966	$18,886	$4,031
	Medium 3	875	$6,006	$9,485	$4,007	$7,788	$11,266	$4,401	$9,385	$12,863	$4,610
	Large 1	1,500	$3,335	$4,028	$1,287	$5,236	$5,927	$1,795	$6,886	$7,576	$2,053
	SO Region										
	Medium 1	400	$5,672	$18,589	$3,325	$9,926	$22,841	$3,632	$12,867	$25,779	$3,823
	Medium 2	625	$4,880	$17,877	$3,602	$7,227	$20,221	$3,961	$8,833	$21,826	$4,184
	Medium 3	875	$6,315	$12,519	$4,161	$10,225	$14,920	$4,573	$12,918	$16,561	$4,829
	Large 1	1,500	$4,436	$17,576	$1,688	$9,426	$22,321	$2,241	$12,859	$25,584	$2,583
	MA Region										
	Medium 1	400	$5,487	$11,996	$2,967	$8,594	$15,098	$3,264	$11,078	$17,581	$3,550
	Medium 2	625	$4,551	$9,321	$3,189	$6,301	$11,068	$3,515	$7,752	$12,518	$3,862
	Medium 3	875	$6,062	$7,682	$3,629	$9,068	$9,465	$3,987	$11,539	$10,974	$4,391
	Large 1	1,500	$4,531	$4,490	$1,450	$8,317	$7,884	$1,904	$11,447	$10,708	$2,436
Dairy- Flush											
	PA Region										
	Medium 1	250	$1,772	$1,794	$1,537	$3,789	$3,808	$3,529	$3,958	$3,975	$3,672
	Medium 2	425	$2,121	$60,242	$1,796	$5,185	$63,290	$4,826	$5,368	$63,458	$4,976
	Medium 3	600	$2,460	$22,406	$2,045	$6,531	$26,461	$6,075	$6,727	$26,642	$6,230
	Large 1	1,430	$2,011	$121,703	$1,174	$11,083	$130,723	$10,166	$13,031	$132,616	$12,034
	MW Region										
	Medium 1	250	$1,912	$1,878	$1,556	$3,951	$3,912	$3,558	$4,131	$4,087	$3,702
	Medium 2	425	$2,351	$32,791	$1,820	$5,446	$35,859	$4,864	$5,648	$36,034	$5,014
	Medium 3	600	$2,781	$2,595	$2,074	$6,896	$6,682	$6,120	$7,119	$6,878	$6,275
	Large 1	1,430	$2,754	$24,811	$1,219	$11,915	$33,876	$10,236	$13,927	$35,792	$12,104
	CE Region										
	Medium 1	250	$1,924	$1,899	$1,537	$3,955	$3,924	$3,529	$4,137	$4,101	$3,672
	Medium 2	425	$2,373	$60,175	$1,796	$5,459	$63,231	$4,826	$5,665	$63,406	$4,976
	Medium 3	600	$2,815	$2,673	$2,045	$6,920	$6,745	$6,075	$7,148	$6,943	$6,230
	Large 1	1,430	$2,863	$32,251	$1,174	$12,013	$41,293	$10,166	$14,039	$43,210	$12,034
	SO Region										
	Medium 1	250	$1,841	$1,820	$1,537	$3,875	$3,849	$3,540	$4,050	$4,018	$3,683
	Medium 2	425	$2,240	$57,886	$1,796	$5,328	$60,946	$4,839	$5,522	$61,112	$4,990
	Medium 3	600	$2,627	$54,503	$2,045	$6,731	$58,578	$6,091	$6,942	$58,762	$6,246
	Large 1	1,430	$2,414	$66,531	$1,174	$11,548	$75,569	$10,191	$13,532	$77,458	$12,059
	MA Region										
	Medium 1	250	$1,416	$1,393	$1,181	$3,386	$3,361	$3,129	$3,499	$3,470	$3,221
	Medium 2	425	$1,790	$42,235	$1,441	$4,809	$45,237	$4,429	$4,933	$45,345	$4,525
	Medium 3	600	$2,160	$8,217	$1,693	$6,188	$12,228	$5,681	$6,325	$12,349	$5,779
	Large 1	1,430	$1,809	$61,026	$791	$10,841	$69,999	$9,739	$12,724	$71,821	$11,539
Dairy- Hose											
	PA Region										
	Medium 1	250	$3,267	$3,376	$2,743	$4,235	$4,342	$3,108	$4,982	$5,087	$3,252
	Medium 2	425	$4,793	$5,387	$4,178	$5,805	$6,385	$4,580	$6,567	$7,131	$4,730
	Medium 3	600	$5,207	$5,797	$4,504	$6,262	$6,835	$4,939	$7,037	$7,595	$5,094
	Large 1	1,430	$2,299	$4,343	$1,174	$3,495	$5,485	$1,712	$4,411	$6,347	$1,969

Table B-1(a)
Total Estimated Annualized Compliance Costs, Option 1

Sector	Model	Head	Cat. 1L	Cat 2L	Cat. 3L	Cat. 1M	Cat. 2M	Cat. 3M	Cat. 1H	Cat. 2H	Cat. 3H
	MW Region										
	Medium 1	250	$2,748	$2,756	$2,021	$4,389	$4,392	$2,399	$5,612	$5,610	$2,545
	Medium 2	425	$3,817	$3,467	$2,515	$6,841	$5,137	$2,933	$9,215	$6,356	$3,086
	Medium 3	600	$4,374	$4,421	$3,297	$6,123	$6,143	$3,751	$7,392	$7,384	$3,910
	Large 1	1,430	$3,149	$2,512	$1,219	$5,103	$4,370	$1,781	$6,511	$5,683	$2,038
	CE Region										
	Medium 1	250	$2,921	$2,969	$2,246	$3,903	$3,946	$2,611	$4,664	$4,701	$2,755
	Medium 2	425	$3,716	$3,974	$2,850	$4,751	$4,979	$3,252	$5,536	$5,731	$3,402
	Medium 3	600	$4,801	$4,764	$3,449	$6,475	$5,820	$3,883	$7,868	$6,596	$4,039
	Large 1	1,430	$3,152	$2,919	$1,174	$4,426	$4,085	$1,712	$5,419	$4,969	$1,969
	SO Region										
	Medium 1	250	$4,058	$4,082	$2,685	$4,869	$4,888	$3,061	$5,449	$5,463	$3,204
	Medium 2	425	$5,551	$5,679	$4,038	$6,415	$6,514	$4,452	$7,014	$7,086	$4,603
	Medium 3	600	$9,316	$6,097	$4,315	$11,496	$6,982	$4,766	$13,379	$7,571	$4,921
	Large 1	1,430	$3,905	$7,203	$1,174	$5,149	$8,191	$1,736	$6,087	$8,873	$1,993
	MA Region										
	Medium 1	250	$2,606	$2,614	$1,807	$3,530	$3,536	$2,132	$4,148	$4,150	$2,227
	Medium 2	425	$3,294	$3,347	$2,380	$4,265	$4,301	$2,742	$4,895	$4,914	$2,841
	Medium 3	600	$4,033	$4,084	$2,999	$5,049	$5,082	$3,396	$5,692	$5,707	$3,498
	Large 1	1,430	$2,784	$2,542	$791	$4,221	$3,598	$1,285	$5,215	$4,261	$1,474
Hogs Liquid											
	MW Region (GF)										
	Medium 1	863	$1,223	$1,834	$1,002	$1,360	$1,909	$1,084	$1,451	$2,001	$1,173
	Medium 2	1,311	$1,264	$2,036	$1,017	$1,405	$2,094	$1,099	$1,496	$2,187	$1,187
	Medium 3	1,884	$1,312	$2,274	$1,030	$1,459	$2,320	$1,112	$1,550	$2,413	$1,200
	Large 1	2,500	$902	$1,947	$899	$1,282	$2,185	$1,189	$1,586	$2,528	$1,363
	Large 2	5,094	$906	$3,334	$899	$1,360	$3,679	$1,246	$1,733	$4,255	$1,480
	MA Region (GF)										
	Medium 1	883	$1,173	$1,717	$1,002	$1,401	$1,879	$1,084	$1,494	$1,972	$1,173
	Medium 2	1,345	$1,223	$1,881	$1,016	$1,469	$2,023	$1,098	$1,563	$2,117	$1,186
	Medium 3	1,887	$1,277	$2,078	$1,029	$1,543	$2,216	$1,111	$1,637	$2,310	$1,199
	Large 1	2,500	$904	$2,148	$899	$1,210	$2,243	$1,188	$1,642	$2,699	$1,361
	Large 2	6,390	$915	$3,548	$899	$1,279	$3,570	$1,239	$1,953	$4,317	$1,464
	MW Region (FF)										
	Medium 1	863	$1,223	$1,834	$1,002	$1,360	$1,909	$1,084	$1,451	$2,001	$1,173
	Medium 2	1,311	$1,264	$2,036	$1,017	$1,405	$2,094	$1,099	$1,496	$2,187	$1,187
	Medium 3	1,884	$1,312	$2,274	$1,030	$1,459	$2,320	$1,112	$1,550	$2,413	$1,200
	Large 1	2,500	$902	$1,947	$899	$1,282	$2,185	$1,189	$1,586	$2,528	$1,363
	Large 2	5,094	$906	$3,334	$899	$1,360	$3,679	$1,246	$1,733	$4,255	$1,480
	MA Region (FF)										
	Medium 1	883	$1,173	$1,717	$1,002	$1,401	$1,879	$1,084	$1,494	$1,972	$1,173
	Medium 2	1,345	$1,223	$1,881	$1,016	$1,469	$2,023	$1,098	$1,563	$2,117	$1,186
	Medium 3	1,887	$1,277	$2,078	$1,029	$1,543	$2,216	$1,111	$1,637	$2,310	$1,199
	Large 1	2,500	$904	$2,148	$899	$1,210	$2,243	$1,188	$1,642	$2,699	$1,361
	Large 2	6,390	$915	$3,548	$899	$1,279	$3,570	$1,239	$1,953	$4,317	$1,464
Hogs Pit											
	MW Region (GF)										
	Medium 1	863	$1,180	$1,274	$919	$1,329	$1,439	$1,008	$1,420	$1,531	$1,096
	Medium 2	1,311	$1,227	$1,331	$919	$1,384	$1,505	$1,008	$1,476	$1,598	$1,096
	Medium 3	1,884	$1,286	$1,425	$919	$1,453	$1,614	$1,008	$1,545	$1,707	$1,096
	Large 1	2,500	$904	$1,527	$899	$1,255	$1,899	$1,118	$1,527	$2,190	$1,223
	Large 2	5,094	$911	$925	$899	$1,346	$1,510	$1,118	$1,694	$1,995	$1,223
	MA Region (GF)										
	Medium 1	883	$1,141	$1,138	$919	$1,398	$1,395	$1,008	$1,492	$2,091	$1,096
	Medium 2	1,345	$1,204	$1,155	$919	$1,493	$1,421	$1,008	$1,587	$3,571	$1,096
	Medium 3	1,887	$1,274	$1,206	$919	$1,598	$1,497	$1,008	$1,694	$4,449	$1,096
	Large 1	2,500	$908	$904	$899	$1,167	$1,154	$1,118	$1,619	$2,006	$1,223
	Large 2	6,390	$926	$915	$899	$1,228	$1,191	$1,118	$2,031	$3,200	$1,223

Table B-1(a)
Total Estimated Annualized Compliance Costs, Option 1

Sector / Model	Head	Cat. 1L	Cat 2L	Cat. 3L	Cat. 1M	Cat. 2M	Cat. 3M	Cat. 1H	Cat. 2H	Cat. 3H
MW Region (FF)										
Medium 1	863	$1,180	$1,274	$919	$1,329	$1,439	$1,008	$1,420	$1,531	$1,096
Medium 2	1,311	$1,227	$1,331	$919	$1,384	$1,505	$1,008	$1,476	$1,598	$1,096
Medium 3	1,884	$1,286	$1,425	$919	$1,453	$1,614	$1,008	$1,545	$1,707	$1,096
Large 1	2,500	$904	$1,527	$899	$1,255	$1,899	$1,118	$1,527	$2,190	$1,223
Large 2	5,094	$911	$925	$899	$1,346	$1,510	$1,118	$1,694	$1,995	$1,223
MA Region (FF)										
Medium 1	883	$1,141	$1,138	$919	$1,398	$1,396	$1,008	$1,492	$2,113	$1,096
Medium 2	1,345	$1,204	$1,155	$919	$1,493	$1,422	$1,008	$1,587	$3,646	$1,096
Medium 3	1,887	$1,274	$1,206	$919	$1,598	$1,500	$1,008	$1,694	$4,553	$1,096
Large 1	2,500	$908	$904	$899	$1,167	$1,154	$1,118	$1,619	$2,006	$1,223
Large 2	6,390	$926	$915	$899	$1,228	$1,191	$1,118	$2,031	$3,200	$1,223
Hogs Evaporate										
CE Region (GF)										
Large 1	2,500	$902	$906	$899	$1,290	$1,350	$1,200	$1,602	$1,714	$1,389
Large 2	6,038	$907	$920	$899	$1,391	$1,577	$1,328	$1,792	$2,138	$1,642
CE Region (FF)										
Large 1	2,500	$902	$906	$899	$1,290	$1,350	$1,200	$1,602	$1,714	$1,389
Large 2	6,038	$907	$920	$899	$1,391	$1,577	$1,328	$1,792	$2,138	$1,642
Broilers										
SO Region										
Medium 1	38,802	$1,456	$1,193	$883	$3,915	$3,558	$3,066	$5,540	$5,192	$4,697
Medium 2	53,942	$1,704	$1,283	$946	$5,039	$4,576	$4,039	$7,288	$6,929	$6,383
Medium 3	82,907	$2,112	$1,434	$1,009	$7,068	$6,313	$5,651	$10,476	$9,878	$9,204
Large 1	125,000	$2,760	$1,683	$1,226	$8,696	$7,509	$6,671	$15,035	$14,328	$13,342
Large 2	219,247	$4,509	$2,349	$1,726	$16,089	$15,352	$14,825	$28,719	$31,090	$31,145
MA Region										
Medium 1	39,642	$1,495	$1,295	$1,021	$1,853	$1,593	$1,119	$3,359	$3,100	$2,615
Medium 2	55,618	$1,724	$1,425	$1,088	$2,138	$1,748	$1,195	$4,224	$3,918	$3,283
Medium 3	85,355	$2,096	$1,597	$1,160	$2,607	$1,958	$1,275	$5,758	$5,238	$4,436
Large 1	125,000	$2,886	$1,947	$1,470	$3,374	$2,262	$1,619	$7,947	$7,123	$7,108
Large 2	219,247	$4,874	$2,834	$2,106	$5,701	$3,269	$2,325	$15,589	$15,123	$16,033
Layers										
Wet SO Region										
Medium 2	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Medium 3	19,500	$808	$809	$801	$1,096	$1,100	$1,015	$1,786	$1,827	$1,173
Large 1	146,426	$955	$918	$902	$1,425	$16,116	$1,129	$4,503	$18,965	$1,300
Dry SO Region										
Medium 1	36,068	$1,378	$1,373	$1,365	$2,705	$2,722	$2,595	$4,189	$3,973	$3,235
Medium 2	61,734	$1,808	$1,801	$1,786	$3,898	$3,923	$3,745	$6,238	$5,918	$4,759
Medium 3	78,546	$2,112	$2,119	$2,084	$4,703	$4,737	$4,521	$7,605	$8,025	$5,784
Large 1	291,153	$3,723	$3,623	$3,618	$8,556	$8,241	$8,017	$16,507	$11,040	$10,347
Large 2	856,368	$9,307	$9,004	$8,999	$23,008	$21,794	$21,518	$45,824	$28,962	$28,132
Dry MW Region										
Medium 1	36,068	$1,126	$1,120	$1,112	$2,175	$2,202	$2,086	$3,607	$3,397	$2,720
Medium 2	61,734	$1,377	$1,369	$1,353	$3,001	$3,042	$2,875	$5,246	$4,927	$3,882
Medium 3	78,546	$1,563	$1,568	$1,533	$3,565	$3,583	$3,416	$6,345	$6,594	$4,670
Large 1	291,153	$2,710	$2,602	$2,597	$6,411	$6,176	$5,965	$13,897	$8,932	$8,278
Large 2	856,368	$6,328	$6,002	$5,996	$16,724	$15,749	$15,487	$38,162	$22,839	$22,059
Turkeys										
MA Region										
Medium 1	22,246	$2,552	$2,128	$1,463	$3,941	$3,660	$2,846	$5,646	$5,548	$4,548
Medium 2	34,640	$3,346	$2,535	$1,770	$5,461	$4,924	$3,877	$8,068	$7,881	$6,479
Medium 3	47,534	$4,167	$3,047	$2,085	$7,037	$6,294	$4,944	$10,582	$10,324	$8,483
Large 1	127,396	$9,311	$5,427	$4,174	$16,957	$14,342	$11,711	$26,327	$25,417	$21,068
MW Region										
Medium 1	22,246	$2,305	$2,030	$1,459	$3,766	$3,623	$2,845	$5,496	$5,523	$4,548
Medium 2	34,640	$3,018	$2,438	$1,767	$5,203	$4,902	$3,876	$7,835	$7,892	$6,479
Medium 3	47,534	$3,754	$2,950	$2,081	$6,693	$6,276	$4,943	$10,262	$10,341	$8,483
Large 1	127,396	$8,515	$5,416	$4,172	$16,102	$14,500	$11,711	$25,468	$25,773	$21,068

Table B-1(b)
Total Estimated Annualized Compliance Costs, Option 2

Sector	Model	Head	Cat. 1L	Cat 2L	Cat. 3L	Cat. 1M	Cat. 2M	Cat. 3M	Cat. 1H	Cat. 2H	Cat. 3H
Beef											
	MW Region										
	Medium 1	370	$7,020	$7,369	$3,723	$8,861	$9,196	$4,010	$10,469	$10,793	$4,201
	Medium 2	552	$8,692	$11,621	$4,594	$10,541	$13,472	$4,935	$12,180	$15,113	$5,140
	Medium 3	766	$11,019	$17,502	$5,649	$13,400	$20,366	$6,023	$15,464	$22,870	$6,252
	Large 1	1,839	$12,630	$15,819	$7,830	$15,912	$19,407	$8,451	$18,877	$22,678	$8,755
	Large 2	25,897	$68,683	$106,164	$94,689	$80,830	$122,510	$98,383	$90,920	$136,798	$100,020
	CE Region										
	Medium 1	370	$6,647	$7,023	$3,703	$8,683	$9,041	$3,933	$10,316	$10,655	$4,131
	Medium 2	552	$9,979	$10,689	$4,532	$14,090	$12,735	$4,793	$17,428	$14,403	$5,003
	Medium 3	766	$10,725	$15,550	$5,947	$12,873	$17,712	$6,224	$14,605	$19,456	$6,454
	Large 1	1,839	$14,380	$16,888	$9,983	$17,255	$20,763	$10,406	$19,644	$23,980	$10,694
	Large 2	25,897	$92,196	$138,303	$120,467	$103,292	$151,823	$122,540	$113,140	$164,098	$123,368
	PA Region										
	Medium 1	370	$9,706	$10,130	$13,585	$11,429	$11,837	$13,883	$13,032	$13,425	$14,059
	Medium 2	552	$13,459	$17,123	$19,262	$15,948	$20,026	$19,603	$18,289	$22,779	$19,793
	Medium 3	766	$17,015	$24,307	$25,897	$19,783	$27,625	$26,280	$22,375	$30,766	$26,486
	Large 1	1,839	$20,910	$40,951	$54,147	$24,802	$45,477	$54,722	$28,400	$49,710	$55,003
	Large 2	25,897	$132,527	$237,752	$548,859	$150,331	$269,815	$551,905	$166,401	$300,145	$553,217
	SO Region										
	Medium 1	370	$5,645	$8,107	$12,443	$8,294	$10,410	$12,749	$10,111	$11,987	$12,939
	Medium 2	552	$6,604	$7,843	$15,886	$9,492	$11,211	$16,236	$11,471	$13,527	$16,454
	Medium 3	766	$8,582	$10,567	$23,093	$12,642	$14,806	$23,492	$15,433	$17,721	$23,742
	Large 1	1,839	$8,926	$32,852	$47,539	$14,763	$38,219	$48,180	$18,758	$41,901	$48,575
	Large 2	25,897	$57,942	$203,623	$485,351	$88,935	$235,605	$490,191	$109,609	$257,120	$492,875
	MA Region										
	Medium 1	370	$7,711	$9,520	$25,069	$9,860	$11,969	$25,364	$11,563	$13,920	$25,649
	Medium 2	552	$10,690	$13,252	$36,431	$14,016	$16,144	$36,752	$16,663	$18,451	$37,090
	Medium 3	766	$13,300	$19,256	$51,645	$16,621	$22,576	$51,996	$19,275	$25,222	$52,388
	Large 1	1,839	$15,415	$22,740	$90,161	$20,011	$27,150	$90,669	$23,721	$30,762	$91,278
	Large 2	25,897	$75,667	$145,294	$735,328	$101,528	$172,361	$738,462	$121,613	$193,714	$741,503
Veal											
	MW Region										
	Medium 1	400	$1,813	$1,535	$1,400	$1,813	$1,535	$1,400	$1,813	$1,535	$1,400
	Medium 2	540	$1,813	$1,535	$1,400	$1,813	$1,535	$1,400	$1,813	$1,535	$1,400
	Medium 3	1,080	$1,813	$1,535	$1,400	$1,813	$1,535	$1,400	$1,813	$1,535	$1,400
	Large 1	1,080	$1,813	$1,535	$1,400	$1,813	$1,535	$1,400	$1,813	$1,535	$1,400
	CE Region										
	Medium 1	400	$1,813	$1,535	$1,400	$1,813	$1,535	$1,400	$1,813	$1,535	$1,400
	Medium 2	540	$1,813	$1,535	$1,400	$1,813	$1,535	$1,400	$1,813	$1,535	$1,400
	Medium 3	1,080	$1,813	$1,535	$1,400	$1,813	$1,535	$1,400	$1,813	$1,535	$1,400
	Large 1	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	PA Region										
	Medium 1	400	$1,813	$1,535	$1,400	$1,813	$1,535	$1,400	$1,813	$1,535	$1,400
	Medium 2	540	$1,813	$1,535	$1,400	$1,813	$1,535	$1,400	$1,813	$1,535	$1,400
	Medium 3	1,080	$1,813	$1,535	$1,400	$1,813	$1,535	$1,400	$1,813	$1,535	$1,400
	Large 1	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	SO Region										
	Medium 1	400	$1,813	$1,535	$1,400	$1,813	$1,535	$1,400	$1,813	$1,535	$1,400
	Medium 2	540	$1,813	$1,535	$1,400	$1,813	$1,535	$1,400	$1,813	$1,535	$1,400
	Medium 3	1,080	$1,813	$1,535	$1,400	$1,813	$1,535	$1,400	$1,813	$1,535	$1,400
	Large 1	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	MA Region										
	Medium 1	400	$1,813	$1,535	$1,400	$1,813	$1,535	$1,400	$1,813	$1,535	$1,400
	Medium 2	540	$1,813	$1,535	$1,400	$1,813	$1,535	$1,400	$1,813	$1,535	$1,400
	Medium 3	1,080	$1,813	$1,535	$1,400	$1,813	$1,535	$1,400	$1,813	$1,535	$1,400
	Large 1	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

Table B-1(b)
Total Estimated Annualized Compliance Costs, Option 2

Sector	Model	Head	Cat. 1L	Cat 2L	Cat. 3L	Cat. 1M	Cat. 2M	Cat. 3M	Cat. 1H	Cat. 2H	Cat. 3H
Heifers											
	MW Region										
	Medium 1	400	$6,849	$7,116	$3,857	$10,173	$10,437	$4,145	$13,130	$13,391	$4,338
	Medium 2	625	$6,337	$8,044	$4,753	$8,575	$10,742	$5,101	$10,577	$13,181	$5,309
	Medium 3	875	$7,261	$10,086	$5,899	$9,771	$13,245	$6,284	$11,942	$16,009	$6,518
	Large 1	1,500	$5,593	$12,798	$6,257	$7,947	$16,338	$6,800	$10,032	$19,610	$7,074
	CE Region										
	Medium 1	400	$6,158	$6,477	$3,789	$9,897	$10,212	$4,020	$12,861	$13,172	$4,218
	Medium 2	625	$5,299	$6,391	$4,683	$7,297	$8,390	$4,949	$8,916	$10,010	$5,161
	Medium 3	875	$6,232	$8,106	$6,225	$8,305	$10,185	$6,508	$9,958	$11,845	$6,742
	Large 1	1,500	$5,906	$11,928	$7,909	$8,464	$15,403	$8,291	$10,572	$18,289	$8,558
	PA Region										
	Medium 1	400	$8,376	$11,294	$13,963	$11,439	$14,353	$14,263	$14,380	$17,291	$14,440
	Medium 2	625	$8,626	$12,242	$20,306	$11,116	$15,172	$20,653	$13,453	$17,949	$20,846
	Medium 3	875	$10,587	$14,228	$27,548	$13,552	$17,567	$27,942	$16,332	$20,720	$28,151
	Large 1	1,500	$7,733	$16,883	$41,643	$10,495	$20,955	$42,151	$13,006	$24,776	$42,408
	SO Region										
	Medium 1	400	$5,970	$10,043	$12,830	$10,229	$14,297	$13,137	$13,172	$17,237	$13,328
	Medium 2	625	$5,804	$9,777	$16,707	$9,084	$13,201	$17,065	$11,342	$15,560	$17,289
	Medium 3	875	$7,076	$9,418	$24,546	$11,216	$13,401	$24,957	$14,069	$16,144	$25,215
	Large 1	1,500	$5,165	$10,607	$36,634	$10,303	$15,993	$37,186	$13,838	$19,699	$37,529
	MA Region										
	Medium 1	400	$7,523	$10,273	$25,570	$11,855	$15,622	$25,867	$15,294	$19,867	$26,153
	Medium 2	625	$6,845	$9,951	$38,506	$9,466	$13,287	$38,832	$11,587	$15,971	$39,179
	Medium 3	875	$8,846	$12,080	$55,092	$12,452	$15,873	$55,450	$15,372	$18,934	$55,854
	Large 1	1,500	$7,221	$14,592	$74,445	$11,431	$19,555	$74,899	$14,871	$23,553	$75,431
Dairy- Flush											
	PA Region										
	Medium 1	250	$4,652	$7,269	$28,483	$6,690	$9,313	$30,475	$6,879	$9,508	$30,619
	Medium 2	425	$7,017	$51,023	$47,017	$10,116	$54,087	$50,048	$10,335	$54,271	$50,198
	Medium 3	600	$9,372	$15,689	$65,543	$13,494	$19,784	$69,573	$13,741	$20,005	$69,728
	Large 1	1,430	$15,821	$180,078	$103,001	$24,993	$189,121	$111,994	$27,041	$191,041	$113,861
	MW Region										
	Medium 1	250	$4,627	$7,424	$10,238	$6,699	$9,508	$12,240	$6,912	$9,733	$12,384
	Medium 2	425	$6,967	$16,283	$16,378	$10,118	$19,383	$19,422	$10,377	$19,591	$19,572
	Medium 3	600	$8,971	$10,607	$21,737	$13,161	$14,766	$25,783	$13,459	$15,035	$25,938
	Large 1	1,430	$14,550	$25,080	$40,084	$23,853	$34,208	$49,102	$26,005	$36,187	$50,968
	CE Region										
	Medium 1	250	$3,888	$5,836	$15,089	$5,945	$7,902	$17,082	$6,154	$8,119	$17,225
	Medium 2	425	$5,633	$24,501	$24,093	$8,763	$27,581	$27,123	$9,014	$27,782	$27,272
	Medium 3	600	$7,185	$8,159	$32,155	$11,347	$12,288	$36,186	$11,635	$12,542	$36,341
	Large 1	1,430	$9,848	$50,375	$53,300	$19,090	$59,457	$62,292	$21,209	$61,412	$64,159
	SO Region										
	Medium 1	250	$2,202	$2,616	$20,425	$4,239	$4,653	$22,427	$4,419	$4,831	$22,571
	Medium 2	425	$2,835	$57,356	$32,779	$5,929	$60,419	$35,822	$6,132	$60,588	$35,971
	Medium 3	600	$3,701	$24,271	$54,658	$7,817	$28,356	$58,703	$8,042	$28,551	$58,858
	Large 1	1,430	$4,583	$135,167	$89,191	$13,743	$144,201	$98,209	$15,755	$146,086	$100,076
	MA Region										
	Medium 1	250	$3,804	$6,294	$49,255	$5,793	$8,289	$51,205	$5,924	$8,428	$51,295
	Medium 2	425	$5,955	$35,356	$75,112	$9,007	$38,374	$78,100	$9,165	$38,497	$78,195
	Medium 3	600	$8,336	$11,129	$103,754	$12,413	$15,180	$107,742	$12,600	$15,341	$107,840
	Large 1	1,430	$14,071	$133,548	$195,095	$23,200	$142,545	$204,044	$25,178	$144,392	$205,843
Dairy- Hose											
	PA Region										
	Medium 1	250	$6,146	$9,077	$7,326	$7,136	$10,072	$7,691	$7,903	$10,845	$7,835
	Medium 2	425	$9,688	$8,418	$11,350	$10,737	$9,431	$11,751	$11,534	$10,192	$11,901
	Medium 3	600	$12,119	$13,740	$14,264	$13,224	$14,820	$14,698	$14,049	$15,618	$14,853
	Large 1	1,430	$16,238	$10,185	$22,383	$17,791	$11,832	$22,920	$19,063	$13,198	$23,177

Table B-1(b)
Total Estimated Annualized Compliance Costs, Option 2

Sector	Model	Head	Cat. 1L	Cat 2L	Cat. 3L	Cat. 1M	Cat. 2M	Cat. 3M	Cat. 1H	Cat. 2H	Cat. 3H
	MW Region										
	Medium 1	250	$5,463	$8,383	$3,020	$7,137	$10,070	$3,399	$8,394	$11,339	$3,544
	Medium 2	425	$8,033	$7,138	$4,002	$9,785	$8,841	$4,419	$11,087	$10,093	$4,573
	Medium 3	600	$10,564	$12,592	$5,196	$12,388	$14,387	$5,650	$13,732	$15,701	$5,809
	Large 1	1,430	$15,067	$10,689	$4,991	$17,547	$13,423	$5,554	$19,408	$15,457	$5,811
	CE Region										
	Medium 1	250	$4,885	$7,047	$3,499	$5,895	$8,065	$3,865	$6,681	$8,859	$4,009
	Medium 2	425	$6,976	$6,459	$4,607	$8,056	$7,489	$5,008	$8,885	$8,267	$5,159
	Medium 3	600	$8,798	$10,509	$5,645	$9,783	$11,622	$6,080	$10,490	$12,453	$6,236
	Large 1	1,430	$10,167	$7,921	$4,771	$11,592	$9,259	$5,309	$12,737	$10,318	$5,566
	SO Region										
	Medium 1	250	$4,419	$5,017	$6,084	$5,235	$5,832	$6,460	$5,819	$6,415	$6,604
	Medium 2	425	$6,145	$6,033	$9,266	$7,016	$6,871	$9,681	$7,623	$7,445	$9,830
	Medium 3	600	$7,040	$7,444	$12,941	$7,966	$8,340	$13,393	$8,596	$8,939	$13,548
	Large 1	1,430	$6,199	$17,097	$20,417	$7,516	$18,081	$20,980	$8,529	$18,761	$21,237
	MA Region										
	Medium 1	250	$4,997	$7,841	$12,464	$5,941	$8,792	$12,790	$6,577	$9,435	$12,883
	Medium 2	425	$7,560	$6,836	$19,288	$8,662	$7,980	$19,651	$9,411	$8,762	$19,749
	Medium 3	600	$10,404	$12,448	$26,808	$11,661	$13,824	$27,205	$12,520	$14,784	$27,306
	Large 1	1,430	$15,300	$10,353	$52,214	$17,057	$12,074	$52,708	$18,333	$13,300	$52,896
Hogs Liquid											
	MW Region (GF)										
	Medium 1	863	$2,841	$3,942	$1,184	$3,022	$4,059	$1,266	$3,115	$4,153	$1,355
	Medium 2	1,311	$3,550	$5,055	$1,300	$3,754	$5,174	$1,382	$3,848	$5,269	$1,471
	Medium 3	1,884	$4,599	$6,467	$1,424	$4,836	$6,599	$1,506	$4,932	$6,696	$1,595
	Large 1	2,500	$3,781	$5,594	$1,736	$4,298	$5,958	$2,025	$4,727	$6,403	$2,200
	Large 2	5,094	$6,771	$14,614	$4,022	$7,498	$15,306	$4,369	$8,118	$16,168	$4,601
	MA Region (GF)										
	Medium 1	883	$2,737	$3,181	$1,181	$3,108	$3,449	$1,263	$3,205	$3,546	$1,352
	Medium 2	1,345	$3,255	$3,162	$1,287	$3,688	$3,379	$1,369	$3,787	$3,475	$1,458
	Medium 3	1,887	$4,128	$3,861	$1,406	$4,656	$4,103	$1,488	$4,758	$4,200	$1,577
	Large 1	2,500	$2,611	$4,033	$1,729	$2,940	$4,144	$2,018	$3,569	$4,670	$2,192
	Large 2	6,390	$5,277	$9,223	$3,702	$5,700	$9,284	$4,042	$6,865	$10,243	$4,267
	MW Region (FF)										
	Medium 1	863	$2,841	$3,942	$1,184	$3,022	$4,059	$1,266	$3,115	$4,153	$1,355
	Medium 2	1,311	$3,550	$5,055	$1,300	$3,754	$5,174	$1,382	$3,848	$5,269	$1,471
	Medium 3	1,884	$4,599	$6,467	$1,424	$4,836	$6,599	$1,506	$4,932	$6,696	$1,595
	Large 1	2,500	$3,781	$5,594	$1,736	$4,298	$5,958	$2,025	$4,727	$6,403	$2,200
	Large 2	5,094	$6,771	$14,614	$4,022	$7,498	$15,306	$4,369	$8,118	$16,168	$4,601
	MA Region (FF)										
	Medium 1	883	$2,737	$3,181	$1,181	$3,108	$3,449	$1,263	$3,205	$3,546	$1,352
	Medium 2	1,345	$3,255	$3,162	$1,287	$3,688	$3,379	$1,369	$3,787	$3,475	$1,458
	Medium 3	1,887	$4,128	$3,861	$1,406	$4,656	$4,103	$1,488	$4,758	$4,200	$1,577
	Large 1	2,500	$2,611	$4,033	$1,729	$2,940	$4,144	$2,018	$3,569	$4,670	$2,192
	Large 2	6,390	$5,277	$9,223	$3,702	$5,700	$9,284	$4,042	$6,865	$10,243	$4,267
Hogs Pit											
	MW Region (GF)										
	Medium 1	863	$2,777	$3,792	$3,050	$2,968	$3,998	$3,139	$3,061	$4,092	$3,228
	Medium 2	1,311	$3,484	$4,919	$4,246	$3,699	$5,153	$4,335	$3,794	$5,248	$4,423
	Medium 3	1,884	$4,531	$6,409	$5,545	$4,781	$6,681	$5,633	$4,877	$6,778	$5,722
	Large 1	2,500	$3,782	$7,448	$10,724	$4,260	$7,936	$10,944	$4,648	$8,332	$11,049
	Large 2	5,094	$6,774	$22,233	$37,555	$7,459	$23,142	$37,775	$8,035	$23,922	$37,880
	MA Region (GF)										
	Medium 1	883	$2,681	$3,301	$6,528	$3,071	$3,661	$6,617	$3,168	$3,897	$6,706
	Medium 2	1,345	$3,205	$7,958	$9,445	$3,666	$8,294	$9,534	$3,765	$9,016	$9,623
	Medium 3	1,887	$4,083	$10,656	$12,769	$4,648	$11,046	$12,858	$4,751	$12,012	$12,946
	Large 1	2,500	$2,614	$24,292	$26,971	$2,895	$24,553	$27,190	$3,527	$25,175	$27,295
	Large 2	6,390	$5,285	$70,928	$88,925	$5,642	$71,235	$89,144	$6,888	$72,557	$89,249

Table B-1(b)
Total Estimated Annualized Compliance Costs, Option 2

Sector	Model	Head	Cat. 1L	Cat 2L	Cat. 3L	Cat. 1M	Cat. 2M	Cat. 3M	Cat. 1H	Cat. 2H	Cat. 3H
	MW Region (FF)										
	Medium 1	863	$2,777	$3,671	$3,050	$2,968	$3,876	$3,139	$3,061	$3,971	$3,228
	Medium 2	1,311	$3,484	$4,736	$4,246	$3,699	$4,969	$4,335	$3,794	$5,064	$4,423
	Medium 3	1,884	$4,531	$6,154	$5,545	$4,781	$6,426	$5,633	$4,877	$6,523	$5,722
	Large 1	2,500	$3,782	$7,085	$10,724	$4,260	$7,573	$10,944	$4,648	$7,969	$11,049
	Large 2	5,094	$6,774	$21,076	$37,555	$7,459	$21,986	$37,775	$8,035	$22,765	$37,880
	MA Region (FF)										
	Medium 1	883	$2,681	$3,186	$6,528	$3,071	$3,546	$6,617	$3,168	$3,787	$6,706
	Medium 2	1,345	$3,205	$7,794	$9,445	$3,666	$8,131	$9,534	$3,765	$8,875	$9,623
	Medium 3	1,887	$4,083	$10,428	$12,769	$4,648	$10,818	$12,858	$4,751	$11,816	$12,946
	Large 1	2,500	$2,614	$23,854	$26,971	$2,895	$24,114	$27,190	$3,527	$24,736	$27,295
	Large 2	6,390	$5,285	$69,614	$88,925	$5,642	$69,921	$89,144	$6,888	$71,244	$89,249
Hogs Evaporate											
	CE Region (GF)										
	Large 1	2,500	$2,604	$2,941	$899	$3,079	$3,452	$1,200	$3,470	$3,875	$1,389
	Large 2	6,038	$5,018	$7,013	$899	$5,708	$7,870	$1,328	$6,296	$8,612	$1,642
	CE Region (FF)										
	Large 1	2,500	$2,604	$2,941	$899	$3,079	$3,452	$1,200	$3,470	$3,875	$1,389
	Large 2	6,038	$5,018	$7,013	$899	$5,708	$7,870	$1,328	$6,296	$8,612	$1,642
Broilers											
	SO Region										
	Medium 1	38,802	$3,906	$1,521	$883	$6,536	$3,890	$3,066	$8,161	$5,525	$4,697
	Medium 2	53,942	$4,546	$1,671	$946	$8,068	$4,968	$4,039	$10,311	$7,320	$6,383
	Medium 3	82,907	$6,610	$1,966	$1,009	$11,861	$6,849	$5,650	$15,259	$10,413	$9,204
	Large 1	125,000	$8,501	$2,267	$1,226	$14,874	$8,100	$6,671	$21,222	$14,923	$13,342
	Large 2	219,247	$14,447	$3,322	$1,690	$26,411	$16,304	$14,785	$38,630	$32,006	$31,100
	MA Region										
	Medium 1	39,642	$3,013	$2,155	$1,021	$3,430	$2,477	$1,119	$4,935	$3,985	$2,615
	Medium 2	55,618	$3,535	$2,435	$1,088	$4,019	$2,784	$1,195	$6,103	$4,948	$3,283
	Medium 3	85,355	$4,813	$3,016	$1,160	$5,430	$3,415	$1,275	$8,577	$6,686	$4,436
	Large 1	125,000	$5,166	$3,577	$1,432	$5,713	$3,922	$1,577	$10,289	$8,769	$7,021
	Large 2	219,247	$8,733	$5,596	$2,107	$9,641	$6,080	$2,325	$19,167	$17,864	$16,102
Layers											
	Wet SO Region										
	Medium 2	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	Medium 3	19,500	$1,268	$2,057	$801	$1,566	$2,367	$2,270	$2,379	$3,358	$2,481
	Large 1	146,426	$4,413	$2,393	$902	$4,949	$16,811	$6,366	$8,961	$19,516	$6,934
	Dry SO Region										
	Medium 1	36,068	$2,820	$2,174	$1,365	$4,175	$3,626	$2,685	$6,049	$4,919	$3,364
	Medium 2	61,734	$4,668	$3,253	$1,786	$6,812	$5,547	$3,900	$9,925	$7,613	$4,980
	Medium 3	78,546	$5,751	$7,451	$2,084	$8,412	$10,174	$4,719	$12,296	$14,202	$6,065
	Large 1	291,153	$17,211	$4,035	$3,618	$22,302	$8,829	$8,751	$33,895	$11,699	$11,387
	Large 2	856,368	$48,980	$9,537	$8,999	$63,438	$22,551	$23,677	$96,968	$29,813	$31,191
	Dry MW Region										
	Medium 1	36,068	$1,903	$1,697	$1,112	$2,962	$2,822	$2,110	$4,573	$4,034	$2,755
	Medium 2	61,734	$2,949	$2,401	$1,353	$4,593	$4,146	$2,917	$7,199	$6,060	$3,943
	Medium 3	78,546	$3,563	$5,309	$1,533	$5,591	$7,386	$3,470	$8,831	$10,840	$4,747
	Large 1	291,153	$10,121	$2,888	$2,597	$13,923	$6,514	$6,167	$23,110	$9,292	$8,563
	Large 2	856,368	$28,127	$6,370	$5,996	$38,818	$16,185	$16,080	$65,259	$23,303	$22,899
Turkeys											
	MA Region										
	Medium 1	22,246	$7,169	$4,094	$1,463	$8,563	$6,432	$3,660	$10,270	$9,253	$6,396
	Medium 2	34,640	$10,536	$4,375	$1,770	$12,657	$8,022	$5,144	$15,270	$12,580	$9,359
	Medium 3	47,534	$14,033	$6,221	$2,085	$16,912	$11,185	$6,683	$20,464	$17,336	$12,435
	Large 1	127,396	$9,311	$10,557	$4,174	$16,957	$24,155	$16,372	$26,327	$41,174	$31,662
	MW Region										
	Medium 1	22,246	$7,496	$3,701	$1,459	$8,959	$5,515	$2,959	$10,692	$7,695	$4,806
	Medium 2	34,640	$11,101	$3,992	$1,767	$13,290	$6,764	$4,054	$15,927	$10,142	$6,882
	Medium 3	47,534	$14,846	$5,648	$2,081	$17,790	$9,389	$5,187	$21,365	$13,982	$9,037
	Large 1	127,396	$8,515	$9,798	$4,172	$16,102	$19,776	$12,363	$25,468	$32,189	$22,551

Table B-2(a)
Per-Animal Pre-tax Annualized Compliance Costs, Option 1

Sector	Model	Head	Cat. 1L	Cat 2L	Cat. 3L	Cat. 1M	Cat. 2M	Cat. 3M	Cat. 1H	Cat. 2H	Cat. 3H
Beef											
	MW Region										
	Medium 1	370	$11.62	$11.85	$6.45	$16.52	$16.73	$7.23	$20.81	$20.99	$7.75
	Medium 2	552	$8.39	$8.54	$4.72	$11.67	$11.81	$5.33	$14.57	$14.69	$5.70
	Medium 3	766	$6.42	$6.53	$3.77	$8.91	$9.02	$4.26	$11.04	$11.14	$4.56
	Large 1	1,839	$2.09	$2.78	$0.74	$3.21	$3.87	$1.08	$4.15	$4.79	$1.24
	Large 2	25,897	$0.77	$0.57	$0.14	$1.19	$0.97	$0.28	$1.52	$1.28	$0.35
	CE Region										
	Medium 1	370	$10.76	$11.08	$6.03	$16.16	$16.45	$6.65	$20.48	$20.73	$7.18
	Medium 2	552	$7.73	$7.95	$4.31	$11.35	$11.54	$4.79	$14.28	$14.44	$5.17
	Medium 3	766	$5.40	$6.06	$3.36	$7.49	$8.74	$3.72	$9.17	$10.87	$4.02
	Large 1	1,839	$2.19	$1.85	$0.77	$3.36	$2.98	$1.00	$4.31	$3.90	$1.16
	Large 2	25,897	$0.90	$0.63	$0.08	$1.27	$0.96	$0.16	$1.58	$1.24	$0.19
	PA Region										
	Medium 1	370	$13.47	$18.76	$7.99	$18.04	$23.31	$8.79	$22.27	$27.53	$9.27
	Medium 2	552	$9.92	$10.46	$6.17	$13.07	$13.59	$6.78	$15.94	$16.45	$7.13
	Medium 3	766	$7.86	$8.24	$5.08	$10.19	$10.56	$5.58	$12.28	$12.65	$5.85
	Large 1	1,839	$2.89	$44.10	$0.72	$4.64	$45.17	$1.03	$6.22	$46.08	$1.18
	Large 2	25,897	$0.82	$1.55	$0.11	$1.29	$2.00	$0.23	$1.69	$2.39	$0.28
	SO Region										
	Medium 1	370	$11.93	$44.20	$8.26	$18.16	$50.39	$9.08	$22.43	$54.63	$9.60
	Medium 2	552	$9.58	$9.14	$6.39	$14.90	$13.38	$7.03	$18.56	$16.29	$7.42
	Medium 3	766	$8.27	$8.38	$5.27	$13.24	$13.33	$5.80	$16.66	$16.74	$6.12
	Large 1	1,839	$2.94	$48.74	$0.98	$6.01	$50.17	$1.32	$8.11	$51.14	$1.54
	Large 2	25,897	$1.17	$9.95	$0.25	$2.31	$10.82	$0.44	$3.07	$11.40	$0.54
	MA Region										
	Medium 1	370	$11.16	$26.16	$7.41	$15.82	$30.79	$8.21	$19.58	$34.53	$8.98
	Medium 2	552	$8.91	$8.36	$5.65	$12.87	$11.52	$6.24	$16.10	$14.13	$6.85
	Medium 3	766	$7.82	$6.64	$4.61	$11.65	$8.97	$5.07	$14.78	$10.92	$5.58
	Large 1	1,839	$2.83	$14.73	$0.82	$5.14	$15.78	$1.10	$7.05	$16.71	$1.43
	Large 2	25,897	$1.07	$2.09	$0.17	$1.98	$2.55	$0.29	$2.70	$2.94	$0.41
Veal											
	MW Region										
	Medium 1	400	$4.53	$3.84	$3.50	$4.53	$3.84	$3.50	$4.53	$3.84	$3.50
	Medium 2	540	$3.36	$2.84	$2.59	$3.36	$2.84	$2.59	$3.36	$2.84	$2.59
	Medium 3	1,080	$1.68	$1.42	$1.30	$1.68	$1.42	$1.30	$1.68	$1.42	$1.30
	Large 1	1,080	$1.68	$1.42	$1.30	$1.68	$1.42	$1.30	$1.68	$1.42	$1.30
	CE Region										
	Medium 1	400	$4.53	$3.84	$3.50	$4.53	$3.84	$3.50	$4.53	$3.84	$3.50
	Medium 2	540	$3.36	$2.84	$2.59	$3.36	$2.84	$2.59	$3.36	$2.84	$2.59
	Medium 3	1,080	$1.68	$1.42	$1.30	$1.68	$1.42	$1.30	$1.68	$1.42	$1.30
	Large 1	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	PA Region										
	Medium 1	400	$4.53	$3.84	$3.50	$4.53	$3.84	$3.50	$4.53	$3.84	$3.50
	Medium 2	540	$3.36	$2.84	$2.59	$3.36	$2.84	$2.59	$3.36	$2.84	$2.59
	Medium 3	1,080	$1.68	$1.42	$1.30	$1.68	$1.42	$1.30	$1.68	$1.42	$1.30
	Large 1	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	SO Region										
	Medium 1	400	$4.53	$3.84	$3.50	$4.53	$3.84	$3.50	$4.53	$3.84	$3.50
	Medium 2	540	$3.36	$2.84	$2.59	$3.36	$2.84	$2.59	$3.36	$2.84	$2.59
	Medium 3	1,080	$1.68	$1.42	$1.30	$1.68	$1.42	$1.30	$1.68	$1.42	$1.30
	Large 1	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	MA Region										
	Medium 1	400	$4.53	$3.84	$3.50	$4.53	$3.84	$3.50	$4.53	$3.84	$3.50
	Medium 2	540	$3.36	$2.84	$2.59	$3.36	$2.84	$2.59	$3.36	$2.84	$2.59
	Medium 3	1,080	$1.68	$1.42	$1.30	$1.68	$1.42	$1.30	$1.68	$1.42	$1.30
	Large 1	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

Table B-2(a)
Per-Animal Pre-tax Annualized Compliance Costs, Option 1

Sector	Model	Head	Cat. 1L	Cat 2L	Cat. 3L	Cat. 1M	Cat. 2M	Cat. 3M	Cat. 1H	Cat. 2H	Cat. 3H
Heifers											
	MW Region										
	Medium 1	400	$15.11	$15.36	$6.27	$23.40	$23.64	$6.99	$30.77	$31.01	$7.47
	Medium 2	625	$7.33	$7.49	$4.23	$10.22	$10.39	$4.79	$12.78	$12.94	$5.12
	Medium 3	875	$5.55	$5.57	$3.37	$7.73	$7.75	$3.81	$9.59	$9.61	$4.08
	Large 1	1,500	$2.29	$2.36	$0.88	$3.59	$3.66	$1.24	$4.70	$4.77	$1.43
	CE Region										
	Medium 1	400	$13.45	$13.75	$5.75	$22.77	$23.06	$6.33	$30.15	$30.44	$6.82
	Medium 2	625	$6.58	$6.77	$3.85	$9.75	$9.94	$4.28	$12.32	$12.50	$4.62
	Medium 3	875	$4.93	$4.98	$3.00	$7.27	$7.32	$3.32	$9.13	$9.18	$3.59
	Large 1	1,500	$2.19	$2.27	$0.92	$3.55	$3.63	$1.18	$4.66	$4.74	$1.35
	PA Region										
	Medium 1	400	$17.47	$57.67	$8.01	$25.10	$65.30	$8.75	$32.43	$72.62	$9.20
	Medium 2	625	$12.07	$24.92	$5.59	$17.33	$27.69	$6.14	$22.35	$30.22	$6.45
	Medium 3	875	$6.86	$10.84	$4.58	$8.90	$12.88	$5.03	$10.73	$14.70	$5.27
	Large 1	1,500	$2.22	$2.69	$0.86	$3.49	$3.95	$1.20	$4.59	$5.05	$1.37
	SO Region										
	Medium 1	400	$14.18	$46.47	$8.31	$24.82	$57.10	$9.08	$32.17	$64.45	$9.56
	Medium 2	625	$7.81	$28.60	$5.76	$11.56	$32.35	$6.34	$14.13	$34.92	$6.69
	Medium 3	875	$7.22	$14.31	$4.76	$11.69	$17.05	$5.23	$14.76	$18.93	$5.52
	Large 1	1,500	$2.96	$11.72	$1.13	$6.28	$14.88	$1.49	$8.57	$17.06	$1.72
	MA Region										
	Medium 1	400	$13.72	$29.99	$7.42	$21.48	$37.75	$8.16	$27.70	$43.95	$8.87
	Medium 2	625	$7.28	$14.91	$5.10	$10.08	$17.71	$5.62	$12.40	$20.03	$6.18
	Medium 3	875	$6.93	$8.78	$4.15	$10.36	$10.82	$4.56	$13.19	$12.54	$5.02
	Large 1	1,500	$3.02	$2.99	$0.97	$5.54	$5.26	$1.27	$7.63	$7.14	$1.62
Dairy- Flush											
	PA Region										
	Medium 1	250	$8.53	$8.61	$7.59	$22.39	$22.46	$21.35	$23.13	$23.19	$21.98
	Medium 2	425	$6.31	$197.80	$5.54	$18.82	$210.27	$17.97	$19.30	$210.72	$18.37
	Medium 3	600	$5.36	$38.60	$4.66	$17.18	$50.40	$16.42	$17.55	$50.74	$16.72
	Large 1	1,430	$1.41	$101.38	$0.82	$12.55	$112.48	$11.91	$14.85	$114.74	$14.15
	MW Region										
	Medium 1	250	$9.15	$9.01	$7.72	$23.13	$22.97	$21.55	$23.91	$23.73	$22.19
	Medium 2	425	$6.89	$78.52	$5.65	$19.50	$91.06	$18.13	$20.03	$91.52	$18.53
	Medium 3	600	$5.93	$5.62	$4.75	$17.85	$17.49	$16.56	$18.26	$17.86	$16.86
	Large 1	1,430	$1.95	$17.38	$0.88	$13.17	$28.53	$11.99	$15.51	$30.80	$14.24
	CE Region										
	Medium 1	250	$9.13	$9.04	$7.59	$23.05	$22.93	$21.35	$23.84	$23.70	$21.98
	Medium 2	425	$6.90	$142.91	$5.54	$19.46	$155.40	$17.97	$20.00	$155.86	$18.37
	Medium 3	600	$5.95	$5.71	$4.66	$17.83	$17.54	$16.42	$18.25	$17.91	$16.72
	Large 1	1,430	$2.00	$30.04	$0.82	$13.20	$41.16	$11.91	$15.55	$43.44	$14.15
	SO Region										
	Medium 1	250	$8.80	$8.72	$7.59	$22.76	$22.66	$21.42	$23.53	$23.40	$22.06
	Medium 2	425	$6.59	$192.26	$5.54	$19.18	$204.78	$18.03	$19.68	$205.22	$18.43
	Medium 3	600	$5.63	$92.09	$4.66	$17.54	$103.95	$16.47	$17.93	$104.30	$16.77
	Large 1	1,430	$1.69	$55.31	$0.82	$12.89	$66.44	$11.94	$15.21	$68.70	$14.18
	MA Region										
	Medium 1	250	$7.13	$7.04	$6.19	$20.81	$20.71	$19.78	$21.30	$21.18	$20.19
	Medium 2	425	$5.55	$100.72	$4.73	$17.96	$113.08	$17.06	$18.28	$113.37	$17.32
	Medium 3	600	$4.87	$14.97	$4.09	$16.63	$26.70	$15.79	$16.89	$26.93	$15.98
	Large 1	1,430	$1.28	$55.21	$0.56	$12.39	$66.29	$11.62	$14.64	$68.49	$13.81
Dairy- Hose											
	PA Region										
	Medium 1	250	$15.89	$16.33	$13.12	$21.85	$22.28	$15.33	$26.24	$26.66	$15.98
	Medium 2	425	$16.99	$18.39	$15.15	$20.67	$22.04	$16.61	$23.30	$24.63	$17.01
	Medium 3	600	$13.04	$14.03	$11.59	$15.76	$16.72	$12.72	$17.65	$18.58	$13.02
	Large 1	1,430	$1.73	$3.15	$0.82	$3.01	$4.40	$1.41	$3.95	$5.31	$1.66

Table B-2(a)
Per-Animal Pre-tax Annualized Compliance Costs, Option 1

Sector	Model	Head	Cat. 1L	Cat 2L	Cat. 3L	Cat. 1M	Cat. 2M	Cat. 3M	Cat. 1H	Cat. 2H	Cat. 3H
	MW Region										
	Medium 1	250	$13.20	$13.23	$9.43	$23.39	$23.40	$11.73	$30.77	$30.76	$12.39
	Medium 2	425	$10.58	$9.76	$7.01	$19.91	$15.90	$8.53	$26.97	$20.24	$8.95
	Medium 3	600	$10.33	$10.40	$8.17	$14.85	$14.89	$9.36	$18.02	$18.01	$9.67
	Large 1	1,430	$2.39	$1.94	$0.88	$4.49	$3.98	$1.50	$5.95	$5.37	$1.75
	CE Region										
	Medium 1	250	$13.90	$14.09	$10.53	$19.92	$20.09	$12.74	$24.36	$24.51	$13.38
	Medium 2	425	$10.37	$10.98	$7.94	$14.10	$14.64	$9.39	$16.79	$17.25	$9.80
	Medium 3	600	$9.38	$9.32	$6.85	$13.13	$12.04	$7.98	$16.05	$13.93	$8.28
	Large 1	1,430	$2.32	$2.16	$0.82	$3.66	$3.43	$1.41	$4.66	$4.34	$1.66
	SO Region										
	Medium 1	250	$20.65	$20.75	$12.68	$25.62	$25.69	$14.97	$28.94	$28.99	$15.61
	Medium 2	425	$19.65	$19.95	$14.63	$22.76	$23.00	$16.14	$24.77	$24.94	$16.54
	Medium 3	600	$20.46	$15.10	$11.10	$24.91	$17.39	$12.27	$28.48	$18.80	$12.57
	Large 1	1,430	$3.64	$5.47	$0.82	$5.09	$6.56	$1.45	$6.16	$7.26	$1.69
	MA Region										
	Medium 1	250	$13.15	$13.19	$8.66	$18.95	$18.97	$10.72	$22.63	$22.63	$11.15
	Medium 2	425	$9.67	$9.80	$6.76	$13.26	$13.35	$8.13	$15.46	$15.51	$8.40
	Medium 3	600	$9.99	$10.07	$7.72	$12.65	$12.70	$8.80	$14.23	$14.26	$9.00
	Large 1	1,430	$2.48	$2.04	$0.56	$4.17	$3.21	$1.13	$5.31	$3.91	$1.32
Hogs Liquid											
	MW Region (GF)										
	Medium 1	863	$1.40	$1.93	$1.03	$1.56	$2.01	$1.11	$1.67	$2.11	$1.20
	Medium 2	1,311	$0.95	$1.39	$0.67	$1.05	$1.43	$0.72	$1.12	$1.49	$0.78
	Medium 3	1,884	$0.69	$1.12	$0.49	$0.77	$1.14	$0.53	$0.82	$1.19	$0.57
	Large 1	2,500	$0.36	$0.56	$0.20	$0.51	$0.63	$0.26	$0.63	$0.73	$0.30
	Large 2	5,094	$0.15	$0.27	$0.05	$0.23	$0.30	$0.07	$0.29	$0.35	$0.09
	MA Region (GF)										
	Medium 1	883	$1.32	$1.67	$1.03	$1.58	$1.82	$1.11	$1.68	$1.91	$1.20
	Medium 2	1,345	$0.89	$1.21	$0.69	$1.07	$1.30	$0.74	$1.14	$1.36	$0.80
	Medium 3	1,887	$0.67	$0.96	$0.50	$0.81	$1.03	$0.54	$0.86	$1.07	$0.58
	Large 1	2,500	$0.34	$0.47	$0.20	$0.45	$0.49	$0.27	$0.62	$0.59	$0.31
	Large 2	6,390	$0.12	$0.26	$0.06	$0.16	$0.26	$0.08	$0.25	$0.31	$0.10
	MW Region (FF)										
	Medium 1	863	$1.40	$1.93	$1.03	$1.56	$2.01	$1.11	$1.67	$2.11	$1.20
	Medium 2	1,311	$0.95	$1.39	$0.67	$1.05	$1.43	$0.72	$1.12	$1.49	$0.78
	Medium 3	1,884	$0.69	$1.12	$0.49	$0.77	$1.14	$0.53	$0.82	$1.19	$0.57
	Large 1	2,500	$0.36	$0.56	$0.20	$0.51	$0.63	$0.26	$0.63	$0.73	$0.30
	Large 2	5,094	$0.15	$0.27	$0.05	$0.23	$0.30	$0.07	$0.29	$0.35	$0.09
	MA Region (FF)										
	Medium 1	883	$1.32	$1.67	$1.03	$1.58	$1.82	$1.11	$1.68	$1.91	$1.20
	Medium 2	1,345	$0.89	$1.21	$0.69	$1.07	$1.30	$0.74	$1.14	$1.36	$0.80
	Medium 3	1,887	$0.67	$0.96	$0.50	$0.81	$1.03	$0.54	$0.86	$1.07	$0.58
	Large 1	2,500	$0.34	$0.47	$0.20	$0.45	$0.49	$0.27	$0.62	$0.59	$0.31
	Large 2	6,390	$0.12	$0.26	$0.06	$0.16	$0.26	$0.08	$0.25	$0.31	$0.10
Hogs Pit											
	MW Region (GF)										
	Medium 1	863	$1.35	$1.34	$0.94	$1.53	$1.51	$1.03	$1.63	$1.61	$1.12
	Medium 2	1,311	$0.92	$0.91	$0.60	$1.04	$1.03	$0.66	$1.11	$1.09	$0.72
	Medium 3	1,884	$0.68	$0.70	$0.43	$0.77	$0.79	$0.48	$0.81	$0.84	$0.52
	Large 1	2,500	$0.36	$0.44	$0.20	$0.50	$0.55	$0.25	$0.61	$0.63	$0.27
	Large 2	5,094	$0.15	$0.08	$0.05	$0.23	$0.12	$0.07	$0.29	$0.16	$0.07
	MA Region (GF)										
	Medium 1	883	$1.28	$1.10	$0.94	$1.57	$1.35	$1.03	$1.68	$2.03	$1.12
	Medium 2	1,345	$0.88	$0.74	$0.62	$1.09	$0.91	$0.68	$1.16	$2.30	$0.74
	Medium 3	1,887	$0.67	$0.56	$0.45	$0.84	$0.69	$0.49	$0.89	$2.06	$0.53
	Large 1	2,500	$0.34	$0.20	$0.20	$0.44	$0.25	$0.25	$0.61	$0.44	$0.28
	Large 2	6,390	$0.12	$0.07	$0.06	$0.16	$0.09	$0.07	$0.26	$0.23	$0.08

Table B-2(a)
Per-Animal Pre-tax Annualized Compliance Costs, Option 1

Sector Model	Head	Cat. 1L	Cat 2L	Cat. 3L	Cat. 1M	Cat. 2M	Cat. 3M	Cat. 1H	Cat. 2H	Cat. 3H
MW Region (FF)										
Medium 1	863	$1.35	$1.34	$0.94	$1.53	$1.51	$1.03	$1.63	$1.61	$1.12
Medium 2	1,311	$0.92	$0.91	$0.60	$1.04	$1.03	$0.66	$1.11	$1.09	$0.72
Medium 3	1,884	$0.68	$0.70	$0.43	$0.77	$0.79	$0.48	$0.81	$0.84	$0.52
Large 1	2,500	$0.36	$0.44	$0.20	$0.50	$0.55	$0.25	$0.61	$0.63	$0.27
Large 2	5,094	$0.15	$0.08	$0.05	$0.23	$0.12	$0.07	$0.29	$0.16	$0.07
MA Region (FF)										
Medium 1	883	$1.28	$1.10	$0.94	$1.57	$1.35	$1.03	$1.68	$2.05	$1.12
Medium 2	1,345	$0.88	$0.74	$0.62	$1.09	$0.92	$0.68	$1.16	$2.35	$0.74
Medium 3	1,887	$0.67	$0.56	$0.45	$0.84	$0.70	$0.49	$0.89	$2.11	$0.53
Large 1	2,500	$0.34	$0.20	$0.20	$0.44	$0.25	$0.25	$0.61	$0.44	$0.28
Large 2	6,390	$0.12	$0.07	$0.06	$0.16	$0.09	$0.07	$0.26	$0.23	$0.08
Hogs Evaporate										
CE Region (GF)										
Large 1	2,500	$0.36	$0.25	$0.18	$0.52	$0.37	$0.24	$0.64	$0.46	$0.28
Large 2	6,038	$0.14	$0.08	$0.03	$0.21	$0.14	$0.04	$0.27	$0.19	$0.05
CE Region (FF)										
Large 1	2,500	$0.36	$0.25	$0.18	$0.52	$0.37	$0.24	$0.64	$0.46	$0.28
Large 2	6,038	$0.14	$0.08	$0.03	$0.21	$0.14	$0.04	$0.27	$0.19	$0.05
Broilers										
SO Region										
Medium 1	38,802	$0.04	$0.03	$0.02	$0.10	$0.09	$0.08	$0.14	$0.13	$0.12
Medium 2	53,942	$0.03	$0.02	$0.02	$0.09	$0.08	$0.07	$0.13	$0.12	$0.11
Medium 3	82,907	$0.03	$0.02	$0.01	$0.08	$0.07	$0.06	$0.12	$0.11	$0.10
Large 1	125,000	$0.02	$0.01	$0.01	$0.07	$0.06	$0.05	$0.12	$0.11	$0.10
Large 2	219,247	$0.02	$0.01	$0.01	$0.06	$0.05	$0.05	$0.11	$0.10	$0.10
MA Region										
Medium 1	39,642	$0.04	$0.03	$0.03	$0.05	$0.04	$0.03	$0.08	$0.08	$0.07
Medium 2	55,618	$0.03	$0.02	$0.02	$0.04	$0.03	$0.02	$0.08	$0.07	$0.06
Medium 3	85,355	$0.02	$0.02	$0.01	$0.03	$0.02	$0.01	$0.07	$0.06	$0.05
Large 1	125,000	$0.02	$0.01	$0.01	$0.03	$0.02	$0.01	$0.06	$0.05	$0.05
Large 2	219,247	$0.02	$0.01	$0.01	$0.02	$0.01	$0.01	$0.06	$0.05	$0.04
Layers										
Wet Layers										
SO Region										
Medium 2	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Medium 3	19,500	$0.04	$0.04	$0.04	$0.06	$0.06	$0.05	$0.09	$0.09	$0.06
Large 1	146,426	$0.01	$0.01	$0.01	$0.01	$0.11	$0.01	$0.03	$0.13	$0.01
Dry Layers										
SO Region										
Medium 1	36,068	$0.04	$0.04	$0.04	$0.07	$0.08	$0.07	$0.12	$0.11	$0.09
Medium 2	61,734	$0.03	$0.03	$0.03	$0.06	$0.06	$0.06	$0.10	$0.10	$0.08
Medium 3	78,546	$0.03	$0.03	$0.03	$0.06	$0.06	$0.06	$0.10	$0.10	$0.07
Large 1	291,153	$0.01	$0.01	$0.01	$0.03	$0.03	$0.03	$0.06	$0.04	$0.04
Large 2	856,368	$0.01	$0.01	$0.01	$0.03	$0.03	$0.03	$0.05	$0.03	$0.03
Dry MW Region										
Medium 1	36,068	$0.03	$0.03	$0.03	$0.06	$0.06	$0.06	$0.10	$0.09	$0.08
Medium 2	61,734	$0.02	$0.02	$0.02	$0.05	$0.05	$0.05	$0.08	$0.08	$0.06
Medium 3	78,546	$0.02	$0.02	$0.02	$0.05	$0.05	$0.04	$0.08	$0.08	$0.06
Large 1	291,153	$0.01	$0.01	$0.01	$0.02	$0.02	$0.02	$0.05	$0.03	$0.03
Large 2	856,368	$0.01	$0.01	$0.01	$0.02	$0.02	$0.02	$0.04	$0.03	$0.03
Turkeys										
MA Region										
Medium 1	22,246	$0.11	$0.10	$0.07	$0.18	$0.16	$0.13	$0.25	$0.25	$0.20
Medium 2	34,640	$0.10	$0.07	$0.05	$0.16	$0.14	$0.11	$0.23	$0.23	$0.19
Medium 3	47,534	$0.09	$0.06	$0.04	$0.15	$0.13	$0.10	$0.22	$0.22	$0.18
Large 1	127,396	$0.07	$0.04	$0.03	$0.13	$0.11	$0.09	$0.21	$0.20	$0.17
MW Region										
Medium 1	22,246	$0.10	$0.09	$0.07	$0.17	$0.16	$0.13	$0.25	$0.25	$0.20
Medium 2	34,640	$0.09	$0.07	$0.05	$0.15	$0.14	$0.11	$0.23	$0.23	$0.19
Medium 3	47,534	$0.08	$0.06	$0.04	$0.14	$0.13	$0.10	$0.22	$0.22	$0.18
Large 1	127,396	$0.07	$0.04	$0.03	$0.13	$0.11	$0.09	$0.20	$0.20	$0.17

Table B-2(b)
Per-Animal Pre-tax Annualized Compliance Costs, Option 2

Sector	Model	Head	Cat. 1L	Cat 2L	Cat. 3L	Cat. 1M	Cat. 2M	Cat. 3M	Cat. 1H	Cat. 2H	Cat. 3H
Beef											
	MW Region										
	Medium 1	370	$18.97	$19.92	$10.06	$23.95	$24.86	$10.84	$28.30	$29.17	$11.36
	Medium 2	552	$15.75	$21.05	$8.32	$19.10	$24.41	$8.94	$22.07	$27.38	$9.31
	Medium 3	766	$14.38	$22.85	$7.37	$17.49	$26.59	$7.86	$20.19	$29.86	$8.16
	Large 1	1,839	$6.87	$8.60	$4.26	$8.65	$10.55	$4.60	$10.26	$12.33	$4.76
	Large 2	25,897	$2.65	$4.10	$3.66	$3.12	$4.73	$3.80	$3.51	$5.28	$3.86
	CE Region										
	Medium 1	370	$17.97	$18.98	$10.01	$23.47	$24.44	$10.63	$27.88	$28.80	$11.16
	Medium 2	552	$18.08	$19.36	$8.21	$25.53	$23.07	$8.68	$31.57	$26.09	$9.06
	Medium 3	766	$14.00	$20.30	$7.76	$16.81	$23.12	$8.13	$19.07	$25.40	$8.43
	Large 1	1,839	$7.82	$9.18	$5.43	$9.38	$11.29	$5.66	$10.68	$13.04	$5.82
	Large 2	25,897	$3.56	$5.34	$4.65	$3.99	$5.86	$4.73	$4.37	$6.34	$4.76
	PA Region										
	Medium 1	370	$26.23	$27.38	$36.72	$30.89	$31.99	$37.52	$35.22	$36.28	$38.00
	Medium 2	552	$24.38	$31.02	$34.90	$28.89	$36.28	$35.51	$33.13	$41.27	$35.86
	Medium 3	766	$22.21	$31.73	$33.81	$25.83	$36.06	$34.31	$29.21	$40.16	$34.58
	Large 1	1,839	$11.37	$22.27	$29.44	$13.49	$24.73	$29.76	$15.44	$27.03	$29.91
	Large 2	25,897	$5.12	$9.18	$21.19	$5.80	$10.42	$21.31	$6.43	$11.59	$21.36
	SO Region										
	Medium 1	370	$15.26	$21.91	$33.63	$22.42	$28.14	$34.46	$27.33	$32.40	$34.97
	Medium 2	552	$11.96	$14.21	$28.78	$17.20	$20.31	$29.41	$20.78	$24.51	$29.81
	Medium 3	766	$11.20	$13.80	$30.15	$16.50	$19.33	$30.67	$20.15	$23.13	$30.99
	Large 1	1,839	$4.85	$17.86	$25.85	$8.03	$20.78	$26.20	$10.20	$22.78	$26.41
	Large 2	25,897	$2.24	$7.86	$18.74	$3.43	$9.10	$18.93	$4.23	$9.93	$19.03
	MA Region										
	Medium 1	370	$20.84	$25.73	$67.75	$26.65	$32.35	$68.55	$31.25	$37.62	$69.32
	Medium 2	552	$19.37	$24.01	$66.00	$25.39	$29.25	$66.58	$30.19	$33.43	$67.19
	Medium 3	766	$17.36	$25.14	$67.42	$21.70	$29.47	$67.88	$25.16	$32.93	$68.39
	Large 1	1,839	$8.38	$12.37	$49.03	$10.88	$14.76	$49.30	$12.90	$16.73	$49.63
	Large 2	25,897	$2.92	$5.61	$28.39	$3.92	$6.66	$28.52	$4.70	$7.48	$28.63
Veal											
	MW Region										
	Medium 1	400	$4.53	$3.84	$3.50	$4.53	$3.84	$3.50	$4.53	$3.84	$3.50
	Medium 2	540	$3.36	$2.84	$2.59	$3.36	$2.84	$2.59	$3.36	$2.84	$2.59
	Medium 3	1,080	$1.68	$1.42	$1.30	$1.68	$1.42	$1.30	$1.68	$1.42	$1.30
	Large 1	1,080	$1.68	$1.42	$1.30	$1.68	$1.42	$1.30	$1.68	$1.42	$1.30
	CE Region										
	Medium 1	400	$4.53	$3.84	$3.50	$4.53	$3.84	$3.50	$4.53	$3.84	$3.50
	Medium 2	540	$3.36	$2.84	$2.59	$3.36	$2.84	$2.59	$3.36	$2.84	$2.59
	Medium 3	1,080	$1.68	$1.42	$1.30	$1.68	$1.42	$1.30	$1.68	$1.42	$1.30
	Large 1	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	PA Region										
	Medium 1	400	$4.53	$3.84	$3.50	$4.53	$3.84	$3.50	$4.53	$3.84	$3.50
	Medium 2	540	$3.36	$2.84	$2.59	$3.36	$2.84	$2.59	$3.36	$2.84	$2.59
	Medium 3	1,080	$1.68	$1.42	$1.30	$1.68	$1.42	$1.30	$1.68	$1.42	$1.30
	Large 1	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	SO Region										
	Medium 1	400	$4.53	$3.84	$3.50	$4.53	$3.84	$3.50	$4.53	$3.84	$3.50
	Medium 2	540	$3.36	$2.84	$2.59	$3.36	$2.84	$2.59	$3.36	$2.84	$2.59
	Medium 3	1,080	$1.68	$1.42	$1.30	$1.68	$1.42	$1.30	$1.68	$1.42	$1.30
	Large 1	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	MA Region										
	Medium 1	400	$4.53	$3.84	$3.50	$4.53	$3.84	$3.50	$4.53	$3.84	$3.50
	Medium 2	540	$3.36	$2.84	$2.59	$3.36	$2.84	$2.59	$3.36	$2.84	$2.59
	Medium 3	1,080	$1.68	$1.42	$1.30	$1.68	$1.42	$1.30	$1.68	$1.42	$1.30
	Large 1	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

Table B-2(b)
Per-Animal Pre-tax Annualized Compliance Costs, Option 2

Sector	Model	Head	Cat. 1L	Cat 2L	Cat. 3L	Cat. 1M	Cat. 2M	Cat. 3M	Cat. 1H	Cat. 2H	Cat. 3H
Heifers											
	MW Region										
	Medium 1	400	$17.12	$17.79	$9.64	$25.43	$26.09	$10.36	$32.83	$33.48	$10.84
	Medium 2	625	$10.14	$12.87	$7.61	$13.72	$17.19	$8.16	$16.92	$21.09	$8.49
	Medium 3	875	$8.30	$11.53	$6.74	$11.17	$15.14	$7.18	$13.65	$18.30	$7.45
	Large 1	1,500	$3.73	$8.53	$4.17	$5.30	$10.89	$4.53	$6.69	$13.07	$4.72
	CE Region										
	Medium 1	400	$15.40	$16.19	$9.47	$24.74	$25.53	$10.05	$32.15	$32.93	$10.54
	Medium 2	625	$8.48	$10.22	$7.49	$11.67	$13.42	$7.92	$14.27	$16.02	$8.26
	Medium 3	875	$7.12	$9.26	$7.11	$9.49	$11.64	$7.44	$11.38	$13.54	$7.71
	Large 1	1,500	$3.94	$7.95	$5.27	$5.64	$10.27	$5.53	$7.05	$12.19	$5.71
	PA Region										
	Medium 1	400	$20.94	$28.24	$34.91	$28.60	$35.88	$35.66	$35.95	$43.23	$36.10
	Medium 2	625	$13.80	$19.59	$32.49	$17.79	$24.28	$33.04	$21.52	$28.72	$33.35
	Medium 3	875	$12.10	$16.26	$31.48	$15.49	$20.08	$31.93	$18.66	$23.68	$32.17
	Large 1	1,500	$5.16	$11.26	$27.76	$7.00	$13.97	$28.10	$8.67	$16.52	$28.27
	SO Region										
	Medium 1	400	$14.93	$25.11	$32.08	$25.57	$35.74	$32.84	$32.93	$43.09	$33.32
	Medium 2	625	$9.29	$15.64	$26.73	$14.54	$21.12	$27.30	$18.15	$24.90	$27.66
	Medium 3	875	$8.09	$10.76	$28.05	$12.82	$15.32	$28.52	$16.08	$18.45	$28.82
	Large 1	1,500	$3.44	$7.07	$24.42	$6.87	$10.66	$24.79	$9.23	$13.13	$25.02
	MA Region										
	Medium 1	400	$18.81	$25.68	$63.93	$29.64	$39.06	$64.67	$38.23	$49.67	$65.38
	Medium 2	625	$10.95	$15.92	$61.61	$15.15	$21.26	$62.13	$18.54	$25.55	$62.69
	Medium 3	875	$10.11	$13.81	$62.96	$14.23	$18.14	$63.37	$17.57	$21.64	$63.83
	Large 1	1,500	$4.81	$9.73	$49.63	$7.62	$13.04	$49.93	$9.91	$15.70	$50.29
Dairy- Flush											
	PA Region										
	Medium 1	250	$20.05	$30.52	$115.37	$33.99	$44.48	$129.13	$34.81	$45.33	$129.77
	Medium 2	425	$17.83	$121.37	$111.95	$30.42	$133.88	$124.38	$30.98	$134.36	$124.78
	Medium 3	600	$16.88	$27.40	$110.49	$28.79	$39.27	$122.25	$29.24	$39.68	$122.55
	Large 1	1,430	$11.06	$125.93	$81.79	$22.28	$137.05	$92.88	$24.65	$139.33	$95.12
	MW Region										
	Medium 1	250	$20.01	$31.20	$42.45	$34.12	$45.35	$56.28	$35.03	$46.32	$56.92
	Medium 2	425	$17.76	$39.68	$39.90	$30.49	$52.29	$52.38	$31.15	$52.83	$52.79
	Medium 3	600	$16.25	$18.97	$37.52	$28.29	$30.97	$49.33	$28.83	$31.46	$49.63
	Large 1	1,430	$10.20	$17.56	$28.06	$21.52	$28.76	$39.17	$23.96	$31.08	$41.42
	CE Region										
	Medium 1	250	$16.99	$24.78	$61.80	$31.01	$38.84	$75.56	$31.91	$39.77	$76.20
	Medium 2	425	$14.57	$58.97	$58.01	$27.24	$71.51	$70.44	$27.88	$72.04	$70.84
	Medium 3	600	$13.23	$14.85	$54.85	$25.21	$26.78	$66.61	$25.73	$27.25	$66.91
	Large 1	1,430	$6.89	$35.23	$37.27	$18.15	$46.38	$48.36	$20.57	$48.68	$50.60
	SO Region										
	Medium 1	250	$10.25	$11.91	$83.14	$24.22	$25.87	$96.97	$25.00	$26.65	$97.61
	Medium 2	425	$7.99	$136.27	$78.44	$20.59	$148.80	$90.93	$21.12	$149.25	$91.33
	Medium 3	600	$7.42	$41.71	$92.35	$19.35	$53.58	$104.16	$19.77	$53.95	$104.46
	Large 1	1,430	$3.20	$94.52	$70.99	$14.42	$105.65	$82.11	$16.77	$107.91	$84.35
	MA Region										
	Medium 1	250	$16.68	$26.64	$247.80	$30.44	$40.42	$261.40	$31.00	$41.01	$261.80
	Medium 2	425	$15.35	$84.53	$207.63	$27.84	$96.93	$219.97	$28.24	$97.25	$220.22
	Medium 3	600	$15.17	$19.82	$195.91	$27.01	$31.62	$207.60	$27.35	$31.92	$207.79
	Large 1	1,430	$9.85	$93.40	$145.55	$21.04	$104.49	$156.61	$23.35	$106.71	$158.80
Dairy- Hose											
	PA Region										
	Medium 1	250	$27.41	$39.13	$31.46	$33.45	$45.20	$33.67	$37.93	$49.69	$34.31
	Medium 2	425	$28.51	$25.52	$32.03	$32.27	$29.20	$33.48	$34.98	$31.83	$33.88
	Medium 3	600	$24.56	$27.27	$27.86	$27.37	$30.03	$28.99	$29.34	$31.96	$29.29
	Large 1	1,430	$11.52	$7.33	$15.65	$13.16	$9.12	$16.25	$14.45	$10.56	$16.49

Table B-2(b)
Per-Animal Pre-tax Annualized Compliance Costs, Option 2

Sector	Model	Head	Cat. 1L	Cat 2L	Cat. 3L	Cat. 1M	Cat. 2M	Cat. 3M	Cat. 1H	Cat. 2H	Cat. 3H
	MW Region										
	Medium 1	250	$24.06	$35.74	$13.43	$34.38	$46.12	$15.73	$41.89	$53.67	$16.38
	Medium 2	425	$20.50	$18.40	$10.51	$26.83	$24.61	$12.03	$31.37	$29.03	$12.45
	Medium 3	600	$20.64	$24.02	$11.34	$25.29	$28.63	$12.52	$28.58	$31.87	$12.83
	Large 1	1,430	$10.77	$7.77	$3.51	$13.40	$10.75	$4.14	$15.31	$12.92	$4.38
	CE Region										
	Medium 1	250	$21.76	$30.41	$15.54	$27.89	$36.56	$17.76	$32.43	$41.15	$18.40
	Medium 2	425	$18.04	$16.83	$12.08	$21.88	$20.55	$13.53	$24.67	$23.21	$13.93
	Medium 3	600	$16.04	$18.90	$10.51	$18.65	$21.71	$11.64	$20.42	$23.70	$11.94
	Large 1	1,430	$7.26	$5.72	$3.34	$8.76	$7.24	$3.93	$9.92	$8.42	$4.18
	SO Region										
	Medium 1	250	$22.09	$24.49	$26.28	$27.08	$29.47	$28.57	$30.41	$32.80	$29.20
	Medium 2	425	$21.05	$20.78	$26.93	$24.18	$23.84	$28.44	$26.21	$25.79	$28.84
	Medium 3	600	$16.67	$17.34	$25.47	$19.03	$19.65	$26.65	$20.51	$21.08	$26.95
	Large 1	1,430	$5.25	$12.39	$14.28	$6.75	$13.47	$14.90	$7.87	$14.18	$15.15
	MA Region										
	Medium 1	250	$22.72	$34.09	$51.29	$28.59	$40.00	$53.35	$32.34	$43.78	$53.77
	Medium 2	425	$20.03	$18.57	$46.54	$24.24	$23.15	$47.92	$27.01	$26.21	$48.18
	Medium 3	600	$20.85	$24.43	$47.41	$24.16	$28.13	$48.48	$26.32	$30.62	$48.68
	Large 1	1,430	$11.25	$7.70	$36.52	$13.17	$9.52	$37.09	$14.52	$10.76	$37.28
Hogs Liquid											
	MA Region (GF)										
	Medium 1	863	$3.28	$4.24	$1.21	$3.49	$4.36	$1.30	$3.59	$4.46	$1.39
	Medium 2	1,311	$2.69	$3.55	$0.85	$2.84	$3.63	$0.91	$2.91	$3.70	$0.97
	Medium 3	1,884	$2.43	$3.27	$0.67	$2.56	$3.34	$0.71	$2.61	$3.39	$0.75
	Large 1	2,500	$1.51	$1.86	$0.39	$1.72	$1.99	$0.45	$1.89	$2.13	$0.49
	Large 2	5,094	$1.21	$1.49	$0.24	$1.34	$1.56	$0.26	$1.45	$1.65	$0.27
	MW Region (GF)										
	Medium 1	883	$3.09	$3.24	$1.21	$3.51	$3.52	$1.29	$3.62	$3.61	$1.38
	Medium 2	1,345	$2.39	$2.09	$0.87	$2.71	$2.23	$0.93	$2.79	$2.30	$0.99
	Medium 3	1,887	$2.18	$1.84	$0.69	$2.46	$1.95	$0.73	$2.51	$2.00	$0.77
	Large 1	2,500	$0.99	$0.94	$0.39	$1.12	$0.97	$0.46	$1.36	$1.09	$0.50
	Large 2	6,390	$0.70	$0.72	$0.25	$0.76	$0.72	$0.27	$0.91	$0.80	$0.29
	MA Region (FF)										
	Medium 1	863	$3.28	$4.24	$1.21	$3.49	$4.36	$1.30	$3.59	$4.46	$1.39
	Medium 2	1,311	$2.69	$3.55	$0.85	$2.84	$3.63	$0.91	$2.91	$3.70	$0.97
	Medium 3	1,884	$2.43	$3.27	$0.67	$2.56	$3.34	$0.71	$2.61	$3.39	$0.75
	Large 1	2,500	$1.51	$1.86	$0.39	$1.72	$1.99	$0.45	$1.89	$2.13	$0.49
	Large 2	5,094	$1.21	$1.49	$0.24	$1.34	$1.56	$0.26	$1.45	$1.65	$0.27
	MW Region (FF)										
	Medium 1	883	$3.09	$3.24	$1.21	$3.51	$3.52	$1.29	$3.62	$3.61	$1.38
	Medium 2	1,345	$2.39	$2.09	$0.87	$2.71	$2.23	$0.93	$2.79	$2.30	$0.99
	Medium 3	1,887	$2.18	$1.84	$0.69	$2.46	$1.95	$0.73	$2.51	$2.00	$0.77
	Large 1	2,500	$0.99	$0.94	$0.39	$1.12	$0.97	$0.46	$1.36	$1.09	$0.50
	Large 2	6,390	$0.70	$0.72	$0.25	$0.76	$0.72	$0.27	$0.91	$0.80	$0.29
Hogs Pit											
	MA Region (GF)										
	Medium 1	863	$3.21	$4.08	$3.13	$3.42	$4.30	$3.22	$3.53	$4.40	$3.31
	Medium 2	1,311	$2.64	$3.45	$2.79	$2.80	$3.62	$2.85	$2.87	$3.69	$2.91
	Medium 3	1,884	$2.40	$3.24	$2.62	$2.53	$3.38	$2.67	$2.58	$3.43	$2.71
	Large 1	2,500	$1.51	$2.48	$2.38	$1.70	$2.65	$2.43	$1.86	$2.78	$2.45
	Large 2	5,094	$1.21	$2.27	$2.24	$1.34	$2.36	$2.25	$1.44	$2.44	$2.26
	MW Region (GF)										
	Medium 1	883	$3.02	$3.36	$6.69	$3.46	$3.73	$6.78	$3.57	$3.97	$6.87
	Medium 2	1,345	$2.36	$5.26	$6.40	$2.70	$5.48	$6.46	$2.77	$5.96	$6.52
	Medium 3	1,887	$2.15	$5.07	$6.23	$2.45	$5.25	$6.27	$2.51	$5.71	$6.31
	Large 1	2,500	$0.99	$5.67	$6.10	$1.10	$5.73	$6.15	$1.34	$5.88	$6.17
	Large 2	6,390	$0.70	$5.53	$5.96	$0.75	$5.55	$5.97	$0.92	$5.66	$5.98

Table B-2(b)
Per-Animal Pre-tax Annualized Compliance Costs, Option 2

Sector	Model	Head	Cat. 1L	Cat 2L	Cat. 3L	Cat. 1M	Cat. 2M	Cat. 3M	Cat. 1H	Cat. 2H	Cat. 3H
	MA Region (FF)										
	Medium 1	863	$3.21	$3.95	$3.13	$3.42	$4.17	$3.22	$3.53	$4.27	$3.31
	Medium 2	1,311	$2.64	$3.33	$2.79	$2.80	$3.49	$2.85	$2.87	$3.56	$2.91
	Medium 3	1,884	$2.40	$3.11	$2.62	$2.53	$3.25	$2.67	$2.58	$3.30	$2.71
	Large 1	2,500	$1.51	$2.36	$2.38	$1.70	$2.52	$2.43	$1.86	$2.66	$2.45
	Large 2	5,094	$1.21	$2.15	$2.24	$1.34	$2.24	$2.25	$1.44	$2.32	$2.26
	MW Region (FF)										
	Medium 1	883	$3.02	$3.25	$6.69	$3.46	$3.61	$6.78	$3.57	$3.86	$6.87
	Medium 2	1,345	$2.36	$5.15	$6.40	$2.70	$5.37	$6.46	$2.77	$5.86	$6.52
	Medium 3	1,887	$2.15	$4.96	$6.23	$2.45	$5.15	$6.27	$2.51	$5.62	$6.31
	Large 1	2,500	$0.99	$5.57	$6.10	$1.10	$5.63	$6.15	$1.34	$5.77	$6.17
	Large 2	6,390	$0.70	$5.43	$5.96	$0.75	$5.45	$5.97	$0.92	$5.56	$5.98
Hogs Evaporate											
	CE Region (GF)										
	Large 1	2,500	$1.04	$0.85	$0.18	$1.23	$1.00	$0.24	$1.39	$1.12	$0.28
	Large 2	6,038	$0.79	$0.68	$0.03	$0.90	$0.76	$0.04	$0.99	$0.83	$0.05
	CE Region (FF)										
	Large 1	2,500	$1.04	$0.85	$0.18	$1.23	$1.00	$0.24	$1.39	$1.12	$0.28
	Large 2	6,038	$0.79	$0.68	$0.03	$0.90	$0.76	$0.04	$0.99	$0.83	$0.05
Broilers											
	SO Region										
	Medium 1	38,802	$0.10	$0.04	$0.02	$0.17	$0.10	$0.08	$0.21	$0.14	$0.12
	Medium 2	53,942	$0.08	$0.03	$0.02	$0.15	$0.09	$0.07	$0.19	$0.13	$0.11
	Medium 3	82,907	$0.08	$0.02	$0.01	$0.14	$0.08	$0.06	$0.18	$0.12	$0.10
	Large 1	125,000	$0.07	$0.02	$0.01	$0.12	$0.06	$0.05	$0.17	$0.11	$0.10
	Large 2	219,247	$0.06	$0.01	$0.01	$0.11	$0.05	$0.05	$0.16	$0.10	$0.10
	MA Region										
	Medium 1	39,642	$0.08	$0.05	$0.03	$0.09	$0.06	$0.03	$0.12	$0.10	$0.07
	Medium 2	55,618	$0.06	$0.04	$0.02	$0.07	$0.05	$0.02	$0.11	$0.09	$0.06
	Medium 3	85,355	$0.06	$0.03	$0.01	$0.06	$0.04	$0.01	$0.10	$0.07	$0.05
	Large 1	125,000	$0.04	$0.03	$0.01	$0.05	$0.03	$0.01	$0.08	$0.07	$0.05
	Large 2	219,247	$0.03	$0.02	$0.01	$0.04	$0.02	$0.01	$0.07	$0.05	$0.04
Layers											
Wet Layers											
	SO Region										
	Medium 2	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	Medium 3	19,500	$0.07	$0.11	$0.04	$0.08	$0.12	$0.12	$0.12	$0.17	$0.13
	Large 1	146,426	$0.03	$0.02	$0.01	$0.03	$0.11	$0.04	$0.06	$0.13	$0.05
Dry Layers											
	SO Region										
	Medium 1	36,068	$0.08	$0.06	$0.04	$0.12	$0.10	$0.07	$0.17	$0.14	$0.09
	Medium 2	61,734	$0.08	$0.05	$0.03	$0.11	$0.09	$0.06	$0.16	$0.12	$0.08
	Medium 3	78,546	$0.07	$0.09	$0.03	$0.11	$0.13	$0.06	$0.16	$0.18	$0.08
	Large 1	291,153	$0.06	$0.01	$0.01	$0.08	$0.03	$0.03	$0.12	$0.04	$0.04
	Large 2	856,368	$0.06	$0.01	$0.01	$0.07	$0.03	$0.03	$0.11	$0.03	$0.04
	Dry MW Region										
	Medium 1	36,068	$0.05	$0.05	$0.03	$0.08	$0.08	$0.06	$0.13	$0.11	$0.08
	Medium 2	61,734	$0.05	$0.04	$0.02	$0.07	$0.07	$0.05	$0.12	$0.10	$0.06
	Medium 3	78,546	$0.05	$0.07	$0.02	$0.07	$0.09	$0.04	$0.11	$0.14	$0.06
	Large 1	291,153	$0.03	$0.01	$0.01	$0.05	$0.02	$0.02	$0.08	$0.03	$0.03
	Large 2	856,368	$0.03	$0.01	$0.01	$0.05	$0.02	$0.02	$0.08	$0.03	$0.03
Turkeys											
	MA Region										
	Medium 1	22,246	$0.32	$0.18	$0.07	$0.38	$0.29	$0.16	$0.46	$0.42	$0.29
	Medium 2	34,640	$0.30	$0.13	$0.05	$0.37	$0.23	$0.15	$0.44	$0.36	$0.27
	Medium 3	47,534	$0.30	$0.13	$0.04	$0.36	$0.24	$0.14	$0.43	$0.36	$0.26
	Large 1	127,396	$0.07	$0.08	$0.03	$0.13	$0.19	$0.13	$0.21	$0.32	$0.25
	MW Region										
	Medium 1	22,246	$0.34	$0.17	$0.07	$0.40	$0.25	$0.13	$0.48	$0.35	$0.22
	Medium 2	34,640	$0.32	$0.12	$0.05	$0.38	$0.20	$0.12	$0.46	$0.29	$0.20
	Medium 3	47,534	$0.31	$0.12	$0.04	$0.37	$0.20	$0.11	$0.45	$0.29	$0.19
	Large 1	127,396	$0.07	$0.08	$0.03	$0.13	$0.16	$0.10	$0.20	$0.25	$0.18

APPENDIX C

METHODOLOGY TO ASSESS MARKET EFFECTS OF CAFO REVENUE

This appendix describes EPA's methodology for estimating changes in farm revenue based on predicted changes in market prices and quantities attributable to the final regulations. This analysis modifies a similar analysis conducted for the 2001 Proposal, in which EPA assumed a portion of the costs are passed up through the food marketing chain under assumptions of long-run market adjustment. Section C.1 presents the methodology and underlying concepts for estimating changes in farm revenues using this approach. Section C.2 describes how EPA applies this information to its discounted cash flow analysis. Section C.3 discusses how EPA uses information on alternative revenue scenarios at representative model CAFOs.

C.1 METHODOLOGY FOR ESTIMATING CHANGES IN FARM REVENUE

The impact of the ELG on farm revenues is directly derived from the market model as described above. The market model for each type of livestock contains baseline equilibrium price (P^0 in Figure C-1) and quantity, as well as equations representing estimated supply and demand responses to changes in price. From the cost annualization model, EPA estimates compliance costs per unit of production (CC/Q in Figure C-1). This measures the vertical shift in the supply curve. Given the vertical shift in the supply curve, the model solves for the post-regulatory equilibrium price (P^1 in Figure C-1). Thus, all components are baseline parameters, inputs, or outputs of the market model.

A key factor that determines how much compliance costs will increase market price is the equations that represent the responsiveness of supply and demand to changes in price. Elasticities are used to measure how responsive supply and demand quantities are to changes in price. To illustrate how elasticities affect price change, Figure C-2 compares how post-regulatory market equilibrium will differ according to the price elasticity of demand in response to a given shift in the supply curve. The steeper of the two demand curves is relatively inelastic: consumers are relatively unresponsive to an increase in price in the sense that they decrease purchases of meat by only a small amount. The flatter of the two demand curves is relatively elastic: consumers are relatively responsive to a price increase in the sense that the decrease in their meat purchases is much larger compared to the case of relatively inelastic demand. Thus, holding all other things constant (e.g., price elasticity of supply, initial market equilibrium price and quantity, and compliance costs per head), an ELG will cause a greater increase in market price if demand is relatively inelastic than if demand is relatively elastic. This can be observed in Figure C-2 in that the post-regulatory equilibrium price if demand is relatively inelastic (P^1) is higher than the post-regulatory equilibrium price if demand is relatively elastic (P^2). In a similar manner, differences in the price elasticity of supply also affect how the market price responds to a shift in supply.

For the purpose of its market analysis, EPA uses estimates of price elasticities of supply and demand obtained through an extensive search of the agricultural economics literature and consultation with leading experts in the field. The price elasticity of demand may be defined as the percentage change in quantity demanded caused by a 1-percent change in price. If demand is inelastic, the price elasticity of

demand lies between zero and minus one: a 1-percent increase in price causes a less than one percent decrease in quantity demanded; consumers are unresponsive to the price change. If demand is elastic, the price elasticity of demand lies between minus one and $-\infty$: a 1-percent increase in price causes a greater than 1-percent decrease in quantity demanded.

The price elasticity of supply may be defined as the percentage change in quantity supplied caused by a 1-percent change in price. If supply is inelastic, the price elasticity of supply is greater than zero but less than one: a 1-percent increase in price causes a less than one percent increase in quantity supplied. If supply is elastic, the price elasticity of supply is greater than one: a 1-percent increase in price causes a greater than one percent increase in quantity supplied.

The measured price elasticities used in the market model are based on econometric estimation of data. That is, the equations that represent the responsiveness of consumers and producers to price changes are based on observation and measurement of their responsiveness in the past.

Much of this research to estimate price elasticities of supply and demand for the livestock and poultry sectors is conducted by the various land grant universities and is published in the leading academic journals. Research by USDA also contributes to this body of work. For the 2001 Proposal, EPA compiled a list of published supply and demand elasticities in each sector for use in its market model. (See Appendix C of the Proposal EA; also, ERG, 1999a, 1999b.) Because the market model is designed to measure long-term market adjustment, elasticities that are specified in the long run are the most appropriate for this analysis. In particular, estimates of supply elasticities are highly dependent on time frame. Generally, the longer the time frame, the more elastic is supply because farms have an opportunity to change production in the most efficient way while these expand or contract their operations. In the short term, however, farms have less flexibility and cannot change production as efficiently. The supply elasticities identified in the literature, however, include short-, intermediate-, and long-run estimates. The demand elasticities identified usually do not specify a time period.

From its compiled studies, EPA selected elasticity values to reflect baseline market conditions. These values represent a consensus of expert opinion on a reasonable estimate of supply and demand elasticities for each sector (Vukina, 2000; Foster, 2000) and are considered to reflect long-run conditions. Appendix C of the Proposal EA contains a complete listing of studies and values found. Section 4.2.6 of the Proposal EA provides more detailed information on EPA's methodology for computing cost passthrough for this analysis.

Table C-1 presents the elasticity values EPA selected for use in its market model and also to estimate regulatory price effects as a percentage of unit compliance costs for this analysis.

Table C-1 also shows EPA's estimate of the relative impact compliance costs will have on price given the specified price elasticities of supply and demand. EPA expresses the price impact as a percent of unit compliance costs for two reasons. First, it simplifies comparing the responsiveness of price in different markets—or different specifications of the same market (see Table C-2)—to regulatory costs. In Table C-1, for example, it is readily apparent that the price of beef cattle is much more responsive to increased regulatory costs than the price of turkeys. Second, because this measure of the responsiveness of markets is essentially determined by the price elasticities of supply and demand (as well as the elasticities of imports and exports), once this measure is estimated, the percentage will remain constant as

long as the elasticities are unchanged. Therefore, the change in market price can be estimated knowing this percentage and per unit compliance costs.[1] EPA demonstrates how it uses this characteristic in its analysis of discounted cash flow in Section C.2.

EPA employs a simple method for calculating the estimated price impact as a percentage of unit compliance costs using supply and demand elasticities. This approach is consistent with that used by the Agency in past regulatory analyses (see references in the Proposal EA, USEPA, 2001a). This approach uses estimates of price elasticity of supply divided by the difference in estimated price elasticity of supply and the price elasticity of demand for each sector, as shown below:

$$\text{Percentage Price Impact} = \frac{\text{price elasticity of supply}}{\text{price elasticity of supply} - \text{price elasticity of demand}}$$

Table C-1. Selected Elasticity Estimates and Estimated Regulatory Price Impact

Animal Sector	Selected Price Elasticity of Supply [a/]	Selected Price Elasticity of Demand [a/]	Price Increase as Percent of per unit Compliance Costs
Beef	1.020	-0.621	70.7%
Dairy	1.527	-0.247	84.8%
Hogs	0.628	-0.728	69.7%
Broiler [b/]	0.200	-0.372	68.7%
Layer	0.942	-0.110	93.7%
Turkey	0.200	-0.535	49.5%

Sources: Various (ERG, 1999a, 199b); also see summary in Appendix C in Proposal EA (USEPA, 2001a).
[a/]Elasticities representing a consensus of expert opinion (Vukina, 2000; Foster, 2000a).
[b/]Includes elasticity estimates for both broilers and chickens because studies vary between the two terms when analyzing the markets for meat from chickens.

C.2 APPLICATION TO DISCOUNTED CASH FLOW ANALYSIS

Conceptually, applying the impact of the ELG on facility revenues to the DCF analysis is straightforward. In essence, the DCF analysis compares the cash flow of a model CAFO with its estimated compliance costs for each year of the project life. Although in some individual years cash flow

[1] Because EPA's CAFO market model is not a constant elasticity model, the change in price as a percentage of unit compliance costs varies as unit compliance costs change. In practice, because of the relatively small magnitude of estimated unit compliance costs used in this analysis, the change in elasticities— and therefore the variance in the measured change in price as a percentage of unit compliance costs—is so small that it can be treated as constant.

might exceed compliance costs and in other years compliance costs might exceed cash flow, over the project life the stream of discounted cash flows must exceed the stream of discounted compliance costs for the rule to be economically achievable.

In effect, EPA first calculates the post-regulatory cash flow for each year of the project life by subtracting operating expenses and compliance costs from operating revenues, discounting the result, and then summing the stream of post-regulatory discounted cash flows over the entire project life. For each year of the project life, this calculation can be represented (in simplified form) as

$$\text{post-regulatory } CF_t = P_t \times Q_t - OE_t - CC_t$$

where:

CF_t	=	cash flow in year t
$P_t \times Q_t$	=	market price times units sold in year t (i.e., operating revenues)
OE_t	=	operating expenses in year t
CC_t	=	compliance costs in year t

As a conservative estimate, EPA performs the analysis assuming that the rule will have no impact on facility level revenues. That is, EPA assumes that the equilibrium market price is unchanged by the rule (i.e., EPA essentially uses price P^0 in Figure C-1 for the analysis).

To estimate post-regulatory cash flow assuming that market price is affected by the ELG, the model CAFO's operating revenues should reflect the expected price after the effluent guideline is promulgated (i.e., price P^1 in Figure C-1). As a practical matter, however, applying this concept to the analysis of the model CAFO's DCF is more complex than plugging the estimated post-regulatory market price (P^1) into the equation above. First, pre-regulatory model CAFO revenues and market model prices are estimated from different (albeit consistent) data sources. Second, model CAFO cash flow is estimated over a 10-year period based on USDA projections of industry conditions. Revenues in each of these years are affected by the ELG. The market model, on the other hand, provides a "snapshot" of the market in two periods: the initial pre-regulatory equilibrium and the long-run, post-regulatory equilibrium after all market adjustments have occurred. The market model does not provide a time series of price estimates over a 10-year period. For detailed discussion of how EPA developed these models, see the Proposal EA. This report provides a summary overview of the DCF model assumptions (Section 2.4) and the market model (Section 2.5).

EPA estimates the increase in model CAFO revenues over the 10-year period based on the relationship between price and unit compliance costs. In Figure C-1, post-regulatory market price, P^1, is equal to the market price in the absence of the regulation, P^0, plus the change in price ($P^1 - P^0$) attributable to the effluent guideline (i.e., the vertical shift in the supply curve). This change in price is expressed as a percentage of unit compliance costs. Because it is a function of the price elasticities of demand and supply used in the market model, it will not change regardless of the size of the supply curve shift (as long as the elasticities are unchanged).

Therefore, for each time period EPA can estimate the change in market price ($P^1_t - P^0_t$)—and thus the model CAFO's change in revenues—from initial revenues ($P^0_t \times Q^0_t$) using the change in price as a percent of unit compliance costs derived from the market model ($\Delta P_{CC} = (P^1_t - P^0_t)/(CC/Q)$) and estimated per unit compliance costs (CC/Q). Using these definitions and substitutions the cash flow analysis for each year after adjusting for market-induced changes in revenues can be represented as:

$$\text{post-regulatory } CF_t = P^1_t \times Q_t - OE_t - CC_t$$

$$= (P^0_t + (P^1_t - P^0_t)) \times Q_t - OE_t - CC_t$$

$$= \left(P^0_t + \Delta P_{CC} \times \left(\frac{CC_t}{Q_t} \right) \right) \times Q_t - OE_t - CC_t$$

$$= P^0_t \times Q_t + \Delta P_{CC} \times CC_t - OE_t - CC_t$$

Discounting for the project year and summing over all years of the project life result conceptually in the DCF formula EPA uses to project impacts after modifying facility revenues to account for market price adjustments. For ease of calculation, EPA performs its DCF analysis using the equivalent calculation:

$$\text{Post-regulatory } CF_t = P^0 \times Q^0 - OE - CC \times (1 - \Delta P_{CC}).$$

In addition, EPA first estimates the discounted stream of pre-regulatory model facility cash flow over the entire 10-year period (i.e., the equivalent of estimating $P^0 \times Q^0 - OE$ for each period, discounting, then summing over all periods) and the discounted stream of compliance costs per period, and then adjusts these compliance costs by $(1 - \Delta P_{CC})$ to account for revenue changes.

C.3 USE OF ALTERNATIVE REVENUE SCENARIO IN IMPACT ESTIMATION

Because of uncertainties over how market-induced price increases will affect farm income, EPA presents its economic impact analysis under two different assumptions: (1) there will be no change in farm revenues to offset compliance costs, and (2) farm prices will increase as projected by the market model to partially offset compliance costs. Although EPA considers the results of both analyses in making its determination of economic achievability, the Agency's overall conclusions do not rely on the assumption that farm revenues will increase to offset compliance costs.

EPA uses these alternative assumptions to estimate a range of potential economic impacts. The most conservative estimate of impacts occurs under the assumption that facilities receive no additional revenues after promulgation of the rule to help offset increased costs of production. This analysis is too pessimistic because the market model clearly demonstrates that price can be expected to increase, and because the facility is assumed to make no changes to its operations to mitigate the impacts of increased costs. Smaller impacts will occur under the alternative assumption that an increased market price resulting from the ELG will increase facilities' revenues, thus partially offsetting the impacts of increased

costs. However, this analysis might be too optimistic for a number of reasons. First, it assumes that the full increase in price will affect revenues immediately; this is an unrealistic assumption in that market adjustment to the final long-run price occurs over time, not instantaneously. Second, this assumption does not account for potential decreases in facility production that may occur in response to increased production costs. Third, the unknown effects of market power and vertical integration on the relationship between processors and growers has the potential to modify these results. Therefore, performing the DCF analysis under alternative assumptions, some of which are too pessimistic, and others of which are too optimistic, provides EPA with upper and lower bounds to the impacts projected by its DCF analysis.

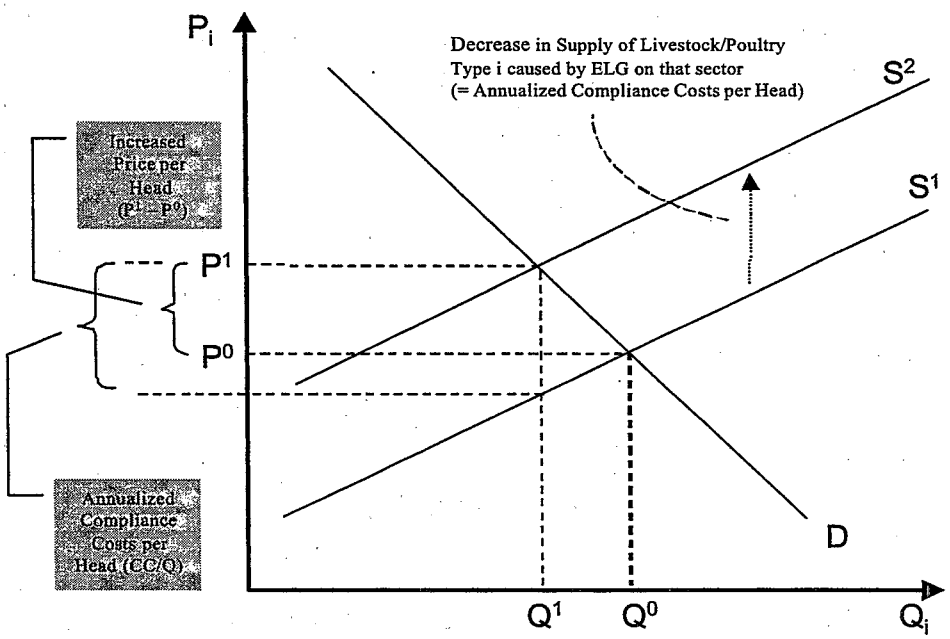
EPA also performs sensitivity analyses to examine how projected market level impacts vary with alternative values for price elasticities of supply and demand. These sensitivity analyses have implications for the DCF analysis because different specifications for the price elasticities affect the responsiveness of market price to unit compliance costs. EPA selected the highest and lowest (acceptable) price elasticity estimates that it found in its literature search as alternative parameter values in its market model.

Table C-2 shows the high and low elasticity estimates used in market model sensitivity analysis and estimated regulatory price impact as a percent of unit compliance costs. As shown in Table C-2, should the true market response be more consistent with the "high" values for price elasticities than with the values EPA selected for its market model, the impact of compliance costs on market price will be larger than those cited in Table C-2. The impact of the rule on facility level DCF will be further mitigated by the increased revenues. Conversely, should the true market response be more consistent with the "low" values for price elasticities than with the values EPA selected, the impact of compliance costs on market price will be smaller and the rule's impact on facility level DCF will be more severe.

Table C-2. Selected High and Low Elasticity Estimates and Estimated Regulatory Price Effect

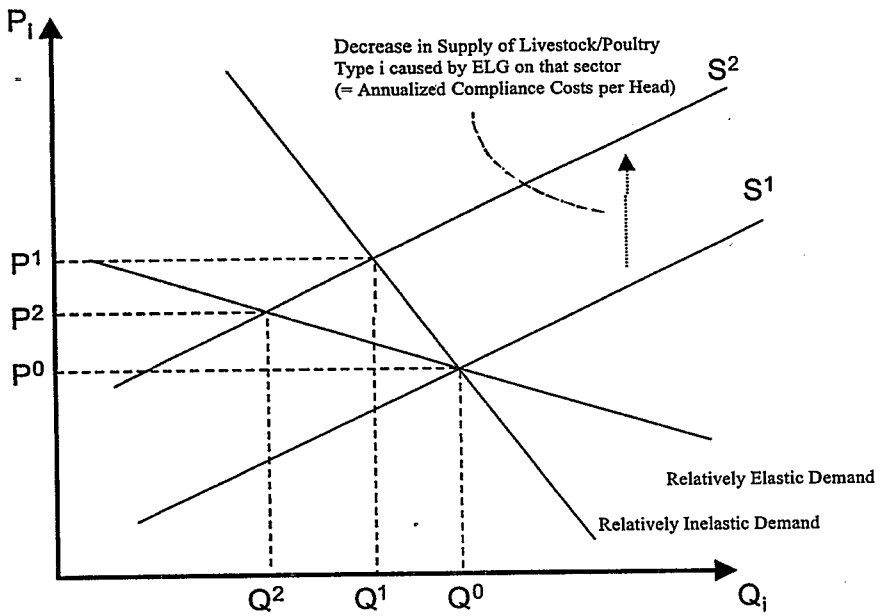
	High Value for Price Elasticities			Low Value for Price Elasticities		
Animal Sector	Selected Price Elasticity of Supply [a/]	Selected Price Elasticity of Demand [a/]	Price Increase as %per unit Compliance Costs	Selected Price Elasticity of Supply [a/]	Selected Price Elasticity of Demand [a/]	Price Increase as %per unit Compliance Costs
Beef	3.240	-0.450	91%	0.060	-1.270	7%
Dairy	4.000	-0.050	96%	0.070	-0.650	10%
Hogs	1.800	-0.070	96%	0.007	-1.234	2%
Broiler [b/]	0.587	-0.104	96%	0.064	-1.250	17%
Layer	0.942	-0.022	99%	0.031	-0.780	7%
Turkey	0.518	-0.372	78%	0.210	-0.680	45%

Sources: Various (ERG, 1999a, 199b); also see summary in Appendix C in Proposal EA (USEPA, 2001a).
[a/] Estimated elasticities as identified in Tables C-1 through C-12, Appendix C of the Proposal EA.
[b/] Includes elasticity estimates for both broilers and chickens because studies vary between the two terms when analyzing the markets for meat from chickens.



D, S^1 = pre-regulatory market supply and demand conditions
D, S^2 = post-regulatory market supply and demand conditions
P^0, Q^0 = pre-requlatory equilibrium price and quantity
P^1, Q^1 = post-requlatory equilibrium price and quantity

Figure C-1.
Impact of the Effluent Guideline on Market for Livestock/Poultry Type i



S^1 = pre-regulatory market supply
S^2 = post-regulatory market supply
P^0, Q^0 = pre-requlatory equilibrium price and quantity
P^1, Q^1 = post-requlatory equilibrium price and quantity if demand is relatively inelastic
P^2, Q^2 = post-requlatory equilibrium price and quantity if demand is relatively elastic

Figure C-2.
Effect of Price Elasticity of Demand on Change in Market Price
Due to Impact of Effluent Guideline on Market for Livestock/Poultry

APPENDIX D

SUMMARY TABLES: ESTIMATED CAFO FINANCIAL EFFECTS

This appendix shows EPA's estimates of financial effects on operations with more than 300 AU for the two technology options evaluated for this rulemaking. The first option (Option 1) will require land application at the CAFO to be consistent with proper agricultural practices, including limiting manure application to the nitrogen needs of the crops grown. The second option (Option 2) will require land application at the CAFO to be consistent with proper agricultural practices, including limiting manure application to the nitrogen needs of the crops grown or where necessary, to the phosphorus needs of the crops.

Using the approach described in Section 2.4 of this report, EPA conducts its analysis first at the farm level based on data reflecting financial conditions for the entire farm operation (i.e., reflecting income and cost information spanning the entire operations, and thus considering the operation's primary livestock production, along with other income sources such as secondary livestock and crop production, government payments, and other farm-related income). Based on the farm level results, EPA also assesses the financial effects on CAFOs at the enterprise level (e.g., limiting the scope of the assessment to the operation's livestock or poultry enterprise, and excluding other non-CAFO related sources of income from the analysis).

This appendix presents estimated financial effects using the farm level data and model and enterpise level data. Financial effects are estimated for each representative model CAFO and are broken out by animal sector, production region, and facility size, as well as groupings based on land availability and the technology needs of the facility. These groupings include the following:

- **Production region**: Midwest (MW); Central (CE); Pacific (PA); Mid-Atlantic (MA); and South (SO). For more information, see Table 2-1 in Section 2 of this report.
- **Facility size**: Varies by sector. See Table 2-1 in Section 2 of this report.
- **Land availability**: Category 1 CAFOs (sufficient cropland for all manure nutrients generated), Category 2 CAFOs (insufficient cropland), and Category 3 CAFOs (no available cropland for land application).
- **Technology needs**: Medium (average needs); Low (least needs); High (most needs).

Results are presented in terms of EPA impact categories to assess the financial effects of the final regulations: Affordable, Moderate, and Stress. As discussed in Section 2.4, the first category is the affordable category, which means that the regulations have little or no financial impact on CAFO operations. The second category, the moderate impact category, means that the regulations will have some financial impact on operations at the affected CAFOs, but EPA does not consider these operations to be vulnerable to closure as a result of compliance. Table D-1 presents these results. The third category is the financial stress category, which means that EPA considers these operations to be vulnerable to closure post-compliance, subject to other considerations. Table D-2 presents these results at the farm level, then combined with the results at the enterprise level. Section 2.4 of this report describes the decision framework that EPA assumes for this analysis.

Table D-1(a)
Option 1
Estimating the Number of Farms
Under Each Achievability Criteria
Affordable and Moderate

Sector/Model	Farm Count by Category										Number of Affordable by Category										Number of Moderate by Category									
	1L	2L	3L	1M	2M	3M	1H	2H	3H	All	1L	2L	3L	1M	2M	3M	1H	2H	3H	All	1L	2L	3L	1M	2M	3M	1H	2H	3H	All
Beef																														
MW Region																														
Medium 1	15	2	1	30	3	3	15	2	1	73	15	2	1	30	3	3	15	2	1	73	0	0	0	0	0	0	0	0	0	0
Medium 2	8	1	1	17	2	1	8	1	1	40	8	1	1	17	2	1	8	1	1	40	0	0	0	0	0	0	0	0	0	0
Medium 3	4	0	0	8	1	1	4	0	0	20	4	0	0	8	1	1	4	0	0	20	0	0	0	0	0	0	0	0	0	0
Large 1	146	45	24	291	90	47	146	45	24	856	146	45	24	291	90	47	146	45	24	856	0	0	0	0	0	0	0	0	0	0
Large 2	5	36	26	11	71	52	5	36	26	268	5	36	26	11	71	52	5	36	26	268	0	0	0	0	0	0	0	0	0	0
CE Region																														
Medium 1	4	0	0	7	1	1	4	0	0	17	4	0	0	7	1	1	4	0	0	17	0	0	0	0	0	0	0	0	0	0
Medium 2	2	0	0	4	0	0	2	0	0	9	2	0	0	4	0	0	2	0	0	9	0	0	0	0	0	0	0	0	0	0
Medium 3	1	0	0	3	0	0	1	0	0	6	1	0	0	3	0	0	1	0	0	6	0	0	0	0	0	0	0	0	0	0
Large 1	72	22	12	144	45	23	72	22	12	424	72	22	12	144	45	23	72	22	12	424	0	0	0	0	0	0	0	0	0	0
Large 2	3	17	13	5	36	26	3	17	13	133	3	17	13	5	36	26	3	17	13	133	0	0	0	0	0	0	0	0	0	0
PA Region																														
Medium 1	0	0	0	1	0	0	0	0	0	2	0	0	0	1	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0
Medium 2	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0
Medium 3	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0
Large 1	10	3	2	20	6	3	10	3	2	57	10	0	2	20	0	3	10	0	2	45	0	0	0	0	0	0	0	0	0	0
Large 2	0	2	2	1	5	4	0	2	2	17	0	2	2	1	5	4	0	2	2	17	0	0	0	0	0	0	0	0	0	0
SO Region																														
Medium 1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Medium 2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Medium 3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Large 1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Large 2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MA Region																														
Medium 1	1	0	0	1	0	0	1	0	0	2	1	0	0	1	0	0	1	0	0	2	0	0	0	0	0	0	0	0	0	0
Medium 2	0	0	0	1	0	0	0	0	0	1	0	0	0	1	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0
Medium 3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Large 1	1	0	0	3	1	0	1	0	0	8	1	0	0	3	1	0	1	0	0	8	0	0	0	0	0	0	0	0	0	0
Large 2	0	1	0	0	1	0	0	1	0	3	0	1	0	0	1	0	0	1	0	3	0	0	0	0	0	0	0	0	0	0
							300-1000AU			173							300-1000AU			173							300-1000AU			0
							>1000 AU			1,766							>1000 AU			1,754							>1000 AU			0
							Total Beef			1,939							Total Beef			1,927							Total Beef			0
Veal																														
MW Region																														
Medium 1	0	0	0	1	0	0	0	0	0	2	0	0	0	1	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0
Medium 2	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0
Medium 3	1	0	0	2	0	0	1	0	0	4	1	0	0	2	0	0	1	0	0	4	0	0	0	0	0	0	0	0	0	0
Large1	3	0	0	6	0	0	3	0	0	12	3	0	0	6	0	0	3	0	0	12	0	0	0	0	0	0	0	0	0	0
CE Region																														
Medium 1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Medium 2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Medium 3	0	0	0	1	0	0	0	0	0	1	0	0	0	1	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0
PA Region																														
Medium 1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Medium 2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Medium 3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
SO Region																														
Medium 1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Medium 2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Medium 3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MA Region																														
Medium 1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Medium 2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Medium 3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
							300-1000AU			8							300-1000AU			8							300-1000AU			0
							>1000 AU			12							>1000 AU			12							>1000 AU			0
							Total Veal			20							Total Veal			20							Total Veal			0
Heifers																														
MW Region																														
Medium 1	31	3	3	63	7	5	31	3	3	150	31	3	3	63	7	5	0	0	3	115	0	0	0	0	0	0	0	0	0	0
Medium 2	4	0	0	8	1	1	4	0	0	20	4	0	0	8	1	1	4	0	0	20	0	0	0	0	0	0	0	0	0	0
Medium 3	2	0	0	3	0	0	2	0	0	8	2	0	0	3	0	0	2	0	0	8	0	0	0	0	0	0	0	0	0	0
Large 1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CE Region																														
Medium 1	2	0	0	3	0	0	2	0	0	8	2	0	0	3	0	0	0	0	0	6	0	0	0	0	0	0	0	0	0	0
Medium 2	5	0	0	9	1	1	5	0	0	22	5	0	0	9	1	1	5	0	0	22	0	0	0	0	0	0	0	0	0	0
Medium 3	2	0	0	4	0	0	2	0	0	9	2	0	0	4	0	0	2	0	0	9	0	0	0	0	0	0	0	0	0	0
Large 1	24	8	4	50	15	8	24	8	4	145	24	8	4	50	15	8	24	8	4	145	0	0	0	0	0	0	0	0	0	0

Table D-1(a)
Option 1
Estimating the Number of Farms
Under Each Achievability Criteria
Affordable and Moderate

Sector/Model	Farm Count by Category										Number of Affordable by Category										Number of Moderate by Category									
	1L	2L	3L	1M	2M	3M	1H	2H	3H	All	1L	2L	3L	1M	2M	3M	1H	2H	3H	All	1L	2L	3L	1M	2M	3M	1H	2H	3H	All
PA Region																														
Medium 1	1	0	0	2	0	0	1	0	0	4	1	0	0	2	0	0	0	0	0	3	0	0	0	0	0	0	0	0	0	0
Medium 2	1	0	0	3	0	0	1	0	0	7	1	0	0	3	0	0	1	0	0	6	0	0	0	0	0	0	0	0	0	0
Medium 3	1	0	0	1	0	0	1	0	0	3	1	0	0	1	0	0	1	0	0	3	0	0	0	0	0	0	0	0	0	0
Large 1	16	5	3	33	10	5	16	5	3	97	16	5	3	33	10	5	16	5	3	97	0	0	0	0	0	0	0	0	0	0
SO Region																														
Medium 1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Medium 2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Medium 3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Large 1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MA Region																														
Medium 1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Medium 2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Medium 3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Large 1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
							300-1000AU			13							300-1000AU			12							300-1000AU			0
							>1000 AU			97							>1000 AU			97							>1000 AU			0
							Total Heifer			110							Total Heifer			109							Total Heifer			0
Dairy- Flush																														
PA Region																														
Medium 1	5	4	1	10	7	3	5	4	1	41	5	4	1	10	7	3	5	4	1	41	0	0	0	0	0	0	0	0	0	0
Medium 2	2	1	1	4	3	1	2	1	1	15	2	0	1	4	0	1	2	0	1	9	0	1	0	0	3	0	0	1	0	5
Medium 3	2	1	1	4	3	1	2	1	1	15	2	1	1	4	3	1	2	1	1	15	0	0	0	0	0	0	0	0	0	0
Large 1	38	72	31	77	145	63	38	72	31	569	38	72	31	77	0	63	38	0	31	351	0	0	0	0	145	0	0	72	0	218
MW Region																														
Medium 1	15	11	4	30	22	8	15	11	4	120	15	11	4	30	22	8	15	11	4	120	0	0	0	0	0	0	0	0	0	0
Medium 2	5	4	2	11	8	3	5	4	2	43	5	4	2	11	8	3	5	4	2	43	0	0	0	0	0	0	0	0	0	0
Medium 3	1	1	0	2	1	0	1	1	0	7	1	1	0	2	1	0	1	1	0	7	0	0	0	0	0	0	0	0	0	0
Large 1	3	6	3	6	12	5	3	6	3	47	3	6	3	6	12	5	3	6	3	47	0	0	0	0	0	0	0	0	0	0
CE Region																														
Medium 1	8	6	2	17	12	5	8	6	2	67	8	6	2	17	12	5	8	6	2	67	0	0	0	0	0	0	0	0	0	0
Medium 2	3	2	1	6	4	2	3	2	1	24	3	0	1	6	0	2	3	0	1	15	0	2	0	0	4	0	0	2	0	9
Medium 3	2	1	0	3	2	1	2	1	0	13	2	1	0	3	2	1	2	1	0	13	0	0	0	0	0	0	0	0	0	0
Large 1	20	38	17	41	77	33	20	38	17	301	20	38	17	41	77	33	20	38	17	301	0	0	0	0	0	0	0	0	0	0
SO Region																														
Medium 1	6	5	2	12	9	3	6	5	2	50	6	5	2	12	9	3	6	5	2	50	0	0	0	0	0	0	0	0	0	0
Medium 2	2	2	1	5	3	1	2	2	1	18	2	0	1	5	0	1	2	0	1	12	0	2	0	0	3	0	0	2	0	7
Medium 3	1	1	0	2	2	1	1	1	0	8	1	1	0	2	0	1	1	0	0	6	0	0	0	0	2	0	0	1	0	2
Large 1	5	9	4	9	17	7	5	9	4	68	5	9	4	9	17	7	5	9	4	68	0	0	0	0	0	0	0	0	0	0
MA Region																														
Medium 1	17	12	5	34	24	9	17	12	5	134	17	12	5	34	24	9	17	12	5	134	0	0	0	0	0	0	0	0	0	0
Medium 2	6	4	2	12	9	3	6	4	2	48	6	4	2	12	9	3	6	4	2	48	0	0	0	0	0	0	0	0	0	0
Medium 3	1	1	0	2	2	1	1	1	0	10	1	1	0	2	2	1	1	1	0	10	0	0	0	0	0	0	0	0	0	0
Large 1	4	7	3	7	13	6	4	7	3	52	4	7	3	7	13	6	4	7	3	52	0	0	0	0	0	0	0	0	0	0
Dairy- Hose																														
PA Region																														
Medium 1	5	4	1	10	7	3	5	4	1	41	5	4	1	10	7	3	5	4	1	41	0	0	0	0	0	0	0	0	0	0
Medium 2	2	1	1	4	3	1	2	1	1	15	2	1	1	4	3	1	2	1	1	15	0	0	0	0	0	0	0	0	0	0
Medium 3	2	1	1	4	3	1	2	1	1	15	2	1	1	4	3	1	2	1	1	15	0	0	0	0	0	0	0	0	0	0
Large 1	13	24	10	26	49	21	13	24	10	190	13	24	10	26	49	21	13	24	10	190	0	0	0	0	0	0	0	0	0	0
MW Region																														
Medium 1	45	32	13	90	64	25	45	32	13	358	45	32	13	90	64	25	45	32	13	358	0	0	0	0	0	0	0	0	0	0
Medium 2	16	12	5	32	23	9	16	12	5	129	16	12	5	32	23	9	16	12	5	129	0	0	0	0	0	0	0	0	0	0
Medium 3	2	2	1	5	3	1	2	2	1	19	2	2	1	5	3	1	2	2	1	19	0	0	0	0	0	0	0	0	0	0
Large 1	3	6	3	6	12	5	3	6	3	48	3	6	3	6	12	5	3	6	3	48	0	0	0	0	0	0	0	0	0	0
CE Region																														
Medium 1	8	6	2	17	12	5	8	6	2	67	8	6	2	17	12	5	8	6	2	67	0	0	0	0	0	0	0	0	0	0
Medium 2	3	2	1	6	4	2	3	2	1	24	3	2	1	6	4	2	3	2	1	24	0	0	0	0	0	0	0	0	0	0
Medium 3	2	1	0	3	2	1	2	1	0	12	2	1	0	3	2	1	2	1	0	12	0	0	0	0	0	0	0	0	0	0
Large 1	7	13	6	14	26	11	7	13	6	100	7	13	6	14	26	11	7	13	6	100	0	0	0	0	0	0	0	0	0	0
SO Region																														
Medium 1	6	5	2	12	9	3	6	5	2	50	6	5	2	12	9	3	6	5	2	50	0	0	0	0	0	0	0	0	0	0
Medium 2	2	2	1	5	3	1	2	2	1	18	2	2	1	5	3	1	2	2	1	18	0	0	0	0	0	0	0	0	0	0
Medium 3	1	1	0	2	1	1	1	1	0	7	1	1	0	2	1	1	1	1	0	7	0	0	0	0	0	0	0	0	0	0
Large 1	2	3	1	3	6	2	2	3	1	23	2	3	1	3	6	2	2	3	1	23	0	0	0	0	0	0	0	0	0	0
MA Region																														
Medium 1	51	36	14	101	73	28	51	36	14	404	51	36	14	101	73	28	51	36	14	404	0	0	0	0	0	0	0	0	0	0
Medium 2	18	13	5	37	26	10	18	13	5	146	18	13	5	37	26	10	18	13	5	146	0	0	0	0	0	0	0	0	0	0
Medium 3	4	3	1	8	6	2	4	3	1	31	4	3	1	8	6	2	4	3	1	31	0	0	0	0	0	0	0	0	0	0
Large 1	4	7	3	7	13	6	4	7	3	52	4	7	3	7	13	6	4	7	3	52	0	0	0	0	0	0	0	0	0	0
							300-1000AU			1,948							300-1000AU			1,925							300-1000AU			23
							>1000 AU			1,450							>1000 AU			1,232							>1000 AU			218
							Total Dairy			3,536							Total Dairy			3,158							Total Dairy			240

Table D-1(a)
Option 1
Estimating the Number of Farms
Under Each Achievability Criteria
Affordable and Moderate

Sector/Model	Farm Count by Category										Number of Affordable by Category										Number of Moderate by Category									
	1L	2L	3L	1M	2M	3M	1H	2H	3H	All	1L	2L	3L	1M	2M	3M	1H	2H	3H	All	1L	2L	3L	1M	2M	3M	1H	2H	3H	All
Hogs Liquid (GFInd)																														
MW Region																														
Medium 1	12	1	2	23	2	3	12	1	2	56	12	1	2	23	2	3	12	1	2	56	0	0	0	0	0	0	0	0	0	0
Medium 2	6	1	1	12	2	2	6	1	1	32	6	1	1	12	2	2	6	1	1	32	0	0	0	0	0	0	0	0	0	0
Medium 3	3	0	1	7	1	1	3	0	1	19	3	0	1	7	1	1	3	0	1	19	0	0	0	0	0	0	0	0	0	0
Large 1	12	4	7	24	9	14	12	4	7	92	12	4	7	24	9	14	12	4	7	92	0	0	0	0	0	0	0	0	0	0
Large 2	9	3	5	17	6	10	9	3	5	66	9	3	5	17	6	10	9	3	5	66	0	0	0	0	0	0	0	0	0	0
MA Region																														
Medium 1	3	1	1	6	2	2	3	1	1	20	3	1	1	6	2	2	3	1	1	20	0	0	0	0	0	0	0	0	0	0
Medium 2	2	2	1	4	4	2	2	2	1	19	2	2	1	4	4	2	2	2	1	19	0	0	0	0	0	0	0	0	0	0
Medium 3	1	1	1	2	2	1	1	1	1	11	1	1	1	2	2	1	1	1	1	11	0	0	0	0	0	0	0	0	0	0
Large 1	13	32	11	25	64	22	13	32	11	225	13	32	11	25	64	22	13	32	11	225	0	0	0	0	0	0	0	0	0	0
Large 2	9	23	8	18	46	16	9	23	8	161	9	23	8	18	46	16	9	23	8	161	0	0	0	0	0	0	0	0	0	0
Hogs Liquid (FFInd)																														
MW Region																														
Medium 1	45	3	7	90	6	14	45	3	7	221	45	3	7	90	6	14	45	3	7	221	0	0	0	0	0	0	0	0	0	0
Medium 2	18	3	4	36	5	7	18	3	4	97	18	3	4	36	5	7	18	3	4	97	0	0	0	0	0	0	0	0	0	0
Medium 3	9	1	2	18	2	4	9	1	2	47	9	1	2	18	2	4	9	1	2	47	0	0	0	0	0	0	0	0	0	0
Large 1	40	14	22	79	28	45	40	14	22	305	40	14	22	79	28	45	40	14	22	305	0	0	0	0	0	0	0	0	0	0
Large 2	28	10	16	57	20	32	28	10	16	219	28	10	16	57	20	32	28	10	16	219	0	0	0	0	0	0	0	0	0	0
MA Region																														
Medium 1	7	2	2	14	4	4	7	2	2	44	7	2	2	14	4	4	7	2	2	44	0	0	0	0	0	0	0	0	0	0
Medium 2	3	3	2	6	6	3	3	3	2	31	3	3	2	6	6	3	3	3	2	31	0	0	0	0	0	0	0	0	0	0
Medium 3	2	1	1	3	3	2	2	1	1	15	2	1	1	3	3	2	2	1	1	15	0	0	0	0	0	0	0	0	0	0
Large 1	15	38	13	30	77	27	15	38	13	267	15	38	13	30	77	27	15	38	13	267	0	0	0	0	0	0	0	0	0	0
Large 2	11	27	10	22	55	19	11	27	10	192	11	27	10	22	55	19	11	27	10	192	0	0	0	0	0	0	0	0	0	0
Hogs Pit (GFInd)																														
MW Region																														
Medium 1	24	2	4	48	3	7	24	2	4	118	24	2	4	48	3	7	24	2	4	118	0	0	0	0	0	0	0	0	0	0
Medium 2	12	2	2	25	3	5	12	2	2	66	12	2	2	25	3	5	12	2	2	66	0	0	0	0	0	0	0	0	0	0
Medium 3	7	1	1	15	2	3	7	1	1	39	7	1	1	15	2	3	7	1	1	39	0	0	0	0	0	0	0	0	0	0
Large 1	29	10	16	58	21	33	29	10	16	223	29	10	16	58	21	33	29	10	16	223	0	0	0	0	0	0	0	0	0	0
Large 2	21	7	12	42	15	24	21	7	12	160	21	7	12	42	15	24	21	7	12	160	0	0	0	0	0	0	0	0	0	0
MA Region																														
Medium 1	1	0	0	2	1	1	1	0	0	7	1	0	0	2	1	1	1	0	0	7	0	0	0	0	0	0	0	0	0	0
Medium 2	1	1	0	1	1	1	1	1	0	7	1	1	0	1	1	1	1	1	0	7	0	0	0	0	0	0	0	0	0	0
Medium 3	0	0	0	1	1	0	0	0	0	4	0	0	0	1	1	0	0	0	0	4	0	0	0	0	0	0	0	0	0	0
Large 1	8	19	7	15	39	13	8	19	7	135	8	19	7	15	39	13	8	19	7	135	0	0	0	0	0	0	0	0	0	0
Large 2	5	14	5	11	28	10	5	14	5	97	5	14	5	11	28	10	5	14	5	97	0	0	0	0	0	0	0	0	0	0
Hogs Pit (FFInd)																														
MW Region																														
Medium 1	55	4	8	110	8	17	55	4	8	269	55	4	8	110	8	17	55	4	8	269	0	0	0	0	0	0	0	0	0	0
Medium 2	22	3	4	44	6	9	22	3	4	119	22	3	4	44	6	9	22	3	4	119	0	0	0	0	0	0	0	0	0	0
Medium 3	11	2	2	21	3	4	11	2	2	58	11	2	2	21	3	4	11	2	2	58	0	0	0	0	0	0	0	0	0	0
Large 1	51	18	29	102	37	58	51	18	29	394	51	18	29	102	37	58	51	18	29	394	0	0	0	0	0	0	0	0	0	0
Large 2	37	13	21	74	26	42	37	13	21	283	37	13	21	74	26	42	37	13	21	283	0	0	0	0	0	0	0	0	0	0
MA Region																														
Medium 1	1	0	0	2	1	1	1	0	0	7	1	0	0	2	1	1	1	0	0	7	0	0	0	0	0	0	0	0	0	0
Medium 2	1	1	0	1	1	1	1	1	0	5	1	1	0	1	1	1	1	1	0	5	0	0	0	0	0	0	0	0	0	0
Medium 3	0	0	0	1	0	0	0	0	0	3	0	0	0	1	0	0	0	0	0	3	0	0	0	0	0	0	0	0	0	0
Large 1	5	12	4	9	24	8	5	12	4	84	5	12	4	9	24	8	5	12	4	84	0	0	0	0	0	0	0	0	0	0
Large 2	3	9	3	7	17	6	3	9	3	60	3	9	3	7	17	6	3	9	3	60	0	0	0	0	0	0	0	0	0	0
Hogs Evaporate																														
CE Region (GFInd)																														
Large 1	3	4	2	6	7	5	3	4	2	35	3	4	2	6	7	5	3	4	2	35	0	0	0	0	0	0	0	0	0	0
Large 2	2	3	2	4	5	4	2	3	2	25	2	3	2	4	5	4	2	3	2	25	0	0	0	0	0	0	0	0	0	0
CE Region (FFInd)																														
Large 1	6	8	6	12	16	11	6	8	6	78	6	8	6	12	16	11	6	8	6	78	0	0	0	0	0	0	0	0	0	0
Large 2	4	6	4	9	11	8	4	6	4	56	4	6	4	9	11	8	4	6	4	56	0	0	0	0	0	0	0	0	0	0
Hogs Liquid (GFCost)																														
MW Region																														
Medium 1	6	0	1	12	1	2	6	0	1	29	6	0	1	12	1	2	6	0	1	29	0	0	0	0	0	0	0	0	0	0
Medium 2	3	0	1	6	1	1	3	0	1	16	3	0	1	6	1	1	3	0	1	16	0	0	0	0	0	0	0	0	0	0
Medium 3	2	0	0	4	1	1	2	0	0	10	2	0	0	4	1	1	2	0	0	10	0	0	0	0	0	0	0	0	0	0
Large 1	15	5	9	31	11	17	15	5	9	118	15	5	9	31	11	17	15	5	9	118	0	0	0	0	0	0	0	0	0	0
Large 2	11	4	6	22	8	12	11	4	6	84	11	4	6	22	8	12	11	4	6	84	0	0	0	0	0	0	0	0	0	0
Hogs Pit (GFCost)																														
MW Region																														
Medium 1	12	1	2	25	2	4	12	1	2	61	12	1	2	25	2	4	12	1	2	61	0	0	0	0	0	0	0	0	0	0
Medium 2	6	1	1	13	2	3	6	1	1	34	6	1	1	13	2	3	6	1	1	34	0	0	0	0	0	0	0	0	0	0
Medium 3	4	1	1	8	1	2	4	1	1	20	4	1	1	8	1	2	4	1	1	20	0	0	0	0	0	0	0	0	0	0
Large 1	37	13	21	74	26	42	37	13	21	284	37	13	21	74	26	42	37	13	21	284	0	0	0	0	0	0	0	0	0	0
Large 2	26	9	15	53	19	30	26	9	15	203	26	9	15	53	19	30	26	9	15	203	0	0	0	0	0	0	0	0	0	0

Table D-1(a)
Option 1
Estimating the Number of Farms
Under Each Achievability Criteria
Affordable and Moderate

Sector/Model	Farm Count by Category										Number of Affordable by Category										Number of Moderate by Category									
	1L	2L	3L	1M	2M	3M	1H	2H	3H	All	1L	2L	3L	1M	2M	3M	1H	2H	3H	All	1L	2L	3L	1M	2M	3M	1H	2H	3H	All
Hogs Evaporate																														
CE Region (GFCont)																														
Large 1	4	5	3	7	9	6	4	5	3	45	4	5	3	7	9	6	4	5	3	45	0	0	0	0	0	0	0	0	0	0
Large 2	3	3	2	5	7	5	3	3	2	32	3	3	2	5	7	5	3	3	2	32	0	0	0	0	0	0	0	0	0	0
							300-1000AU			1,485							300-1000AU			1,485							300-1000AU			0
							>1000 AU			3,924							>1000 AU			3,924							>1000 AU			0
							Total Hog			5,409							Total Hog			5,409							Total Hog			0
Broilers																														
SO Region																														
Medium 1	2	14	7	4	27	14	2	14	7	90	2	14	7	0	0	0	0	0	0	23	0	0	0	4	27	14	2	14	7	68
Medium 2	1	23	9	3	46	18	1	23	9	133	1	23	9	0	0	18	0	0	0	51	0	0	0	3	46	0	1	23	9	82
Medium 3	1	21	8	2	42	16	1	21	8	120	1	21	8	0	42	16	0	0	0	88	0	0	0	2	0	0	1	21	8	33
Large 1	3	125	46	7	250	91	3	125	46	698	3	125	46	0	250	91	0	0	0	516	0	0	0	7	0	0	0	125	46	178
Large 2	2	72	26	4	145	53	2	72	26	404	2	72	26	0	145	53	0	0	0	299	0	0	0	4	0	0	2	72	26	105
MA Region																														
Medium 1	2	5	6	3	10	11	2	5	6	48	2	5	6	3	10	11	0	0	6	42	0	0	0	0	0	0	2	5	0	6
Medium 2	2	8	6	3	16	12	2	8	6	64	2	8	6	3	16	12	0	8	6	63	0	0	0	0	0	0	2	0	0	2
Medium 3	2	8	6	3	16	12	2	8	6	64	2	8	6	3	16	12	2	8	6	64	0	0	0	0	0	0	0	0	0	0
Large 1	7	50	27	15	100	53	7	50	27	336	7	50	27	15	100	53	0	50	27	329	0	0	0	0	0	0	7	0	0	7
Large 2	4	29	15	8	58	31	4	29	15	194	4	29	15	8	58	31	0	29	15	190	0	0	0	0	0	0	4	0	0	4
							300-1000AU			520							300-1000AU			330							300-1000AU			190
							>1000 AU			1,632							>1000 AU			1,334							>1000 AU			294
							Total Broiler			2,152							Total Broiler			1,664							Total Broiler			485
Layers (Wet)																														
SO Region																														
Medium 3	1	2	3	2	5	5	1	2	3	24	1	2	3	2	5	5	1	2	3	24	0	0	0	0	0	0	0	0	0	0
Large 1	10	40	46	21	79	91	10	40	46	383	10	40	46	21	79	91	10	40	46	383	0	0	0	0	0	0	0	0	0	0
							300-1000AU			24							300-1000AU			24							300-1000AU			0
							>1000 AU			383							>1000 AU			383							>1000 AU			0
							Total Wet Layer			407							Total Wet Layer			407							Total Wet Layer			0
Layers (Dry)																														
SO Region																														
Medium 1	1	1	1	1	2	1	1	1	1	8	1	1	1	1	2	1	1	1	1	8	0	0	0	0	0	0	0	0	0	0
Medium 2	0	0	0	0	1	1	0	0	0	4	0	0	0	0	1	1	0	0	0	4	0	0	0	0	0	0	0	0	0	0
Medium 3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Large 1	6	24	28	13	49	56	6	24	28	235	6	24	28	13	49	56	6	24	28	235	0	0	0	0	0	0	0	0	0	0
Large 2	1	3	3	1	5	6	1	3	3	25	1	3	3	1	5	6	1	3	3	25	0	0	0	0	0	0	0	0	0	0
MW Region																														
Medium 1	1	1	1	1	2	1	1	1	1	8	1	1	1	1	2	1	1	1	1	8	0	0	0	0	0	0	0	0	0	0
Medium 2	0	0	0	0	1	1	0	0	0	4	0	0	0	0	1	1	0	0	0	4	0	0	0	0	0	0	0	0	0	0
Medium 3	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0
Large 1	11	42	49	22	84	97	11	42	49	407	11	42	49	22	84	97	11	42	49	407	0	0	0	0	0	0	0	0	0	0
Large 2	2	6	7	3	13	15	2	6	7	62	2	6	7	3	13	15	2	6	7	62	0	0	0	0	0	0	0	0	0	0
							300-1000AU			26							300-1000AU			26							300-1000AU			0
							>1000 AU			729							>1000 AU			729							>1000 AU			0
							Total Dry Layer			755							Total Dry Layer			755							Total Dry Layer			0
Turkeys																														
MA Region																														
Medium 1	0	1	1	1	3	2	0	1	1	11	0	1	1	1	3	2	0	1	1	11	0	0	0	0	0	0	0	0	0	0
Medium 2	0	1	0	0	2	1	0	1	0	6	0	1	0	0	2	1	0	1	0	6	0	0	0	0	0	0	0	0	0	0
Medium 3	0	0	0	0	1	1	0	0	0	3	0	0	0	0	1	1	0	0	0	3	0	0	0	0	0	0	0	0	0	0
Large 1	3	22	16	6	44	32	3	22	16	163	3	22	16	6	44	32	3	22	16	163	0	0	0	0	0	0	0	0	0	0
MW Region																														
Medium 1	0	1	1	1	2	1	0	1	1	9	0	1	1	1	2	1	0	1	1	9	0	0	0	0	0	0	0	0	0	0
Medium 2	0	1	0	0	2	1	0	1	0	5	0	1	0	0	2	1	0	1	0	5	0	0	0	0	0	0	0	0	0	0
Medium 3	0	0	0	0	1	1	0	0	0	3	0	0	0	0	1	1	0	0	0	3	0	0	0	0	0	0	0	0	0	0
Large 1	4	30	22	8	61	43	4	30	22	225	4	30	22	8	61	43	4	30	22	225	0	0	0	0	0	0	0	0	0	0
							300-1000AU			37							300-1000AU			37							300-1000AU			0
							>1000 AU			388							>1000 AU			388							>1000 AU			0
							Total Turkey			425							Total Turkey			425							Total Turkey			0

Table D-1(b)
Option 2
Estimating the Number of Farms
Under Each Achievability Criteria
Affordable and Moderate

Sector/Model	Farm Count by Category										Number of Affordable by Category										Number of Moderate by Category									
	1L	2L	3L	1M	2M	3M	1H	2H	3H	All	1L	2L	3L	1M	2M	3M	1H	2H	3H	All	1L	2L	3L	1M	2M	3M	1H	2H	3H	All
Beef																														
MW Region																														
Medium 1	15	2	1	29	4	3	15	2	1	73	15	2	1	29	4	3	15	0	1	70	0	0	0	0	0	0	0	0	0	0
Medium 2	8	1	1	16	2	1	8	1	1	40	8	1	1	16	2	1	8	1	1	40	0	0	0	0	0	0	0	0	0	0
Medium 3	4	1	0	8	1	1	4	1	0	20	4	1	0	8	1	1	4	0	0	19	0	0	0	0	0	0	0	0	0	0
Large 1	139	52	24	277	104	47	139	52	24	856	139	52	24	277	104	47	139	52	24	856	0	0	0	0	0	0	0	0	0	0
Large 2	5	36	26	10	72	52	5	36	26	268	5	36	26	10	72	52	5	36	26	268	0	0	0	0	0	0	0	0	0	0
CE Region																														
Medium 1	3	1	0	6	1	1	3	1	0	17	3	1	0	6	1	1	3	0	0	16	0	0	0	0	0	0	0	0	0	0
Medium 2	2	0	0	4	1	0	2	0	0	9	2	0	0	4	1	0	0	0	0	8	0	0	0	0	0	0	0	0	0	0
Medium 3	1	0	0	2	1	0	1	0	0	6	1	0	0	2	1	0	1	0	0	6	0	0	0	0	0	0	0	0	0	0
Large 1	49	46	12	97	91	23	49	46	12	424	49	46	12	97	91	23	49	46	12	424	0	0	0	0	0	0	0	0	0	0
Large 2	2	19	13	3	38	26	2	19	13	133	2	19	13	3	38	26	2	19	13	133	0	0	0	0	0	0	0	0	0	0
PA Region																														
Medium 1	0	0	0	1	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Medium 2	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Medium 3	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0
Large 1	6	7	2	12	14	3	6	7	2	57	6	0	0	12	0	0	0	0	0	17	0	0	0	0	0	0	0	0	0	0
Large 2	0	2	2	0	5	4	0	2	2	17	0	2	0	0	5	0	0	2	0	10	0	0	0	0	0	0	0	0	0	0
SO Region																														
Medium 1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Medium 2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Medium 3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Large 1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Large 2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MA Region																														
Medium 1	0	0	0	1	0	0	0	0	0	2	0	0	0	1	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0
Medium 2	0	0	0	1	0	0	0	0	0	1	0	0	0	1	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0
Medium 3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Large 1	1	1	0	2	1	0	1	1	0	8	1	1	0	2	1	0	1	0	0	6	0	0	0	0	0	0	0	0	0	0
Large 2	0	1	0	0	1	0	0	1	0	3	0	1	0	0	1	0	0	1	0	2	0	0	0	0	0	0	0	0	0	0
							300-1000AU			173							300-1000AU			164							300-1000AU			0
							>1000 AU			1,766							>1000 AU			1,717							>1000 AU			0
							Total Beef			1,939							Total Beef			1,881							Total Beef			0
Veal																														
MW Region																														
Medium 1	0	0	0	1	0	0	0	0	0	2	0	0	0	1	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0
Medium 2	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0
Medium 3	1	0	0	2	0	0	1	0	0	4	1	0	0	2	0	0	1	0	0	4	0	0	0	0	0	0	0	0	0	0
Large1	3	0	0	6	0	0	3	0	0	12	3	0	0	6	0	0	3	0	0	12	0	0	0	0	0	0	0	0	0	0
CE Region																														
Medium 1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Medium 2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Medium 3	0	0	0	1	0	0	0	0	0	1	0	0	0	1	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0
PA Region																														
Medium 1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Medium 2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Medium 3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
SO Region																														
Medium 1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Medium 2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Medium 3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MA Region																														
Medium 1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Medium 2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Medium 3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
							300-1000AU			8							300-1000AU			8							300-1000AU			0
							>1000 AU			12							>1000 AU			12							>1000 AU			0
							Total Veal			20							Total Veal			20							Total Veal			0
Heifers																														
MW Region																														
Medium 1	30	4	3	61	9	5	30	4	3	150	30	4	3	61	9	5	0	0	3	115	0	0	0	0	0	0	0	0	0	0
Medium 2	4	1	0	8	1	1	4	1	0	20	4	1	0	8	1	1	4	1	0	20	0	0	0	0	0	0	0	0	0	0
Medium 3	2	0	0	3	0	0	2	0	0	8	2	0	0	3	0	0	2	0	0	8	0	0	0	0	0	0	0	0	0	0
Large 1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CE Region																														
Medium 1	2	0	0	3	1	0	2	0	0	8	2	0	0	3	1	0	0	0	0	6	0	0	0	0	0	0	0	0	0	0
Medium 2	4	1	0	8	2	1	4	1	0	22	4	1	0	8	2	1	4	1	0	22	0	0	0	0	0	0	0	0	0	0
Medium 3	2	0	0	3	1	0	2	0	0	9	2	0	0	3	1	0	2	0	0	9	0	0	0	0	0	0	0	0	0	0
Large 1	17	16	4	34	31	8	17	16	4	145	17	16	4	34	31	8	17	16	4	145	0	0	0	0	0	0	0	0	0	0

Table D-1(b)
Option 2
Estimating the Number of Farms
Under Each Achievability Criteria
Affordable and Moderate

Sector/Model	Farm Count by Category										Number of Affordable by Category										Number of Moderate by Category									
	1L	2L	3L	1M	2M	3M	1H	2H	3H	All	1L	2L	3L	1M	2M	3M	1H	2H	3H	All	1L	2L	3L	1M	2M	3M	1H	2H	3H	All
PA Region																														
Medium 1	1	0	0	1	0	0	1	0	0	4	1	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0
Medium 2	1	0	0	2	1	0	1	0	0	7	1	0	0	2	1	0	1	0	0	6	0	0	0	0	0	0	0	0	0	0
Medium 3	0	0	0	1	0	0	0	0	0	3	0	0	0	1	0	0	0	0	0	3	0	0	0	0	0	0	0	0	0	0
Large 1	10	12	3	20	24	5	10	12	3	97	10	12	0	20	24	0	10	0	0	75	0	0	0	0	0	0	0	0	0	0
SO Region																														
Medium 1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Medium 2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Medium 3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Large 1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MA Region																														
Medium 1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Medium 2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Medium 3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Large 1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
							300-1000AU			230							300-1000AU			189							300-1000AU			0
							>1000 AU			242							>1000 AU			220							>1000 AU			0
							Total Heifer			472							Total Heifer			409							Total Heifer			0
Dairy- Flush																														
PA Region																														
Medium 1	4	5	1	7	10	3	4	5	1	41	4	5	0	7	10	0	4	5	0	35	0	0	1	0	0	3	0	0	1	6
Medium 2	1	2	1	3	4	1	1	2	1	15	1	0	0	3	0	0	1	0	0	5	0	2	1	0	4	1	0	2	1	10
Medium 3	1	2	1	3	4	1	1	2	1	15	1	2	0	3	4	0	1	2	0	13	0	0	1	0	0	1	0	0	1	2
Large 1	24	87	31	48	174	63	24	87	31	569	24	0	31	48	0	63	24	0	31	221	0	87	0	0	174	0	0	87	0	348
MW Region																														
Medium 1	12	14	4	24	28	8	12	14	4	120	12	14	4	24	28	8	12	14	4	120	0	0	0	0	0	0	0	0	0	0
Medium 2	4	5	2	9	10	3	4	5	2	43	4	5	2	9	10	3	4	5	2	43	0	0	0	0	0	0	0	0	0	0
Medium 3	1	1	0	1	1	0	1	1	0	7	1	1	0	1	1	0	1	1	0	7	0	0	0	0	0	0	0	0	0	0
Large 1	2	7	3	5	13	5	2	7	3	47	2	7	3	5	13	5	2	7	3	47	0	0	0	0	0	0	0	0	0	0
CE Region																														
Medium 1	6	8	2	13	16	5	6	8	2	67	6	8	2	13	16	5	6	8	2	67	0	0	0	0	0	0	0	0	0	0
Medium 2	2	3	1	5	6	2	2	3	1	24	2	3	1	5	6	2	2	3	1	24	0	0	0	0	0	0	0	0	0	0
Medium 3	1	2	0	2	3	1	1	2	0	13	1	2	0	2	3	1	1	2	0	13	0	0	0	0	0	0	0	0	0	0
Large 1	16	42	17	33	85	33	16	42	17	301	16	42	17	33	85	33	16	42	17	301	0	0	0	0	0	0	0	0	0	0
SO Region																														
Medium 1	6	5	2	11	10	3	6	5	2	50	6	5	2	11	10	3	6	5	2	50	0	0	0	0	0	0	0	0	0	0
Medium 2	2	2	1	4	4	1	2	2	1	18	2	0	1	4	0	1	2	0	1	11	0	2	0	0	4	0	0	2	0	8
Medium 3	1	1	0	2	2	1	1	1	0	8	1	1	0	2	2	0	1	1	0	7	0	0	0	0	0	1	0	0	0	1
Large 1	3	10	4	7	20	7	3	10	4	68	3	0	4	7	0	7	3	0	4	28	0	10	0	0	20	0	0	10	0	40
MA Region																														
Medium 1	13	16	5	26	32	9	13	16	5	134	13	16	0	26	32	0	13	16	0	115	0	0	5	0	0	9	0	0	5	19
Medium 2	5	6	2	9	12	3	5	6	2	48	5	6	0	9	12	0	5	6	0	42	0	0	2	0	0	3	0	0	2	7
Medium 3	1	1	0	2	2	1	1	1	0	10	1	1	0	2	2	0	1	1	0	9	0	0	0	0	0	1	0	0	0	1
Large 1	2	8	3	5	16	6	2	8	3	52	2	0	0	5	0	0	2	0	0	9	0	8	3	0	16	6	0	8	3	43
Dairy- Hose																														
PA Region																														
Medium 1	4	5	1	7	10	3	4	5	1	41	4	5	1	7	10	3	4	5	1	41	0	0	0	0	0	0	0	0	0	0
Medium 2	1	2	1	3	4	1	1	2	1	15	1	2	1	3	4	1	1	2	1	15	0	0	0	0	0	0	0	0	0	0
Medium 3	1	2	1	3	4	1	1	2	1	15	1	2	1	3	4	1	1	2	1	15	0	0	0	0	0	0	0	0	0	0
Large 1	8	29	10	16	59	21	8	29	10	190	8	29	10	16	59	21	8	29	10	190	0	0	0	0	0	0	0	0	0	0
MW Region																														
Medium 1	35	42	13	71	83	25	35	42	13	358	35	42	13	71	83	25	35	42	13	358	0	0	0	0	0	0	0	0	0	0
Medium 2	13	15	5	25	30	9	13	15	5	129	13	15	5	25	30	9	13	15	5	129	0	0	0	0	0	0	0	0	0	0
Medium 3	2	2	1	4	4	1	2	2	1	19	2	2	1	4	4	1	2	2	1	19	0	0	0	0	0	0	0	0	0	0
Large 1	2	7	3	5	14	5	2	7	3	48	2	7	3	5	14	5	2	7	3	48	0	0	0	0	0	0	0	0	0	0
CE Region																														
Medium 1	6	8	2	13	16	5	6	8	2	67	6	8	2	13	16	5	6	8	2	67	0	0	0	0	0	0	0	0	0	0
Medium 2	2	3	1	5	6	2	2	3	1	24	2	3	1	5	6	2	2	3	1	24	0	0	0	0	0	0	0	0	0	0
Medium 3	1	1	0	2	3	1	1	1	0	12	1	1	0	2	3	1	1	1	0	12	0	0	0	0	0	0	0	0	0	0
Large 1	5	14	6	11	28	11	5	14	6	100	5	14	6	11	28	11	5	14	6	100	0	0	0	0	0	0	0	0	0	0
SO Region																														
Medium 1	6	5	2	11	10	3	6	5	2	50	6	5	2	11	10	3	6	5	2	50	0	0	0	0	0	0	0	0	0	0
Medium 2	2	2	1	4	4	1	2	2	1	18	2	2	1	4	4	1	2	2	1	18	0	0	0	0	0	0	0	0	0	0
Medium 3	1	1	0	2	2	1	1	1	0	7	1	1	0	2	2	1	1	1	0	7	0	0	0	0	0	0	0	0	0	0
Large 1	1	3	1	2	6	2	1	3	1	23	1	3	1	2	6	2	1	3	1	23	0	0	0	0	0	0	0	0	0	0
MA Region																														
Medium 1	39	48	14	77	96	28	39	48	14	404	39	48	14	77	96	28	39	48	14	404	0	0	0	0	0	0	0	0	0	0
Medium 2	14	17	5	28	35	10	14	17	5	146	14	17	5	28	35	10	14	17	5	146	0	0	0	0	0	0	0	0	0	0
Medium 3	3	4	1	6	7	2	3	4	1	31	3	4	1	6	7	2	3	4	1	31	0	0	0	0	0	0	0	0	0	0
Large 1	2	8	3	5	16	6	2	8	3	52	2	8	3	5	16	6	2	8	3	52	0	0	0	0	0	0	0	0	0	0
							300-1000AU			1,948							300-1000AU			1,895							300-1000AU			53
							>1000 AU			1,450							>1000 AU			1,019							>1000 AU			431
							Total Dairy			3,398							Total Dairy			2,915							Total Dairy			483

Table D-1(b)
Option 2
Estimating the Number of Farms
Under Each Achievability Criteria
Affordable and Moderate

Sector/Model	Farm Count by Category										Number of Affordable by Category										Number of Moderate by Category									
	1L	2L	3L	1M	2M	3M	1H	2H	3H	All	1L	2L	3L	1M	2M	3M	1H	2H	3H	All	1L	2L	3L	1M	2M	3M	1H	2H	3H	All
Hogs Liquid (GFInd)																														
MW Region																														
Medium 1	10	2	2	21	4	3	10	2	2	56	10	2	2	21	4	3	10	2	2	56	0	0	0	0	0	0	0	0	0	0
Medium 2	5	2	1	10	4	2	5	2	1	32	5	2	1	10	4	2	5	2	1	32	0	0	0	0	0	0	0	0	0	0
Medium 3	3	1	1	6	2	1	3	1	1	19	3	1	1	6	2	1	3	1	1	19	0	0	0	0	0	0	0	0	0	0
Large 1	8	8	7	16	16	14	8	8	7	92	8	8	7	16	16	14	8	8	7	92	0	0	0	0	0	0	0	0	0	0
Large 2	6	6	5	12	12	10	6	6	5	66	6	6	5	12	12	10	6	6	5	66	0	0	0	0	0	0	0	0	0	0
MA Region																														
Medium 1	3	2	1	5	3	2	3	2	1	20	3	2	1	5	3	2	3	2	1	20	0	0	0	0	0	0	0	0	0	0
Medium 2	1	2	1	3	5	2	1	2	1	19	1	2	1	3	5	2	1	2	1	19	0	0	0	0	0	0	0	0	0	0
Medium 3	1	1	1	2	3	1	1	1	1	11	1	1	1	2	3	1	1	1	1	11	0	0	0	0	0	0	0	0	0	0
Large 1	7	38	11	13	77	22	7	38	11	225	7	38	11	13	77	22	7	38	11	225	0	0	0	0	0	0	0	0	0	0
Large 2	5	28	8	9	55	16	5	28	8	161	5	28	8	9	55	16	5	28	8	161	0	0	0	0	0	0	0	0	0	0
Hogs Liquid (FFInd)																														
MW Region																														
Medium 1	41	7	7	82	15	14	41	7	7	221	41	7	7	82	15	14	41	7	7	221	0	0	0	0	0	0	0	0	0	0
Medium 2	15	6	4	30	11	7	15	6	4	97	15	6	4	30	11	7	15	6	4	97	0	0	0	0	0	0	0	0	0	0
Medium 3	7	3	2	15	5	4	7	3	2	47	7	3	2	15	5	4	7	3	2	47	0	0	0	0	0	0	0	0	0	0
Large 1	27	27	22	54	54	45	27	27	22	305	27	27	22	54	54	45	27	27	22	305	0	0	0	0	0	0	0	0	0	0
Large 2	19	19	16	39	38	32	19	19	16	219	19	19	16	39	38	32	19	19	16	219	0	0	0	0	0	0	0	0	0	0
MA Region																														
Medium 1	5	3	2	11	7	4	5	3	2	44	5	3	2	11	7	4	5	3	2	44	0	0	0	0	0	0	0	0	0	0
Medium 2	2	4	2	4	8	3	2	4	2	31	2	4	2	4	8	3	2	4	2	31	0	0	0	0	0	0	0	0	0	0
Medium 3	1	2	1	2	4	2	1	2	1	15	1	2	1	2	4	2	1	2	1	15	0	0	0	0	0	0	0	0	0	0
Large 1	8	46	13	16	91	27	8	46	13	267	8	46	13	16	91	27	8	46	13	267	0	0	0	0	0	0	0	0	0	0
Large 2	6	33	10	11	65	19	6	33	10	192	6	33	10	11	65	19	6	33	10	192	0	0	0	0	0	0	0	0	0	0
Hogs Pit (GFInd)																														
MW Region																														
Medium 1	22	4	4	44	8	7	22	4	4	118	22	4	4	44	8	7	22	4	4	118	0	0	0	0	0	0	0	0	0	0
Medium 2	10	4	2	21	8	5	10	4	2	66	10	4	2	21	8	5	10	4	2	66	0	0	0	0	0	0	0	0	0	0
Medium 3	6	2	1	12	4	3	6	2	1	39	6	2	1	12	4	3	6	2	1	39	0	0	0	0	0	0	0	0	0	0
Large 1	20	20	16	39	39	33	20	20	16	223	20	20	16	39	39	33	20	20	16	223	0	0	0	0	0	0	0	0	0	0
Large 2	14	14	12	28	28	24	14	14	12	160	14	14	12	28	28	24	14	14	12	160	0	0	0	0	0	0	0	0	0	0
MA Region																														
Medium 1	1	1	0	2	1	1	1	1	0	7	1	1	0	2	1	1	1	1	0	7	0	0	0	0	0	0	0	0	0	0
Medium 2	0	1	0	1	2	1	0	1	0	7	0	1	0	1	2	1	0	1	0	7	0	0	0	0	0	0	0	0	0	0
Medium 3	0	0	0	1	1	0	0	0	0	4	0	0	0	1	1	0	0	0	0	4	0	0	0	0	0	0	0	0	0	0
Large 1	4	23	7	8	46	13	4	23	7	135	4	0	0	8	0	0	4	0	0	16	0	0	0	0	0	0	0	0	0	0
Large 2	3	17	5	6	33	10	3	17	5	97	3	0	0	6	0	0	3	0	0	11	0	0	0	0	0	0	0	0	0	0
Hogs Pit (FFInd)																														
MW Region																														
Medium 1	50	9	8	100	18	17	50	9	8	269	50	9	8	100	18	17	50	9	8	269	0	0	0	0	0	0	0	0	0	0
Medium 2	18	7	4	37	13	9	18	7	4	119	18	7	4	37	13	9	18	7	4	119	0	0	0	0	0	0	0	0	0	0
Medium 3	9	3	2	18	7	4	9	3	2	58	9	3	2	18	7	4	9	3	2	58	0	0	0	0	0	0	0	0	0	0
Large 1	35	35	29	70	69	58	35	35	29	394	35	35	29	70	69	58	35	35	29	394	0	0	0	0	0	0	0	0	0	0
Large 2	25	25	21	50	50	42	25	25	21	283	25	25	21	50	50	42	25	25	21	283	0	0	0	0	0	0	0	0	0	0
MA Region																														
Medium 1	1	1	0	2	1	1	1	1	0	7	1	1	0	2	1	1	1	1	0	7	0	0	0	0	0	0	0	0	0	0
Medium 2	0	1	0	1	1	1	0	1	0	5	0	1	0	1	1	1	0	1	0	5	0	0	0	0	0	0	0	0	0	0
Medium 3	0	0	0	0	1	0	0	0	0	1	0	0	0	0	1	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0
Large 1	2	14	4	5	29	8	2	14	4	84	2	14	4	5	29	8	2	14	4	84	0	0	0	0	0	0	0	0	0	0
Large 2	2	10	3	4	21	6	2	10	3	60	2	10	3	4	21	6	2	10	3	60	0	0	0	0	0	0	0	0	0	0
Hogs Evaporate																														
CE Region (GFInd)																														
Large 1	2	4	2	4	9	5	2	4	2	35	2	4	2	4	9	5	2	4	2	35	0	0	0	0	0	0	0	0	0	0
Large 2	1	3	2	3	6	4	1	3	2	25	1	3	2	3	6	4	1	3	2	25	0	0	0	0	0	0	0	0	0	0
CE Region (FFInd)																														
Large 1	4	10	6	9	19	11	4	10	6	78	4	10	6	9	19	11	4	10	6	78	0	0	0	0	0	0	0	0	0	0
Large 2	3	7	4	6	14	8	3	7	4	56	3	7	4	6	14	8	3	7	4	56	0	0	0	0	0	0	0	0	0	0
Hogs Liquid (GFCont)																														
MW Region																														
Medium 1	5	1	1	11	2	2	5	1	1	29	5	1	1	11	2	2	5	1	1	29	0	0	0	0	0	0	0	0	0	0
Medium 2	3	1	1	5	2	1	3	1	1	16	3	1	1	5	2	1	3	1	1	16	0	0	0	0	0	0	0	0	0	0
Medium 3	2	1	0	3	1	1	2	1	0	10	2	1	0	3	1	1	2	1	0	10	0	0	0	0	0	0	0	0	0	0
Large 1	10	10	9	21	21	17	10	10	9	118	10	0	9	0	0	17	0	0	9	45	0	10	0	21	21	0	10	10	0	72
Large 2	7	7	6	15	15	12	7	7	6	84	7	7	6	15	15	12	7	0	6	77	0	0	0	0	0	0	0	7	0	7
Hogs Pit (GFCont)																														
MW Region																														
Medium 1	11	2	2	23	4	4	11	2	2	61	11	2	2	23	4	4	11	2	2	61	0	0	0	0	0	0	0	0	0	0
Medium 2	5	2	1	11	4	3	5	2	1	34	5	2	1	11	4	3	5	2	1	34	0	0	0	0	0	0	0	0	0	0
Medium 3	3	1	1	6	2	2	3	1	1	20	3	1	1	6	2	2	3	1	1	20	0	0	0	0	0	0	0	0	0	0
Large 1	25	25	21	50	50	42	25	25	21	284	25	0	0	0	0	0	0	0	0	25	0	25	21	50	50	42	25	25	21	259
Large 2	18	18	15	36	36	30	18	18	15	203	18	0	0	36	0	0	18	0	0	72	0	18	15	0	36	30	0	18	15	132

Table D-1(b)
Option 2
Estimating the Number of Farms
Under Each Achievability Criteria
Affordable and Moderate

Sector/Model	Farm Count by Category										Number of Affordable by Category										Number of Moderate by Category									
	1L	2L	3L	1M	2M	3M	1H	2H	3H	All	1L	2L	3L	1M	2M	3M	1H	2H	3H	All	1L	2L	3L	1M	2M	3M	1H	2H	3H	All
Hogs Evaporate																														
CE Region (GFCont)																														
Large 1	2	6	3	5	11	6	2	6	3	45	2	6	3	5	11	6	2	6	3	45	0	0	0	0	0	0	0	0	0	0
Large 2	2	4	2	4	8	5	2	4	2	32	2	4	2	4	8	5	2	4	2	32	0	0	0	0	0	0	0	0	0	0
							300-1000AU			1,484							300-1000AU			1,483							300-1000AU			0
							>1000 AU			3,924							>1000 AU			3,249							>1000 AU			470
							Total Hog			5,408							Total Hog			4,733							Total Hog			470
Broilers																														
SO Region																														
Medium 1	2	14	7	3	28	14	2	14	7	90	0	14	7	0	0	0	0	0	0	21	2	0	0	0	28	14	0	14	7	64
Medium 2	1	23	9	2	46	18	1	23	9	133	0	23	9	0	0	18	0	0	0	50	1	0	0	0	46	0	0	23	9	79
Medium 3	1	21	8	2	42	16	1	21	8	120	0	21	8	0	0	16	0	0	0	45	1	0	0	2	42	0	0	21	8	74
Large 1	3	126	46	6	252	91	3	126	46	698	0	126	46	0	0	91	0	0	0	263	3	0	0	0	252	0	0	126	46	426
Large 2	2	73	26	3	146	53	2	73	26	404	0	73	26	0	146	53	0	0	0	298	2	0	0	3	0	0	0	73	26	104
MA Region																														
Medium 1	1	5	6	2	11	11	1	5	6	48	0	5	6	0	11	11	0	0	6	38	1	0	0	2	0	0	1	5	0	10
Medium 2	1	9	6	2	18	12	1	9	6	64	1	9	6	2	18	12	0	0	6	54	0	0	0	0	0	0	1	9	0	10
Medium 3	1	9	6	2	18	12	1	9	6	64	1	9	6	2	18	12	0	0	6	54	0	0	0	0	0	0	1	9	0	10
Large 1	4	54	27	7	108	53	4	54	27	336	4	54	27	7	108	53	0	0	27	279	0	0	0	0	0	0	4	54	0	57
Large 2	2	31	15	4	62	31	2	31	15	194	2	31	15	4	62	31	0	31	15	192	0	0	0	0	0	0	2	0	0	2
							300-1000AU			520							300-1000AU			263							300-1000AU			248
							>1000 AU			1,632							>1000 AU			1,032							>1000 AU			590
							Total Broiler			2,152							Total Broiler			1,295							Total Broiler			838
Layers (Wet)																														
SO Region																														
Medium 3	1	3	3	1	5	5	1	3	3	24	1	3	3	1	5	5	1	3	3	24	0	0	0	0	0	0	0	0	0	0
Large 1	7	43	46	14	86	91	7	43	46	383	7	43	46	14	86	91	7	43	46	383	0	0	0	0	0	0	0	0	0	0
							300-1000AU			24							300-1000AU			24							300-1000AU			0
							>1000 AU			383							>1000 AU			383							>1000 AU			0
							Total Wet Layer			407							Total Wet Layer			407							Total Wet Layer			0
Layers (Dry)																														
SO Region																														
Medium 1	0	1	1	1	2	1	0	1	1	8	0	1	1	1	2	1	0	1	1	8	0	0	0	0	0	0	0	0	0	0
Medium 2	0	0	0	0	1	1	0	0	0	4	0	0	0	0	1	1	0	0	0	4	0	0	0	0	0	0	0	0	0	0
Medium 3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Large 1	3	27	28	7	55	56	3	27	28	235	3	27	28	7	55	56	3	27	28	235	0	0	0	0	0	0	0	0	0	0
Large 2	0	3	3	1	6	6	0	3	3	25	0	3	3	1	6	6	0	3	3	25	0	0	0	0	0	0	0	0	0	0
MW Region																														
Medium 1	0	1	1	1	2	1	0	1	1	8	0	1	1	1	2	1	0	1	1	8	0	0	0	0	0	0	0	0	0	0
Medium 2	0	0	0	0	1	1	0	0	0	4	0	0	0	0	1	1	0	0	0	4	0	0	0	0	0	0	0	0	0	0
Medium 3	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0
Large 1	8	46	49	15	91	97	8	46	49	407	8	46	49	15	91	97	8	46	49	407	0	0	0	0	0	0	0	0	0	0
Large 2	1	7	7	2	14	15	1	7	7	62	1	7	7	2	14	15	1	7	7	62	0	0	0	0	0	0	0	0	0	0
							300-1000AU			26							300-1000AU			26							300-1000AU			0
							>1000 AU			729							>1000 AU			729							>1000 AU			0
							Total Dry Layer			755							Total Dry Layer			755							Total Dry Layer			0
Turkeys																														
MA Region																														
Medium 1	0	2	1	0	3	2	0	2	1	11	0	2	1	0	3	2	0	2	1	11	0	0	0	0	0	0	0	0	0	0
Medium 2	0	1	0	0	2	1	0	1	0	6	0	1	0	0	2	1	0	1	0	6	0	0	0	0	0	0	0	0	0	0
Medium 3	0	0	0	0	1	1	0	0	0	3	0	0	0	0	1	1	0	0	0	3	0	0	0	0	0	0	0	0	0	0
Large 1	1	24	16	2	48	32	1	24	16	163	1	24	16	2	48	32	1	24	16	163	0	0	0	0	0	0	0	0	0	0
MW Region																														
Medium 1	0	1	1	0	3	1	0	1	1	9	0	1	1	0	3	1	0	1	1	9	0	0	0	0	0	0	0	0	0	0
Medium 2	0	1	0	0	2	1	0	1	0	5	0	1	0	0	2	1	0	1	0	5	0	0	0	0	0	0	0	0	0	0
Medium 3	0	0	0	0	1	1	0	0	0	3	0	0	0	0	1	1	0	0	0	3	0	0	0	0	0	0	0	0	0	0
Large 1	2	33	22	3	66	43	2	33	22	225	2	33	22	3	66	43	2	33	22	225	0	0	0	0	0	0	0	0	0	0
							300-1000AU			37							300-1000AU			37							300-1000AU			0
							>1000 AU			388							>1000 AU			388							>1000 AU			0
							Total Turkey			425							Total Turkey			425							Total Turkey			0

Table D-2(a)
Option 1
Estimating the Number of Farms
Under Each Achievability Criteria
Farm and Enterprise Stress

Sector/Model	Farm Count by Category										No. of Distress by Category (Farm Level)										No. of Distress by Cat. (Farm plus Enterprise)									
	1L	2L	3L	1M	2M	3M	1H	2H	3H	All	1L	2L	3L	1M	2M	3M	1H	2H	3H	All	1L	2L	3L	1M	2M	3M	1H	2H	3H	All
Beef																														
MW Region																														
Medium 1	15	2	1	30	3	3	15	2	1	73	0	0	0	0	0	0	0	0	0	0	15	2	0	30	3	0	15	2	0	68
Medium 2	8	1	1	17	2	1	8	1	1	40	0	0	0	0	0	0	0	0	0	0	0	0	0	17	2	0	8	1	0	28
Medium 3	4	0	0	8	1	1	4	0	0	20	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Large 1	146	45	24	291	90	47	146	45	24	856	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Large 2	5	36	26	11	71	52	5	36	26	268	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CE Region																														
Medium 1	4	0	0	7	1	1	4	0	0	17	0	0	0	0	0	0	0	0	0	0	4	0	0	7	1	0	4	0	0	16
Medium 2	2	0	0	4	0	0	2	0	0	9	0	0	0	0	0	0	0	0	0	0	0	0	0	4	0	0	2	0	0	7
Medium 3	1	0	0	3	0	0	1	0	0	6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1
Large 1	72	22	12	144	45	23	72	22	12	424	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Large 2	3	17	13	5	36	26	3	17	13	133	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
PA Region																														
Medium 1	0	0	0	1	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	2
Medium 2	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Medium 3	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Large 1	10	3	2	20	6	3	10	3	2	57	0	3	0	0	6	0	0	3	0	12	0	3	0	0	6	0	0	3	0	12
Large 2	0	2	2	1	5	4	0	2	2	17	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
SO Region																														
Medium 1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Medium 2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Medium 3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Large 1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Large 2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MA Region																														
Medium 1	1	0	0	1	0	0	1	0	0	2	0	0	0	0	0	0	0	0	0	0	1	0	0	1	0	0	1	0	0	2
Medium 2	0	0	0	1	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	1
Medium 3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Large 1	1	0	0	3	1	0	1	0	0	8	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Large 2	0	1	0	0	1	0	0	1	0	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
						300-1000AU				173							300-1000AU			0							300-1000AU			126
						>1000 AU				1,766							>1000 AU			12							>1000 AU			12
						Total Beef				1,939							Total Beef			12							Total Beef			138
Veal																														
MW Region																														
Medium 1	0	0	0	1	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Medium 2	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Medium 3	1	0	0	2	0	0	1	0	0	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Large1	3	0	0	6	0	0	3	0	0	12	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CE Region																														
Medium 1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Medium 2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Medium 3	0	0	0	1	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
PA Region																														0
Medium 1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0										
Medium 2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Medium 3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
SO Region																														
Medium 1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Medium 2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Medium 3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MA Region																														
Medium 1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Medium 2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Medium 3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
						300-1000AU				8							300-1000AU			0							300-1000AU			0
						>1000 AU				12							>1000 AU			0							>1000 AU			0
						Total Veal				20							Total Veal			0							Total Veal			0
Heifers																														
MW Region																														
Medium 1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	31	3	0	35	0	0	0	0	0	0	31	3	0	35
Medium 2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Medium 3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Large 1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CE Region																														
Medium 1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	2	0	0	0	0	0	0	2	0	0	2
Medium 2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Medium 3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Large 1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Table D-2(a)
Option 1
Estimating the Number of Farms
Under Each Achievability Criteria
Farm and Enterprise Stress

Sector/Model	Farm Count by Category										No. of Distress by Category (Farm Level)										No. of Distress by Cat. (Farm plus Enterprise)									
	1L	2L	3L	1M	2M	3M	1H	2H	3H	All	1L	2L	3L	1M	2M	3M	1H	2H	3H	All	1L	2L	3L	1M	2M	3M	1H	2H	3H	All
PA Region																														
Medium 1	1	0	0	2	0	0	1	0	0	4	0	0	0	0	0	0	1	0	0	1	0	0	0	0	0	0	1	0	0	1
Medium 2	1	0	0	3	0	0	1	0	0	7	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Medium 3	1	0	0	1	0	0	1	0	0	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Large 1	16	5	3	33	10	5	16	5	3	97	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
SO Region																														
Medium 1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Medium 2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Medium 3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Large 1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MA Region																														
Medium 1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Medium 2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Medium 3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Large 1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
						300-1000AU				13						300-1000AU				38						300-1000AU				38
						>1000 AU				97						>1000 AU				0						>1000 AU				0
						Total Heifer				110						Total Heifer				38						Total Heifer				38
Dairy- Flush																														
PA Region																														
Medium 1	5	4	1	10	7	3	5	4	1	41	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Medium 2	2	1	1	4	3	1	2	1	1	15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Medium 3	2	1	1	4	3	1	2	1	1	15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Large 1	38	72	31	77	145	63	38	72	31	569	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MW Region																														
Medium 1	15	11	4	30	22	8	15	11	4	120	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Medium 2	5	4	2	11	8	3	5	4	2	43	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Medium 3	1	1	0	2	1	0	1	1	0	7	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Large 1	3	6	3	6	12	5	3	6	3	47	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CE Region																														
Medium 1	8	6	2	17	12	5	8	6	2	67	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Medium 2	3	2	1	6	4	2	3	2	1	24	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Medium 3	2	1	0	3	2	1	2	1	0	13	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Large 1	20	38	17	41	77	33	20	38	17	301	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
SO Region																														
Medium 1	6	5	2	12	9	3	6	5	2	50	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Medium 2	2	2	1	5	3	1	2	2	1	18	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Medium 3	1	1	0	2	2	1	1	1	0	8	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Large 1	5	9	4	9	17	7	5	9	4	68	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MA Region																														
Medium 1	17	12	5	34	24	9	17	12	5	134	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Medium 2	6	4	2	12	9	3	6	4	2	48	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Medium 3	1	1	0	2	2	1	1	1	0	10	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Large 1	4	7	3	7	13	6	4	7	3	52	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Dairy- Hose																														
PA Region																														
Medium 1	5	4	1	10	7	3	5	4	1	41	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Medium 2	2	1	1	4	3	1	2	1	1	15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Medium 3	2	1	1	4	3	1	2	1	1	15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Large 1	13	24	10	26	49	21	13	24	10	190	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MW Region																														
Medium 1	45	32	13	90	64	25	45	32	13	358	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Medium 2	16	12	5	32	23	9	16	12	5	129	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Medium 3	2	2	1	5	3	1	2	2	1	19	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Large 1	3	6	3	6	12	5	3	6	3	48	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CE Region																														
Medium 1	8	6	2	17	12	5	8	6	2	67	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Medium 2	3	2	1	6	4	2	3	2	1	24	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Medium 3	2	1	0	3	2	1	2	1	0	12	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Large 1	7	13	6	14	26	11	7	13	6	100	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
SO Region																														
Medium 1	6	5	2	12	9	3	6	5	2	50	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Medium 2	2	2	1	5	3	1	2	2	1	18	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Medium 3	1	1	0	2	1	1	1	1	0	7	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Large 1	2	3	1	3	6	2	2	3	1	23	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MA Region																														
Medium 1	51	36	14	101	73	28	51	36	14	404	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Medium 2	18	13	5	37	26	10	18	13	5	146	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Medium 3	4	3	1	8	6	2	4	3	1	31	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Large 1	4	7	3	7	13	6	4	7	3	52	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
						300-1000AU				1,948						300-1000AU				0						300-1000AU				0
						>1000 AU				1,450						>1000 AU				0						>1000 AU				0
						Total Dairy				3,398						Total Dairy				0						Total Dairy				0

Table D-2(a)
Option 1
Estimating the Number of Farms
Under Each Achievability Criteria
Farm and Enterprise Stress

Sector/Model	Farm Count by Category										No. of Distress by Category (Farm Level)										No. of Distress by Cat. (Farm plus Enterprise)									
	1L	2L	3L	1M	2M	3M	1H	2H	3H	All	1L	2L	3L	1M	2M	3M	1H	2H	3H	All	1L	2L	3L	1M	2M	3M	1H	2H	3H	All
Hogs Liquid (GFInd)																														
MW Region																														
Medium 1	12	1	2	23	2	3	12	1	2	56	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Medium 2	6	1	1	12	2	2	6	1	1	32	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Medium 3	3	0	1	7	1	1	3	0	1	19	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Large 1	12	4	7	24	9	14	12	4	7	92	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Large 2	9	3	5	17	6	10	9	3	5	66	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MA Region																														
Medium 1	3	1	1	6	2	2	3	1	1	20	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Medium 2	2	2	1	4	4	2	2	2	1	19	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Medium 3	1	1	1	2	2	1	1	1	1	11	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Large 1	13	32	11	25	64	22	13	32	11	225	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Large 2	9	23	8	18	46	16	9	23	8	161	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Hogs Liquid (FFInd)																														
MW Region																														
Medium 1	45	3	7	90	6	14	45	3	7	221	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Medium 2	18	3	4	36	5	7	18	3	4	97	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Medium 3	9	1	2	18	2	4	9	1	2	47	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Large 1	40	14	22	79	28	45	40	14	22	305	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Large 2	28	10	16	57	20	32	28	10	16	219	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MA Region																														
Medium 1	7	2	2	14	4	4	7	2	2	44	v	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Medium 2	3	3	2	6	6	3	3	3	2	31	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Medium 3	2	1	1	3	3	2	2	1	1	15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Large 1	15	38	13	30	77	27	15	38	13	267	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Large 2	11	27	10	22	55	19	11	27	10	192	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Hogs Pit (GFInd)																														
MW Region																														
Medium 1	24	2	4	48	3	7	24	2	4	118	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Medium 2	12	2	2	25	3	5	12	2	2	66	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Medium 3	7	1	1	15	2	3	7	1	1	39	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Large 1	29	10	16	58	21	33	29	10	16	223	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Large 2	21	7	12	42	15	24	21	7	12	160	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MA Region																														
Medium 1	1	0	0	2	1	1	1	0	0	7	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Medium 2	1	1	0	1	1	1	1	1	0	7	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Medium 3	0	0	0	1	1	0	0	0	0	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Large 1	8	19	7	15	39	13	8	19	7	135	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Large 2	5	14	5	11	28	10	5	14	5	97	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Hogs Pit (FFInd)																														
MW Region																														
Medium 1	55	4	8	110	8	17	55	4	8	269	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Medium 2	22	3	4	44	6	9	22	3	4	119	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Medium 3	11	2	2	21	3	4	11	2	2	58	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Large 1	51	18	29	102	37	58	51	18	29	394	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Large 2	37	13	21	74	26	42	37	13	21	283	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MA Region																														
Medium 1	1	0	0	2	1	1	1	0	0	7	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Medium 2	1	1	0	1	1	1	1	1	0	5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Medium 3	0	0	0	1	0	0	0	0	0	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Large 1	5	12	4	9	24	8	5	12	4	84	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Large 2	3	9	3	7	17	6	3	9	3	60	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Hogs Evaporatic																														
CE Region (GFInd)																														
Large 1	3	4	2	6	7	5	3	4	2	35	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Large 2	2	3	2	4	5	4	2	3	2	25	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CE Region (FFInd)																														
Large 1	6	8	6	12	16	11	6	8	6	78	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Large 2	4	6	4	9	11	8	4	6	4	56	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Hogs Liquid (GPCont)																														
MW Region																														
Medium 1	6	0	1	12	1	2	6	0	1	29	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Medium 2	3	0	1	6	1	1	3	0	1	16	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Medium 3	2	0	0	4	1	1	2	0	0	10	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Large 1	15	5	9	31	11	17	15	5	9	118	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Large 2	11	4	6	22	8	12	11	4	6	84	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Hogs Pit (GPCont)																														
MW Region																														
Medium 1	12	1	2	25	2	4	12	1	2	61	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Medium 2	6	1	1	13	2	3	6	1	1	34	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Medium 3	4	1	1	8	1	2	4	1	1	20	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Large 1	37	13	21	74	26	42	37	13	21	284	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Large 2	26	9	15	53	19	30	26	9	15	203	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Table D-2(a)
Option 1
Estimating the Number of Farms
Under Each Achievability Criteria
Farm and Enterprise Stress

Sector/Model	Farm Count by Category										No. of Distress by Category (Farm Level)										No. of Distress by Cat. (Farm plus Enterprise)									
	1L	2L	3L	1M	2M	3M	1H	2H	3H	All	1L	2L	3L	1M	2M	3M	1H	2H	3H	All	1L	2L	3L	1M	2M	3M	1H	2H	3H	All
Hogs Evaporate																														
CE Region (GF)																														
Large 1	4	5	3	7	9	6	4	5	3	45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Large 2	3	3	2	5	7	5	3	3	2	32	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
						300-1000AU				1,485						300-1000AU				0						300-1000AU				0
						>1000 AU				3,924						>1000 AU				0						>1000 AU				0
						Total Hog				5,409						Total Hog				0						Total Hog				0
Broilers																														
SO Region																														
Medium 1	2	14	7	4	27	14	2	14	7	90	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Medium 2	1	23	9	3	46	18	1	23	9	133	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Medium 3	1	21	8	2	42	16	1	21	8	120	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Large 1	3	125	46	7	250	91	3	125	46	698	0	0	0	0	0	0	3	0	0	3	0	0	0	0	0	0	3	0	0	3
Large 2	2	72	26	4	145	53	2	72	26	404	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MA Region																														
Medium 1	2	5	6	3	10	11	2	5	6	48	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Medium 2	2	8	6	3	16	12	2	8	6	64	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Medium 3	2	8	6	3	16	12	2	8	6	64	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Large 1	7	50	27	15	100	53	7	50	27	336	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Large 2	4	29	15	8	58	31	4	29	15	194	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
						300-1000AU				520						300-1000AU				0						300-1000AU				3
						>1000 AU				1,632						>1000 AU				3						>1000 AU				0
						Total Broiler				2,152						Total Broiler				3						Total Broiler				3
Layers (Wet)																														
SO Region																														
Medium 3	1	2	3	2	5	5	1	2	3	24	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Large 1	10	40	46	21	79	91	10	40	46	383	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
						300-1000AU				24						300-1000AU				0						300-1000AU				0
						>1000 AU				383						>1000 AU				0						>1000 AU				0
						Total Wet Layer				407						Total Wet Layer				0						Total Wet Layer				0
Layers (Dry)																														
SO Region																														
Medium 1	1	1	1	1	2	1	1	1	1	8	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Medium 2	0	0	0	0	1	1	0	0	0	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Medium 3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Large 1	6	24	28	13	49	56	6	24	28	235	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Large 2	1	3	3	1	5	6	1	3	3	25	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MW Region																														
Medium 1	1	1	1	1	2	1	1	1	1	8	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Medium 2	0	0	0	0	1	1	0	0	0	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Medium 3	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Large 1	11	42	49	22	84	97	11	42	49	407	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Large 2	2	6	7	3	13	15	2	6	7	62	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
						300-1000AU				26						300-1000AU				0						300-1000AU				0
						>1000 AU				729						>1000 AU				0						>1000 AU				0
						Total Dry Layer				755						Total Dry Layer				0						Total Dry Layer				0
Turkeys																														
MA Region																														
Medium 1	0	1	1	1	3	2	0	1	1	11	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Medium 2	0	1	0	0	2	1	0	1	0	6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Medium 3	0	0	0	0	1	1	0	0	0	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Large 1	3	22	16	6	44	32	3	22	16	163	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MW Region																														
Medium 1	0	1	1	1	2	1	0	1	1	9	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Medium 2	0	1	0	0	2	1	0	1	0	5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Medium 3	0	0	0	0	1	1	0	0	0	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Large 1	4	30	22	8	61	43	4	30	22	225	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
						300-1000AU				37						300-1000AU				0						300-1000AU				0
						>1000 AU				388						>1000 AU				0						>1000 AU				0
						Total Turkey				425						Total Turkey				0						Total Turkey				0

Table D-2(b)
Option 2
Estimating the Number of Farms
Under Each Achievability Criteria
Farm and Enterprise Stress

Sector/Model	Farm Count by Category										No. of Distress by Category (Farm Level)										No. of Distress by Cat. (Farm plus Enterprise)									
	1L	2L	3L	1M	2M	3M	1H	2H	3H	All	1L	2L	3L	1M	2M	3M	1H	2H	3H	All	1L	2L	3L	1M	2M	3M	1H	2H	3H	All
Beef																														
MW Region																														
Medium 1	15	2	1	29	4	3	15	2	1	73	0	0	0	0	0	0	0	2	0	2	15	2	0	29	4	3	15	2	1	71
Medium 2	8	1	1	16	2	1	8	1	1	40	0	0	0	0	0	0	0	0	0	0	8	1	0	16	2	0	8	1	0	37
Medium 3	4	1	0	8	1	1	4	1	0	20	0	0	0	0	0	0	0	1	0	1	4	1	0	8	1	0	4	1	0	18
Large 1	139	52	24	277	104	47	139	52	24	856	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Large 2	5	36	26	10	72	52	5	36	26	268	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CE Region																														
Medium 1	3	1	0	6	1	1	3	1	0	17	0	0	0	0	0	0	0	1	0	1	3	1	0	6	1	1	3	1	0	17
Medium 2	2	0	0	4	1	0	2	0	0	9	0	0	0	0	0	0	2	0	0	2	2	0	0	4	1	0	2	0	0	9
Medium 3	1	0	0	2	1	0	1	0	0	6	0	0	0	0	0	0	0	0	0	0	1	0	0	2	1	0	1	0	0	6
Large 1	49	46	12	97	91	23	49	46	12	424	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Large 2	2	19	13	3	38	26	2	19	13	133	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
PA Region																														
Medium 1	0	0	0	1	0	0	0	0	0	2	0	0	0	1	0	0	0	0	0	2	0	0	0	1	0	0	0	0	0	2
Medium 2	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	1
Medium 3	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	1
Large 1	6	7	2	12	14	3	6	7	2	57	0	7	2	0	14	3	6	7	2	40	0	7	2	0	14	3	6	7	2	40
Large 2	0	2	2	0	5	4	0	2	2	17	0	0	2	0	0	4	0	0	2	7	0	0	2	0	0	4	0	0	2	7
SO Region																														
Medium 1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Medium 2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Medium 3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Large 1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Large 2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MA Region																														
Medium 1	0	0	0	1	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	1	0	0	0	1	0	0	0	0	0	2
Medium 2	0	0	0	1	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	1
Medium 3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Large 1	1	1	0	2	1	0	1	1	0	8	0	0	0	0	0	0	0	1	0	2	0	0	0	0	0	0	0	1	0	2
Large 2	0	1	0	0	1	0	0	1	0	3	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	1
						300-1000AU				173						300-1000AU				10						300-1000AU				167
						>1000 AU				1,766						>1000 AU				49						>1000 AU				49
						Total Beef				1,939						Total Beef				59						Total Beef				216
Veal																														
MW Region																														
Medium 1	0	0	0	1	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Medium 2	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Medium 3	1	0	0	2	0	0	1	0	0	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Large1	3	0	0	6	0	0	3	0	0	12	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CE Region																														
Medium 1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Medium 2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Medium 3	0	0	0	1	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
PA Region																														0
Medium 1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Medium 2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Medium 3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
SO Region																														
Medium 1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Medium 2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Medium 3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MA Region																														
Medium 1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Medium 2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Medium 3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
						300-1000AU				8						300-1000AU				0						300-1000AU				0
						>1000 AU				12						>1000 AU				0						>1000 AU				0
						Total Veal				20						Total Veal				0						Total Veal				0
Heifers																														
MW Region																														
Medium 1	30	4	3	61	9	5	30	4	3	150	0	0	0	0	0	0	30	4	0	35	0	0	0	0	0	0	30	4	0	35
Medium 2	4	1	0	8	1	1	4	1	0	20	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Medium 3	2	0	0	3	0	0	2	0	0	8	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Large 1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CE Region																														
Medium 1	2	0	0	3	1	0	2	0	0	8	0	0	0	0	0	0	2	0	0	2	0	0	0	0	0	0	2	0	0	2
Medium 2	4	1	0	8	2	1	4	1	0	22	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Medium 3	2	0	0	3	1	0	2	0	0	9	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Large 1	17	16	4	34	31	8	17	16	4	145	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Table D-2(b)
Option 2
Estimating the Number of Farms
Under Each Achievability Criteria
Farm and Enterprise Stress

Sector/Model	Farm Count by Category										No. of Distress by Category (Farm Level)										No. of Distress by Cat. (Farm plus Enterprise)									
	1L	2L	3L	1M	2M	3M	1H	2H	3H	All	1L	2L	3L	1M	2M	3M	1H	2H	3H	All	1L	2L	3L	1M	2M	3M	1H	2H	3H	All
PA Region																														
Medium 1	1	0	0	1	0	0	1	0	0	4	0	0	0	1	0	0	1	0	0	3	0	0	0	1	0	0	1	0	0	3
Medium 2	1	0	0	2	1	0	1	0	0	7	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	1
Medium 3	0	0	0	1	0	0	0	0	0	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Large 1	10	12	3	20	24	5	10	12	3	97	0	0	3	0	0	5	0	12	3	22	0	0	3	0	0	5	0	12	3	22
SO Region																														
Medium 1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Medium 2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Medium 3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Large 1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MA Region																														
Medium 1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Medium 2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Medium 3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Large 1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
						300-1000AU				230						300-1000AU				41						300-1000AU				41
						>1000 AU				242						>1000 AU				22						>1000 AU				22
						Total Heifer				472						Total Heifer				63						Total Heifer				63
Dairy- Flush																														
PA Region																														
Medium 1	4	5	1	7	10	3	4	5	1	41	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Medium 2	1	2	1	3	4	1	1	2	1	15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Medium 3	1	2	1	3	4	1	1	2	1	15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Large 1	24	87	31	48	174	63	24	87	31	569	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MW Region																														
Medium 1	12	14	4	24	28	8	12	14	4	120	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Medium 2	4	5	2	9	10	3	4	5	2	43	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Medium 3	1	1	0	1	1	0	1	1	0	7	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Large 1	2	7	3	5	13	5	2	7	3	47	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CE Region																														
Medium 1	6	8	2	13	16	5	6	8	2	67	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Medium 2	2	3	1	5	6	2	2	3	1	24	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Medium 3	1	2	0	2	3	1	1	2	0	13	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Large 1	16	42	17	33	85	33	16	42	17	301	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
SO Region																														
Medium 1	6	5	2	11	10	3	6	5	2	50	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Medium 2	2	2	1	4	4	1	2	2	1	18	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Medium 3	1	1	0	2	2	1	1	1	0	8	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Large 1	3	10	4	7	20	7	3	10	4	68	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MA Region																														
Medium 1	13	16	5	26	32	9	13	16	5	134	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Medium 2	5	6	2	9	12	3	5	6	2	48	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Medium 3	1	1	0	2	2	1	1	1	0	10	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Large 1	2	8	3	5	16	6	2	8	3	52	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Dairy- Hose																														
PA Region																														
Medium 1	4	5	1	7	10	3	4	5	1	41	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Medium 2	1	2	1	3	4	1	1	2	1	15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Medium 3	1	2	1	3	4	1	1	2	1	15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Large 1	8	29	10	16	59	21	8	29	10	190	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MW Region	0	0	0	0	0	0	0	0	0	0																				
Medium 1	35	42	13	71	83	25	35	42	13	358	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Medium 2	13	15	5	25	30	9	13	15	5	129	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Medium 3	2	2	1	4	4	1	2	2	1	19	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Large 1	2	7	3	5	14	5	2	7	3	48	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CE Region																														
Medium 1	6	8	2	13	16	5	6	8	2	67	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Medium 2	2	3	1	5	6	2	2	3	1	24	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Medium 3	1	1	0	2	3	1	1	1	0	12	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Large 1	5	14	6	11	28	11	5	14	6	100	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
SO Region																														
Medium 1	6	5	2	11	10	3	6	5	2	50	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Medium 2	2	2	1	4	4	1	2	2	1	18	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Medium 3	1	1	0	2	2	1	1	1	0	7	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Large 1	1	3	1	2	6	2	1	3	1	23	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MA Region																														
Medium 1	39	48	14	77	96	28	39	48	14	404	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Medium 2	14	17	5	28	35	10	14	17	5	146	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Medium 3	3	4	1	6	7	2	3	4	1	31	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Large 1	2	8	3	5	16	6	2	8	3	52	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
						300-1000AU				1,948						300-1000AU				0						300-1000AU				0
						>1000 AU				1,450						>1000 AU				0						>1000 AU				0
						Total Dairy				3,398						Total Dairy				0						Total Dairy				0

Table D-2(b)
Option 2
Estimating the Number of Farms
Under Each Achievability Criteria
Farm and Enterprise Stress

Sector/Model	Farm Count by Category									
	1L	2L	3L	1M	2M	3M	1H	2H	3H	All
Hogs Liquid (GFInd)										
MW Region										
Medium 1	10	2	2	21	4	3	10	2	2	56
Medium 2	5	2	1	10	4	2	5	2	1	32
Medium 3	3	1	1	6	2	1	3	1	1	19
Large 1	8	8	7	16	16	14	8	8	7	92
Large 2	6	6	5	12	12	10	6	6	5	66
MA Region										
Medium 1	3	2	1	5	3	2	3	2	1	20
Medium 2	1	2	1	3	5	2	1	2	1	19
Medium 3	1	1	1	2	3	1	1	1	1	11
Large 1	7	38	11	13	77	22	7	38	11	225
Large 2	5	28	8	9	55	16	5	28	8	161
Hogs Liquid (FFInd)										
MW Region										
Medium 1	41	7	7	82	15	14	41	7	7	221
Medium 2	15	6	4	30	11	7	15	6	4	97
Medium 3	7	3	2	15	5	4	7	3	2	47
Large 1	27	27	22	54	54	45	27	27	22	305
Large 2	19	19	16	39	38	32	19	19	16	219
MA Region										
Medium 1	5	3	2	11	7	4	5	3	2	44
Medium 2	2	4	2	4	8	3	2	4	2	31
Medium 3	1	2	1	2	4	2	1	2	1	15
Large 1	8	46	13	16	91	27	8	46	13	267
Large 2	6	33	10	11	65	19	6	33	10	192
Hogs Pit (GFInd)										
MW Region										
Medium 1	22	4	4	44	8	7	22	4	4	118
Medium 2	10	4	2	21	8	5	10	4	2	66
Medium 3	6	2	1	12	4	3	6	2	1	39
Large 1	20	20	16	39	39	33	20	20	16	223
Large 2	14	14	12	28	28	24	14	14	12	160
MA Region										
Medium 1	1	1	0	2	1	1	1	1	0	7
Medium 2	0	1	0	1	2	1	0	1	0	7
Medium 3	0	0	0	1	1	0	0	0	0	4
Large 1	4	23	7	8	46	13	4	23	7	135
Large 2	3	17	5	6	33	10	3	17	5	97
Hogs Pit (FFInd)										
MW Region										
Medium 1	50	9	8	100	18	17	50	9	8	269
Medium 2	18	7	4	37	13	9	18	7	4	119
Medium 3	9	3	2	18	7	4	9	3	2	58
Large 1	35	35	29	70	69	58	35	35	29	394
Large 2	25	25	21	50	50	42	25	25	21	283
MA Region										
Medium 1	1	1	0	2	1	1	1	1	0	7
Medium 2	0	1	0	1	1	1	0	1	0	5
Medium 3	0	0	0	0	1	0	0	0	0	1
Large 1	2	14	4	5	29	8	2	14	4	84
Large 2	2	10	3	4	21	6	2	10	3	60
Hogs Evaporate										
CE Region (GFInd)										
Large 1	2	4	2	4	9	5	2	4	2	35
Large 2	1	3	2	3	6	4	1	3	2	25
CE Region (FFInd	0	0	0	0	0	0	0	0	0	0
Large 1	4	10	6	9	19	11	4	10	6	78
Large 2	3	7	4	6	14	8	3	7	4	56
Hogs Liquid (GFCont)										
MW Region										
Medium 1	5	1	1	11	2	2	5	1	1	29
Medium 2	3	1	1	5	2	1	3	1	1	16
Medium 3	2	1	0	3	1	1	2	1	0	10
Large 1	10	10	9	21	21	17	10	10	9	118
Large 2	7	7	6	15	15	12	7	7	6	84
Hogs Pit (GFCont)										
MW Region										
Medium 1	11	2	2	23	4	4	11	2	2	61
Medium 2	5	2	1	11	4	3	5	2	1	34
Medium 3	3	1	1	6	2	2	3	1	1	20
Large 1	25	25	21	50	50	42	25	25	21	284
Large 2	18	18	15	36	36	30	18	18	15	203

Sector/Model	No. of Distress by Category (Farm Level)									
	1L	2L	3L	1M	2M	3M	1H	2H	3H	All
Hogs Liquid (GFInd)										
MW Region										
Medium 1	0	0	0	0	0	0	0	0	0	0
Medium 2	0	0	0	0	0	0	0	0	0	0
Medium 3	0	0	0	0	0	0	0	0	0	0
Large 1	0	0	0	0	0	0	0	0	0	0
Large 2	0	0	0	0	0	0	0	0	0	0
MA Region										
Medium 1	0	0	0	0	0	0	0	0	0	0
Medium 2	0	0	0	0	0	0	0	0	0	0
Medium 3	0	0	0	0	0	0	0	0	0	0
Large 1	0	0	0	0	0	0	0	0	0	0
Large 2	0	0	0	0	0	0	0	0	0	0
Hogs Liquid (FFInd)										
MW Region										
Medium 1	0	0	0	0	0	0	0	0	0	0
Medium 2	0	0	0	0	0	0	0	0	0	0
Medium 3	0	0	0	0	0	0	0	0	0	0
Large 1	0	0	0	0	0	0	0	0	0	0
Large 2	0	0	0	0	0	0	0	0	0	0
MA Region										
Medium 1	0	0	0	0	0	0	0	0	0	0
Medium 2	0	0	0	0	0	0	0	0	0	0
Medium 3	0	0	0	0	0	0	0	0	0	0
Large 1	0	0	0	0	0	0	0	0	0	0
Large 2	0	0	0	0	0	0	0	0	0	0
Hogs Pit (GFInd)										
MW Region										
Medium 1	0	0	0	0	0	0	0	0	0	0
Medium 2	0	0	0	0	0	0	0	0	0	0
Medium 3	0	0	0	0	0	0	0	0	0	0
Large 1	0	0	0	0	0	0	0	0	0	0
Large 2	0	0	0	0	0	0	0	0	0	0
MA Region										
Medium 1	0	0	0	0	0	0	0	0	0	0
Medium 2	0	0	0	0	0	0	0	0	0	0
Medium 3	0	0	0	0	0	0	0	0	0	0
Large 1	0	23	7	0	46	13	0	23	7	119
Large 2	0	17	5	0	33	10	0	17	5	85
Hogs Pit (FFInd)										
MW Region										
Medium 1	0	0	0	0	0	0	0	0	0	0
Medium 2	0	0	0	0	0	0	0	0	0	0
Medium 3	0	0	0	0	0	0	0	0	0	0
Large 1	0	0	0	0	0	0	0	0	0	0
Large 2	0	0	0	0	0	0	0	0	0	0
MA Region										
Medium 1	0	0	0	0	0	0	0	0	0	0
Medium 2	0	0	0	0	0	0	0	0	0	0
Medium 3	0	0	0	0	0	0	0	0	0	0
Large 1	0	0	0	0	0	0	0	0	0	0
Large 2	0	0	0	0	0	0	0	0	0	0
Hogs Evaporate										
CE Region (GFInd)										
Large 1	0	0	0	0	0	0	0	0	0	0
Large 2	0	0	0	0	0	0	0	0	0	0
CE Region (FFInd										
Large 1	0	0	0	0	0	0	0	0	0	0
Large 2	0	0	0	0	0	0	0	0	0	0
Hogs Liquid (GFCont)										
MW Region										
Medium 1	0	0	0	0	0	0	0	0	0	0
Medium 2	0	0	0	0	0	0	0	0	0	0
Medium 3	0	0	0	0	0	0	0	0	0	0
Large 1	0	0	0	0	0	0	0	0	0	0
Large 2	0	0	0	0	0	0	0	0	0	0
Hogs Pit (GFCont)										
MW Region										
Medium 1	0	0	0	0	0	0	0	0	0	0
Medium 2	0	0	0	0	0	0	0	0	0	0
Medium 3	0	0	0	0	0	0	0	0	0	0
Large 1	0	0	0	0	0	0	0	0	0	0
Large 2	0	0	0	0	0	0	0	0	0	0

Sector/Model	No. of Distress by Cat. (Farm plus Enterprise)									
	1L	2L	3L	1M	2M	3M	1H	2H	3H	All
Hogs Liquid (GFInd)										
MW Region										
Medium 1	0	0	0	0	0	0	0	0	0	0
Medium 2	0	0	0	0	0	0	0	0	0	0
Medium 3	0	0	0	0	0	0	0	0	0	0
Large 1	0	0	0	0	0	0	0	0	0	0
Large 2	0	0	0	0	0	0	0	0	0	0
MA Region										
Medium 1	0	0	0	0	0	0	0	0	0	0
Medium 2	0	0	0	0	0	0	0	0	0	0
Medium 3	0	0	0	0	0	0	0	0	0	0
Large 1	0	0	0	0	0	0	0	0	0	0
Large 2	0	0	0	0	0	0	0	0	0	0
Hogs Liquid (FFInd)										
MW Region										
Medium 1	0	0	0	0	0	0	0	0	0	0
Medium 2	0	0	0	0	0	0	0	0	0	0
Medium 3	0	0	0	0	0	0	0	0	0	0
Large 1	0	0	0	0	0	0	0	0	0	0
Large 2	0	0	0	0	0	0	0	0	0	0
MA Region										
Medium 1	0	0	0	0	0	0	0	0	0	0
Medium 2	0	0	0	0	0	0	0	0	0	0
Medium 3	0	0	0	0	0	0	0	0	0	0
Large 1	0	0	0	0	0	0	0	0	0	0
Large 2	0	0	0	0	0	0	0	0	0	0
Hogs Pit (GFInd)										
MW Region										
Medium 1	0	0	0	0	0	0	0	0	0	0
Medium 2	0	0	0	0	0	0	0	0	0	0
Medium 3	0	0	0	0	0	0	0	0	0	0
Large 1	0	0	0	0	0	0	0	0	0	0
Large 2	0	0	0	0	0	0	0	0	0	0
MA Region										
Medium 1	0	0	0	0	0	0	0	0	0	0
Medium 2	0	0	0	0	0	0	0	0	0	0
Medium 3	0	0	0	0	0	0	0	0	0	0
Large 1	0	23	7	0	46	13	0	23	7	119
Large 2	0	17	5	0	33	10	0	17	5	85
Hogs Pit (FFInd)										
MW Region										
Medium 1	0	0	0	0	0	0	0	0	0	0
Medium 2	0	0	0	0	0	0	0	0	0	0
Medium 3	0	0	0	0	0	0	0	0	0	0
Large 1	0	0	0	0	0	0	0	0	0	0
Large 2	0	0	0	0	0	0	0	0	0	0
MA Region										
Medium 1	0	0	0	0	0	0	0	0	0	0
Medium 2	0	0	0	0	0	0	0	0	0	0
Medium 3	0	0	0	0	0	0	0	0	0	0
Large 1	0	0	0	0	0	0	0	0	0	0
Large 2	0	0	0	0	0	0	0	0	0	0
Hogs Evaporate										
CE Region (GFInd)										
Large 1	0	0	0	0	0	0	0	0	0	0
Large 2	0	0	0	0	0	0	0	0	0	0
CE Region (FFInd										
Large 1	0	0	0	0	0	0	0	0	0	0
Large 2	0	0	0	0	0	0	0	0	0	0
Hogs Liquid (GFCont)										
MW Region										
Medium 1	0	0	0	0	0	0	0	0	0	0
Medium 2	0	0	0	0	0	0	0	0	0	0
Medium 3	0	0	0	0	0	0	0	0	0	0
Large 1	0	0	0	0	0	0	0	0	0	0
Large 2	0	0	0	0	0	0	0	0	0	0
Hogs Pit (GFCont)										
MW Region										
Medium 1	0	0	0	0	0	0	0	0	0	0
Medium 2	0	0	0	0	0	0	0	0	0	0
Medium 3	0	0	0	0	0	0	0	0	0	0
Large 1	0	0	0	0	0	0	0	0	0	0
Large 2	0	0	0	0	0	0	0	0	0	0

Table D-2(b)
Option 2
Estimating the Number of Farms
Under Each Achievability Criteria
Farm and Enterprise Stress

Sector/Model	Farm Count by Category										No. of Distress by Category (Farm Level)										No. of Distress by Cat. (Farm plus Enterprise)									
	1L	2L	3L	1M	2M	3M	1H	2H	3H	All	1L	2L	3L	1M	2M	3M	1H	2H	3H	All	1L	2L	3L	1M	2M	3M	1H	2H	3H	All
Hogs Evaporate																														
CE Region (GF)																														
Large 1	2	6	3	5	11	6	2	6	3	45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Large 2	2	4	2	4	8	5	2	4	2	32	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
						300-1000AU				1,484						300-1000AU				0						300-1000AU				0
						>1000 AU				3,924						>1000 AU				204						>1000 AU				204
						Total Hog				5,408						Total Hog				204						Total Hog				204
Broilers																														
SO Region																														
Medium 1	2	14	7	3	28	14	2	14	7	90	0	0	0	3	0	0	2	0	0	5	0	0	0	3	0	0	2	0	0	5
Medium 2	1	23	9	2	46	18	1	23	9	133	0	0	0	2	0	0	1	0	0	4	0	0	0	2	0	0	1	0	0	4
Medium 3	1	21	8	2	42	16	1	21	8	120	0	0	0	0	0	0	1	0	0	1	0	0	0	0	0	0	1	0	0	1
Large 1	3	126	46	6	252	91	3	126	46	698	0	0	0	6	0	0	3	0	0	8	0	0	0	6	0	0	3	0	0	8
Large 2	2	73	26	3	146	53	2	73	26	404	0	0	0	0	0	0	2	0	0	2	0	0	0	0	0	0	2	0	0	2
MA Region																														
Medium 1	1	5	6	2	11	11	1	5	6	48	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Medium 2	1	9	6	2	18	12	1	9	6	64	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Medium 3	1	9	6	2	18	12	1	9	6	64	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Large 1	4	54	27	7	108	53	4	54	27	336	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Large 2	2	31	15	4	62	31	2	31	15	194	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
						300-1000AU				520						300-1000AU				10						300-1000AU				10
						>1000 AU				1,632						>1000 AU				10						>1000 AU				10
						Total Broiler				2,152						Total Broiler				19						Total Broiler				19
Layers (Wet)																														
SO Region																														
Medium 3	1	3	3	1	5	5	1	3	3	24	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Large 1	7	43	46	14	86	91	7	43	46	383	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
						300-1000AU				24						300-1000AU				0						300-1000AU				0
						>1000 AU				383						>1000 AU				0						>1000 AU				0
						Total Wet Layer				407						Total Wet Layer				0						Total Wet Layer				0
Layers (Dry)																														
SO Region																														
Medium 1	0	1	1	1	2	1	0	1	1	8	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Medium 2	0	0	0	0	1	1	0	0	0	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Medium 3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Large 1	3	27	28	7	55	56	3	27	28	235	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Large 2	0	3	3	1	6	6	0	3	3	25	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MW Region																														
Medium 1	0	1	1	1	2	1	0	1	1	8	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Medium 2	0	0	0	0	1	1	0	0	0	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Medium 3	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Large 1	8	46	49	15	91	97	8	46	49	407	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Large 2	1	7	7	2	14	15	1	7	7	62	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
						300-1000AU				26						300-1000AU				0						300-1000AU				0
						>1000 AU				729						>1000 AU				0						>1000 AU				0
						Total Dry Layer				755						Total Dry Layer				0						Total Dry Layer				0
Turkeys																														
MA Region																														
Medium 1	0	2	1	0	3	2	0	2	1	11	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Medium 2	0	1	0	0	2	1	0	1	0	6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Medium 3	0	0	0	0	1	1	0	0	0	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Large 1	1	24	16	2	48	32	1	24	16	163	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MW Region																														
Medium 1	0	1	1	0	3	1	0	1	1	9	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Medium 2	0	1	0	0	2	1	0	1	0	5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Medium 3	0	0	0	0	1	1	0	0	0	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Large 1	2	33	22	3	66	43	2	33	22	225	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
						300-1000AU				37						300-1000AU				0						300-1000AU				0
						>1000 AU				388						>1000 AU				0						>1000 AU				0
						Total Turkey				425						Total Turkey				0						Total Turkey				0

APPENDIX E

COST-EFFECTIVENESS ANALYSIS

As part of the process of setting effluent limitations guidelines (ELG) and developing standards, EPA uses cost-effectiveness calculations to compare the efficiencies of regulatory options for removing priority and nonconventional pollutants.[1] Although not required by the Clean Water Act, a cost-effectiveness (C-E) analysis offers a useful metric to compare the efficiency of alternative regulatory options in removing pollutants and to compare the proposed technology option with other regulatory alternatives that EPA considered.[2]

The American Society of Agricultural Engineers (ASAE) reports that the constituents present in livestock and poultry manure include boron, cadmium, calcium, chlorine, copper, iron, lead, magnesium, manganese, molybdenum, nickel, potassium, sodium, sulfur, zinc, nitrogen and phosphorus species, total suspended solids, and pathogens. Of these pollutants, EPA's standard C-E analysis is suitable to analyze only the removals of metals and metallic compounds. EPA's standard C-E analysis does not adequately address removals of nutrients, total suspended solids, and pathogens. To account for the estimated removal of nutrients and sediments under the final rule, the Agency developed an alternative approach to evaluate the pollutant removal effectiveness for nutrients and sediment relative to the cost of these pollutant removals. For this rule, EPA estimates the expected percentage reductions in pathogens from agricultural runoff but does not compare these removals to the costs of the regulatory controls.

The C-E analysis conducted for this rule evaluates the cost-effectiveness of removing select nonconventional and conventional pollutants, including nitrogen, phosphorus, and sediments. For this analysis, sediments are used as a proxy for total suspended solids. This analysis compares the estimated compliance cost per pound of pollutant removed to a recognized benchmark, such as EPA's benchmark for conventional pollutants or other criteria for existing treatment, as reported in available cost-effectiveness studies. The research in this area has mostly been conducted at municipal facilities, including publicly owned treatment works (POTWs) and wastewater treatment plants (WWTPs). Additional information is available based on the effectiveness of various nonpoint source controls and BMPs and other pollutant control technologies that are commonly used to control runoff from agricultural lands. Benchmark estimates were used to evaluate the efficiency of the final rule in removing a range of pollutants. This approach also allowed for an assessment of the types of management practices that will be implemented to comply with the final regulations.

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[1] A list of priority ("toxic") and conventional pollutants is provided at 40 CFR Part 401. There are more than 120 priority pollutants, including metals, pesticides, and organic and inorganic compounds. Conventional pollutants include biological oxygen demand (BOD), total suspended solids (TSS), pH, fecal coliform bacteria, and oil and grease. Nonconventional pollutants comprise all other pollutants, including nutrients; that is, they do not include conventional and priority pollutants.

[2] EPA defined cost-effectiveness similarly for Phase II of the Storm Water rule (USEPA, 1999f) and examined the incremental annualized cost of each pollution control option to the incremental pound of TSS removed annually.

The organization of this section is as follows. Section E.1 provides an introduction and describes the types and concentrations of pollutants found in animal manure and wastewater. Section E.2 summarizes EPA's estimated baseline loadings and removals of metals, nutrients, total suspended solids, and pathogens from feedlot and land application areas, for selected regulatory alternatives. Section E.3 presents an analysis of the cost-effectiveness of loadings reductions of nutrients and total suspended solids and compares the overall effectiveness of the final regulations to other options considered by EPA during the development of this rulemaking. Section E.5 concludes with a discussion of EPA's analysis that uses a standard C-E approach to analyze a subset of metallic compounds that are found in animal manure and wastewater.

More detail on the environmental damages associated with livestock and poultry operations and the pollutants in animal manure is provided in the *Environmental Assessment* (USEPA, 2000b) and the *Benefits Analysis* (USEPA, 2002k). Section 5.4 of this report summarizes EPA's estimates of the loading reductions for these pollutants. Additional information on EPA's estimated loadings and removals under post-compliance conditions is provided in the *Development Document* (USEPA, 2000a) and also in the *Benefits Analysis* (USEPA, 2002k).

E.1 POLLUTANTS OF CONCERN

E.1.1 Introduction

Manure and wastewater from animal feeding operations have the potential to contribute pollutants such as nutrients (e.g., nitrogen and phosphorus), organic matter, sediments, pathogens, metals and metallic compounds, hormones, antibiotics, and ammonia to the environment (USEPA, 2000g; USDA and USEPA, 1999). Additional information on the pollutants in animal manure and on water quality impairment and risks associated with manure discharge and runoff is provided in Section 5 of the proposed rule preamble and in the *Environmental Assessment* (USEPA, 2000g).

National and local studies have confirmed the presence of manure pollutants in U.S. waters. EPA's 1998 *National Water Quality Inventory* (USEPA, 2000h), prepared under section 305(b) of the Clean Water Act, presents information on impaired water bodies based on reports from the states. Agricultural operations, including animal feeding operations, are considered a significant source of water pollution in the United States (USEPA, 2000h). As shown in Table E-1, 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, and the nation's lakes, ponds, and reservoirs. Agriculture is also identified as the fifth leading contributor to identified water quality impairments in the nation's estuaries (USEPA, 2000h). These data also confirm that water quality concerns tend to be greatest in areas where crops are intensively cultivated and where livestock operations are concentrated.

Table E-1 also lists the leading pollutants that impair surface water quality in the United States, as identified in the *1998 Inventory*. Livestock and poultry operations are a potential source of all of these, but they are most commonly associated with nutrients, pathogens, oxygen-depleting substances, and solids (siltation). Animal operations are also a potential source of other leading causes of water quality impairment, such as metals and pesticides, and they can contribute to the growth of noxious aquatic plants due to the discharge of excess nutrients. Animal operations can also contribute loadings of

priority toxic organic chemicals and oil and grease, but most likely to a lesser extent than they contribute to loadings of other leading pollutants.

Table E-2 presents additional summary statistics from the *1998 Inventory*. These data indicate that agriculture contributes to the impairment of at least 170,000 river miles, 2.4 million lake acres, and almost 2,000 estuarine square miles. Animal feeding operations are a subset of the agriculture category. The portion of impairment attributable to animal agriculture nationwide is unknown, because not all states and tribes identified sources and tribes identify specific agricultural activities contributing to water quality impacts on rivers and streams. States that specifically report potential water quality impairment attributable to animal feeding operations in the *1998 Inventory* are: Hawaii, Illinois, Kansas, Louisiana, Michigan, Minnesota, Mississippi, Montana, Nebraska, Ohio, Oklahoma, Rhode Island, South Carolina, Tennessee, Virginia, West Virginia, Wisconsin, and Wyoming. Impairment due specifically to land application of manure is not reported. For rivers and streams, estimates from these states indicate that 16 percent of the total reported agricultural sector impairment is from the animal feeding operation industry (including feedlots, animal holding areas, and other animal operations), and 17 percent of the agricultural sector impairment is from both range and pasture grazing. For lakes, ponds, and reservoirs, estimates from these states indicate that 4 percent of the total reported agricultural sector impairment is from the animal feeding operation industry and 39 percent of the agricultural sector impairment is from both range and pasture grazing.

E.1.2 Pollutant Concentrations in Animal Manure and Wastewater

Table E-3 lists the reported amounts of macro- and micro-nutrients in livestock and poultry waste, along with documented levels of other inorganic and metallic constituents. As shown, the ASAE reports that the constituents present in livestock and poultry manure include: boron, cadmium, calcium, chlorine, copper, iron, lead, magnesium, manganese, molybdenum, nickel, potassium, sodium, sulfur, zinc, nitrogen and phosphorus species, total suspended solids (TSS), and pathogens (ASAE, 1993). Other research conducted by various land grant universities reports that arsenic, selenium, and other constituents are also present in some animal manures (NCSU, 1994; Sims, 1995).

Concentrations shown in Table E-3 are reported in pounds per 1,000 pounds of live animal weight per day and vary by animal species. As shown in Table E-3, poultry manure typically has a higher nutrient content than most other farm animal manure and wastewater. Actual nutrient values of manure depend on many factors, including animal size, maturity, and species; health and diet of the animals; and the feed composition and protein content of the ration fed (USDA, 1992). Additional details on the constituents in animal manure are provided in the *Environmental Assessment* (USEPA, 2000b) and the *Development Document* (USEPA, 2000a).

Table E-1. Leading Sources and Pollutants of Water Quality Impairment in the United States, 1998

Rank	Rivers & Streams	Lakes, Ponds, & Reservoirs	Estuaries
		Sources [a/]	
1	Agriculture (59%)	Agriculture (31%)	Municipal point sources (28%)
2	Hydromodification (20%)	Hydromodification (15%)	Urban runoff/storm sewers (28%)
3	Urban Runoff/storm sewers (11%)	Urban runoff/storm sewers (12%)	Atmospheric deposition (23%)
4	Municipal point sources (10%)	Municipal point sources (11%)	Industrial discharges (15%)
5	Resource extraction (9%)	Atmospheric deposition (8%)	Agriculture (15%)
		Pollutants [b/]	
1	Siltation (38%)	Nutrients (44%)	Pathogens (47%)
2	Pathogens (36%)	Metals (27%)	Oxygen-depleting substances (42%)
3	Nutrients (29%)	Siltation (15%)	Metals (27%)
4	Oxygen-depleting substances (23%)	Oxygen-depleting substances (14%)	Nutrients (23%)
5	Metals (21%)	Suspended solids (10%)	Thermal modifications (18%)

Source: USEPA, 2000h. Figure totals exceed 100 percent because water bodies may be impaired by more than one source or pollutant.

[a/]Fraction of impairment attributed to each source is shown in parentheses. For example, agriculture is listed as a source of impairment in 59 percent of impaired river miles. The portion of "agricultural" impairment attributable to animal waste (as compared to crop production, pasture grazing, range grazing, and aquaculture) is not specified.

[b/]Percent impairment attributed to each pollutant is shown in parentheses. For example, siltation is listed as a cause of impairment in 51 percent of impaired river miles.

Table E-2. Summary of Statistics from the National U.S. Water Quality Impairment Survey, 1998

Total Quantity in U.S.	Waters Assessed	Quantity Impaired by All Sources	Quantity Impaired by Agriculture [a/]
Rivers 3,662,255 miles	23% of total (840,402 miles)	35% of assessed (291,263 miles)	59% of impaired (170,750 miles)
Lakes, Ponds, and Reservoirs 41.6 million acres	42% of total (17.4 million acres)	45% of assessed (7.9 million acres)	31% of impaired (2,417,801 acres)
Estuaries 90,465 square miles	32% of total (28,687 square miles)	44% of assessed (12,482 square miles)	15% of impaired (1,827 square miles)

Source: USEPA, 2000h.

[a/]AFOs are a subset of the agriculture category. Summaries of impairment by non-agricultural sources are not presented here.

Table E-3. Nutrients, Metals, and Pathogens in Livestock and Poultry Manures

Constituent	Sector						
	Beef	Dairy	Veal	Hog	Broiler	Layer	Turkey
	(average pounds per 1,000 pounds live animal weight per day)						
Mass of animal	793.7	1410.9	200.6	134.5	992.1	4.0	4.0
Manure (wet basis)	58	86	62	84	85	64	47
Urine	18	26		39			
Density (lbs/ft^3)	1000	990	1000	990	1000	970	1000
Total Solids	8.5	12.0	5.2	11.0	22.0	16.0	12.0
Volatile Solids	7.2	10.0	2.3	8.5	17.0	12.0	9.1
BOD (5-day)	1.6	1.6	1.7	3.1		3.3	2.1
COD (5-day)	7.8	11.0	5.3	8.4	16.0	11.0	9.3
pH	7.0	7.0	8.1	7.5		6.9	
Nitrogen (Total Kjeldahl)	3.40e-01	4.50e-01	2.70e-01	5.20e-01	1.10e+00	8.40e-01	6.20e-01
Nitrogen (Ammonia)	8.60e-02	7.90e-02	1.20e-01	2.90e-01		2.10e-01	8.00e-02
Phosphorus (Total)	9.2e-02	9.4e-02	6.6e-02	1.8e-01	3.0e-01	3.0e-01	2.3e-01
Orthophosphorus	3.0e-02	6.1e-02		1.2e-01		9.0e-02	
Potassium	2.1e-01	2.9e-01	2.8e-01	2.9e-01	4.0e-01	3.0e-01	2.4e-01
Calcium	1.4e-01	1.6e-01	5.9e-02	3.3e-01	4.1e-01	1.3e+00	6.3e-01
Magnesium	4.9e-02	7.1e-02	3.3e-02	7.0e-02	1.5e-01	1.4e-01	7.3e-02
Sulfur	4.5e-02	5.1e-02		7.6e-02	8.1e-02	1.4e-01	
Sodium	3.0e-02	5.2e-02	8.9e-02	6.7e-02	1.5e-01	1.0e-01	6.6e-02
Chloride		1.3e-01		2.6e-01		5.6e-01	
Iron	7.8e-03	1.2e-02	3.3e-04	1.6e-02		6.0e-02	7.5e-02
Manganese	1.2e-03	1.9e-03		1.9e-03		1.0e-03	2.4e-03
Boron	8.8e-04	7.1e-04		3.1e-03		1.8e-03	
Molybdenum	4.2e-05	7.4e-05		2.8e-05		3.0e-04	
Zinc	1.1e-03	1.8e-03	1.3e-02	5.0e-03	3.6e-03	1.9e-02	1.5e-02
Copper	3.1e-04	4.5e-04	4.8e-05	1.2e-03	9.8e-04	8.3e-04	7.1e-04
Cadmium		3.0e-06		2.7e-05		3.8e-05	
Nickel		2.8e-04				2.5e-04	

Table E-3. Nutrients, Metals, and Pathogens in Livestock and Poultry Manures (continued)

Constituent	Sector						
	Beef	Dairy	Veal	Hog	Broiler	Layer	Turkey
	(average pounds per 1,000 pounds live animal weight per day)						
Lead				8.4e-05		7.4e-04	
Arsenic	na	na	na	6.9e-04	4.8e-04	5.5e-06	na
Total coliform bacteria (colonies)	29	500		21		50	
Fecal coliform bacteria (colonies)	13	7.2		8		3.4	0.62
Fecal streptococcus bacteria (colonies)	14	42		240		7.4	

Source: ASAE, 1993. Arsenic values are from NCSU, 1994. Converted from reported (lb./yr./1,000 lb. animal weight) values of 0.002 (layers), 0.176 (broilers), and 0.252 (hogs). All values are in pounds unless otherwise noted.

E.2 ESTIMATED POLLUTANT REMOVALS

For this analysis, EPA has estimated the expected reduction of selected pollutants for each of the regulatory options considered. These estimates measure the amounts of nutrients, sediments, and metals originating from animal production areas that are removed under a post-regulation scenario (as compared to a baseline scenario) and do not reach U.S. waters. Additional information on EPA's estimated loadings and removals under post-compliance conditions is provided in the *Development Document* (USEPA, 2002) and the *Benefits Analysis* (USEPA, 2002k) that support the rulemaking.

USDA estimates that in 1997 manure generation from all livestock and poultry production totaled 1.1 billion tons, of which about one-half (0.5 billion tons of manure) was generated by operations with confined animals, using an approach described in Kellogg et al. (2000, 2002) and Lander (1998).[3] More information on these estimates are presented in the rulemaking record. Table E-4 shows these estimates broken out by major subcategory.

Of this total, USDA estimates that operations that confine livestock and poultry animals generate about 500 million tons of manure annually (as excreted). This compares to EPA estimates of about 0.15 billion tons (wet weight) of human sanitary waste produced annually in the United States, assuming a U.S. population of 285 million and an average waste generation of about 0.518 tons per person per year. By this estimate, all confined animals generate 3 times more raw waste that is generated by humans in the United States. EPA is regulating close to 60 percent of all manure generated by operations that confine animals. Of the estimated amount of nutrients generated by these operations that is in excess of cropland

[3]USDA's estimates do not include manure generated from other animal agricultural operations, such as sheep and lamb, goats, horses, and other miscellaneous animal species.

needs, EPA's regulation will account for nearly 70 percent of manure generated by these operations. For more information on EPA's human waste estimates, see information in the record (USEPA, 2002m).[4]

Section 5.4 of this report summarizes EPA's estimates of the loading reductions for these pollutants. The series of summary tables in that section show EPA's aggregated estimates of loadings from all contributions, including the land application area and the production area. Results are shown for operations with more than 1,000 AU and a subset of affected operations with between 300 and 1,000 AU that are defined as CAFOs under the existing NPDES regulations. Post-regulatory conditions are modeled by EPA and expressed in terms of baseline loadings and reductions compared to baseline conditions (pre- versus post-regulatory). Loadings and reductions are modeled for total nitrogen, total phosphorus, and TSS. Under this approach, EPA also simulates loadings and reductions for six selected metallic compounds that are present in animal manure (cadmium, copper, nickel, lead, zinc, and arsenic) and also pathogens (expressed as fecal coliform bacteria and fecal streptococcus).

Pollutant loadings estimates are provided in terms of both estimated "edge-of-field" loadings and "at-stream" loadings. EPA estimates edge-of-field loadings using a simulation modeling approach based on representative model CAFOs used to estimate compliance costs of the final regulations, as described in *Development Document* (USEPA, 2000a, 2002). This model uses estimates of manure generation and information on cropping systems specific to animal operations under various pre- and post-regulation model simulation conditions. Model CAFOs take into account differing conditions at representative operations. These conditions include animal type, production region, facility size, current management systems and practices, and regionally based physiographic conditions regarding soil, rainfall, hydrology, crop rotation, and other factors. Edge-of-field loadings are differentiated by broad animal sector categories (cattle, dairy, hog, and poultry). More details on these models and a summary of the estimated loadings and post-compliance reductions are provided in the *Development Document* (USEPA, 2000a, 2002).

Edge-of-field loading estimates are used as inputs to EPA's water quality modeling framework that simulates the potential amount of pollutant loadings that reach U.S. waterways (measured as rivers and streams). The resultant loading estimates are referred to in EPA's analysis as "at-stream" loadings. Information on EPA's fate and transport model and a comparison of edge-of-field loadings and pollutants that reach U.S. waters is provided in the *Benefits Analysis* (USEPA, 2000d, 2002k). This analysis indicates that roughly 80 percent of all land applied manure runoff of nitrogen, phosphorous, and sediments (edge-of-field) reach U.S. waters (at-stream) (USEPA, 2000d, 2002k). The level of nutrients reaching U.S. waters can be explained by differing assumptions on a variety of levels, including manure generation by animal species, the share of animals in confinement, and losses due to volatization and management practice, as well as other factors, including rounding and truncation error and assumptions regarding background levels. Because EPA's at-stream estimates are not differentiated by broad animal sector categories (but reflect the total across all sector), the Agency uses the edge-of-field pollutant

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[4] A direct comparison of the environmental and human health impacts of these quantities is not possible because of different waste characteristics and waste-handling practices and regulations. The disposal of animal waste typically involves land application of all the manure without an associated point source discharge (if properly applied), and it has been largely unregulated. Human sanitary waste, by contrast, is typically treated at a wastewater treatment plant. The liquid effluent is discharged after treatment to surface water and the residual solids (sludge, or biosolids) are land applied, landfilled, or incinerated. Both the effluent and the biosolids are highly regulated (USEPA, 2002m).

loading reductions adjusted by the delivery rates (expressing the change between edge-of-field and at-stream concentrations) to determine the at-stream loading reductions for use in the cost-effectiveness analysis. This allows EPA to differentiate the cost-effectiveness among the four broad sector groups.

E.3 COST-EFFECTIVENESS ANALYSIS: NUTRIENTS AND SEDIMENTS

For this analysis, EPA estimated average cost-effectiveness values that reflect the increment between no revisions to the current regulations and the final regulatory requirements in the final regulations. Estimates reflect the cost-effectiveness of removing selected non-conventional and conventional pollutants, including nitrogen, phosphorus, and sediments. For this analysis, sediments are used as a proxy for TSS. All costs are expressed in pre-tax 2001 dollars. Estimated compliance costs used to calculate the cost-effectiveness of the final regulations include total estimated costs to CAFOs and costs to the permitting authority.

This analysis does not follow the methodological approach of a standard C-E analysis. Instead, it compares the estimated compliance cost per pound of pollutant removed to a recognized benchmark, such as EPA's benchmark for conventional pollutants or other criteria for existing treatment, as reported in available cost-effectiveness studies. A review of this literature is provided in Section E.3.1 and is based on an assessment of the types of management practices that would be implemented to comply with the final regulations. Section E.3.2 presents the results of EPA's analysis and compares these results obtained for the final regulations with other regulatory alternatives considered by EPA during the development of this rulemaking.

E.3.1 Review of Literature

To evaluate the cost per pound removal of nutrients and sediments, EPA reviewed the available information on pollutant removal costs for nutrients and sediments. This research can be broadly grouped according to estimates derived for industrial point sources and various nonpoint sources, including agricultural operations. In general, the point source research provides information on technology and retrofitting costs—and in some cases, cost per pound of pollutant removed—at municipal facilities, including POTWs and WWTPs. This research differs from other cost-effectiveness estimates, because it uses actual cost data collected at a particular facility undergoing an upgrade. Other cost-effectiveness information is available based on the effectiveness of various nonpoint source controls and best management practices (BMPs) and other pollutant control technologies that are commonly used to control runoff from agricultural lands. Typically, this information uses a modeling approach and simulates costs for a representative facility.

For this analysis, EPA assumes the following benchmark values to evaluate cost-effectiveness. For nitrogen, EPA uses a cost-effectiveness benchmark established by the Agency's Chesapeake Bay Program to assess the costs to WWTPs to implement system retrofits to achieve biological nutrient removal. This nitrogen benchmark estimate is approximately $4 per pound of nitrogen removed. For phosphorus, EPA assumes a cost-effectiveness benchmark of roughly $10 per pound based on a review of values reported in the agricultural research of the costs to remove phosphorus using various nonpoint source controls and management practices. For sediments, EPA uses a POTW benchmark for conventional pollutants removed (total suspended solids and biological oxygen demand) of about $0.73 per pound. More information on these benchmark values is as follows.

Table E-4 summarizes the cost-effectiveness values for nutrients and sediments reported in the studies that EPA reviewed for its analysis. A wide range of costs per pound of pollutant removed is estimated by those studies where estimates span both point sources and nonpoint sources, as well as those where estimates span a range of municipal, urban, and agricultural practices. Annualized costs also vary widely depending on various factors, such as the type of treatment system or practice evaluated, and whether the costs are evaluated as a retrofit to an existing operation or as construction of a new facility.

A series of case studies were compiled by researchers at Virginia Tech, who evaluated total costs for biological nutrient removal (BNR) retrofits at WWTPs throughout the Chesapeake Bay watershed (Randall et al., 1999). These case studies were compiled to estimate a range of costs per pound of nitrogen removed at these facilities. This research was commissioned by EPA's Chesapeake Bay Program and was conducted with the assistance of the Maryland Department of the Environment and the Public Utilities Division of Anne Arundel County. As part of this work, BNR retrofit costs were estimated for 51 WWTPs located in Maryland, Pennsylvania, Virginia, and New York. The final report in this series compares these costs to the projected change in effluent total nitrogen concentrations, assuming that the influent flow meets the design or projected flow after 20 years (Randall et al., 1999). As shown in Table E-4, this study concludes that the costs of nitrogen removal are very plant-specific, with the costs per pound of addition nitrogen removal ranging from $0.79 per pound to $5.92 per pound (Randall et al., 1999).[5] The range of these estimates is comparatively narrow given that the study examines a single retrofit category across similar facilities. The time frame for this analysis ranges from 1995 to 1998 according to the available case study data for each WWTP. A 20-year capital renewal period is assumed; interest and inflation rates of 6 and 3 percent, respectively, are used (Randall, 2000). The primary emphasis in this study is nitrogen, since the cost to upgrade for phosphorus removal is both configuration- and site-specific (Randall, 2000).[6]

Based on this analysis and other data from the Maryland Department of the Environment, EPA's Chesapeake Bay Program Office has derived a cost-effectiveness value for BNR of $3.64 per pound of nitrogen removed, as shown in Table E-4 (Wiedeman, 1998). Based on this information and the results of the Randall study, EPA's cost-effectiveness analysis assumes that an estimated cost to remove nitrogen of less than $4 per pound demonstrates cost-effectiveness.

A number of other studies have been conducted to assess the cost-effectiveness of various state-level programs to reduce nutrients in Wisconsin (NEWWT, 1994), Vermont (LCBP, 2000), and North Carolina (Tippett and Dodd, 1995). In Wisconsin, a series of studies were conducted to compare the cost-effectiveness of point and nonpoint source controls across 41 subwatersheds in the Fox-Wolf watershed (NEWWT, 1994). These studies estimated the cost of reducing phosphorus and TSS loads from municipal treatment facilities and agricultural sources. Baseline projections were compared to necessary reductions to meet future water quality objectives, as mandated by that State's current regulations. The base year for the analysis is 1990. Phosphorus removal costs for rural sources are

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[5]The costs per pound of additional nitrogen removed were flow-weighted to determine the average for each state and for all plants evaluated.

[6]For conventional plug-flow activated sludge configurations, all that is required for phosphorus removal is the installation of relatively low-cost baffles and mixers; for oxidation ditches, the addition of an anaerobic reactor separate from the ditch is needed (Randall, 2000).

estimated at $9.64 per pound, whereas municipal treatment facilities are associated with an average annual cost of $165 per pound of phosphorus removed (NEWWT, 1994).

The Lake Champlain Basin Program (LCBP) conducted a similar study to evaluate costs to meet Vermont's water quality goals. The study estimated phosphorus removal costs ranging from $270 to more than $1,000 per pound at a large municipal facility, compared to $440 to $544 per pound of phosphorus removed using agricultural BMPs (LCBP, 2000). The base year for this analysis is 1995. Another study by Research Triangle Institute assessed the cost-effectiveness of agricultural BMPs for North Carolina's nutrient trading program. Estimated costs ranged from $2.72 to $135.17 per pound of phosphorus removed using anaerobic lagoons, and $0.36 to $34.27 per pound of phosphorus removed for land application practices (Tippett and Dodd, 1995). Estimated costs reflect the wide range of costs associated with land application, given preexisting practices at different types of operations. Costs summarized for this analysis span 1985 to 1994. Estimated values are shown in Table E-4. Observations by researchers at Virginia Tech who estimated removal costs for nitrogen at WWTPs conclude that it will cost about the same to remove a pound of phosphorus as it costs to remove a pound of nitrogen, if removing only one nutrient. If the facility is upgraded to remove both nitrogen and phosphorus, the cost typically will be only slightly more than the cost to remove nitrogen alone (Randall, 2000).

For this analysis, EPA assumes a benchmark of $10 per pound to remove phosphorus. This estimate is a conservative estimate given the range of estimates in the literature (Table E-4). Since the 2001 Proposal, EPA has obtained additional research estimates that further justify use of the benchmark value for phosphorus. Faeth (2000) measures the cost per pound of phosphorus removed for controls under different policy scenarios for both point source and agricultural conservation practices.[7] Estimates are based on three case studies: Minnesota River, Saginaw Bay, and Rock River. For point sources, Faeth estimates a range of costs from $10.40 to $23.90 per pound of phosphorus removed, averaging about $18 per pound removed. Estimates for agricultural sources range from $9.50 to $16.30 per pound of phosphorus removed, averaging $10.50 per pound removed.

EPA's benchmark to compare the potential costs per pound of sediments removed is the cost reasonableness test the Agency established in developing technology-based effluent limits for conventional pollutants (see 51 FR 24982). This benchmark measures the cost per pound of TSS and BOD removed for an "average" POTW with a flow of 2.26 million gallons per day (USGPO, 1986).[8] Indexed to 2001 dollars, these costs are about $0.73 per pound of TSS and BOD removed. EPA used this benchmark to evaluate the estimated cost per pound of TSS removed by municipalities in a recent EPA rulemaking, which estimated the range of costs for stormwater controls to be between $0.04 to $0.18 per pound of TSS removed (USEPA, 1999f). The Northeast Wisconsin Water for Tomorrow studies estimate average cost to reduce TSS of $0.008 per pound removed from rural land and $4.61 per pound removed at municipal treatment facilities (NEWWT, 1994).

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[7] Point source performance requirements and conventional subsidies for agricultural BMPs, respectively.

[8] The technologies used for secondary treatment at POTWs removes both TSS and BOD at the same time. Estimating only the tons of TSS removed from secondary treatment is not possible.

Table E-4. Summary of Pollutant Removal Cost Estimates and Benchmarks

Type of Pollutant	Low Estimate	High Estimate	Treatment Type	Literature Sources
	($ per pound removed)			
Total Nitrogen (TN)	$0.79	$5.92	WWTPs	Randall et al, 1999
	--	$3.64	WWTPs	Wiedeman, 2000
	$0.91	$9.53	Ag lagoon	Tippett and Dodd, 1995
	$0.09	$2.18	Ag land application	Tippett and Dodd, 1995
Total Phosphorus (TP)	$5.76	$16.29	Conventional subsidies for agricultural BMPs	Faeth, 2000
	$10.38	$23.89	PS performance requirements	Faeth, 2000
	$9.64	$165.00	Ag (low) to municipal (high)	NEWWT, 1994
	$270.34	$1,179.35	Large PS facility (0.2 mg/L)	LCBP, 1995
	$439.99	$544.32	Agricultural BMPs	LCBP, 1995
	$2.72	$135.17	Ag lagoon	Tippett and Dodd, 1995
	$0.36	$34.27	Ag land application	Tippett and Dodd, 1995
Total Suspended Solids (TSS)	$0.01	$4.61	Ag.(low) to municipal (high)	NEWWT, 1994
	--	$0.25 [a]	POTWs (BOD and TSS)	USGPO, 1986
	$0.04	$0.18	Urban Stormwater Controls	USEPA, 1999f

[a] TSS and BOD removals (1976 dollars). Indexed to 2001 dollars, costs are about $70 per pound removed.
Full citations are provided in references. Time frames of dollar values shown vary by source (shown below). Notes summarize timeframe of analysis, study assumptions (where available), and range of sources/treatment.
Faeth, P. (2000): Case-studies in Minnesota River, Saginaw Bay, Rock River. Study include estimates under permit trading scenarios (not shown in table).
Randall et al. (1999): 1995-1998; 6% interest and 20-year capital renewal; BNR retrofits at WWTP only.
NEWWT (1994): 5% interest and 20-year capital renewal; low bound is agricultural BMPs and high bound is municipal treatment facilities.
Tippett and Dodd (1995): No discount rate was applied, and annual cost equals total lifetime costs adjusted by design life (varies by practice); "Ag lagoon" signifies aerobic lagoon and "Ag land" is land application (both with varying increasing overapplication of land applied manure under preexisting conditions). Cost-effectiveness values that assume direct discharge of animal wastes are not shown.
LCBP (2000): 1995: No discount rate was applied, and annual cost equals total lifetime costs adjusted by design life (varies by practice); low bound is agricultural BMPs and high bound is larger industrial point sources.

E.3.2 Cost-Effectiveness Results

Table E-5 shows the results of EPA's cost-effectiveness analysis for across all subcategories under both Option 1 and Option 2. Results are shown in terms of the average cost-effectiveness, reflecting the increment between no regulation and these two regulatory options. For this rule, EPA estimates an average cost-effectiveness of nutrient removal ranging from about $2 per pound to $3 per pound of nitrogen removed (pre-tax, 2001 dollars) between Option 1 and Option 2. For phosphorus removal, removal costs range from about $6 per pound to $7 per pound of phosphorus removed under these two options. All values are based on approximated "at stream" concentrations.

EPA's estimated cost-effectiveness to remove nitrogen falls within the estimated range of removal costs and is less than the average benchmark value assumed for this rule. For phosphorus, EPA assumed a cost-effectiveness benchmark of roughly $10 per pound based on a review of values reported in the agricultural research of the costs to remove phosphorus using various nonpoint source controls and management practices. EPA's estimated cost-effectiveness to remove phosphorus under this rule also falls below the $10 per pound benchmark value, indicating that the requirements are cost-effective. This is particularly true when compared to the reported cost to remove phosphorus at industrial point source dischargers, where reported average costs are twice that for agricultural sources and often exceed $100 per pound of phosphorus removed. For sediments, EPA's estimated per-pound removal cost is low compared to EPA's POTW benchmark for conventional pollutants for some options. Based on these results, EPA concludes that these regulatory options demonstrate cost-effectiveness.

Table E-5 shows the results of EPA's analysis by major subcategory groupings (cattle, dairy, hogs, poultry) for both Option 1 and Option 2. As shown, removal costs vary by commodity sector. In general, the cost to remove a pound of nitrogen or phosphorus is greatest in the hog and dairy sectors.

Given estimates of generally lower removal costs for nutrients, Option 1 may be considered more cost-effective than Option 2 (where removal costs are estimated to be higher). See Table E-5 and E-6. Results shown in these tables also present the incremental cost-effectiveness of Option 2 relative to Option 1. Incremental cost-effectiveness is the appropriate measure for comparing one regulatory alternative to another for the same subcategory. In general, the lower the incremental C-E value, the more cost-efficient the regulatory option is in removing pollutants. As shown in the table, Option 1 may be considered more cost-efficient relative to Option 2 since the incremental cost between Option 2 from Option 1 is higher than that the average cost-effectiveness for Option 1.

The results presented here do not show the average or incremental cost-effectiveness estimates for other regulatory options considered by EPA during the development of this rulemaking, including Option 3 and Option 5. This analysis was provided in the Proposal EA evaluating these options, indicating that these alternative options were less cost-effective and less cost-efficient than both Option 1 or Option 2. These general conclusions should hold for the final rule analysis as well. For the final rule, the total costs of Options 3 and 5 are higher than that estimated for Option 2 (see cost estimates provided in Table 3.5 in Section 3 of this report); also EPA does not expect a corresponding substantial change in the estimated pollutant reductions for these options, as compared to Option 2 (see summary tables presented in Section 5.4 of this report). Given generally higher costs and roughly similar reductions for these alternative options, as compared to Option 2, these options are likely less cost-effective and less cost-efficient at removing nutrients than both Option 1 and Option 2.

Table E-6 shows the results of EPA's cost-effectiveness analysis of removing sediments. Under Option 2, EPA estimates the cost-effectiveness of sediment removal at $0.30 per pound (pre-tax, 2001 dollars). This estimated per-pound removal cost is low compared to EPA's POTW benchmark for conventional pollutants of about $0.70 per pound of TSS and BOD removed. Sediment removal costs under Option 1, however, are considerably greater than for Option 2 (because of much lower estimated removals for that option, see summary tables in Section 5.4). The average cost-effectiveness for this option is estimated at nearly $2.70 per pound of sediment removed (thus exceeding EPA's benchmark).

Table E-5. Cost-Effectiveness Results: Nutrients ($2001), Option 1 & Option 2

Option/ Scenario	Total Cost [a/]	Nitrogen			Phosphorus		
		Removals	Avg. C-E	Increm. C-E	Removals	Avg. C-E	Increm. C-E
	($mill.)	(mill. lbs.)	($/lb. removed)		(mill. lbs.)	($/lb. removed)	
Option 1: All Subcategories							
>1000 A	$115.5	72.6	$1.59	----	20.8	$5.55	---
300-1,000 AU	$19.1	4.8	$3.98	----	1.3	$14.28	---
>300 AU	$134.5	77.4	$1.74	----	22.1	$6.07	
Option 1: Individual Sectors							
Cattle [c/]	$22.3	36.7	$0.61	----	11.9	$1.87	---
Dairy	$71.0	15.3	$4.65	----	3.5	$20.40	---
Hog	$8.8	0.3	$32.92	----	0.1	$105.26	---
Poultry [c/]	$32.4	25.0	$1.30	---	6.7	$4.83	---
Option 2: All Subcategories							
>1000 A	$278.3	83.4	$3.34	$15.00	42.9	$7.03	$8.67
300-1,000 AU	$37.7	6.0	$6.25	$15.11	4.1	$10.93	$8.80
>300 AU	$316.0	89.5	$3.53	$15.02	47.0	$7.34	$8.69
Option 2: Individual Sectors							
Cattle [c/]	$93.9	39.0	$2.41	$32.14	17.8	$5.29	$12.20
Dairy	$150.2	16.1	$9.32	$94.02	5.9	$26.00	$34.51
Hog	$33.0	4.0	$8.18	$6.43	7.3	$8.04	$6.02
Poultry [c/]	$38.9	30.3	$1.28	$1.22	16.3	$2.54	$0.75

Source: USEPA. "Incremental C-E" measures Option 2 as incremental to Option 1.

[A/] Costs are pre-tax and indexed to 2001 dollars using the Construction Cost Index (ENR, 2000, 2002).

[b/] "Cattle" includes beef, heifer, and veal operations. "Poultry" includes broiler, egg, and turkey operations.

Table E-6. Cost-Effectiveness Results: Sediments ($2001), Option 1 & Option 2

Option/ Scenario	Total Cost [a/]	Sediments Removed	Average Cost-Effectiveness	Incremental Cost-Effectiveness
	($mill.)	(million lbs.)	(average $ per pound removed)	
Option 1: All Subcategories				
>1000 AU	$115.5	1,327.8	$0.09	---
300-1,000 AU	$19.1	7.1	$2.69	---
>300 AU	$134.5	1,334.9	$0.10	---
Option 2: All Subcategories				
>1000 AU	$278.3	1,626.6	$0.17	$0.54
300-1,000 AU	$37.7	85.3	$0.44	$0.24
>300 AU	$316.0	1,711.9	$0.18	$0.48

Source: USEPA.
[a/] Costs are pre-tax and indexed to 2001 dollars using the Construction Cost Index (ENR, 2000, 2002).

E.4 COST-EFFECTIVENESS ANALYSIS: TOXIC POLLUTANTS

EPA decided not to conduct a more traditional C-E analysis for selected toxic pollutants for the final regulations, given that these compounds are present in trace amounts in animal manure (see Table E-3). Nevertheless, this section provides a brief summary of EPA estimates of the weighted pound-equivalent removals for selected toxic pollutants. These estimates provide a means to evaluate the appropriateness of whether EPA should conduct a more traditional C-E analysis for selected toxic pollutant removals given that the principal pollutants of concern for this rule are nutrients and sediments.

This analysis follows the guidelines of the standard C-E analysis commonly used by EPA to compare the efficiency of regulatory options for effluent guidelines in removing priority and non-conventional pollutants. More detailed information is provided in the Proposal EA (USEPA, 2001a). EPA's standard C-E analysis evaluates cost-effectiveness as the incremental and average annualized cost of a pollution control option in an industry (or industry subcategory) per incremental and total pound equivalent of pollutant (i.e., pound of pollutant adjusted for toxicity) removed by that control option. This analysis involves the following seven steps:

1. Determine the pollutants of concern (priority or other pollutants).
2. Estimate relative toxic weights for these pollutants.
3. Define the regulatory pollution control options.
4. Calculate pollutant removals for each control option.
5. Determine the total annualized cost for each control option.
6. Calculate cost-effectiveness values (and adjust to 1981 dollars).
7. Compare cost-effectiveness values.

For this discussion, EPA addresses only steps 1 and 2. However, Section 5.3 of this report summarizes how the pollutant loadings estimated for the final regulations are calculated for each animal

sector under each regulatory option for comparison with baseline loadings (steps 3 and 4). For more information, see the *Development Document* (USEPA, 2002). Total costs of the rule are presented in Section 3.3 (step 5).

For this C-E analysis, EPA identified six toxic pollutants of concern (step 1), including arsenic, zinc, copper, cadmium, nickel, and lead. Factors considered in selecting these pollutants included toxicity, frequency of occurrence in wastestream effluent, and amount of pollutant in the waste stream (USEPA, 2002). As shown in Table E-3, this is a subset of all the toxic compounds reported to be present in farm animal manures (which vary by animal type). Therefore, the cost-effectiveness results presented here are conservative (i.e., a higher per-pound removal value is estimated than would be the case if all metals were considered in this analysis).

In C-E analyses, pollutant removals are measured in toxicity normalized units called "pounds-equivalent," where the pounds-equivalent removed for a particular pollutant is determined by multiplying the number of pounds of a pollutant removed by each option by a toxocity weighting factor (TWF) for each pollutant. These factors are used to account for differences in toxicity among pollutants and to adjust the estimated pollutant loading values to account for the fact that different pollutants have different potential effects on human and aquatic life (e.g., a pound of zinc in an effluent stream has a different effect than a pound of arsenic).

The TWF is the sum of two criteria-weighted ratios: the "benchmark/old" copper criterion divided by the human health criterion for the particular pollutant and the "benchmark/old" copper criterion divided by the aquatic chronic criterion. TWFs for pollutants are derived using ambient water quality criteria and toxicity values.[9] The factors are standardized by relating them to a "benchmark" toxicity value that was based on the toxicity of copper when the methodology was developed.[10] For most pollutants, TWFs are derived from chronic freshwater aquatic criteria. In cases where a human health criterion has also been established for the consumption of fish, the sum of both the human and aquatic criteria are used to derive toxic weighting factors. More information is in Appendix E of the Proposal EA.

Table E-7 presents the TWFs for the regulated pollutants used in this C-E analysis (step 2) and the resultant pound-equivalent estimates for the six metallic compounds (cadmium, copper, nickel, lead, zinc, and arsenic). These estimates are measured in terms of in-stream concentration and have been adjusted from EPA's estimated "edge-of-field" estimates assuming that about 70 percent of land applied manure reached U.S. waters. As was d one for nutrients and sediments, this estimate is based on extensive simulations of EPA's water quality model developed for this rulemaking. This analysis indicates that roughly 70 percent of all land applied manure metal constituents reach U.S. waters (measured as rivers and streams). For more information, see Appendix E of the Proposal EA and also the *Benefits Analysis* (USEPA, 2000d, 2002k).

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[9]Human health and aquatic chronic criteria are maximum contamination thresholds. Units for criteria are micrograms of pollutant per liter of water. Most values are those reported in the toxicology literature.

[10]Although the water quality criterion has been revised (to 12.0 µg/L), all C-E analyses for effluent guideline regulations continue to use the "old" criterion of 5.6 µg/L as a benchmark so that cost-effectiveness values can continue to be compared to those for other effluent guidelines. Where copper is present in the effluent, the revised higher criterion for copper results in a TWF for copper of 0.467 rather than 1.0.

The resultant weighted pound-equivalent removals of these pollutants are less 200,000 pounds, or less than one-tenth of one million pounds-equivalent (Table E-7). Table E-7 shows results for both Option 1 and Option 2. The magnitude of these reductions is low compared to those estimated for other effluent guideline regulations where priority pollutants are the primary pollutants of concern. These findings are consistent with the fact that these substances exist in trace amounts in animal manure and wastewater. Table E-3 shows estimates by ASAE of the concentration of these pollutants in animal waste.

Table E-7. Total Metal Removals ("At Stream" Concentrations)

Metal	TWF	Option 1		Option 2	
		Lb.	Lb.-Eq.	Lb.	Lb.-Eq.
		(millions of pounds or pounds-equivalent)			
Zinc	0.05	0.0905	0.0043	0.0936	0.0044
Copper	0.63	0.0174	0.0110	0.0194	0.0122
Cadmium	2.60	0.0009	0.0024	0.0013	0.0035
Nickel	0.11	0.0080	0.0009	0.0091	0.0010
Lead	2.20	0.0059	0.0131	0.0081	0.0178
Arsenic	4.00	0.0042	0.0167	0.0085	0.0341
Total	**NA**	**0.1270**	**0.0484**	**0.1401**	**0.0730**

Source: TWFs are calculated by EPA and are based on freshwater chronic criteria for copper (USEPA, 2000j). Pound removals are estimated by EPA (USEPA, 2002). Pounds-equivalent are calculated by multiplying the estimated pound of removals by the TWFs shown here.