

EPA used data from scientific literature, USDA data on beef and dairy mortality from poisoning and gastrointestinal illness, EPA data on rural groundwater quality, and published recommendations for livestock drinking water quality, to estimate the potential to reduce on-farm beef and dairy cattle mortality associated with pathogens and nitrates in ground water. From this, EPA estimated the avoided cost of replacing cattle mortalities. The ELG requirements are expected to reduce nitrate and pathogen contamination of ground water at Large CAFOs and, as a result, reduce annual cattle mortality from nitrate poisoning and pathogens at Large CAFOs by approximately 4,300 mature cattle and 3,900 calves. Using a replacement value of \$1,185 for mature cattle and \$54 for day-old calves (2002 dollars), the monetary benefit of reduced on-farm beef and dairy cattle mortality at Large CAFOs is estimated at \$5.3 million annually.

D. Other (Non-Water Quality) Environmental Impacts and Benefits

In analyzing the effects of this rule, EPA also considered how the requirements promulgated today would affect the amount and form of compounds released to air, as well as the energy that is required to operate the CAFO. In addition to the water quality impacts and benefits discussed above, EPA's analyses for this rule have also evaluated these other types of environmental impacts, often referred to as non-water quality environmental impacts. These non-water quality environmental impacts include changes in air emissions from CAFO production areas and land where CAFO-generated manure is spread, changes in energy use, and improvements in soil properties. EPA's estimates of changes in air emissions and energy use are described in more detail in the *Technical Development Document*.

To assess the potential changes in air emissions resulting from this rule, EPA quantified the releases from the production area, including animal housing and animal waste storage and treatment areas; land application activities; and emissions from vehicles, including the off-site transport of waste and on-site composting operations.

EPA projects increased emissions of criteria air pollutants (particulate matter, volatile organic compounds, nitrogen oxides, and carbon monoxide) related to increased fuel consumption as excess manure is transported away from the CAFO. The contribution of these projected increases is limited compared to the national criteria pollutant

inventory. For example, for the year 2000, the total national inventory for nitrogen oxides was 25 million tons. The contribution of the projected increase in CAFO emissions of nitrogen oxides is less than 0.01 percent of that amount. The national inventory values for other criteria pollutants are also much larger than the projected changes in emissions from CAFOs.

CAFOs are a source of ammonia, which is a contributor to the formation of fine particulate matter. This rule is not expected to significantly alter ammonia emissions from CAFOs. During the rulemaking, EPA evaluated a number of regulatory options and, as part of those analyses, considered the potential air quality benefits associated with changes in ammonia emissions. For further discussion of those analyses, refer to Chapter 13 of the *Technical Development Document* and Section 22 of the rulemaking record.

CAFOs are also a source of hydrogen sulfide emissions. EPA's calculations indicate that today's rule will reduce hydrogen sulfide emissions from Large CAFOs by 12 percent nationally. Reductions in hydrogen sulfide emissions are expected to lead to human health benefits, but EPA has not been able to calculate the economic value of these reductions.

Finally, CAFOs are a source of greenhouse gases. Emissions of nitrous oxide at CAFOs arise mainly from the feedlot area during denitrification of nitrogen compounds during waste storage on the drylot and from fields where animal wastes are land applied. Emissions of methane also mainly arise during waste storage, created during the anaerobic decomposition of carbon compounds. CAFOs currently contribute approximately 3 percent of all U.S. nitrous oxide emissions and a similar percentage of U.S. methane emissions. EPA estimates that emissions of nitrous oxide at Large CAFOs will increase by 4 percent as the requirements of today's rule are implemented, and emissions of methane will decrease by 11 percent.

EPA also expects that the properties of the soil at a number of land application areas might improve because of reduced overapplication of manure. The soil properties of cropland that does not currently receive manure, but becomes a recipient as additional manure is hauled away from CAFOs that have excess manure are also expected to benefit from the organic matter content (improving tilth) and the micronutrients present in manure.

VIII. Costs and Economic Impacts

This section presents EPA's estimate of the total annual costs and the economic impacts that would be incurred by the livestock and poultry industry as a result of today's rule. This section also discusses EPA's estimated effects on small businesses and presents the results of the Agency's cost-effectiveness and cost-benefit analysis. All costs presented in this section are reported in pre-tax 2001 dollars (unless otherwise indicated).

EPA estimates the total monetized social costs of the final regulations at about \$335 million annually. These costs include compliance costs borne by CAFOs and also administrative costs to federal and State governments. EPA estimates the total compliance cost for Large CAFOs at \$283 million per year (pre-tax, \$2001). Costs to Medium CAFOs are estimated at \$39 million per year. Costs to Medium and Small operations that are designated as CAFOs are estimated at \$4 million per year. EPA estimates that the administrative cost to federal and State governments to implement this rule is \$9 million per year.

For the veal, dairy, turkey, and egg laying sectors, the final regulations are not expected to result in any CAFO level business closures. In the beef cattle, heifer, hog, and broiler sectors, however, the final rule is expected to cause some existing CAFOs to experience financial stress. These operations might be vulnerable to closure as a result of complying with the final regulations. Across all sectors, an estimated 285 existing Large CAFOs might be vulnerable to facility closure. This accounts for approximately 3 percent of all Large CAFOs. 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. 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 governments.

Detailed information on estimated compliance costs are provided in the *Technical Development Document* and the *Cost Support Document*, which are in the administrative record for today's rule. EPA's detailed economic assessment can be found in *Economic Analysis* which is also in the administrative record.

A. Costs of the Final Rule

1. Method for Estimating the Costs of This Rule

For the purpose of estimating the total costs and economic impacts CAFOs will bear in complying with this rule, 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.

The data and information used to develop EPA's cost estimates were compiled with the assistance of USDA, in combination with other information collected by EPA from extensive literature searches, more than 100 farm site visits, and numerous consultations with industry, universities, and agricultural extension agencies. Additional detailed information on the data and assumptions used to develop EPA's cost estimates is provided in the *Technical Development Document*. Refer to the preamble for the proposed rule for a summary of EPA's data collection activities and the sources of data that the Agency used to estimate compliance costs (66 FR 3079-3080).

For the purpose of estimating costs and financial effects to Medium CAFOs, 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 Medium CAFOs had to comply with the ELG.

2. Estimated Annual Costs of the Final CAFO Regulations

a. *Costs borne by CAFOs.* Table 8.1 summarizes the total annualized compliance costs to CAFOs. The table

shows these costs broken out by sector and broad facility size category. As shown in the table, EPA estimates the total cost of the final rule to CAFOs at \$326 million annually. (Total monetized estimated social costs of the rule include an additional \$9 million to federal and State governments.) 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).

Of this total, EPA estimates that Large CAFOs will incur costs of \$283 million per year. Total annualized costs to facilities defined as Medium CAFOs are estimated at \$39 million annually. Table 8.1 also shows estimated total cost to Small and Medium AFOs that might incur costs if designated as CAFOs, which EPA estimates at about \$4 million annually. More information on these costs and how they were calculated is provided in the *Economic Analysis*.

EPA has estimated 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. 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.

TABLE 8.1.—ANNUAL PRE-TAX COST OF THE RULE, \$2001

Sector	No. operations		Aggregate incremental costs			
	Large CAFOs	Medium CAFOs	Total	Large CAFOs	Medium CAFOs	Designated CAFOs
	(number)		(\$2001, millions, pre-tax)			
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 ¹	729	26	7.5	7.2	0.1	0.2
Layers: Wet ¹	383	24	8.9	8.4	0.5	<0.1
Turkeys	388	37	8.7	8.1	0.3	0.3

TABLE 8.1.—ANNUAL PRE-TAX COST OF THE RULE, \$2001—Continued

Sector	No. operations		Aggregate incremental costs			
	Large CAFOs	Medium CAFOs	Total	Large CAFOs	Medium CAFOs	Designated CAFOs
Total	10,526	4,452	326.0	283.2	39.1	3.8

Source: USEPA. May not add due to rounding. Number of operations do not include designated facilities. Assumes that the estimated costs for Medium CAFOs to comply with BPJ-based limitations under the revised NPDES regulations are similar to the costs that would be incurred by those sized operations if they had to comply with the ELG.

¹ “Layers: dry” are operations with dry manure systems. “Layers: wet” are operations with liquid manure systems.

b. Costs to the NPDES permitting authority. The NPDES permitting authority will 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 may 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 an estimated 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 \$8.7 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 X.D of this preamble. More detailed information is in the *Technical Development Document*.

B. Economic Effects

1. Effects on the CAFO Operation

To estimate the impacts of the final regulations, EPA examined the economic effects on regulated CAFOs and national markets. This section

presents EPA’s analysis of financial impacts on 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 Large CAFOs because only large facilities will be subject to the effluent guidelines and NSPS. This section also presents EPA’s analysis of the economic effects on existing operations that are small businesses. More detailed information on those effects are presented in the *Economic Analysis*.

The preamble to the proposed rule summarizes EPA’s data collection activities and the sources of data that the Agency used to estimate economic effects for the final regulations (66 FR 3079–3080). 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. More detailed information on these comments and how EPA addressed them is in section 2 of the final *Economic Analysis*. EPA’s detailed responses to these public comments, and the comments themselves, are contained in the *Comment Response Document* in the administrative record for today’s rule. Both Notices also present new data received following proposal that EPA used in conducting its final analysis.

a. *Methodology used to assess impacts to the CAFO operation.* 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 evaluated the economic achievability of the rule at 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 notes that its discounted cash flow analysis likely understates impacts because it does not include any allowance for depreciation or replacement of capital in its definition of cash flow. However, EPA has conducted a sensitivity analysis that shows that the number of estimated CAFO closures would not be different if allowances for replacement of capital are made (see section 3.3 of the *Economic Analysis*).

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 notes, as discussed below, 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. See the Economic Analysis and EPA response to comment on this issue for more information.

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. Additional detailed information on this decision framework is provided in section 2 of the *Economic Analysis*.

b. Economic effects on existing CAFOs affected by the Effluent Guidelines. Table 8.2 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 Large CAFOs.

EPA's analysis indicates that, for all Large CAFOs in the veal, dairy, turkey, and egg laying sectors, the impacts due to this rule are characterized as "Affordable" or "Moderate" and no facility closures are projected for these facilities. Therefore, EPA determined the rule being promulgated today is economically achievable for existing facilities in these animal sectors. In the beef cattle, heifer, hog and broiler sectors, however, EPA's analysis

indicates that the final rule will cause some existing CAFOs to experience financial stress, making these operations vulnerable to facility closure. Across all sectors, an estimated 285 existing Large CAFOs might be vulnerable to facility closure. This accounts for approximately 3 percent of all Large CAFOs. 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. 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 the final rule is economically achievable for existing CAFOs. More detailed information is provided in the *Economic Analysis*.

The results described above do not reflect long-run market adjustment and cost share assistance through federal and State conservation programs due to uncertainties associated with these considerations, for reasons discussed in the *Economic Analysis*. Although EPA concluded, based on the results in Table 8.2, that the final regulation is economically achievable, the *Economic Analysis* presents the results of alternative analyses under varying assumptions of long-run market adjustment and potential cost share assistance. Under assumptions of long run market adjustment, as reflected in eventual increases in CAFO revenue

and producer prices, the number of potential facility closures is reduced from 285 closures to a single facility closure in the beef sector. All operations in the heifer, hog, and broiler sectors are expected to be able to absorb the estimated compliance costs under an assumption that incorporates long run market adjustment. 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 closures is reduced only somewhat from 285 closures to 261 closures (comprised of 43 beef, 11 heifer, 204 hog, and 3 broiler operations). EPA conducted these analyses only for the beef, heifer, hog and broiler sectors since all Large CAFOs in the other sectors are estimated to be able to absorb costs associated with the final rule.

TABLE 8.2.—FINANCIAL EFFECTS ON LARGE CAFOs: FINAL REGULATIONS

Sector	Number large CAFOs	Number			Percent of total operations		
		Affordable	Moderate	Stress	Affordable	Moderate	Stress
Fed Cattle	1,766	1,717	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 ¹	729	729	0	0	100	0	0
Layers: Wet ¹	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. See *Economic Analysis*. May not add due to rounding.

¹“Layers: dry” are operations with dry manure systems. “Layers: wet” are operations with liquid manure systems.

c. Economic effects to existing CAFOs that are small businesses. (1) Number of affected small businesses. This section presents EPA’s analysis of the economic effects on CAFOs that are small businesses. It summarizes the estimated number of small entities to which the rule will apply and describes the potential effects of the final rule on these businesses.

The 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 administrative record and in Section 4 of the *Economic Analysis*.

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 the *Economic Analysis* and the administrative 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 will be affected by the final rule. Table 8.3 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 Large CAFOs about 2,330 operations are small businesses (accounting for about one-fourth of all Large CAFOs). Most affected small businesses are in the broiler sector. Among Medium CAFOs, EPA estimates about 3,870 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.

For reasons noted in the administrative 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.

(2) Estimated financial effects on small businesses. 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 sections 609(b) and 603 of the RFA, respectively. The 2001 proposal provides more information on EPA's small business outreach and the Panel activities during the development of this rulemaking (66 FR 3121). Section XI of this preamble presents EPA's Final Regulatory Flexibility Analysis (FRFA),

as required under section 604 of the RFA. More detailed information on this analysis is provided in section 4 of the *Economic Analysis*.

In examining the effects on small businesses for the final rule, EPA followed the same approach used to evaluate the impacts on other existing CAFOs, described in section VIII.B.1(a). For the purposes of this analysis, EPA 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.

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 this approach, EPA's analysis indicates that the final rule could cause financial stress to some small businesses, making these businesses vulnerable to closure. Among the estimated 6,200 small businesses, EPA estimates that 262 Large and Medium CAFOs might be vulnerable to facility closure (Table 8.3). Thus, EPA estimates that potential facility closures associated with this rule constitutes about 4 percent of all affected small business CAFOs. Medium CAFOs comprise the majority (about 85 percent) of these estimated number of closures. These results do not consider long-run market adjustment or cost share assistance through federal and State conservation programs. More detailed information is provided in the *Economic Analysis*.

TABLE 8.3.—FINANCIAL EFFECTS ON SMALL BUSINESS CAFOs

Sector	Number of small businesses	Number			Percent of total operations		
		Affordable	Moderate	Stress	Affordable	Moderate	Stress
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 ¹	0	—	—	—	—	—	—
Layers: Wet ¹	383	383	0	0	100	0	0
Turkeys	0	—	—	—	—	—	—
Total	2,326	1,795	532	34	76	23	1
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 ¹	24	24	0	0	100	0	0
Layers: Wet ¹	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

Source: USEPA. See *Economic Analysis*. May not add due to rounding. 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.

¹“Layers: dry” are operations with dry manure systems. “Layers: wet” are operations with liquid manure systems.

d. Economic effects to 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 IV.C of this preamble. More detailed information is provided in the *Cost Report* and the *Economic Analysis* supporting the final regulations.

2. Market Analysis

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 the *Economic Analysis*.

a. Commodity prices and quantities. EPA's market model predicts that the final rule will not result in significant industry-level changes in production and prices for most sectors. 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 of the pre-regulation baseline price. The exception is in the hog sector, where estimated compliance costs slightly exceed one percent of the baseline price. 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.

b. Aggregate employment and national economic output. EPA does not expect the final rule to cause significant changes in aggregate employment or national economic output, measured in terms of 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 increases in other parts of the economy and other sector employment that might be stimulated as a result of the final rule, such as the construction and farm services sectors.

Employment losses are measured in full-time equivalents (FTEs) per year, including both direct and indirect employment. EPA estimates that the reduction in total direct employment is about 1,600 FTEs. This projected change is compared to total national employment of about 129.6 million jobs in 1997. More detailed information on these results is presented in the *Economic Analysis*.

c. Regional and community impacts. EPA 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 the *Economic Analysis*.

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.

d. 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. However, EPA predicts that foreign trade impacts as a result of the final rule 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 in section VIII.B.2(a). Measured as potential for changes in traded volumes, such as increases in imports and decreases in exports, EPA estimates that increases in imports and decreases in exports 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 rule will not significantly alter the competitiveness of U.S. export markets for meat, dairy foods, and poultry products.

C. Cost-Benefit and Cost-Effectiveness Analyses

1. Cost-Benefit Analysis

This section presents a comparison of the costs and benefits attributable to the final rule. As Table 8.4 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. As discussed in section VII, EPA estimates that the monetized benefits of the final rule range from \$204 million to \$355 million annually. 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. As discussed in Section VII of this preamble, EPA also identified a number of benefits categories that could not be monetized. These benefits are described in more detail in Section VII of this preamble and in the *Benefits Analysis* and other supporting

documentation provided in the administrative record.

This compares to EPA's estimate of the total social costs of the final regulations of about \$335 million annually. These costs cover compliance costs to all CAFOs (Large, Medium, and Small), and administrative costs to States and federal governments. Costs to all CAFOs are estimated at \$326 million per year (pre-tax, \$2001). EPA estimates the administrative cost to State and federal governments to implement this rule is \$9 million per year. There may be additional social costs that have not been monetized. For a detailed discussion of these costs, see the *Technical Development Document* and the *Economic Analysis*. A comparison of the total costs and benefits for other regulatory options considered and analyzed by EPA can be found in the *Economic Analysis*.

TABLE 8.4.—TOTAL ANNUAL MONETIZED SOCIAL COSTS AND BENEFITS
[Millions of 2001 dollars]

Category	Large CAFOs	All CAFOs
Social Costs:		
Industry Compliance Costs (pre-tax)	\$298	\$352
State/Federal Administrative Costs	6	9
Total	304	360
Benefits (Total for all CAFOs)	\$204 to \$355	(**)

**Benefits analysis does not reflect monetized benefits for Medium CAFOs. May not add due to rounding. See Table 7.1 for information on benefit categories that EPA was not able to monetize.

2. Cost-Effectiveness Analysis

As part of the process of developing effluent limitations guidelines and standards, EPA typically conducts a cost-effectiveness (C-E) analysis to compare the efficiencies of regulatory options for removing pollutants. This analysis defines cost-effectiveness as the incremental annualized cost of a regulatory control option per incremental pound of pollutant removed annually by that option.

The American Society of Agricultural Engineers 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, TSS, 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, TSS, 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.

The C-E analysis conducted for this rule evaluates the cost-effectiveness of removing select non-conventional and conventional pollutants, including nitrogen, phosphorus, and sediments. For this analysis, sediments are used as a proxy for TSS. 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. A summary of

this literature is provided in the *Economic Analysis*. 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.

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 promulgated today. 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.

EPA estimates an average cost-effectiveness of nutrient removal at about \$3 per pound of nitrogen removed (pre-tax, 2001 dollars). For phosphorus removal, removal costs are estimated at about \$7 per pound of phosphorus removed. For nitrogen, EPA used a cost-effectiveness benchmark established by

its 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, based on a range of costs of \$0.80 to \$5.90 per pound of nitrogen removed. EPA's estimated cost-effectiveness to remove nitrogen falls within the estimated range of removal costs and is less than this 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 this \$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 other industrial point source dischargers, where reported average costs are twice that for agricultural sources and often exceed \$100 per pound of phosphorus removed. Based on these results, EPA concludes that these values are cost-effective.

EPA also examined the cost-effectiveness of removing sediments under the regulations. EPA estimates a cost of less than \$0.30 per pound of sediment removal in this rule (pre-tax, 2001 dollars). This estimated per-pound removal cost is low compared to EPA's POTW benchmark for conventional pollutants. That benchmark measures the potential costs per pound of TSS and BOD removed for an "average" POTW (see 51 FR 24982). Indexed to 2001 dollars, EPA's benchmark costs are about \$0.73 per pound of TSS and BOD removed. For information on EPA's cost-effectiveness, see the *Economic Analysis*.

IX. Coordination With Other Federal Programs

A. How Does Today's Rule Function in Relation to Other EPA Programs?

The relationship between animal agriculture and water quality is affected by existing programs other than the CAFO regulations. This section of the preamble presents today's action in the context of some of these other programs.

1. Water Quality Trading

EPA proposed a water quality trading policy on May 15, 2002, for public review and comment. The proposed policy lays out guidelines for States and

local governments/municipalities to consider when implementing a water quality trading program to maintain or reduce pollutant loading and achieve the goals of the Clean Water Act. Water quality trading is considered by some to be a more efficient and quicker pollution reduction process to meet water quality standards than conventional Clean Water Act methods. The proposed trading policy encourages currently regulated and nonregulated sources of pollution to interact more and make mutually beneficial agreements to reduce pollutant loading they might otherwise not be motivated to make. CAFOs may find mutually beneficial opportunities for water quality pollutant trading with other point and nonpoint sources in their watershed. For CAFOs interested in more details about Water Quality Trading, please go <http://www.epa.gov/ow>. The trading policy includes a general EPA water quality trading policy statement and identifies elements that define a successful trading program and provisions that should ensure consistency with the Clean Water Act.

2. Total Maximum Daily Load (TMDL)

The TMDL provisions of the Clean Water Act are intended to be the second line of defense for protecting the quality of surface water resources. When technology-based controls on point sources are inadequate for water to meet State water quality standards, section 303(d) of the Clean Water Act requires States to identify those waters and to develop TMDLs. A TMDL study must be conducted for each pollutant that causes a water body to fail to meet State water quality standards. More than 20,000 waters are identified nationally as being impaired and possibly requiring a TMDL. The top impairments in 1998 were sediment, nutrients, and pathogens. AFOs and CAFOs can be sources of all three pollutants.

A TMDL is a calculation of the greatest amount of a pollutant that a water body can receive without exceeding water quality standards. A TMDL allocates the amount of pollution that can be contributed by the pollutant sources. A TMDL study identifies both point and nonpoint sources of each pollutant that cause a water to fail to meet water quality standards. Water quality sampling, biological and habitat monitoring, and computer modeling help the TMDL writer determine how much each pollutant source must reduce its contribution to ensure that the water quality standard is met. Through the TMDL process, pollutant loads are allocated to all sources. Wasteload allocations for point sources

are enforced through NPDES discharge permits. Load allocations for nonpoint sources are not federally enforceable, but can be met through voluntary approaches. In some impaired watersheds, AFOs and CAFOs may be affected by TMDLs since improved management practices may be necessary to restore water quality. In the case of CAFOs, any necessary pollutant loading reductions would be achieved through the use of NPDES permits issued in accordance with the requirements contained in today's final rule.

3. Watershed Permitting

Watershed-based permits are NPDES permits that are issued to point sources on a geographic or watershed basis. They focus on watershed goals and consider multiple pollutant sources and stressors, including the level of nonpoint source control needed. A watershed approach provides a framework for addressing all stressors within a hydrologically defined drainage basin instead of viewing individual pollutant sources in isolation. More than 20 States have implemented some form of the watershed approach and manage their resources on a rotating basin cycle.

Because of the recent emphasis on water quality-based permits and development of TMDLs that focus on water quality impacts, EPA is looking at ways to use watershed-based permits to achieve watershed goals. The watershed-based permit is a tool that can assist with implementation of a watershed approach. The utility of this tool relies heavily on a detailed, integrated, and inclusive watershed planning process. Many of the actions necessary for a successful TMDL are also needed for a successful watershed approach. The process and data needs for developing a watershed-based permit and for developing a TMDL are very similar. In places where TMDLs have been developed, watershed permits may be useful tools for implementing TMDLs. For example, North Carolina's nutrient management strategy for the Neuse River Basin includes a watershed-based permit approach for TMDL implementation. The strategy recognizes the need for all groups to work together and includes an approach for permitted dischargers to work collectively to meet a combined nitrogen allocation, rather than be subject to individual allocations. The implementation of the approach is being developed (NC DWQ, 1998, 2002). A watershed permit approach was also used for municipal discharges in Connecticut contributing nutrients to the Long Island Sound (CTDEP, 2001).