SECTION SIX

SUMMARY OF ECONOMIC IMPACTS: POULTRY SUBCATEGORIES

This section presents a profile of the poultry industry, including farmers in the broiler, egg, and turkey sectors (Section 6.1) and also poultry processors (Section 6.2). Following the industry profile, this section provides a detailed summary of EPA's economic analysis of the proposed CAFO regulations as it affects regulated CAFOs (Section 6.3), poultry processors (Section 6.4), and national markets (Section 6.5).

6.1 PROFILE OF THE POULTRY PRODUCTION INDUSTRY

This section presents a profile of poultry production operations (broiler, egg, and turkey operations) and provides background information for analyzing the costs and benefits of the proposed CAFO regulations. The purpose of this profile is to provide a baseline description of the current activities, structure, and performance of the poultry production industries. The following sections describe the types of operations in this sector and present an overview of the industry, describing the number and size of operations (including the subset of regulated operations), geographic distribution, supply and demand conditions, price trends, and the financial conditions that characterize this sector.

6.1.1 Industry Definition

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:

- *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).

- *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).

- *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).

Beyond the poultry production sector, manufacturing and further processing are conducted by firms classified under NAICS 311615, Poultry Slaughtering, as well as an array of food processing sectors. Egg processors are classified under NAICS 311999(G), Liquid, dried, and frozen eggs. Almost 70 percent of all egg production is sold in fresh form to retail stores or to institutional buyers. See Section 6.2 for more information about poultry processors.

6.1.2 Overview of the Poultry Industry

The poultry market is among the most robust of all the U.S. livestock industries, showing increasing production and efficiency gains, ongoing strong growth in both domestic consumer demand and exports, continued favorable farm prices and returns, and increasing economies and enhanced efficiency within the poultry sector marketing chain. This is especially true of the poultry meat markets. The U.S. poultry industry is characterized by its rapid rates of growth and emphasis on increased industrialization, specialization, and consolidation. Historically, the poultry industry has been a highly integrated industry, with operations combining breeding, hatching, and growing functions, as well as grain farming and feed operations. Increased production efficiencies have generally favored larger operations and have encouraged the continued emphasis on specialization (Kohls and Uhl, 1998). Consequently, poultry meat and egg production has become concentrated among fewer, larger producers, as evidenced by a reduction in the number of poultry operations but an increase in the average size of these operations. Another major trend in this industry is a trend away from traditional areas of operation to emerging areas of operation where costs of production are lower.

6.1.2.1 Trends in the Number and Size

USDA reports that in 1997 there were a total of 63,200 commercial poultry farms in the United States, based on annual sales (USDA/NASS, 1999a). Table 6-1 shows USDA's estimate of the number of farms in the broiler, turkey, and egg sectors. In 1997, there were nearly 24,000 broiler operations based on annual sales. At year-end 1997, there were more than 12,000 turkey operations and 72,600 egg laying operations, based on inventories (Table 6-1). These data on the number of farms include both commercial and non-commercial operations, as well as confinement and non-confinement operations.

Table 6-1 shows broad trends based on data on the number of poultry operations and corresponding total number of animals by facility size categories for selected years between 1974 and 1997. As shown, the number of poultry farms is declining. In the broiler sector, the number of operations declined from 34,340 operations in 1974 to 24,000 operations in 1997, a 30 percent decline in the number of operations (Table 6-1). In the turkey sector, the number of operations decreased from 13,000 to 12,000 between 1974 and 1997. The number of egg laying operations dropped from 316,200 operations in 1974 to 72,600 operations by 1997, a reduction of 77 percent (Table 6-1).

Table 6-1. Trends in Number of Poultry Operations and Birds, 1974-1997

Year	Operations	Birds	Flock Size	Percent of Operations	Percent of Birds
		(million)	(number)		
Broiler				(>100million birds [sales])	
1974	34,340	2,519	73,400	30%	70%
1978	31,743	3,062	96,500	38%	82%
1982	30,100	3,517	116,800	44%	89%
1987	27,645	4,362	157,800	52%	93%
1992	23,949	5,429	226,700	65%	97%
1997	23,937	6,742	281,700	68%	98%
Layer				(>100K birds [inventory])	
1974	316,243	336	1,100	0.1%	30.1%
1978	240,891	354	1,500	0.1%	31.9%
1982	215,812	362	1,700	0.2%	41.6%
1987	144,438	374	2,600	0.3%	54.0%
1992	88,235	351	4,000	0.7%	62.2%
1997	72,616	367	5,100	0.8%	69.2%
Turkey				(>100K birds [inventory])	
1974 [a/]	12,787	27	2,100	12%	61%
1978 [a/]	18,936	36	1,900	10%	66%
1982	25,366	47	1,900	11%	72%
1987	19,031	74	3,900	17%	76%
1992	13,766	88	6,400	23%	80%
1997	12,118	104	8,600	28%	83%

Source: USDA/NASS, 1999a; USDC, 1994; USDC, 1989. Broilers (sales data); turkey/egg (year-end inventory). Average flock size per operation is computed from the USDA shown, rounded to the nearest hundred.
[a/]Turkey data for 1974 and 1978 imputed from sales data.

Meanwhile, overall poultry production and sales have continued to rise steadily. Although the number of broiler operations has decreased, total sales from all U.S. farms rose from an estimated 2.4 billion broilers in 1974 to 6.7 billion broilers in 1997, nearly a three-fold increase. Year-end inventories at turkey operations rose from 27 million turkeys in 1974 to 104 million

turkeys in 1997, or nearly quadrupling over that time period.[1] Year-end laying hen inventories have increased from 336 million in 1974 to 367 million in 1997, a 9 percent increase.

Increasing production is due to increasing flock sizes and production efficiency gains in these sectors. Across these sectors, average flock size per operation in 1997 was nearly four to five times that in the 1970s. Among broiler operations, average flock size rose from 73,400 birds in 1974 to 281,700 birds in 1997 (Table 6-1). At turkey operations, average flock size increased from 2,100 birds in 1974 to 8,600 birds in 1997. Average flock size at egg laying operations rose from 1,100 birds in 1974 to 5,100 birds in 1997.

The trend toward large farm size in these sectors is also indicated by data in Table 6-1. In the broiler sector, the proportion of operations selling more than 100,000 birds has grown from about 30 percent in 1974 to more than 68 percent in 1997. These larger sized operation accounted for almost 98 percent of total broiler sales, up from 70 percent in 1974 (Table 6-1). In the turkey sector, animal inventories and production are heavily concentrated among the larger sized turkey operations: operations with more than 100,000 turkeys account for about 83 percent of total inventory. In 1974, about 60 percent of turkey inventories were associated with larger-sized operations. In the egg sector, operations account for almost 70 percent of overall animal inventory in 1997, up from 30 percent in 1974 (Table 6-1).

For the purpose of this analysis, EPA estimates the number of confinement operations that may be subject to the proposed CAFO regulations using 1997 Census data that are aggregated by USDA's NASS. NASS developed a methodology for identifying farms likely to be CAFOs based on the Census survey information and estimated animal units on these operations based on reported data. A summary of these data are provided in the *Development Document* (USEPA, 2000a). These summary data reflect average flock size throughout the year, accounting for both animals sales and inventories. Where applicable, data are adjusted for the average number of marketing cycles (USEPA, 2000a). This avoids misrepresentation due to seasonal fluctuations in inventory and the number and timing of animals sold. From these data, EPA has estimated the number of confinement operations (referred to here as AFOs) using available data and other information from the Census as well as other USDA and industry publications (USDA/NASS, 1999a, 1999d, and 1998b). These data may differ from that presented in Table 6-1.

Expressed on this basis, USDA estimates that there were the USDA reports that there were 34,860 broiler operations that raised a total of 1.9 billion broilers during the year (Table 6-2). There were also 13,720 turkey operations raising a total 112.8 million turkeys. Operations with egg layers and pullets totaled 75,170 with an average annual inventory of 393 million egg layers on-site. Not all of these operations would be subject to the proposed regulations. See Table 6-2.

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[1]Given that inventories are reported as of December 31 for each census year and given the proximity of this reporting time frame to the Thanksgiving slaughter period, inventory numbers reported by U.S. Census may be, in part, explained by market conditions for a particular year in addition to structural changes in the farm sector.

Table 6-2 presents EPA's estimates of the number of operations that are CAFOs that would be subject to the proposed regulations. Under the two-tier structure, EPA estimates that there are 9,780 broiler operations, 1,280 turkey operations and 1,640 egg laying and pullet operations that have more than 500 AU (i.e., operations with more than 50,000 chickens or more than 27,500 turkeys). Under the three-tier structure, EPA estimates that 13,740 broiler operations, 2,060 turkey operations and 2,010 egg laying operations with more than 300 AU (i.e., operations with more than 30,000 chickens or more than 16,500 turkeys) would meet the "risk-based" conditions described in Section VII of the preamble and thus require a permit (Table 6-2). (More information on the co-proposed tier structures is provided in Section 3.)

Table 6-2. EPA's Estimate of the Number of CAFOs Affected under the Co-Proposed Tier Structures

Sector	Total Number of AFOs	Number of CAFOs						
		>1,000 AU [a/]	Two-Tier Structure (500 AU Threshold)			Three-Tier Structure (Scenario 3)		
			500-1,000 AU	<500 AU	Total CAFOs	300-1,000 AU	<300AU	Total CAFOs
Broilers	34,860	3,940	5,840	20	9,800	9,800	0	13,740
Layers-wet	3,110	50	310	20	380	310	0	360
Layers-dry	72,060	590	690	0	1,280	1,060	0	1,660
Turkeys	13,720	370	910	0	1,280	1,690	0	2,060
Sum Total	**123,750**	**4,950**	**7,760**	**40**	**12,740**	**12,860**	**0**	**17,820**

Source: USEPA, 2000a. See Section 2 for more information. See Table 3-1 for definitions of the options/scenarios.
"Layers: wet" are operations with liquid manure systems; "Layers: dry" are operations with dry systems. The number of operations shown eliminates double counting of operations with mixed animal types.
[a/]As defined for the proposed regulations, one AU is equivalent to 55 turkeys and 100 chickens regardless of the animal waste system used.

EPA expects few, if any, poultry AFOs with fewer than 500 AU will be subject to the revised requirements. Most poultry operations have fewer than 500 AU (USDA/NASS, 1999a). Under the two-tier structure, EPA expects that designation of broiler operations with fewer than 50,000 chickens will be limited to two broiler and two egg operations being designated annually, or a total of 40 poultry operations over a 10-year period. EPA expects that no turkey operations would be designated as CAFOs and subject to the proposed regulations. EPA expects that no confinement poultry operations will be designated as CAFOs under the proposed requirements under the three-tier structure (Table 6-2).

As shown in Table 6-2, EPA estimates that a total of 9,800 broiler operations, 1,660 layer operations, and 1,280 turkey operations would either to be defined (>500 AU) or designated

(<500 AU) as CAFOs under the two-tier structure. A total of 13,740 broiler operations, 2,020 layer operations, and 2,060 turkey operations would be defined as CAFOs under the three-tier structure. EPA does not expect poultry operations with fewer than 300 AU to be designated as CAFOs under the three-tier structure. These estimates adjust for operations with more than a single animal type.

More information on how EPA estimated the number of affected animal confinement operations is presented in Section 2 of this report, along with additional estimates on the number of affected poultry operations under other regulatory options considered by EPA.

6.1.2.2 Geographic Distribution

Poultry production is almost entirely managed through contract production, with operations located near poultry integrators who continue to develop newer, larger, more automated hatcheries, processing plants, distribution centers, and water treatment plants. Egg production has expanded mostly in the North Atlantic states (Kohls and Uhl, 1998). Broiler and turkey production has shifted from the northern to the southern states (Kohls and Uhl, 1998). The Southeast offers a number of cost advantages compared with other producing regions, including its relatively lower labor costs, proximity to end markets, lower housing and energy costs, and milder weather contributing to greater feed efficiency (USGAO, 1995; NCSU, 1998; Kohls and Uhl, 1998). Poultry production and feedgrain production are closely interrelated; however, it has become cheaper to transport surplus grains from surplus-producing areas in the north to low-cost poultry producing areas than to raise birds near grains. The seasonality of poultry production has been reduced as production has shifted to warmer climates and as use of confinement production has become more prevalent (Kohls and Uhl, 1998).

Nearly 60 percent of all broiler production is concentrated among the top five producing states. In 1997, Georgia and Arkansas were the largest broiler producing states, each representing about 15 percent of all broiler meat production (Table 6-3). Alabama accounted for another 12 percent of production. Mississippi and North Carolina were also among the top five producing states, each accounting for about 9 percent of U.S. production. Other top ten producing states in 1997 included Texas, Maryland, Virginia, Delaware, and Missouri (Table 6-3). Combined, the top ten producing states accounted for 79 percent of U.S. broiler production in 1997 (Table 6-3).

U.S. egg production is fairly evenly distributed among the top five producing states, with a combined market share of 42 percent of all egg production in 1997. These five leading states included Ohio, California, Pennsylvania, Indiana, and Iowa, with production shares ranging from 9.5 percent to 7.5 percent each (Table 6-4). Other top ten producing states in 1997 included Georgia, Texas, Arkansas, Minnesota, and North Carolina. The top ten states accounted for 66 percent of egg production in 1997. The top 20 states represented 90 percent of all production (Table 6-4).

Table 6-3. Geographic Distribution of Broiler Operations by Major Producing State, 1997

Major Producing State	Broilers Produced		Operations Reporting Sales	
	(thousands)	(percent)	(number)	(percent)
Georgia	1,182,800	15%	2,245	9%
Arkansas	1,164,600	15%	3,650	15%
Alabama	906,200	12%	2,477	10%
Mississippi	720,300	9%	1,393	6%
North Carolina	665,000	9%	2,086	9%
Texas	455,100	6%	1,000	4%
Maryland	295,300	4%	997	4%
Virginia	259,400	3%	671	3%
Delaware	256,900	3%	805	3%
Missouri	250,000	3%	451	2%
California	237,300	3%	240	1%
Oklahoma	197,400	3%	632	3%
South Carolina	182,800	2%	366	2%
Tennessee	138,600	2%	548	2%
Pennsylvania	135,200	2%	845	4%
Florida	132,400	2%	321	1%
Kentucky	110,600	1%	243	1%
West Virginia	90,800	1%	186	1%
Minnesota	46,300	1%	621	3%
Ohio	45,800	1%	496	2%
All Other	287,000	4%	3,664	15%
Top 5 states	4,638,900	60%	11,851	50%
Top 10 states	6,155,600	79%	15,775	66%
Top 20 states	7,472,800	96%	20,273	85%
Total U.S.	7,760,200	100%	23,937	100%

Source: USDA/NASS, 1998f and USDA/NASS, 1999a. (Farms reporting sales).

Table 6-4. Geographic Distribution of Layer Operations by Major Producing State, 1997

Major Producing State	Eggs Produced		Operations Reporting Inventory	
	(million)	(percent)	(number)	(percent)
Ohio	6,976	9%	3,190	4%
California	6,663	9%	2,731	4%
Pennsylvania	5,900	8%	3,259	4%
Indiana	5,652	8%	1,846	3%
Iowa	5,527	8%	1,892	3%
Georgia	4,867	7%	1,295	2%
Texas	4,186	6%	6,473	9%
Arkansas	3,215	4%	1,835	3%
Minnesota	2,957	4%	1,964	3%
North Carolina	2,794	4%	1,726	2%
Alabama	2,499	3%	1,250	2%
Florida	2,499	3%	1,203	2%
Nebraska	2,469	3%	1,506	2%
Missouri	1,719	2%	3,707	5%
Mississippi	1,547	2%	941	1%
Maine	1,434	2%	554	1%
Washington	1,379	2%	1,543	2%
Michigan	1,327	2%	2,276	3%
South Carolina	1,228	2%	730	1%
Wisconsin	998	1%	2,543	4%
All Other	7,633	10.4%	30,152	42%
Top 5 states	30,718	42%	12,918	18%
Top 10 states	48,737	66%	26,211	36%
Top 20 states	65,836	90%	42,464	58%
Total U.S.	73,469	100%	72,616	100%

Source: USDA/NASS, 1998f and USDA/NASS, 1999a. (Farms reporting year-end inventory of layers and pullets 13 weeks old and older).

The top five turkey producing states account for almost 60 percent of all turkeys sold commercially. North Carolina was the largest producing state with 18 percent of the market in 1997 (Table 6-5). Minnesota was the second largest producer, accounting for 15 percent of sales. Virginia, Arkansas, and California—each with roughly 8 percent of total sales—were also among the top five producing turkey states. Other top ten producing states in 1997 included Missouri, Indiana, South Carolina, Texas, and Pennsylvania. The top 10 producing states accounted for more than 80 percent of turkey production (Table 6-5).

Table 6-5. Geographic Distribution of Turkey Operations by Major Producing State, 1997

Major Producing State	Turkeys Sold		Operations Reporting Sales	
	(thousands)	(percent)	(number)	(percent)
North Carolina	56,471	18%	733	12%
Minnesota	47,185	15%	359	6%
Virginia	26,031	8%	389	6%
Arkansas	25,454	8%	289	5%
California	23,552	8%	211	3%
Missouri	21,085	7%	402	7%
Indiana	13,685	4%	259	4%
South Carolina	13,504	4%	168	3%
Texas	12,767	4%	215	4%
Pennsylvania	10,702	3%	304	5%
Iowa	7,280	2%	206	3%
Michigan	6,481	2%	241	4%
Ohio	6,469	2%	281	5%
West Virginia	4,468	1%	80	1%
South Dakota	3,566	1%	51	1%
Illinois	3,160	1%	109	2%
North Dakota	2,624	1%	29	0%
Oklahoma	1,749	1%	65	1%
Kansas	1,617	1%	62	1%
Maryland	751	0%	49	1%
All Other	18,986	6%	1,529	25%
Top 5 states	178,693	58%	1,981	33%
Top 10 states	250,435	81%	3,329	55%
Top 20 states	288,600	94%	4,502	75%
Total U.S.	307,587	100%	6,031	100%

Source: USDA/NASS, 1999a. (Turkeys sold and farms reporting sales).

6.1.2.3 Supply and Demand Conditions

The poultry industry experienced large gains in production in the past decade, especially in broiler/chicken meat and turkey production. These gains were driven, in part, by continued strong domestic and also international demand growth. Poultry meat consumption in the United States totaled more than 100 pounds per person in 1997, more than double that reported for 1970. Increased demand for poultry meat products abroad has also helped boost production, particularly turkey exports. The U.S. is a net exporter of poultry and the dominant world supplier (USDA/WAOB, 1999). Table 6-6 shows terns in poultry meat and eggs from 1992 through 1997, as reported by USDA (Putnam and Allshouse, 1997 and 1999).

U.S. broiler and chicken meat production continues to increase steadily, rising nearly 30 percent between 1992 and 1997. Demand for broiler and other chicken is also increasing, rising 15 percent between 1992 and 1997 (Table 6-6). Expressed on a per capita basis, demand for broilers rose from 76.9 pounds per person in 1992 to 83.8 pounds per person in 1997. U.S. broiler and chicken meat exports account for almost one-fifth of total production annually. From 1992 to 1997, broiler exports nearly tripled from 1.7 billion pounds to 5.0 billion pounds (Table 6-6). U.S. imports of broiler and chicken meat are low and account for less than one percent of total supplies.

U.S. egg production has increased steadily each year since 1992, reaching 6.4 billion dozen eggs produced in 1997 (Table 6-6). Aside from a spike in per capita demand to above 240 eggs per person per year in 1997 (reflects both whole shell egg demand and use in processed foods), egg demand has more or less stabilized at about 235 eggs per person per year (with some annual fluctuations). While the market conditions for eggs remain strong, aggregate demand for eggs is down compared to 1970s when demand per person was 300 eggs per person per year (Putnam and Allshouse, 1997 and 1999). The United States exports more than 200 million dozen eggs annually, accounting for more than 3 percent of total production. Egg exports increased more than 25 percent during the 1990s, rising from 175 million dozen eggs exported in 1992 to 220 million dozen eggs exported in 1997 (Table 6-6). Egg imports remain negligible.

Turkey production (carcass weight basis) rose 13 percent from 4.8 billion pounds to 5.4 billion pounds (Table 6-6). During the same period, total domestic demand for turkey meat increased slightly to 4.7 billion pounds in 1997. Expressed on a per capita basis, however, demand for turkey products dropped by nearly 2 percent from 1992 to 1997. Since 1990, annual demand growth has been more or less flat, and the demand for turkey meat appears to have reached a plateau at roughly 18 pounds per person annually (Table 6-6). Turkey exports constitute an increasing share of U.S. turkey production. Turkey exports more than tripled between 1992 and 1997, increasing from 186 million pounds to 598 million pounds (Table 6-6). Currently, exports account for more than 10 percent of total annual production. U.S. turkey imports are negligible, and almost all U.S. demand is supplied domestically.

Table 6-6. Total U.S. Poultry Supply and Demand, 1992-1997

Year	Production	Imports	Exports	Total Demand	Per Capita Demand
Broiler and Chicken Meat					
	(million pounds ready-to-cook, carcass weight)				(lbs./person)
1992	21,423	—	1,732	19,624	76.9
1993	22,530	—	2,174	20,368	78.9
1994	24,175	1	2,966	21,103	80.8
1995	25,323	4	3,993	21,238	80.5
1996	26,615	4	4,685	21,854	82.0
1997	27,551	5	5,048	22,541	83.8
%92-97	**29%**	**NA**	**192%**	**15%**	**9%**
Eggs					
	(million dozen)				(eggs/person**)**
1992	5,905	4	175	5,002	235
1993	6,006	5	176	5,068	236
1994	6,178	1	212	5,160	238
1995	6,216	4	229	514	235
1996	6,359	5	276	5,228	236
1997	6,436	6	220	5,325	242
%92-97	**9%**	**48%**	**26%**	**7%**	**3%**
Turkey Meat					
	(million pounds ready-to-cook, carcass weight)				(lbs./person)
1992	4,777	NA	186	4,584	17.9
1993	4,798	NA	224	4,596	17.8
1994	4,937	NA	280	4,652	17.8
1995	5,069	NA	348	4,706	17.8
1996	5,401	NA	438	4,906	18.4
1997	5,412	NA	598	4,727	17.6
%92-97	**13%**	**NA**	**222%**	**3%**	**-2%**

Source: Putnam and Allshouse, 1997 and 1999. Supplemented with information from USDA/ERS, 1998c and 1997f. Excludes beginning and ending stocks, shipments to U.S. territories, and hatching. Per capita demand is shown to depict real demand growth, adjusting for growth in U.S. population, which has grown, on average, at about 1% per year.

6.1.2.4 Farm Price Trends

The poultry sectors experience cyclical expansions and contractions in output. Price cycles in the poultry meat and egg sectors are caused by a relatively elastic supply and the tendency for producers to base future production plans on current prices and profits (Kohls and Uhl, 1998). Perishability of poultry products raises the urgency of farmers to market their products, thus limiting producer flexibility. Birds must be sold when they reach proper market weight and maturity; eggs must be sold fresh, regardless of market conditions and prices (Kohls and Uhl, 1998). Table 6-7 presents the average quarterly and annual broiler, turkey, and egg prices received by producers from 1992 through 1997.

Table 6-7. Average Quarterly and Annual Poultry Prices Received by Farmers, Total U.S., 1992-1997

Year	Average Q1	Average Q2	Average Q3	Average Q4	Average Annual
Broilers Monthly Prices Received by Farmers ($/pound)					
1992	0.299	0.314	0.335	0.326	0.319
1993	0.323	0.347	0.361	0.346	0.344
1994	0.345	0.369	0.355	0.329	0.350
1995	0.325	0.325	0.367	0.369	0.347
1996	0.355	0.378	0.403	0.405	0.385
1997	0.392	0.370	0.396	0.338	0.374
All Eggs Monthly Prices Received by Farmers ($/dozen)					
1992	0.558	0.530	0.552	0.617	0.564
1993	0.650	0.663	0.581	0.622	0.629
1994	0.640	0.592	0.598	0.604	0.609
1995	0.606	0.577	0.633	0.736	0.638
1996	0.777	0.721	0.732	0.811	0.760
1997	0.744	0.633	0.663	0.750	0.698
Turkeys Monthly Prices Received by Farmers ($/pound)					
1992	0.363	0.375	0.377	0.391	0.376
1993	0.363	0.376	0.398	0.422	0.390
1994	0.376	0.398	0.419	0.437	0.407
1995	0.384	0.384	0.417	0.455	0.410
1996	0.416	0.433	0.445	0.446	0.435
1997	0.376	0.407	0.410	0.404	0.399

Source: USDA/NASS, 1998a.

Broiler prices have been steadily increasing in response to growing market demand. From 1992 to 1997, average annual farm-gate prices rose more than 17 percent, up from $0.32 per pound to $0.37 per pound (USDA/NASS, 1998a). Broiler prices quoted in Table 6-7 from USDA/NASS are "equivalent liveweight returns to producers" and are derived from retail, ready-to-cook prices by subtracting processing costs and multiplying by the dressing percentage. Egg prices rose between 1992 and 1996, rising 35 percent from $0.56 per dozen to $0.76 per dozen. Changing market conditions by 1997, however, dropped farm prices back down to $0.69 per dozen (USDA/NASS, 1998a). Turkey farm prices increased steadily each year from 1992 to 1996, rising more than 15 percent from $0.37 per pound to $0.43 per pound. By 1997, however, farm prices had dropped back down to $0.40 cents per pound.

The actual price a farmer receives will depend on whether the operation is an independent owner-operator or whether the operation grows animals under a production contract with a processor/integrator. The price that a contract grower receives tends to be lower than the market price received by an independent operator. However, the contract grower's production costs are oftentimes much lower than those incurred by independents because the contractor provides many of the production inputs to the grower. In addition to reduced variable costs, contract growers face less price risk because the integrator guarantees the grower a sales outlet and a certain range of fees. In comparison, independent growers must cover all production costs, find a sales outlet, and cope with market price fluctuations. Growers accept integrators' contracts to reduce risk and gain access to inputs and outlets. Whether the grower is better or worse off with a contract depends on the grower's attitude toward risk and business objectives, as well as the perceived gains given the specific terms of the contract.

Sample broiler contract prices reported by the National Poultry Growers Association range from 3.25 to 7 cents per pound (NPGA, 1998). This same source indicates an average basic broiler payment of $200/thousand birds, or 3.6 cents per bird assuming a 5.5 pound average bird. Perry et al. (1999) estimate contract fees of about 22 to 24 cents per bird (1995 data), or about 4 cents per pound, assuming 5.5 lbs. per bird. Compared to USDA-reported producer prices of about 37 cents per pound (Table 6-7), the price the grower receives is roughly 10 percent of the farm gate price.

The contract broiler grower's payment rate is compensation for the services provided in growing chicks to market weight. The integrator retains ownership of the birds and provides feed, veterinary services, medicines, technical support, and transportation of the animals. These items amount to approximately 60 percent of the variable expenses of raising broilers (Perry et al., 1999). Easterling and Lasley (1985) estimate that feed, chicks, and veterinary and other items cost the contractor a total of 20.6 cents per pound. As a result, average cash expenses are only $53,446 compared to the nearly $200,000 average for farms with no poultry that generate sales of $50,000 or more. Contract broiler growers' income statements show most of their income as "Other farm-related income," which reflects contracting fees collected, rather than as livestock sales (Perry et al., 1999). Livestock costs for broiler producers with sales of more than $50,000 averaged $1,754 in 1995 while comparable farms without poultry averaged $14,825. Broiler

operations feed costs averaged only $3,725 compared to $26,742 at non-poultry operations (Perry, et al., 1999). Thus, while the average farm, with sales of $50,000 or more, retains 21 cents for every dollar of sales, the average broiler producer retains 39 cents. The dollar value of broiler producers' sales are lower because they receive only the contract rate rather than the full price of the product. However, this relationship makes the average annual gross income for broiler producers only $86,048 compared to the U.S. average of $250,478 for farms without poultry that generate sales of $50,000 or more (Perry et al., 1999). Broiler producers' average net farm income in 1995 was $15,969, about half that of farms without poultry that generate sales of $50,000 or more (Perry et al., 1999).

Egg contract prices, based on layer production budgets by flock size are reported at 7 cents per dozen (DPRA, 1995) compared to the USDA-reported producer price of 70 cents per dozen in 1997 (Table 6-7), or about 10 percent. A older USDA study (Easterling and Lasley, 1985) estimated contract payments of 6 cents per dozen, or about 9 percent of the estimated wholesale egg price used in this study (68.6 cents per dozen). As for broilers, lower prices to contract growers may be substantially offset by the contractor's provision of production inputs. Easterling and Lasely (1985) estimate that feed, pullets, veterinary and other livestock production items cost the contractor a total of 41 cents per dozen. These are items typically provided by contractors.

Grower payments for turkeys are also estimated by Easterling and Lasley (1985) to be 4.5 cents per pound liveweight in 1984. Growers may also receive substantial production inputs from contractors. Easterling and Lasley estimate the feed, poults, and veterinary costs and other production items cost the contractor a total of 33.6 cents per pound. Again, the contract price of 4.5 cents per pound appears to be about 10 percent of the USDA-reported producer price, which averages about 40 cents per pound (Table 6-7).

6.1.3 Financial Characteristics of Poultry Operations

6.1.3.1 Overview of Financial Characteristics

USDA reports commercial poultry farms in the U.S. generated a total of $22.3 billion in annual revenue in 1997 (USDA/NASS, 1999a).[2] As shown in Table 6-8, virtually all (99 percent) poultry farm revenues were from the sales of all poultry meat and eggs. Less than $0.3 billion of all poultry farm revenue was generated from the sales of other livestock or crop production (Table 6-8).

[2]USDA defines commercial farms as those with gross sales of $50,000 or more during a given year.

Table 6-8. Farm Revenue at Poultry Farms (>$50,000 in Sales), by Revenue Category and Economic Class

Revenue Category/Economic Class	# Poultry Farms (1,000's)	Revenues ($1,000)
Sales by Revenue Category (reported and percentage share)		
Primary Livestock	27,680	21,903,113
Secondary Livestock	534	202,729
Crop Sales	261	65,855
All Farms	**28,475**	**22,171,699**
Primary Livestock	97%	99%
Secondary Livestock	2%	1%
Crop Sales	1%	0%
All Farms	**100%**	**100%**
Sales by Economic Class (reported and percentage share)		
>$1 million in revenue	5,380	12,852,259
Between $0.5-$1.0	8,454	5,709,457
Between $0.25-$0.50	7,421	2,619,496
Between $0.10-$0.25	5,364	857,460
Between $0.05-$0.10	1,855	133,026
All Farms	**28,474**	**22,171,698**
>$1 million in revenue	19%	58%
Between $0.5-$1.0	30%	26%
Between $0.25-$0.50	26%	12%
Between $0.10-$0.25	19%	4%
Between $0.05-$0.10	7%	1%
All Farms	**100%**	**16667%**

Source: USDA/NASS, 1999a (Table 50 and Table 51). Based on data for commercial farms with more than $50,000 in annual revenues. Excludes non-commercial farms with revenues below $50,000.
Primary Livestock: Hogs (NAICS 1122) and Poultry (NAICS 1123), respectively.
Secondary Livestock: Beef (beef farming, NAICS 112111, and beef feedlots, NAICS 112112), Dairy (NAICS 11212), miscellaneous categories (NAICS 1122, NAICS 1124, NAICS 1125), along with Hogs (NAICS 1122) and Poultry (NAICS 1123), respectively.
Crop Sales: Oilseed/Grains (NAICS 1111), Vegetables (NAICS 1112), Fruits/Nuts (NAICS 1113), Greenhouse (NAICS 1114) and other crops (NAICS 1119).

As the Census data do not report farm revenues separately among the primary poultry sectors, sales are estimated based on other available USDA data for these sectors (USDA/ERS, 1996c). Accordingly, the broiler sector captures the largest share of total U.S. poultry sales, claiming nearly two-thirds of all farm sector poultry receipts. The farm value of all U.S. broiler and chicken meat production is estimated $13.6 billion in 1997 (USDA/NASS, 1999a; USDA/ERS, 1996c). Turkey revenues account for under 15 percent of total poultry receipts generated annually. In 1997, the farm value of all U.S. turkey production was estimated at $3.2 billion. Revenues from egg sales account for about one-fifth of total annual poultry receipts, totaling an estimated $4.5 billion in 1997 (Table 6-8).[3] The remaining 3 percent of all poultry revenues ($0.7 billion) were generated from the sale of miscellaneous poultry products.

As shown in Table 6-8 almost one-half of all commercial poultry farms generate more than $0.5 million in revenue annually (USDA/NASS, 1999a). The remaining share of farms generate revenues below $0.5 million. These data do not distinguish among the primary poultry sectors (broilers, turkeys, and layers). The $0.5 million threshold corresponds with the definition of a "small business" in the broiler and turkey sectors established by the Small Business Administration; SBA's definition of a "small" layer operation is one with less than $9.0 million in annual revenues (SBA, 1998; USGPO, 2000). (Section 9 provides additional information on EPA's small business analysis.)

6.1.3.2 Income Statement and Balance Sheet Information

Table 6-9 presents average income statement and balance sheet data for commercial poultry farms from 1993 through 1997. (These data do not distinguish among the primary poultry sectors—broilers, turkeys, and layers.) The average U.S. poultry farm was in a favorable financial position from 1993 through 1997 with a positive net farm income and a debt-to-asset ratio that from ranged from 0.19 to 0.30 from 1993 to 1997. (USDA's farm performance criteria are described in Section 4.2.5.) While the national average income statement shows a positive net income, additional information show that between 1991 and 1994 about 21 percent of all poultry farms experienced negative income (USDA/ERS, 1997b). Operations in the poorer performing category likely are smaller operations that are not affected by the proposed CAFO regulations.

Direct financial comparisons between poultry meat and egg production are difficult because of the way USDA data are structured. However, there are cost and return characteristics that can be compared across poultry sectors. For example, because feed costs comprise a large share of total production costs, each subcategory's feed conversion ratio (i.e., the pounds of feed per unit of production) is an important indicator of production efficiency. Broilers have a lower (i.e., more efficient) feed conversion ratio than turkeys, requiring less feed per pound of product produced (Easterling and Lasley, 1985). This translates into a lower feed cost per pound of meat produced. Feed is also a smaller percentage of total cost for broilers than for turkeys or layers.

[3] This does not include layer farms revenues generated from the sales of culled inventories for chicken meat or the sales of below grade eggs for use in processing.

Table 6-9. Income Statement and Balance Sheet for Poultry Farms (Sales >$50,000), 1993-97

Item	1993	1994	1995	1996	1997
	Dollars per Farm				
Income Statement					
Gross cash income	**$147,575**	**$204,915**	**$203,711**	**$174,089**	**$341,206**
Livestock sales	$79,102	$130,438	$122,364	$74,105	$238,281
Crop sales (incl. net CCC loans)	$11,106	$6,273	$5,700	$5,958	$10,158
Government payments	$1,156	$653	$507	$350	$1,213
Other farm-related income [a/]	$56,211	$67,551	$75,139	$93,676	$91,554
Less: Cash expenses	**$108,528**	**$166,355**	**$161,491**	**$116,614**	**$271,349**
Variable Cash expenses	**$87,977**	**$148,413**	**$138,373**	**$96,855**	**$244,282**
Fixed Cash expenses	**$20,550**	**$17,941**	**$23,118**	**$19,759**	**$27,066**
Equals: Net cash farm income	**$39,047**	**$38,560**	**$42,220**	**$57,475**	**$69,858**
Less: Depreciation	$25,943	$20,017	$20,866	$19,895	$20,417
Labor, non-cash benefits	$301	$617	$527	$269	$384
Plus: Value of inventory change	$3,007	$5,317	$8,197	$494	$5,603
Non-money income [b/]	$4,680	$5,078	$5,933	$5,132	$5,043
Equals: Net farm income	**$20,490**	**$28,322**	**$34,957**	**$42,937**	**$59,703**
Balance Sheet					
Farm assets	**$537,351**	**$611,305**	**$578,753**	**$560,174**	**680,690**
Current assets	$58,152	$90,618	$79,672	$41,207	71,598
Non-current assets	$479,199	$520,687	$499,082	$518,967	609,092
Farm liabilities	**$130,914**	**$114,579**	**$136,437**	**$168,055**	**173,200**
Current liabilities	$33,339	$23,863	$51,424	$30,849	38,139
Non-current liabilities	$97,575	$90,715	$85,013	$137,206	135,061
Farm equity	**$406,437**	**$496,727**	**$442,316**	**$392,119**	**507,490**
Debt/asset ratio	**0.24**	**0.19**	**0.24**	**0.30**	**0.25**

Source: USDA/ERS, 1999a and 1996e.

[a] Includes income from machine-hire, custom work, livestock grazing, land rental, contract production fees, outdoor recreation, and any other farm-related source.

[b] Defined as home consumption and imputed rental value of farm dwellings owned by the farm operation.

Table 6-10 provides additional information from USDA (1993 data) that describes income statement differences among broiler operations (USDA/ERS, 1996c). At the average single-contract farm, fixed expenses account for about one-third of the cash expenses, with interest and insurance as the largest components of fixed expenses. At contract operations, there is no one dominant expense category for the variable expenses. Although the average poultry operation shows a positive net cash income, the average contract broiler operation shows approximately one-half the gross income ($77,452 versus $147,575), about 65 percent of the net cash income ($25,341 versus $39,047), and a higher proportion of fixed expenses (33 percent versus 19

percent) compared to the average poultry operation. On the other hand, feed accounts for 38 percent of the variable costs for the poultry operation but only 6 percent of the variable costs for the contract broiler operation.

Table 6-10. Income Statements for Single-Contract Farms with Broilers, 1993

Item	Farms with Contract Value of			
	Farm with One Broiler Contract	Under $300,000	$300,000 to $599,999	More than $600,000
	($ per cwt. gain)			
Gross cash income	**$77,452**	**$33,625**	**$73,957**	**$150,438**
Production fees	$53,552	$20,836	$53,140	$102,840
Cash expenses	**$52,111**	**$25,119**	**$47,510**	**$102,848**
Variable expenses	$34,682	$19,802	$30,741	$65,972
Livestock purchase	S	S	S	S
Feed purchase	$2,063	$1,393	$1,404	$4,607
Livestock related	$11,495	$914	$1,839	$1,539
Seed and plants	$1,082	$215	$959	$2,652
Fertilizer and chemicals	$2,916	$591	$2,907	$6,470
Labor	$6,716	$4,034	$5,199	$14,262
Fuels and oils	$5,476	$3,018	$5,249	$9,882
Repairs and maintenance	$5,071	$3,460	$4,657	$8,426
Machine work/custom hire	$865	$334	$643	$2,175
Utilities	$5,417	$3,734	$4,917	$9,083
Other variable expenses	$2,963	$2,109	$2,714	$4,813
Fixed expenses	$17,429	$5,317	$16,769	$38,876
Real estate/property taxes	$1,756	$838	$1,901	$2,769
Interest and insurance	$14,503	$4,065	$13,535	$32,208
Rent/lease payments	$1,170	$414	$1,333	$1,899
Net cash income	**$25,341**	**$8,506**	**$27,477**	**$47,590**

Source: USDA/ERS, 1996c. S = suppressed because the relative standard error exceeds 50 percent.

Table 6-11 provides other financial information on the broiler, turkey, and egg laying sectors that summarize farm and wholesale costs and estimated net returns from 1990 to 1995. These data are compiled monthly by USDA, based on estimated costs and regional spot market prices, and represent national average returns to producers and wholesalers (USDA/ERS, 1997d). Feed accounts for between 60 percent and 64 percent of costs to raise broilers, turkeys, and egg layers (see Table 6-11). Costs for broilers range from $0.26 to $0.27 per pound while prices range from $0.31 to $0.35 per pound. Costs for turkeys range from $0.36 to $0.38 per pound, while prices range from $0.38 to $0.41 per pound (USDA/ERS, 1997d). Costs for eggs range

from $0.46 to $0.47 per dozen while prices range from $0.45 to $0.62 per dozen. In 1992, the cost exceeded the price for eggs (Table 6-11).

Net returns as a percentage of price range from 14 percent to 24 percent for broilers. For turkeys, net returns are much lower, i.e., 2 percent to 13 percent of price. Eggs show the largest fluctuation in net returns as a percentage of price, from a 3 percent decrease in 1992 to a 25 percent gain in 1990 (USDA/ERS, 1997d). See Table 6-11.

6.1.3.3 Baseline Conditions for Poultry Operations

Tables 6-12 through 6-17 provide a summary of the financial baseline conditions assumed for this analysis. These data are aggregated from the 1997 ARMS data set and are obtained by USDA's ERS, as described in Section 4. These data are separated by select facility size and production region groupings (see Table 4-4), but do not reflect conditions separately across the different types of poultry operations within a sector (e.g., dry layers vs. wet layers or contract operations vs. non-contract operations). Additional information on how these data differ by region are provided in the record (USDA/ERS, 1999a, see DCN 70063).

According to the 1997 ARMS data the average poultry operation demonstrated a favorable financial position in 1997 with positive net income and a debt-to-asset ratio that ranged from 7 percent (small turkey operations) to 30 percent (large broiler operations), across select operation sizes (USDA/ERS, 1999a). See Tables 6-12, 6-14, and 6-16. These debt-to-asset ratios indicate that—on average—poultry operations are not in a vulnerable financial position and have a low potential for cash flow problems and a low relative risk of insolvency. Based on these data, EPA assumes that baseline (prior to regulation) net cash flow for all model types for the poultry sector is estimated to be positive, and baseline debt-to-asset ratios for all model types are 40 percent or less. All poultry operations in this analysis, therefore, are considered financially healthy, on average, in the regulatory baseline.

Broiler Operations

Data shown in Table 6-12 are distributed by broad facility size groups. As shown, more than 75 percent of operations have fewer than 30,000 birds, however, these operations only account for about 7 percent of all broilers raised annually (Table 6-12). There are fewer larger-sized operations with more than 90,000 birds (7 percent of all farms), but these operations raise over 49 percent of all broilers annually (Table 6-12). Smaller broiler operations with less than 30,000 birds are slightly more diversified than larger ones, with about 17 percent of all farm revenue from crops. This compares to broiler operations with more than 90,000 birds, where livestock comprises the bulk of all annual farm sales and only 3 percent of farm revenues are from crops (Table 6-12). Overall, the average broiler operation does not have a large value of crop production, regardless of size of operation.

Table 6-11 Distribution of Commercial Farms, by Net Farm Income, 1990-1995

Sector	1990	1991	1992	1993	1994	1995
Broilers (cents per pound)						
Farm price	32.38	30.91	31.85	34.43	34.95	34.66
Farm production costs	26.87	26.67	26.68	26.39	27.16	26.38
Feed costs	16.59	16.34	16.33	16.04	16.81	16.03
Feed costs as a % of farm costs	62%	61%	61%	61%	62%	61%
Farm net returns	5.51	4.24	5.17	8.04	7.79	8.28
Net returns as % of price	17%	14%	16%	23%	22%	24%
Wholesale price	54.77	52.03	52.57	55.18	55.80	56.23
Wholesale cost	49.24	49.06	49.32	48.83	49.84	48.81
Wholesale net returns [a/]	5.53	2.97	3.25	6.35	5.96	7.42
Net returns as % of price	10%	6%	6%	12%	11%	13%
Turkeys (cents per pound)						
Farm price	38.37	37.65	37.63	38.99	40.74	41.08
Farm production costs	37.10	36.42	36.86	36.09	37.68	35.63
Feed costs	23.40	22.72	23.16	22.39	23.98	21.93
Feed costs as a % of farm costs	63%	62%	63%	62%	64%	62%
Farm net returns	1.27	1.23	0.77	2.90	3.06	5.45
Net returns as % of price	3%	3%	2%	7%	8%	13%
Wholesale price	62.35	60.79	60.48	62.83	65.53	65.89
Wholesale cost	62.60	61.83	62.38	61.42	63.40	60.83
Wholesale net returns [a/]	-0.25	-1.04	-1.90	1.41	2.13	5.06
Net returns as % of price	-0%	-2%	-3%	2%	3%	8%
Eggs (cents per dozen)						
Farm price	62.00	56.65	45.00	51.34	49.20	53.58
Farm production costs	46.61	46.25	46.23	45.95	47.08	47.05
Feed costs	28.41	28.05	28.03	27.75	28.88	28.85
Feed costs as a % of farm costs	61%	61%	61%	60%	61%	61%
Farm net returns	15.39	10.40	-1.23	5.39	2.12	6.53
Net returns as % of price	25%	18%	-3%	10%	4%	12%
Wholesale price	83.81	79.49	68.43	75.06	71.09	76.36
Wholesale cost	67.33	67.07	66.73	66.46	67.58	67.55
Wholesale net returns [a/]	16.48	12.42	1.70	8.60	3.51	8.81
Net returns as % of price	20%	16%	2%	11%	5%	12%

Source: Derived from USDA/ERS, 1997d.

[a/]Average for 12-Metro area.

Table 6-12 also shows the percentage of broilers owned by farmers compared to those not owned by farmers. EPA uses this information on animal ownership as an indication of the extent of production contract use in these sectors (see Section 2.3). Across all broiler operations in 1997, nearly all (98 percent) broilers and meat chickens were not owned by farmers (USDA/ERS,

1999a). Percentages vary slightly across farm sizes, with up to 99.6 percent of birds not owned by the farming operation for farms with more than 90,000 birds, compared to 92 percent among smaller-sized operations (Table 6-12).

The data shown in Table 6-13 are also differentiated by selected size categories and reveal differences among operations by size. The income statement data for broiler operations reflect the prevalence of production contracting in this sector. These data also point to increasing specialization as the size of an operation increases. A larger proportion of birds are not owned at the largest operations than at the smallest operations and the smallest operations may have proportionately larger expenditures on livestock-related expenses than large operations. Operations with fewer than 30,000 birds have average feed expenditures of $4,275, while operations with more than 90,000 birds have average feed expenditures of only $2,525 (Table 6-13). This is expected given that nearly 100 percent of broilers are not owned at large operations and feed is most likely provided by the contractor.

Operating margins (measured as average net cash farm income as a percentage of average gross cash income) indicate that there may be large economies of scale associated with broiler sector operations (USDA/ERS, 1999a). Operating margins are negligible at operations with fewer than 90,000 birds, as compared to 39 percent and 43 percent at operations with 30,000 to 90,000 birds, and more than 90,000 birds. The smallest operations also show the lowest return on assets (measured as average net farm income to average farm assets); operations with less than 30,000 birds show average return on assets of 1.2 percent, as compared to 6.8 percent and 10 percent at operations with between 30,000 and 90,000 birds and more than 90,000 birds, respectively (USDA/ERS, 1999a). See Table 6-13. The 1997 ARMS data include, among an average farm's assets, the value of the owner's home when it is located on the farm. Since smaller operations may be more likely to have the owner's dwelling located on the farm than larger operations, if dwelling values were excluded, the returns on the "business" assets might be higher for these smallest operations.

Section 4 of this report presents key financial data used for this analysis, shown in Table 6-13, that are calculated onto a per-animal basis. For the broiler sector, total gross farm revenues are estimated to range from $1.10 to $1.50 per bird (includes revenue from other farm-related sources). Net cash income ranges from $0.50 to $0.60 per bird among CAFO models, depending on facility size and region (see Tables 4-5 and 4-6).

Layer Operations

Data shown in Table 6-14 are distributed by broad facility size groups. As shown, nearly 100 percent of layer operations have fewer than 90,000 birds, however, these operations only account for about 39 percent of all layers raised at these operations (Table 6-14). There are very few larger-sized operations with more than 120,000 birds (0.2 percent of all farms), but these operations are associated with approximately 56 percent of all layers (Table 6-14). The average

Table 6-12. Typical Financial Characteristics of Broiler Operations, By Size of Operation

Item	All Farms	Less than 30,000 Birds	30,000 to 90,000 Birds	More than 90,000 Birds
Number of farms	34,264	24,813	6,167a	2,284
Percent of farms	100.0%	75.3%	18.0%	6.7%
Percent of value of production	100.0%	19.4%	46.9%	33.7%
Livestock value of production	94.7%	82.9%	97.7%	97.4%
Crop value of production	5.3%	17.1%a	2.3%a	2.6%b
Number of broilers and fryers	763,830,283	50,401,533a	343,127,493	370,301,257
Distribution of broilers and fryers	100.0%	6.6%	44.9%	48.5%
Percent of broilers and fryers owned	2.4%c	7.8%c	3.7%	0.4%
Percent of broilers and fryers not owned	97.6%	92.2%	96.3%	99.6%
Number of sample farms with broilers/ fryers	275	85	102	88
Debt-to-Asset Ratios				
All Regions	0.1930	0.1476a	0.2076	0.3042
Mid-Atlantic	d	d	d	d
South	0.1846	0.1207a	0.1910	0.2640
EPA Derived Gross Cash Income Per Animal [1/]				
All Regions	$1.93	$10.95	$1.47	$1.13
Mid-Atlantic	d	d	d	d
South	$1.53	$5.17	$1.42	$1.16
EPA Derived Net Cash Income Per Animal [1/]				
All Regions	$0.49	$0.01	$0.57	$0.48
Mid-Atlantic	d	d	d	d
South	$0.51	$0.16	$0.57	$0.49

Source: USEPA and USDA/ERS, 1999a.

a = The relative standard error of the estimate exceeds 25 percent, but no more than 50 percent.

b = The relative standard error of the estimate exceeds 50 percent, but no more than 75 percent

c = The relative standard error of the estimate exceeds 75 percent.

d = Data insufficient for disclosure.

[1/]EPA derived gross cash and net cash income per animal by dividing the average gross or net cash income line items by the average number of animals as reported for each size group and region.

Table 6-13. Income Statement and Balance Sheet for Broiler Operations, By Size of Operation

Item	All Farms	Less than 30,000 Birds	30,000 to 90,000 Birds	More than 90,000 Birds
Income Statement				
Gross cash income	**43,033**	**21,378a**	**81,731**	**183,266**
Livestock income	10,064a	8,622a	10,256b	25,837a
Crop sales (incl. net CCC loans)	7,985a	6,258a	7,716a	28,229b
Government payments	995a	813a	d	d
Other farm-related income [1/]	23,989	5,684a	d	d
Total variable expenses	**23,228**	**15,681a**	**37,266a**	**70,615**
Livestock purchases	1,199a	991	d	d
Feed	3,925a	4,275a	2,980b	2,525a
Other variable expenses [2/]	18,104	10,415a	31,992a	33,924
Total fixed expenses	**8,825**	**5,680a**	**12,598a**	**34,185**
Equals: Net cash farm income	**10,979a**	**17c**	**31,868**	**78,466**
Less: Depreciation and Other [3/]	6,566a	3,901a	10,014a,b	27,359b
Plus: Value of inventory change	3,298	3,021b	1,768b	10,560c
Plus: Non-money income [4/]	3,886	3,508	4,799	5,690
Equals: Net farm income	**11,598**	**2,645c**	**28,421**	**67,357**
Balance Sheet				
Farm assets	**301,982**	**226,233a**	**396,477**	**902,856**
Current assets	18,162	145,528a	17,388a	61,320
Non-current assets	283,820	211,705a	379,090a	841,537
Land, buildings, and equipment [5/]	276,084	204,444a	373,408	822,877
Farm liabilities	**58,270a**	**33,385a**	**82,296a**	**274,606**
Current liabilities	14,260a	11,728b	17,524a	34,052
Non-current liabilities	44,010a	21,657a	64,773a	240,554
Farm equity	**243,712**	**192,847**	**314,181a**	**628,250**

Source: Based on USDA/ERS, 1999a. Copies of these data are in the rulemaking record (DCN 70063).
[1/]Machine-hire, custom work, livestock grazing, land rental, contract fees, and other farm-related sources.
[2/]Incl. livestock leasing, custom feed processing, bedding, grazing, supply, transportation, storage, general business expenses, and registration fees. Footnote a or b refers to an RSE on "other livestock-related" portion of the total.
[3/]Includes labor, non-cash benefits. Footnote (a) refers to an RSE on "non-cash benefits" portion of the total. Footnote (a,b) refers to an RSE on "depreciation" for "a" and "non-cash benefits" for "b."
[4/]The value of home consumption plus an imputed rental value of farm dwellings.
[5/]The value of the operator's dwelling and associated liabilities are included if the dwelling was located on the farm. a = Relative standard error (RSE) of the estimate exceeds 25 percent, but no more than 50 percent. b = RSE of estimate >50%, but <75%. c = RSE of estimate >75%. d = Data insufficient for disclosure.

small layer operation does not have a high value of crop production; livestock value of production for small operations is greater than 70 percent. Large layer operations typically have a livestock value of production of almost 100 percent.

Table 6-14 also shows the percentage of layers owned by farmers compared to those not owned by farmers. EPA uses this information on animal ownership as an indication of the extent of production contract use in these sectors (see Section 2.3). Across all layer operations in 1997, about 43 percent of layers and pullets were not owned by farmers (USDA/ERS, 1999a). Percentages vary across farm sizes, with only about 10 percent of birds not owned by the farming operation for farms with more than 120,000 birds, compared to 84 percent among smaller-sized operations (Table 6-14).

The data shown in Table 6-15 are also differentiated by selected size categories, however, data are not disclosed for any but small operations with fewer than 90,000 birds and overall average operations. The income statement data (as well as the data in Table 6-14) point to increasing specialization as the size of an operation increases. A larger proportion of animals are not owned at the smallest operations (compared to overall operations), and the smaller operations have proportionately smaller expenditures on livestock-related expenditures than the overall operation. Expenditures on livestock and feed average about 46 percent of total variable expenses at an average layer operation; operations with fewer than 90,000 birds are associated with expenditures on livestock and feed averaging 39 percent of total variable expenses (Table 6-15).

Operating margins (measured as net cash farm income to gross cash income) are not substantially different between the smallest operations and all operations. Operating margins average 11 percent at the smallest operations and 16 percent for all layer operations. Return on assets data (measured as average net farm income to average farm assets) are also similar. The smallest layer operations average a 2.7 percent return on assets compared to a 3.6 percent return on average for all layer operations (USDA/ERS, 1999a). See Table 6-15. The 1997 ARMS data include, among an average farm's assets, the value of the owner's home when it is located on the farm. Since smaller operations may be more likely to have the owner's dwelling located on the farm than larger operations, if dwelling values were excluded, the returns on the "business" assets might be higher for these smallest operations**.**

Section 4 of this report presents key financial data used for this analysis, shown in Table 7-10, that are calculated onto a per-animal basis. For the egg laying sector, total gross farm revenues are estimated at $25 per bird (includes revenue from other farm-related sources). Net cash income is estimated at about $4 per bird among CAFO models, depending on facility size and region (see Tables 4-5 and 4-6).

Table 6-14. Typical Financial Characteristics of Layer Operations, By Size of Operation

Item	All Farms	Less than 90,000 Birds	90,000 to 120,000 Birds	More than 120,000 Birds
Number of farms	129,172	128,846	d	d
Percent of farms	100.0%	99.7%	d	0.2%
Percent of value of production	100.0%	71.8%	d	25.3%
Livestock value of production	100.0%	71.8%	d	99.5%
Crop value of production	20.5%	28.2%	d	d
Number of layers and pullets	213,362,980	82,179,082	d	d
Distribution of layers and pullets	100.0%	38.5%	d	56.2%
Percent of layers and pullets owned	56.7%	16.5%a	d	89.2%
Percent of layers and pullets not owned	43.3%	83.5%	d	d
Number of sample farms with layers and pullets	409	378	11	20
Debt-to-Asset Ratios				
All Regions	0.1059	0.0985	d	d
Mid-Atlantic	0.1236	0.1173	d	d
South	0.1047	0.0983	d	d
EPA Derived Gross Cash Income Per Animal [1/]				
All Regions	$24.63	$46.26	d	d
Mid-Atlantic	$45.27	$140.84	d	d
South	$13.02	$16.54	d	d
EPA Derived Net Cash Income Per Animal [1/]				
All Regions	$4.06	$5.12	d	d
Mid-Atlantic	$11.39	$30.72	d	d
South	$1.31	($0.54)	d	d

Source: USEPA and USDA/ERS, 1999a.

a = The relative standard error of the estimate exceeds 25 percent, but no more than 50 percent.

b = The relative standard error of the estimate exceeds 50 percent, but no more than 75 percent.

c = The relative standard error of the estimate exceeds 75 percent.

d = Data insufficient for disclosure.

[1/]EPA derived gross cash and net cash income per animal by dividing the average gross or net cash income line items by the average number of animals as reported for each size group and region.

Table 6-15. Income Statement and Balance Sheet for Layer Operations, By Size of Operation

Item	All Farms	<90,000 Birds	90,000-120,000Birds	>120,000 Birds
Income Statement				
Gross cash income	**40,679**	**29,503**	**d**	**d**
Livestock income	28,039	17,652	d	d
Crop sales (incl. net CCC loans)	6,130a	6,075a	d	d
Government payments	609	608	d	d
Other farm-related income [1/]	5,902a	5,168a	d	d
Total variable expenses	**27,655**	**20,493**	**d**	**d**
Livestock purchases	1,874a	1,249a	d	d
Feed	10,952	6,827a	d	d
Other variable expenses [2/]	14,829	12,414	d	d
Total fixed expenses	**6,323**	**5,743**	**d**	**d**
Equals: Net cash farm income	**6,701a**	**3,267b**	**d**	**d**
Less: Depreciation and Other [3/]	4,344a	3,977a	d	d
Plus: Value of inventory change	3,745a	3,720a	d	d
Plus: Non-money income [4/]	4,738	4,740	d	d
Equals: Net farm income	**10,840a**	**7,750a**	**d**	**d**
Balance Sheet				
Farm assets	**301,193**	**291,889**	**d**	**d**
Current assets	29,713	28,067a	d	d
Non-current assets	271,480	263,822	d	d
Land, buildings, and equipment [5/]	258,617	251,478	d	d
Farm liabilities	**31,883**	**28,739**	**d**	**d**
Current liabilities	9,026	8,392	d	d
Non-current liabilities	22,857	20,347	d	d
Farm equity	**269,309**	**263,151**	**d**	**d**

Source: Based on USDA/ERS, 1999a. Copies of these data are in the rulemaking record (DCN 70063).

[1/]Machine-hire, custom work, livestock grazing, land rental, contract fees, and other farm-related sources.

[2/]Incl. livestock leasing, custom feed processing, bedding, grazing, supply, transportation, storage, general business expenses, and registration fees.

[3/]Includes labor, non-cash benefits. Footnote (a) refers to an RSE on "non-cash benefits" portion of the total.

[4/]The value of home consumption plus an imputed rental value of farm dwellings.

[5/]The value of the operator's dwelling and associated liabilities are included if the dwelling was located on the farm. a = Relative standard error (RSE) of the estimate exceeds 25 percent, but no more than 50 percent. b = RSE of estimate >50%, but <75%. c = RSE of estimate >75%. d = Data insufficient for disclosure.

Turkey Operations

Data shown in Table 6-16 are distributed by broad facility size groups. As shown, approximately 82 percent of operations have fewer than 10,000 birds. The exact number of large turkey operations and the distribution at these operations are not disclosed. The average small turkey operation has a high value of crop production; livestock value of production for small operations is only about 33 percent (Table 6-16). Large turkey operations typically have a livestock value of production of almost 99 percent (Table 6-16).

Table 6-16 also shows the percentage of turkeys owned by farmers compared to those not owned by farmers. EPA uses this information on animal ownership as an indication of the extent of production contract use in these sectors (see Section 2.3). Across all turkey operations in 1997, about 70 percent of turkeys were not owned by farmers (USDA/ERS, 1999a). For small operations, more than 85 percent of turkeys were not owned by farmers; the percentage of turkeys not owned by large operations was not disclosed, but is probably less than the percentage not owned among smaller operations, since the overall percentage not farmer-owned (70 percent) is lower than the percentages associated with smaller and mid-size operations (86 percent and 83 percent).

Table 6-17 also presents average income statement and balance sheet information for turkey operations in 1997, by size of operation, although data for the largest operations are not disclosed. The income statement data (as well as the data in Table 6-16) point to increasing specialization as the size of an operation increases. A larger proportion of birds are not owned at the smallest operations than at largest operations based on the fact that operations with less than 10,000 birds and with 10,000 to 40,000 birds show equivalent percentages of turkeys not owned, while the average for all turkey operations is much lower. However, the smallest operations have proportionately smaller expenditures on livestock-related expenses than larger operations. Expenditures on livestock and feed average about a quarter of total variable expenses at a turkey operation with fewer than 10,000 birds; operations with between 10,000 and 40,000 birds are associated with expenditures on livestock and feed averaging nearly two-thirds of total variable expenses (Table 6-17). Explanations for these differences may include differences in the degree of specialization and feeding strategies, and other factors.

Operating margins (measured as net cash farm income to gross cash income) decline with size. Operations with fewer than 10,000 birds show an operating margin of 30 percent, as compared with 23 percent and 9 percent for operations with between 10,000 and 40,000 birds and all operations, respectively (USDA/ERS, 1999a). However, return on assets does not vary much by size. The smallest operations show a return on assets (measured as average net farm income to average farm assets) of 5.2 percent, as compared with 6.4 percent and 4.4 percent at operations with between 10,000 and 40,000 turkeys and all turkey operations, respectively (USDA/ERS, 1999a). See Table 6-17. The 1997 ARMS data include, among an average farm's assets, the value of the owner's home when it is located on the farm. Since smaller operations may be more likely to have the owner's dwelling located on the farm than larger operations, if

Table 6-16 Typical Financial Characteristics of Turkey Operations, By Size of Operation

Item	All Farms	Less than 10,000 Birds	10,000 to 40,000 Birds	More than 40,000 Birds
Number of farms	11,266a	9,267a	1,406a	d
Percent of farms	100.0%	82.3%	12.5%a	d
Percent of value of production	100.0%	12.2%b	10.6%a	77.2%
Livestock value of production	89.8%	32.9%b	88.9%	98.9%
Crop value of production	10.2%c	67.1%a	11.1%a	d
Number of turkeys	153,994,175a	d	26,923,570	d
Distribution of turkeys	100.0%	d	17.5%	d
Percent of turkeys owned	30.0%b	14.5%c	16.9%a	d
Percent of turkeys not owned	70.0%	85.5%a	83.1%	d
Number of sample farms with turkeys	146	40	83	23
Debt-to-Asset Ratios				
All Regions	0.1512a	0.0736a	0.2305a	d
Mid-Atlantic	0.2039	d	0.2177	d
Midwest	0.1258	d	d	d
EPA Derived Gross Cash Income Per Animal [1/]				
All Regions	$20.08	$8.60	$11.24	d
Mid-Atlantic	$5.78	d	$6.47	d
Midwest	$26.34	d	d	d
EPA Derived Net Cash Income Per Animal [1/]				
All Regions	$1.77	$2.56	$2.55	d
Mid-Atlantic	$1.24	d	$2.92	d
Midwest	$2.00	d	d	d

Source: USEPA and USDA/ERS, 1999a.

a = The relative standard error of the estimate exceeds 25 percent, but no more than 50 percent.

b = The relative standard error of the estimate exceeds 50 percent, but no more than 75 percent

c = The relative standard error of the estimate exceeds 75 percent.

d = Data insufficient for disclosure.

[1/]EPA derived gross cash and net cash income per animal by dividing the average gross or net cash income line items by the average number of animals as reported for each size group and region.

Table 6-17. Income Statement and Balance Sheet for Turkey Operations, By Size of Operation

Item	All Farms	Less than 10,000 Birds	10,000 to 40,000 Birds	More than 40,000 Birds
Income Statement				
Gross cash income	**274,433c**	**43,020c**	**215,299a**	**d**
Livestock income	227,043c	13,616c	123,810a	d
Crop sales (incl. net CCC loans)	25,219c	d	16,228a	d
Government payments	859b	d	1,553b	d
Other farm-related income [1/]	21,312c	2,546c	73,728	d
Total variable expenses	**236,362c**	**24,854c**	**137,788a**	**d**
Livestock purchases	d	943a	15,862b	d
Feed	122,678c	4,573c	63,237b	d
Other variable expenses [2/]	76,253c	19,338c	48,689b	d
Total fixed expenses	**13,939b**	**5,346c**	**28,731a**	**d**
Equals: Net cash farm income	**24,131c**	**12,819c**	**48,780**	**d**
Less: Depreciation and Other [3/]	12,470b,c	4,406b,d	17,492a,b	d
Plus: Value of inventory change	6,022b	5,570a	10,869a	d
Plus: Non-money income [4/]	5,822	d	4,885	d
Equals: Net farm income	**23,500c**	**19,743c**	**47,043**	**d**
Balance Sheet				
Farm assets	**531,744b**	**380,924b**	**734,905**	**d**
Current assets	57,496a	16,057b	72,363a	d
Non-current assets	424,248a	364,867b	662,543	d
Land, buildings, and equipment [5/]	454,787a	354,689b	637,930	d
Farm liabilities	**80,381c**	**28,048c**	**169,430a**	**d**
Current liabilities	27,651c	7,956c	40,855a	d
Non-current liabilities	52,731b	20,092c	128,574b	d
Farm equity	**451,363a**	**352,876a**	**565,476**	**d**

Source: Based on USDA/ERS, 1999a. Copies of these data are in the rulemaking record (DCN 70063).

[1/]Machine-hire, custom work, livestock grazing, land rental, contract fees, and other farm-related sources.

[2/]Incl. livestock leasing, custom feed processing, bedding, grazing, supply, transportation, storage, general business expenses, and registration fees. Footnote (c) or (b) refers to an RSE on "other livestock-related" portion of the total.

[3/]Includes labor, non-cash benefits. Footnote (b,c) refers to an RSE on "depreciation" for "b" and "non-cash benefits" for "c." Footnote (b,d) refers to an RSE on "depreciation" for "b" and "non-cash benefits" for "d." Footnote (a,b) refers to an RSE on "depreciation" for "a" and "non-cash benefits" for "b."

[4/]The value of home consumption plus an imputed rental value of farm dwellings.

[5/]The value of the operator's dwelling and associated liabilities are included if the dwelling was located on the farm. a = Relative standard error (RSE) of the estimate exceeds 25 percent, but no more than 50 percent. b = RSE of estimate >50%, but <75%. c = RSE of estimate >75%. d = Data insufficient for disclosure.

dwelling values were excluded, the returns on the "business" assets might be higher for these smallest operations**.**

Section 4 of this report presents key financial data used for this analysis, shown in Table 6-17 that are calculated onto a per-animal basis. For the turkey sector, total gross farm revenues are estimated to range from $11 to $20 per bird (includes revenue from other farm-related sources). Net cash income ranges from $1.80 to $2.60 per bird among CAFO models, depending on facility size and region (see Tables 4-5 and 4-6).

6.2 PROFILE OF POULTRY PROCESSING SECTORS

Poultry farms represent the beginning of the chicken meat and egg products marketing chain that also includes poultry slaughtering facilities, poultry and food processors, integrators, and retailers. Farms provide the raw materials to slaughterers and processors in the form of live birds and eggs, which then are converted into cuts of meat and processed foods. These products are eventually sold to consumers at retail establishments.

Most broilers and turkeys are marketed as eviscerated, ice-packed, or frozen "ready-to-cook" (RTC) poultry, which is available in many forms, including whole birds, cut-up birds, poultry parts, and self-basting poultry. Chicken and turkey products may also be "further processed," referring to breaded and pre-cooked parts, ready-made and frozen meals, and other manufactured products. Egg processors are classified under NAICS 311999(G), Liquid, dried, and frozen eggs. Almost 70 percent of all egg production is sold in fresh form to retail stores or to institutional buyers. Another 29 percent of all shell eggs are sold to "breakers," which are firms that process eggs into dried, frozen, and liquid egg products used as ingredients by processors in numerous food products; the remaining one percent of egg output is exported (American Egg Board, 1998). See Section 2 for more information about poultry processors.

Additional information on the processing sectors in these industries is provided in Section 2, which also shows how EPA estimated the potential number of processors that may be affected by the proposed regulations as co-permittees.

As presented in Section 2.4, EPA estimates that about 270 poultry processing establishments would be subject to co-permitting requirements. EPA's determination is based largely on the fact that production contracting accounts for a large share of poultry production (USDA/ERS, 1999a and 1996c; Heffernan, et al., 1999). In the poultry sector, vertical integration has progressed to the point where large, multifunction producer-packer-processor-distributor firms are the dominant force in poultry and egg production and marketing (Kohls and Uhl, 1998). Today's integrators are subsidiaries of feed companies, independents, cooperatives, meat packers, or retailers, or are affiliates of conglomerate corporations. These firms may own and/or direct the entire process from the production of hatching eggs through the merchandising of ready-to-eat-sized broiler portions to restaurants (Hayenga et al., 1996). Coordination through production contracting now dominates the poultry industry (Aust, 1997). Nearly all poultry is

grown through contract production, with fully integrated production operations comprising a small share of production. Spot market trading of poultry is insignificant (USDA/ERS, 1996c).

Elements specific to the poultry sector—including assets at several levels (breeding flocks, hatcheries, broiler houses, and processing plants), a short biological process, and a perishable product—have led to a tightly coordinated flow of eggs, chicks, and broilers. This setup minimizes transaction costs and risks and reduces production costs, allowing integrators to supersede the market (Hayenga et al., 1996). Decentralization and direct sales have accompanied integration of the poultry marketing channels, with most poultry meat and shell eggs moving directly from packaging plants to retail buyers (Kohls and Uhl, 1998).

In a 1993 study, USDA showed that almost 90 percent of all poultry production is produced under contract (USDA/ERS, 1996c). Contract production across all market segments in the poultry industry accounted for 86 percent of the value of all production. Nearly all poultry grown under contract is through production contracts. Under most poultry production contracts, the integrator supplies some inputs (chicks, feed, medication, field supervision) and the farmer provides other inputs (housing, water, and fuel, etc.) (Kohls and Uhl, 1998).

Across all broiler farms in 1997, nearly all (98 percent) broilers and meat chickens were not owned by farmers (USDA/ERS, 1999a). This compares to the turkey and layer sectors where an estimated 70 percent of turkeys and 37 percent of layers were not owned by the farmers that raise them, respectively (USDA/ERS, 1999a). Percentages vary across farm sizes and indicate large differences in the organization and ownership across these three sectors. For the most part, the broiler sector appears to be dominated by production contracting since most operators— both small and large—do not claim ownership of their flocks. By comparison, a greater share of smaller-sized layer and turkey operations report that they do not own their flocks while larger operations in these sectors do own their animals, indicating greater use of contract arrangements among smaller operators (USDA/ERS, 1999a).

Turkey production, while dominated by integrators and year-round confinement buildings, is not as industrialized as the broiler sector (Hayenga et al., 1996). Contract arrangements are the primary means of procuring turkey meat, accounting for 65 percent of all output in 1990, most of which consists of production contracts (Kohls and Uhl, 1998). Owner-integrated and non-integrated (independent) enterprises accounted for 28 percent and 7 percent, respectively, in 1990 (Kohls and Uhl, 1998).

Information on the organization of the U.S. egg industry is limited. Large regional cooperatives dominate the U.S. egg industry. Because of spoilage, fragility, and corresponding transportation costs, shell eggs are not a national market. Shell egg processing is often managed directly by retailers. Integrators have achieved economies of scale by concentrating both the packaging and handling of eggs into larger, more automated facilities. Available information on this sector from the 1980s indicate that contracting accounts for over one-half of all egg production, but the arrangements are less formalized than in the poultry meat sectors (Kohls and Uhl, 1998). Owner-integrated enterprises accounted for nearly 40 percent. This form of integration is one in which the producing and marketing firms are the same. One-tenth of annual output was from independent businesses (Kohls and Uhl, 1998).

6.3 CAFO ANALYSIS

This section presents the results of EPA's CAFO level analysis for the poultry sectors, including broiler, turkey, and egg laying operations. As discussed in Section 4, EPA uses a representative farm approach to estimate the impact of the proposed CAFO regulations on affected operations. Each model CAFO differs by facility size groupings and key farm production regions. For these sectors, the production regions reflected in this analysis are the Mid-Atlantic (MA), Midwest (MW) and South (SO) regions, as defined in Table 4-1 (Section 4). Section 4 provides a summary of how EPA developed the various financial models used for this analysis. The *Development Document* (USEPA, 2000a) provides additional information on the cost models developed by EPA.

Results presented in this section focus on the "BAT Option" that refers to EPA's proposed technology option for the CAFO regulations (described in Section 3). For the purpose of this discussion, the "*two-tier structure"* refers to the combination of BAT Option 5 for the poultry subcategory and NPDES Scenario 4a that covers all operations with more than 500 AU. Where indicated, the two-tier structure may refer to the alternative threshold at 750 AU (Scenario 5). The "*three-tier structure"* refers to the combination of BAT Option 5 (poultry subcategory) and NPDES Scenario 3 that covers operations down to 300 AU based on certain conditions. Results for other technology options and scoping scenarios considered by EPA as part of this rulemaking are also summarized. Table 3-1 summarizes EPA's proposed and alternative ELG Options and NPDES Scenarios discussed in this section.

Section 6.3.1 presents a summary of the cost input data that EPA uses for this analysis, including (post-tax) per-animal and per-facility costs for EPA's model CAFOs. Section 6.3.2 presents EPA's estimate of the aggregate, national level costs of the proposed CAFO regulations for the poultry sector. Section 6.3.3 presents EPA's predicted financial impacts to this sector in terms of the estimated number and percentage of CAFOs that are expected to experience financial stress as a result of the proposed CAFO regulations. EPA evaluates economic impacts to CAFOs in this sector two ways—assuming that a portion of the costs may be passed on from the CAFO to the consumer (Partial CPT) and assuming that no costs pass through so that all costs are absorbed by the CAFO (Zero CPT).

6.3.1 Overview of Cost Input Data

Tables 6-18 through 6-20 presents estimated input costs that EPA uses for this analysis to assess costs and impacts to the broiler, turkey, and egg sectors. These data include the post-tax annualized compliance costs, estimated on a per-animal and per-facility. These costs reflect EPA's estimated capital costs, annual operating and maintenance costs, start-up or first year costs, and also recurring costs (discussed in the *Development Document*, USEPA, 2000a). These

facility costs are annualized using the approach described in Appendix A of this report. Appendix A shows the individual sector costs by model across all technology options.[4]

Other input data for this analysis include EPA's estimate of the number of affected CAFOs and baseline financial conditions at model CAFOs. EPA's estimate of the number of animal confinement operations that would be defined or designated as CAFOs is presented in Section 6.1.2.1 (see Table 6-2). Additional information is provided in Section 2 of this report. The average baseline financial conditions for model CAFOs that EPA assumes for this analysis are presented in Section 4. Tables 4-5 through 4-9 in that section present the financial data used in this analysis and include gross farm revenues, net cash flow, and debt-to-asset ratios for this sector, as derived by EPA using the 1997 ARMS data.

Table 6-18. Per-Animal and Per-Facility Post-tax Annualized Compliance Costs (Option 5) for Broilers

Sector	Reg.	Model	Average Animals Per Facility	Cat. 1	Cat. 2	Cat. 3	Cat. 1	Cat. 2	Cat. 3
				Per Animal			Per Facility		
				($1997)					
Broiler	SO	M1(a)	36,634	$0.15	$0.10	$0.08	$5,341	$3,614	$2,826
		M1(b)	51,362	$0.14	$0.09	$0.07	$7,172	$4,647	$3,706
		M2	73,776	$0.13	$0.08	$0.07	$9,924	$6,177	$4,953
		L1	117,581	$0.13	$0.08	$0.06	$15,296	$9,109	$7,508
		L2	281,453	$0.11	$0.06	$0.05	$29,715	$16,776	$14,834
	MA	M1(a)	36,796	$0.13	$0.11	$0.08	$4,948	$4,134	$2,901
		M1(b)	51,590	$0.13	$0.10	$0.07	$6,612	$5,353	$3,784
		M2	73,590	$0.12	$0.10	$0.07	$9,051	$7,167	$5,023
		L1	115,281	$0.12	$0.09	$0.07	$13,744	$10,746	$7,522
		L2	303,155	$0.10	$0.07	$0.05	$29,187	$20,397	$16,126

Source: USEPA. See Table 4-1 for model sizes and regions. Costs reflect the estimated capital costs, annual operating and maintenance costs, start-up or first year costs, and also recurring costs assumed by EPA (see the *Development Document,* USEPA, 2000a) that are annualized using the approach described in Appendix A.

[4]The estimated costs are the same across the NPDES Scenarios, i.e., technology option costs do not change by scenario, although total costs change due to the difference in numbers of CAFOs affected under each scenario.

Tables 6-18 through 6-20 present the estimated post-tax annualized compliance costs per animal (in 1997 dollars) for each of the poultry sector under the proposed BAT Option (Option 5). EPA estimates post-tax costs for these sectors to range from $0.05 per bird to $0.15 per bird in the broiler sector, from $0.02 per bird to $0.60 per bird for the layer sector, and from $0.05 per bird to $0.83 per bird for the turkey sector (Tables 6-18 through 6-20). The range in costs is explained by differences in the assumed availability of land for manure applications (see definition of Category 1, 2, and 3 in Section 4.1.2), region, and size of operation. In general, the annualized post-tax compliance costs per representative CAFO increase with model size. These tables also present the range of post-tax annualized compliance costs per CAFO. Per CAFO compliance costs range from $2,830 to $29,720 in the broiler sector, from $660 to $53,090 for the layer sector, and from $1,640 to $102,790, in the turkey sector (Tables 6-18 through 6-20). As documented in the *Development Document* (USEPA, 2000a), EPA believes that its estimated costs are conservative.

Table 6-19. Per-Animal and Per-Facility Post-tax Annualized Compliance Costs (Option 5) for Layers

Sector	Reg.	Model	Average Animals Per Facility	Cat. 1	Cat. 2	Cat. 3	Cat. 1	Cat. 2	Cat. 3
				Per Animal			Per Facility		
				($1997)					
Wet Layers	SO	M2	3,654	$0.55	$0.60	$0.39	$2,018	$2,197	$1,420
		L1	86,898	$0.27	$0.27	$0.15	$23,885	$23,704	$12,856
Dry Layers	SO	M1(a)	32,375	$0.18	$0.04	$0.02	$5,783	$1,372	$664
		M1(b)	44,909	$0.14	$0.04	$0.02	$6,241	$1,630	$861
		M2	97,413	$0.15	$0.03	$0.02	$14,213	$3,009	$1,602
		L1	293,512	$0.18	$0.02	$0.02	$51,613	$6,547	$4,593
		L2	884,291	$0.00 [a/]	$0.02	$0.02	$0 [a/]	$16,983	$13,582
	MW	M1(a)	37,906	$0.25	$0.05	$0.02	$9,418	$1,813	$868
		M1(b)	52,582	$0.27	$0.04	$0.02	$14,280	$2,166	$1,158
		M2	97,484	$0.23	$0.04	$0.02	$22,246	$3,722	$1,886
		L1	279,202	$0.19	$0.03	$0.02	$53,092	$7,476	$5,201
		L2	1,229,095	$0.00 [a/]	$0.02	$0.02	$0 [a/]	$26,401	$22,440

Source: USEPA. See Table 4-1 for model sizes and regions. Costs reflect the estimated capital costs, annual operating and maintenance costs, start-up or first year costs, and also recurring costs assumed by EPA (see the *Development Document,* USEPA, 2000a) that are annualized using the approach described in Appendix A.
[a/]EPA did not estimate costs for layer operations under Options 2 through 7.

The costs presented here are those assumed to be incurred by the regulated CAFO and do not account for the likelihood that some compliance costs will be passed on through the marketing levels in the industry.

Table 6-20. Per-Animal and Per-Facility Post-tax Annualized Compliance Costs (Option 5) for Turkeys

Sector	Reg.	Model	Average Animals Per Facility	Cat. 1	Cat. 2	Cat. 3	Cat. 1	Cat. 2	Cat. 3
				Per Animal			Per Facility		
				($1997)					
Turkeys	MA	M1(a)	18,539	$0.71	$0.29	$0.09	$13,251	$5,297	$1,641
		M1(b)	31,267	$0.70	$0.23	$0.07	$21,774	$7,066	$2,265
		M2	45,193	$0.61	$0.18	$0.06	$27,353	$7,988	$2,500
		L1	97,111	$0.57	$0.16	$0.05	$55,756	$15,380	$4,513
	MW	M1(a)	18,092	$0.83	$0.28	$0.13	$15,008	$5,042	$2,418
		M1(b)	30,514	$0.79	$0.22	$0.12	$23,972	$6,702	$3,679
		M2	45,469	$0.65	$0.18	$0.10	$29,571	$7,999	$4,603
		L1	158,365	$0.65	$0.15	$0.10	$102,793	$23,609	$15,278

Source: USEPA. See Table 4-1 for model sizes and regions. Costs reflect the estimated capital costs, annual operating and maintenance costs, start-up or first year costs, and also recurring costs assumed by EPA (see the *Development Document*, USEPA, 2000a) that are annualized using the approach described in Appendix A.

Table 6-21 presents the range of per animal post-tax compliance costs in 1997 dollars for broiler, layer, and turkey operations. (The proposed and alternative ELG Option and NPDES Scenarios considered by EPA during this rulemaking are defined in Table 3-1.) For broilers, option costs range from $0.05 to $0.28 per animal. For layers, option costs range from $0.01 to $1.95 per animal. For turkeys, option costs range from $0.05 to $0.98 per animal. As shown, the proposed BAT Option (Option 5) is the second least expensive option for the poultry sectors.

6.3.2 Estimates of National Annual Compliance Costs

Table 6-22 presents EPA's estimate of the aggregate national level compliance costs for the poultry sectors under the proposed BAT Option (Option 5) and the co-proposed two-tier structure (Scenario 4a at 500 AU threshold) and the three-tier structure (Scenario 3). Costs under the two-tier structure at the 750 AU threshold (Scenario 5) are also briefly discussed, along

Table 6-21. Summary of the Range of Post-Tax Annualized Compliance Costs Per Animal, By Option

Option	Broiler		Layer [a/]		Turkey	
	Minimum	Maximum	Minimum	Maximum	Minimum	Maximum
	($1997)					
Option 1	$0.05	$0.09	$0.01	$0.55	$0.05	$0.17
Option 2	$0.05	$0.15	$0.02	$0.60	$0.05	$0.83
Option 3	$0.05	$0.18	$0.02	$0.93	$0.05	$0.92
Option 4	$0.07	$0.28	$0.02	$1.95	$0.09	$0.98
Option 5	$0.05	$0.15	$0.02	$0.60	$0.05	$0.83
Option 6	$0.05	$0.15	$0.02	$0.60	$0.05	$0.83
Option 7	$0.05	$0.15	$0.02	$0.60	$0.05	$0.83

Source: USEPA.
[a/]EPA did not estimate costs for layer operations under Options 2 through 7.

with other regulatory alternatives considered by EPA during this rulemaking. The description of the proposed BAT Option and the co-proposed NPDES Scenarios is provided in Section 3.

Across all the poultry sectors, EPA estimates total incremental costs (post-tax) of the proposed BAT Option at $97 million per year under the two-tier structure and $117 million per year under the three-tier structure (Table 6-22). About one-half of this total estimated cost is for operations with more than 1,000 AU. The majority of compliance costs would be incurred by the broiler sector, estimated at about 80 percent of total costs to these sectors (Table 6-23). Table 6-22 shows estimated costs for each sector. (EPA estimates that the costs of the proposed BAT option under the two-tier structure at 750 AU threshold will total $78 million per year across the poultry sectors.)

6.3.3 Analysis of CAFO Financial Impacts

EPA's impact analysis uses a representative farm approach to estimate the number of CAFOs that would experience affordable, moderate, or stress impacts as a result of the CAFO regulations, as described in Section 4. Economic achievability is determined by applying the proposed criteria, which include a sales test and also analysis of post-compliance cash flow and debt-to-asset ratio for an average model CAFO. Impacts are extrapolated to all CAFOs in the poultry sector using the estimated number of operations represented by each model CAFO.

As described in Section 4.2.5, if an average model facility is determined to incur economic impacts under regulation that are regarded as "Affordable" or "Moderate," then the proposed regulations are considered economically achievable. ("Moderate" impacts are not expected to result in closure and are considered to be economically achievable by EPA.) If an average operation is determined to incur "Stress," then the proposed regulations are not considered to be

Table 6-22. Total Estimated Post-Tax Compliance Costs

Scenario/Size	Option	Broilers	Wet Layers	Dry Layers	Turkeys
		($1997 millions)			
>1,000 AU	Number of CAFOs	3,940	50	590	370
	Cost of Proposed BAT Option	$41.8	$0.9	$5.4	$6.8
	Cost of Alternative Options	$37.3 - $61.5	$0.9 - $1.1	$4.7 - $7.6	$4.7 - $8.6
Total Alternative Two-Tier Structure (>750 AU)	Number of CAFOs	7,780	320	1,140	740
	Cost of Proposed BAT Option	$60.8	$1.2	$7.1	$9.1
	Cost of Alternative Options	$53.9 - $100.9	$1.2 - $2.4	$5.6 - $11.8	$5.9 - $12.6
Total Two-Tier Structure (>500 AU)	Number of CAFOs	9,780	360	1,280	1,280
	Cost of Proposed BAT Option	$74.4	$1.5	$7.6	$13.3
	Cost of Alternative Options	$66.2 - $124.0	$1.4 - $3.2	$5.9 - $12.5	$8.3 - 19.4
Total Two-Tier Structure (>300 AU)	Number of CAFOs	14,120	360	1,700	2,100
	Cost of Proposed BAT Option	$89.7	$1.5	$8.4	$17.3
	Cost of Alternative Options	$81.8-$161.5	$1.4-$3.2	$6.3-$15.0	$10.3-$27.6
Total Three-Tier Structure (>300 AU)	Number of CAFOs	13,740	360	1,660	2,040
	Cost of Proposed BAT Option	$90.0	$1.4	$8.4	$17.4
	Cost of Alternative Options	$78.1 - $159.7	$1.4 - $3.7	$6.0 - $14.4	$10.2 - $27.4

Source: USEPA. Numbers of CAFOs include defined CAFOs only. Costs include those for designated operations.

economically achievable. “Affordable” and “Moderate” impacts are associated with positive post-compliance cash flow over a 10-year period and a debt-to-asset ratio not exceeding 40 percent, in conjunction with a sales test result that shows that compliance costs are less than 5 percent of sales (“Affordable”) or between 5 and 10 percent (“Moderate”). “Stress” impacts are associated with negative cash flow or if the post-compliance debt-to-asset ratio exceeds 40 percent, or sales test results that show costs equal to or exceeding 10 percent of sales.

Using this classification scheme, EPA's analysis indicates that some poultry operations would experience financial stress as a result of the proposed CAFO regulations under the proposed BAT Option and both co-proposed scenario, assuming compliance costs cannot be passed through the marketing chain.

Table 6-23 presents the results of EPA's analysis for layer and turkey operations. As shown, none of the model facilities evaluated for these sectors are estimated to experience financial stress as a result of the proposed regulation. Given these results, EPA did not conduct further analysis to examine the economic impacts to these sectors under a cost passthrough scenario.

Table 6-24 presents the results of EPA's analysis for broiler operations. As shown, EPA's analysis projects that a total of 150 broiler operations (one percent of all poultry operations) might experience financial stress under the two-tier structure. Alternatively, results for the two-tier structure at 750 AU threshold also indicate that 150 broiler operations might experience financial stress. Under the three-tier structure, EPA estimates that a total of 330 broiler operations (2 percent of all poultry operations) might experience financial stress. Under the two-tier structure, all broiler operations with stress impacts have more than 1,000 AU. Under the three-tier structure, affected broiler facilities include operations with more than 1,000 AU, as well as operations with less than 1,000 AU. EPA does not expect that any designated broiler operations will be impacted under the stress category under either co-proposed tier structure. These results assume that no cost are passed through to consumers. However, EPA expects that long-run market and structural adjustment producers in these sectors will diminish the estimated impacts to these sectors as costs are passed through to consumers.

For the broiler sector, EPA also evaluates financial impacts with an assumption of cost passthrough. For the purpose of this analysis, EPA assumes that the broiler sector could passthrough 35 percent of compliance costs. EPA derives these estimates from price elasticities of supply and demand for each sector reported in the academic literature (see Section 4). Assuming this level of cost passthrough, the magnitude of the estimated impacts decreases to the affordable or moderate impact category under the proposed BAT Option and the co-proposed scenarios (Table 6-24). When partial CPT is assumed in the broiler sector, no poultry operations experience stress impacts under the proposed BAT Option and all regulatory scenarios investigated. However, a total of 1,170 broiler operations (12 percent of poultry operations) are estimated to experience moderate impacts under the two-tier structure (500 AU threshold), and a total of 1,440 broiler operations (10 percent of all poultry operations) are estimated to experience moderate impacts under the three-tier structure, using the partial CPT assumption. EPA does not consider moderate impacts to adversely affect a finding of economic achievability. Based on the results presented here, EPA proposes that the proposed CAFO regulations are economically achievable under the co-proposed scenarios.

Table 6-23. Impacted CAFOs Under ELG Options & NPDES Scenarios, Layer and Turkey Operations

Alternative ELG Options and NPDES Scenarios	Layers			Turkeys		
	Affordable	Moderate	Stress	Affordable	Moderate	Stress
	(Number of Affected Operations)					
Two-Tier (>1000)						
Number of CAFOS	640			370		
BAT Option	640	0	0	370	0	0
Alt. ELG Options	640	0	0	370	0	0
Two-Tier (>750 AU, Scenario 5)						
Number of CAFOS	1,460			740		
BAT Option	1,460	0	0	720	20	0
Alt. ELG Options	1,310-1,460	0-160	0	720-740	0 -20	0
Two-Tier (>500 AU, Scenario 4a)						
Number of CAFOS	1,640			1,280		
BAT Option	1,640	0	0	1,230	50	0
Alt. ELG Options	1,330-1,640	0-310	0	1,230-1,280	0-50	0
Two-Tier (>300 AU, Scenario 4b)						
Number of CAFOS	2,060			2,100		
BAT Option	2,060	0	0	1,990	110	0
Alt. ELG Options	1,750-2,060	0-310	0	1,990-2,100	0-110	0
Three-Tier (Scenario 3)						
Number of CAFOS	2,010			2,060		
BAT Option	2,010	0	0	1,950	110	0
Alt. ELG Options	1,700-2,010	0-310	0	1,950-2,060	0-110	0

Source: USEPA. Does not include impacts to designated CAFOs.

Compared to the alternative options, the proposed BAT Option results in stress impacts that are generally greater than Option 1 impacts (the low end of the range shown in Tables 6-23 and 6-24) and substantially less than Option 4 impacts (the high end of the range shown in Tables 6-23 and 6-24). Stress impacts for other options are similar to the BAT Option. Section 5 provides additional information that compares the co-proposed scenarios with other alternative scenarios.

Table 6-24. Impacted CAFOs Under ELG Options & NPDES Scenarios, Broiler Operations

Alternative ELG Options and NPDES Scenarios	Total # CAFOs	Aff.	Moderate	Stress	Affordable	Moderate	Stress
		Zero Cost Passthrough			Partial Cost Passthrough		
		(Number of Affected Operations)					
Two-Tier (>1000)							
BAT Option	3,940	200	3,600	150	3,080	860	0
Alt. ELG Options		0-500	1,670-3,800	0-2,270	630-3,940	0-3,310	0
Two-Tier (>750 AU, Scenario 5)							
BAT Option	7,780	1,650	5,980	150	6,740	1,040	0
Alt. ELG Options		0-1,950	3,120-7,520	0-4,660	630-7,780	0-7,150	0
Two-Tier (>500 AU, Scenario 4a)							
BAT Option	9,780	1,960	7,670	150	8,610	1,170	0
Alt. ELG Options		0-2,270	3,120-9,390	0-6,660	630-9,780	0-9,020	0-130
Two-Tier (>300 AU, Scenario 4b)							
BAT Option	14,140	1,960	11,860	320	12,690	1,450	0
Alt. ELG Options		0-2,270	3,120-13,320	0-11,020	630-14,140	0-10,770	0-2,740
Three-Tier (Scenario 3)							
BAT Option	13,740	1,850	11,580	330	12,320	1,420	0
Alt. ELG Options		0-2,150	3,010-12,940	0-10,750	630-13,740	0-10,510	0-2,610

Source: USEPA. Does not include impacts to designated CAFOs.

Tables 6-25 and 6-26 present a more detailed breakout of EPA's affordability results under the proposed BAT Option by model CAFO type, land availability, and type of operation (broiler, layer, turkey). The results are the same for the two-tier and three-tier structure because only the numbers of CAFOs represented by each model type changes. The impacts are presented by model CAFO and indicate the level of impact under each of the economic affordability criteria. These results reflect a "zero" cost passthrough assumption.

These tables show that show that financial stress impacts for broilers are being driven by the revenue test in the Large 1 models in both regions (revenue test of greater than 10 percent is considered an indication of financial stress). Broiler operations, however, primarily operate under production contracts, regardless of size. Operations with production contracts are often

Table 6-25. Economic Achievability Results for Broiler CAFOs

Model	Category 1			Category 2			Category 3		
	Sales	DCF	DA	Sales	DCF	DA	Sales	DCF	DA
Zero CPT									
SO Region									
Medium 1a	10.2%	Pass	0.25	6.9%	Pass	0.25	5.4%	Pass	0.25
Medium 1b	9.8%	Pass	0.25	6.3%	Pass	0.25	5.1%	Pass	0.25
Medium 2	9.4%	Pass	0.25	5.9%	Pass	0.25	4.7%	Pass	0.25
Large 1	11.3%	Pass	0.33	6.7%	Pass	0.33	5.5%	Pass	0.33
Large 2	9.1%	Pass	0.33	5.2%	Pass	0.33	4.6%	Pass	0.33
MA Region									
Medium 1a	9.2%	Pass	0.27	7.6%	Pass	0.27	5.4%	Pass	0.26
Medium 1b	8.7%	Pass	0.27	7.1%	Pass	0.27	5.0%	Pass	0.26
Medium 2	8.4%	Pass	0.27	6.6%	Pass	0.26	4.6%	Pass	0.26
Large 1	10.5%	Pass	0.37	8.2%	Pass	0.37	5.8%	Pass	0.37
Large 2	8.5%	Pass	0.37	6.0%	Pass	0.37	4.7%	Pass	0.37
Partial CPT									
SO Region									
Medium 1a	6.7%	Pass	0.23	4.5%	Pass	0.23	3.5%	Pass	0.23
Medium 1b	6.4%	Pass	0.23	4.1%	Pass	0.23	3.3%	Pass	0.23
Medium 2	6.1%	Pass	0.23	3.8%	Pass	0.23	3.1%	Pass	0.23
Large 1	7.3%	Pass	0.31	4.4%	Pass	0.31	3.6%	Pass	0.31
Large 2	5.9%	Pass	0.31	3.4%	Pass	0.31	3.0%	Pass	0.31
MA Region									
Medium 1a	6.0%	Pass	0.25	5.0%	Pass	0.25	3.5%	Pass	0.25
Medium 1b	5.7%	Pass	0.25	4.6%	Pass	0.25	3.2%	Pass	0.25
Medium 2	5.4%	Pass	0.25	4.3%	Pass	0.25	3.0%	Pass	0.25
Large 1	6.9%	Pass	0.35	5.4%	Pass	0.35	3.8%	Pass	0.34
Large 2	5.5%	Pass	0.35	3.9%	Pass	0.35	3.1%	Pass	0.34

Source: USEPA.

Table 6-26. Economic Achievability Results for Layer and Turkey CAFOs

Model	Category 1			Category 2			Category 3		
	Sales	**DCF**	**DA**	**Sales**	**DCF**	**DA**	**Sales**	**DCF**	**DA**
Egg Laying Operations									
Wet SO Region									
Medium 2	2.2%	Pass	0.12	2.4%	Pass	0.12	1.6%	Pass	0.12
Large 1	1.1%	Pass	0.11	1.1%	Pass	0.11	0.6%	Pass	0.11
Dry SO Region									
Medium 1a	0.7%	Pass	0.11	0.2%	Pass	0.11	0.1%	Pass	0.11
Medium 1b	0.6%	Pass	0.11	0.1%	Pass	0.11	0.1%	Pass	0.11
Medium 2	0.6%	Pass	0.11	0.1%	Pass	0.11	0.1%	Pass	0.11
Large 1	0.7%	Pass	0.11	0.1%	Pass	0.11	0.1%	Pass	0.11
Large 2	NA	NA	NA	0.0%	Pass	0.11	0.0%	Pass	0.11
Dry MW Region									
Medium 1a	1.0%	Pass	0.11	0.2%	Pass	0.11	0.1%	Pass	0.11
Medium 1b	1.1%	Pass	0.11	0.2%	Pass	0.11	0.1%	Pass	0.11
Medium 2	0.9%	Pass	0.11	0.2%	Pass	0.11	0.1%	Pass	0.11
Large 1	NA	NA	NA	0.1%	Pass	0.11	0.1%	Pass	0.11
Large 2	NA	NA	NA	0.0%	Pass	0.11	0.0%	Pass	0.11
Turkey Operations									
MA Region									
Medium 1a	6.4%	Pass	0.24	2.5%	Pass	0.24	0.8%	Pass	0.24
Medium 1b	6.2%	Pass	0.24	2.0%	Pass	0.24	0.6%	Pass	0.24
Medium 2	5.4%	Pass	0.24	1.6%	Pass	0.24	0.5%	Pass	0.24
Large 1	2.9%	Pass	0.16	0.8%	Pass	0.16	0.2%	Pass	0.16
MW Region									
Medium 1a	7.4%	Pass	0.25	2.5%	Pass	0.25	1.2%	Pass	0.25
Medium 1b	7.0%	Pass	0.25	2.0%	Pass	0.25	1.1%	Pass	0.25
Medium 2	5.8%	Pass	0.25	1.6%	Pass	0.25	0.9%	Pass	0.25
Large 1	3.2%	Pass	0.17	0.7%	Pass	0.17	0.5%	Pass	0.17

Source: USEPA.

associated with lower revenues and lower costs than operations without a production contract. Thus, the revenue test may not be a fair assessment of the level of impact on these operations, particularly if zero CPT is assumed. Under an assumption of partial cost passthrough, all model CAFOs show revenue tests below 10 percent.

EPA believes there may be mitigating circumstances affecting financial impacts in the poultry sectors other than the potential for cost passthrough. Poultry manure is a valuable soil amendment. One beneficial effect of complying with the proposed CAFO regulations is that poultry operations would produce a poultry litter with low moisture content, which is more easily handled than liquid manures. This manure can, in many cases, be sold to other agricultural operations for crop amendment purposes. EPA does not include a cost offset for sale of dry poultry litter in the model cost estimates, as discussed in Section 4.2.7. EPA did, however, conduct a sensitivity analysis to examine the potential impact such gains could have on analytical results.

EPA uses an offset of 40 cents per head to estimate manure sales (U.S. EPA, 2000k). EPA estimates that sales of dry poultry litter in the broiler sector could offset the total costs of meeting the requirements of the proposed CAFO regulations by approximately one-half. This would reduce net costs from an estimated $74 million to about $36 million under the co-proposed two-tier structure. Net costs would be reduced by from an estimated $10 million to about $45 million under the three-tier structure.

Table 6-27 presents the results of EPA's analysis for broiler CAFOs assuming a manure sale offset for the two-tier and three-tier structures. As shown, if manure is sold, then no broiler operations are expected to incur stress impacts as a result of the proposed CAFO regulations. Additionally, only 4 percent of all broiler CAFOs (2 percent of operations with more than 1,000 AU and 6 percent of operations with less than 1,000 AU) are estimated to experience moderate impacts. In comparison, under a partial CPT assumption of 35 percent for broilers (without considering manure sales), 5 percent of all broiler operations (4 percent of l operations with more than 1,000 AU and 6 percent of operations with less than 1,000 AU) are estimated to incur moderate impacts. The analysis shows that sales of poultry litter could offset the cost of CAFO regulatory requirements even more than the CPT assumption assumed for this analysis. Furthermore, manure sales could offset these costs sufficiently to eliminate all stress impacts without the need to assume any cost passthrough.

Past analyses that estimate costs to livestock and poultry producers for environmental improvements at the farm site often examine the potential for the value of manure (expressed in terms of nitrogen, phosphorus, and potassium) to offset production costs associated with capital improvements and annual operation and maintenance costs (see, e.g., Christensen, et al., 1981).

Table 6-27. Number and Percentage of Affected Broiler CAFOs (Manure Sales Assumption)

Size	Number of CAFOs	Affordable		Moderate		Stress	
		(number)	(percent)	(number)	(percent)	(number)	(percent)
>1,000 AU	3,940	3,770	96%	170	4%	0	0%
500-1,000 AU (Two-Tier)	5,840	5,530	95%	310	5%	0	0%
300-1,000 AU (Three-Tier)	9,820	9,240	94%	580	6%	0	0%
>500 AU (Two-Tier)	9,780	9,300	95%	480	5%	0	0%
>300 AU (Three-Tier)	13,720	13,020	95%	740	5%	0	0%

Source: USEPA. Proposed BAT Option is Option 5. Results do not include designated CAFOs.
Assume manure sales valued at $.40/head as an offset to estimate compliance costs.

6.4 PROCESSOR ANALYSIS

As discussed in Section 4.3, EPA does not conduct a detailed estimate of the costs and impacts that would accrue to individual co-permittees due to lack of data and market information. However, EPA believes that the framework used to estimate costs to CAFOS provides a means to evaluate the possible upper bound of costs that could accrue to potential co-permittees, based on the potential share of (pre-tax) costs that may be passed on from the CAFO (described in Section 4.3). EPA is proposing that this amount approximates the magnitude of the costs that may be incurred by processing firms in those industries that may be affected by the proposed co-permitting requirements.

Table 6-28 presents the results of EPA's analysis. This analysis focuses on the potential magnitude of costs to co-permittees in the poultry sector. As presented in Section 2, EPA estimates that about 227 broiler processors may be subject to the proposed co-permitting requirements. EPA does not evaluate the potential magnitude of costs to egg and turkey processors because the compliance costs to CAFOs in these industries are expected to be easily absorbed by CAFOs (see Table 6-23). Using the framework to estimate costs and impacts to regulated CAFOs, EPA calculates the estimated upper bound of costs that could accrue to broiler processors based the estimated pre-tax cost estimated for CAFOs, assuming that either all or a portion of these costs are absorbed by processors as markets adjust to the proposed CAFO regulations. EPA's partial cost passthrough scenario assumes that 35 percent of all broiler compliance costs are passed on to the food processing sectors. (For more information on this approach, see Section 4.2).

Using this approach, EPA estimates that the range of potential annual costs to broiler processors is $34 million (partial cost passthrough, two-tier structure) to $117 million (full cost passthrough, three-tier structure). These estimates are expressed in 1999 pre-tax dollars.

To assess the magnitude of impacts that could accrue to processors using this approach, EPA compares the passed through compliance costs to both aggregate processor costs of production and to revenues (a sales test). The results of this analysis are shown in Table 6-28 and are presented in terms of the equivalent 1999 pre-tax compliance cost as compared to 1997 data from the Department of Commerce on the revenue and costs among processors in the broiler industries. As shown, EPA estimates that, even under full cost passthrough, incremental cost changes are less than two percent and passed through compliance costs as a share of revenue are less than one percent.

This suggested approach does not assume any addition to the total costs of the rule as a result of co-permitting. This approach also does not assume that there will be a cost savings to contract growers as result of a contractual arrangement with a processing firm. This approach merely attempts to quantify the potential magnitude of costs that could accrue to processors that may be affected by the co-permitting requirements. Due to lack of data, EPA did not conduct a detailed analysis of the costs and impacts that would accrue to individual co-permittees. Additional limitations of this approach as recognized by EPA are discussed in Section 4.3.

Table 6-28. Impact of Passed Through Compliance Costs under Co-proposed Alternatives, Broiler Sector

Sector	Passed Through Pre-tax Compliance Cost [a/]		1997 Revenues	1997 Delivered Cost [b/]	Passed Through Compliance Cost as % of Revenues (Sales Test)		Passed Through Compliance Cost as % of Delivered Cost	
	Partial CPT	100% CPT			Partial CPT	100% CPT	Partial CPT	100% CPT
	$1999 (million)				(percent)			
Two-Tier Structure	$34	$97	$17,700	$9,100	0.2%	0.5%	0.4%	1.0%
Three-Tier Structure	$41	$117			0.2%	0.6%	0.4%	1.2%

Source: USEPA. 1997 processor revenues and costs are from the Department of Commerce (USDC, 1999a). Option/Scenario definitions are provided in Section 3. Proposed BAT Option is Option 5.

[a/] Pre-tax compliance costs that are estimated to be passed from the CAFO to the processors using a mid-range CPT of 35% for the broiler sector (see Section 4.2.6.1).

[b/] Delivered costs include all raw materials put into production during the year.

6.5 MARKET ANALYSIS

This section presents the results of EPA's market model analysis for the poultry sectors. The results presented in this section briefly compare the results of the two-tier (500 AU threshold) and the three-tier (Scenario 3) structures that are being co-proposed by EPA. Additional results on the alternative regulatory options and scenarios considered by EPA as part of this rulemaking are provided in Section 5.4. For further explanation of the market model and sources of the baseline input data, see Section 4.4 and Appendix B.

A summary of the key results of the market model for the broiler, layer, and turkey sectors is shown in Tables 6-29, 6-30, and 6-31 for both the two-tier and three-tier structures. 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 proposed CAFO regulations will raise broiler producer prices by 0.19 cents per pound to 0.22 cents per pound, or less than 0.06 percent of the baseline producer price, depending on the co-proposed tier structure (Table 6-29). At the retail level, consumer prices for broiler products will rise about 0.2 cents per pound.

From a baseline producer price of 69.8 cents per dozen, EPA's market model predicts that the proposed CAFO regulations will raise egg prices by 0.13 cents per dozen to 0.14 cents per dozen, or less than 0.03 percent of the baseline producer price, depending on the co-proposed tier structure (Table 6-30). At the retail level, consumer prices for eggs will rise about 0.14 cents per dozen.

Compared to a baseline producer price of 40.1 cents per pound, EPA's market model predicts that the proposed CAFO regulations will raise turkey producer prices by 0.12 cents per pound to 0.16 cents per pound, or less than 0.4 percent of the baseline producer price, depending on the co-proposed tier structure (Table 6-31). At the retail level, consumer prices for turkey products will rise about 0.15 cents per pound.

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. poultry product imports will not change compared to baseline imports. U.S. broiler exports will decrease by less than 0.1 percent compared to baseline, while egg and turkey exports will remain unchanged.

Absorption of compliance costs by the producers and small declines in quantities are expected to result in fewer jobs in the poultry industry. Tables 6-29 through 6-31 also present EPA's estimates of both the direct (i.e., farm and processor level) and total (i.e., national level) reductions in employment for the poultry sector. Overall, changes in national aggregate employment in the broiler sector are estimated to range from a total reduction of 1,870 to 2,260

jobs, measured in full-time equivalents (FTEs). Changes in national aggregate employment in the layer sector are estimated to range from 200 to 220 FTEs. Changes in national aggregate employment in the turkey sector are estimated to range from 370 to 490 FTEs. This analysis does not adjust for offsetting increases in other parts of the economy and other sector employment that may be stimulated as a result of the proposed regulations, such as the construction and farm services sectors.

EPA's projected job losses are estimated throughout the entire economy, using available modeling approaches described in Section 4, and are not attributable to the regulated community only. As shown in Tables 6-29 through 6-31, about 80 percent of these estimated job losses are in the non-agricultural or farm services support industries (i.e., indirect or induced employment affects; see Section 4.4).

At the CAFO level, EPA predicts that job losses in the broiler production sector associated with the proposed CAFO regulations will range from 340 to 410 jobs under the proposed BAT Option, depending on tier structure (Table 6-29). EPA estimates that job losses in the layer sector at the CAFO level will range from 13 to 15 jobs (Table 6-30) and that job losses in the turkey sector at the CAFO level will range from and 100 to 130 jobs (Table 6-31). These estimates include CAFO owner-operators and employed family members, as well as hired farm labor. These estimated reductions compare to an estimated total farm level employment of 71,800 FTEs in the poultry sector nationwide (Table 2-17; Abel, Daft, and Earley, 1993, as updated by EPA). EPA estimates that job losses in the broiler processing sector will range from 60 to 70 jobs (Table 6-29), while fewer than 10 jobs will be lost in either the egg or turkey processing industries (Tables 6-30 and 6-31). These estimated losses compare to the more than 204,000 persons employed in poultry processing in 1997 (USDC, 1999a).

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. For this analysis, EPA disaggregates the national employment results to examine the potential regional employment impacts of the proposed CAFO regulations. The method EPA uses to allocate impacts is based on broiler and egg production at large operations and turkey production at all farms. This allocation does not take into account existing environmental practices or other production factors (see Section 4.4). Table 6-29 shows that the dominant broiler producing regions of the South would be the most affected, followed by the Mid-Atlantic. Turkey and egg production have their largest impacts 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 at under 0.01 percent; about 60 percent of the estimated agricultural job losses in the broiler sector are expected in the South (Table 6-29). About 40 percent of the egg and turkey industry job losses are expected in the Midwest (Tables 6-30 and 6-31). Economy-wide employment losses are estimated at under 0.01 percent compared to the baseline.

Table 6-29. Summary of Market Model Results for the Broiler Sector

Variable	Pre-Regulatory Value/Units	Two-Tier Structure		Three-Tier Structure	
		BAT Option	Range of Alternative Options	BAT Option	Range of Alternative Options
Farm Products					
Price	37.00¢/lb.	37.19	37.17 - 37.31	37.22	37.19 - 37.40
Quantity Produced	27,551 mil. lbs.	27,538	27,530 - 27,540	27,536	27,524 - 27,538
Retail Products					
Price	151.00¢/lb.	151.19	151.17 - 151.31	151.22	151.19 - 151.40
Quantity Demanded	27,551 mil. lbs.	27,538	27,530 - 27,540	27,536	27,524 - 27,538
Quantity Exported	5,048 mil. lbs.	5,046	5,044 - 5,046	5,045	5,043 - 5,046
Quantity Imported	5 mil. lbs.	5	5 - 5	5	5 - 5
Employment Reduction [a/ b/]					
Direct Farm	71,800 FTEs	338	301 - 564	411	355 - 727
Direct Processor	204,200 FTEs	57	51 - 96	70	60 - 123
Total Economy	129.6 mil. FTEs	1,865	1,660 - 3,108	2,262	1,959 - 4,008
Output Reduction					
National	$ million	185	165 - 309	225	195 - 398
Regional Farm and Processing Employment Reduction					
Pacific	FTEs	17	15 - 29	21	18 - 37
Central	FTEs	33	29 - 55	40	35 - 71
Midwest	FTEs	18	16 - 31	22	19 - 40
South	FTEs	226	201 - 377	274	237 - 486
Mid-Atlantic	FTEs	101	90 - 169	123	106 - 218
Total	FTEs	396	352 - 660	480	416 - 851

Source: Post-regulatory changes are estimated by USEPA. Pre-regulatory prices, quantities, and trade volumes, see Table 4-16 (Section 4). Pre-regulatory employment, see Table 2-17 (Section 2).

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

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

Table 6-30. Summary of Market Model Results for the Layer Sector

Variable	Pre-Regulatory Value/Units	Two-Tier Structure		Three-Tier Structure	
		BAT Option	Range of Alternative Options	BAT Option	Range of Alternative Options
Farm Products					
Price	69.80¢/doz.	69.93	69.91 - 70.03	69.94	69.91 - 70.06
Quantity Produced	6,473 mil. doz.	6,472	6,472 - 6,472	6,472	6,471 - 6,472
Retail Products					
Price	106.00¢/doz	106.13	106.11 - 106.23	106.14	106.11 - 106.26
Quantity Demanded	5,578 mil. doz.	5,577	5,577 - 5,577	5,577	5,576 - 5,577
Quantity Exported	228 mil. doz.	228	228 - 228	228	228 - 228
Quantity Imported	7 mil. doz.	7	7 - 7	7	7 - 7
Employment Reduction [a/ b/]					
Direct Farm	71,800 FTEs	13	11 - 23	15	11 - 27
Direct Processor	204,200 FTEs	3	3 - 6	4	3 - 7
Total Economy	129.6 mil. FTEs	202	162 - 348	218	170 - 401
Output Reduction					
National	$ million	19	15 - 33	20	16 - 38
Regional Farm and Processing Employment Reduction					
Pacific	FTEs	2	2 - 3	2	2 - 4
Central	FTEs	2	1 - 3	2	1 - 3
Midwest	FTEs	6	5 - 11	7	5 - 13
South	FTEs	4	3 - 6	4	3 - 7
Mid-Atlantic	FTEs	3	3 - 6	4	3 - 7
Total	FTEs	17	14 - 29	18	14 - 33

Source: Post-regulatory changes are estimated by USEPA. Pre-regulatory prices, quantities, and trade volumes, see Table 4-16 (Section 4). Pre-regulatory employment, see Table 2-17 (Section 2).

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

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

Table 6-31. Summary of Market Model Results for the Turkey Sector

Variable	Pre-Regulatory Value/Units	Two-Tier Structure		Three-Tier Structure	
		BAT Option	Range of Alternative Options	BAT Option	Range of Alternative Options
Farm Products					
Price	40.10¢/lb.	40.22	40.18 - 40.28	40.26	40.19 - 40.35
Quantity Produced	5,412 mil. lbs.	5,409	5,407 - 5,410	5,408	5,405 - 5,409
Retail Products					
Price	105.10¢/lb	105.22	105.18 - 105.28	105.26	105.19 - 105.35
Quantity Demanded	5,412 mil. lbs.	5,409	5,407 - 5,410	5,408	5,405 - 5,409
Quantity Exported	598 mil. lbs.	598	597 - 598	598	597 - 598
Employment Reduction [a/ b/]					
Direct Farm	71,800 FTEs	98	61 - 142	127	75 - 200
Direct Processor	204,200 FTEs	9	5 - 13	11	7 - 18
Total Economy	129.6 mil. FTEs	373	231 - 543	486	286 - 765
Output Reduction					
National	$ million	38	24 - 55	49	29 - 78
Regional Farm and Processing Employment Reduction					
Pacific	FTEs	10	6 - 14	13	7 - 20
Central	FTEs	7	4 - 10	9	5 - 14
Midwest	FTEs	41	26 - 60	54	32 - 85
South	FTEs	15	9 - 21	19	11 - 30
Mid-Atlantic	FTEs	34	21 - 49	44	26 - 69
Total	FTEs	106	66 - 155	138	81 - 218

Source: Post-regulatory changes are estimated by USEPA. Pre-regulatory prices, quantities, and trade volumes, see Table 4-16 (Section 4). Pre-regulatory employment, see Table 2-17 (Section 2).

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

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

SECTION SEVEN

SUMMARY OF ECONOMIC IMPACTS: HOG SUBCATEGORY

This section presents a profile of the hog industry, including farmers (Section 7.1) and processors (Section 7.2). Following the industry profile, this section provides a detailed summary of EPA's economic analysis of the proposed CAFO regulations as it affects regulated CAFOs (Section 7.3), hog processors (Section 7.4), and national markets (Section 7.5).

7.1 PROFILE OF THE HOG PRODUCTION SECTORS

This section presents a profile of hog production operations and provides background information for analyzing the private sector costs of the proposed CAFO regulations. The purpose of this profile is to provide a baseline description of the current activities, structure, and performance of the hog production industries. The following sections describe the types of operations in this sector and present an overview of the industry, describing the number and size of operations (including the subset of regulated operations), geographic distribution, supply and demand conditions, price trends, and the financial conditions that characterize this sector.

7.1.1 Industry Definition

Hog production operations are those that raise or feed hogs and pigs either independently or on a contract basis. These operations are identified under NAICS 11221, Hog and pig farming (SIC 0213, Hogs). Hog production operations may be categorized by six facility types based on the life stage of the animal in which they specialize (NPPC, 1998; USDA/APHIS, 1995b). These categories include:

- *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.
- *Grow-finishing or feeder-to-finish* operations that handle 40- to 60-pound pigs and "finish" these 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.

USDA's Animal and Plant Health Inspection Service (APHIS) reports that in a 1995 survey of hog production operations, 86 percent of respondents produced market hogs (comprised of 62 percent farrow-to-finish operations and 24 percent grower-to-finish operations), 12 percent produced feeder pigs (nurseries), and 3 percent produced weaned pigs and breeding stock (USDA/APHIS, 1995b).

Fresh meat cuts from a typical hog carcass constitute nearly 40 percent of carcass weight. This phase of production is typically handled beyond the production phase by meat packing plants (NAICS 311611, Animal [except poultry] slaughtering). The remaining carcass weight is further processed into sausages and other prepared meats (NAICS 311612, Meat processed from carcasses). Other by-products, such as hides, lard, and offal, have value in the manufacture of clothing, foodstuffs, fertilizers, and other industrial products. Additional information on the hog processing sector is presented in Section 7.2.

7.1.2 Overview of the Hog Industry

The hog industry is undergoing rapid and significant change, including changing technology usage, size of operations, location, and product characteristics (Schrader, 1998). Structural change is reflected by a tendency toward fewer but larger operations as hog production shifts from family-based, small-scale, independent production operations to more specialized, larger production operations that are less dependent on market coordination between production phases (Schrader, 1998; Warner, 1998). Major geographic shifts are also evident as production operations relocate from the more traditional Cornbelt region to the Southern states. Increased industrialization and management intensity have accompanied changes in ownership structure and the increased use of contract production (Lawrence, et al., 1998; Warner, 1998), as discussed later in Section 7.2. The rise in the use of production contracts has contributed to changes in several areas, including geographic distribution and prices received by producers, as noted in the following sections. Meanwhile, market conditions have been unstable in the hog industry and have been characterized by production expansion in excess of domestic and export demand, which have pushed prices lower.

7.1.2.1 Trends in the Number and Size

USDA reports that in 1997 there were 109,800 hog farms in the United States, based on year-end inventories (USDA/NASS, 1999a). See Table 7-1. These data on the number of farms

include both commercial and non-commercial operations, as well as operations that confine and graze animals. This estimate includes all facility types, including operations that finish market hogs for slaughter and operations that raise breeder stock.

The number of hog farms is declining. In 1987 there were 243,400 hog farms in the United States (USDC, 1994). This compares to 109,800 hog farms in 1997, reflecting a decrease of nearly 60 percent over the 10-year period (Table 7-1). During the same period, however, total year-end hog inventory among all operations increased, rising from 52.2 million hogs in 1987 to 61.2 million hogs in 1997—a 17 percent increase (USDA/NASS, 1999a; USDC, 1994). Increased production is also the result of production efficiency gains and large-scale expansion among some producers. Average herd size across all operations more than doubled between 1987 and 1997, from a national average of 220 hogs to 560 hogs per operation (USDA/NASS, 1999a; USDC, 1994). Table 7-1 shows these trends based on data on the number of hog operations and corresponding total number of animals for selected years between 1974 and 1997.

Data on the distribution of animals across the various operation sizes indicate that the majority of hog operations (93 percent) have fewer than 1,250 head, accounting for about one-third of overall inventories (USDA/NASS, 1999a). Nearly half the inventories are concentrated among the 3 percent of operations with more than 2,500 head.

Table 7-1. Number of Hog Operations and Animals, 1974-1997

Year	Operations	Animals	Herd Size	Percent of Operations	Percent of Animals
		(thousand)	(head)	(>1,000 head)	
1974	470,258	45,504	97	0.9%	15.6%
1978	445,117	57,697	130	1.6%	22.7%
1982	329,833	55,366	168	2.8%	30.8%
1987	243,398	52,217	215	4.0%	38.0%
1992	191,347	57,563	301	6.2%	50.3%
1997	109,754	61,206	558	11.6%	75.3%

Source: USDA/NASS, 1999a, and USDC, 1994. Data are based on year-end inventory.

For the purpose of this analysis, EPA estimates the number of confinement operations that may be subject to the proposed CAFO regulations using 1997 Census data that are aggregated by USDA's NASS. NASS developed a methodology for identifying farms likely to be CAFOs based on the Census survey information and estimated animal units on these operations based on reported data. A summary of these data are provided in the *Development Document*, USEPA, 2000a. These summary data reflect average herd size throughout the year, accounting for both

animals sales and inventories. Where applicable, data are adjusted for the average number of marketing cycles (USEPA, 2000a). This avoids misrepresentation due to seasonal fluctuations in inventory and the number and timing of animals sold. From these data, EPA has estimated the number of confinement operations (referred to here as AFOs) using available data and other information from the Census as well as other USDA and industry publications (USDA/NASS, 1999a; USDA/APHIS, 1995b; NPPC, 1998). These data may differ from those presented in Table 7-1.

Expressed on this basis, USDA estimates that there were 117,880 hog operations with 56.7 million market and breeding hogs in 1997 (Table 7-2). Not all of these operations would be subject to the proposed regulations. As shown in Table 7-2, under the two-tier structure, EPA estimates that there are 5,860 farrow-finish feedlots (including breeder and nursery operations) and 2,690 grow-finish feedlots with more than 1,250 head (i.e., 500 AU equivalent). Under the three-tier structure, EPA estimates that 5,700 farrow-finish feedlots (including breeder and nursery operations) and 2,650 grow-finish feedlots with more than 750 head (i.e., 300 AU equivalent) would meet EPA's proposed "risk-based" conditions and thus require a permit. (More information on the co-proposed tier structures is provided in Section 3.)

Under the two-tier structure EPA expects that designation of hog operations with fewer than 1,250 head will be limited to about 20 confinement operations annually, or 200 operations over a 10-year time period. Under the three-tier structure, EPA expects that about 5 hog operations with fewer than 750 head would be designated annually, or 50 operations over a 10-year time period. EPA expects that designated facilities will be located in more traditional farming regions.

As shown in Table 7-2, a total of 2,690 grow-finish operations and 6,060 farrow-finish operations are estimated either to be defined (>500 AU) or designated (<500 AU) as CAFOs under the two-tier structure at the 500 AU threshold. A total of 2,650 grow-finish CAFOs and 5,750 farrow-finish CAFOs are estimated to be defined (>300 AU) or designated (<300 AU) under the three-tier structure. These estimates adjust for operations with more than a single animal type.

More information on how EPA estimated the number of affected animal confinement operations is presented in Section 2 of this report, along with additional estimates on the number of affected hog operations under other regulatory options considered by EPA.

7.1.2.2 Geographic Distribution

Hog production is concentrated among the top five producing states. In 1997, these five states supplied 60 percent of the U.S. market for pork, measured in terms of marketed head. Iowa was the largest hog producing state, representing 20 percent of all hogs marketed in 1997 (Table 7-3). The second largest producing state was North Carolina with 16 percent of sales.

Table 7-2. EPA's Estimate of the Number of CAFOs Affected Under the Co-Proposed Tier Structures

Sector	Total Number of AFOs	Number of CAFOs						
		>1,000 AU [a/]	Two-Tier Structure (500 AU Threshold)			Three-Tier Structure (Scenario 3)		
			500-1,000 AU	<500 AU	Total CAFOs	300-1,000 AU	<300 AU	Total CAFOs
Hog-GF	53,620	1,670	1,020	0	2,690	980	0	2,650
Hog-FF	64,260	2,420	3,430	200	6,060	3,280	50	5,750
Total	**117,880**	**4,090**	**4,450**	**200**	**8,750**	**4,260**	**50**	**8,400**

Source: USEPA, 2000a. See Section 2 for more information. See Table 3-1 for definitions of the options/scenarios.
"Hogs: FF" are farrow-finish (includes breeder and nursery pigs); "Hogs: GF" are grower-finish only. The number of operations shown eliminates double counting of operations with mixed animal types.
[a/]As defined for the proposed regulations, one AU is equivalent to 2.5 hogs (over 55 pounds) or 5 nursery pigs.

Other top five producing states included Minnesota with 9 percent, Illinois with 8 percent, and Missouri with 7 percent of hogs marketed in 1997. Other major producing states in 1997 included Indiana, Nebraska, Oklahoma, Kansas, and Ohio. Combined, the top ten producing hog states accounted for 82 percent of U.S. production in 1997 (Table 7-3).

Despite North Carolina's large production share, the majority of commercial hog operations are located in the Midwest. In 1997, Iowa had the most hog operations with 18,400 (see Table 7-3). Other states with large numbers of hog operations included Minnesota (7,700), Illinois (7,400), Ohio (5,900), Indiana (6,600) and Nebraska (6,300 operations). By comparison, North Carolina had 2,700 commercial hog operations (USDA/NASS, 1999a).

The Southeast has seen rapid growth in hog production. Consolidation has been one factor in the region's increasing hog inventories. Other factors include increased vertical integration (modeled on the integrated poultry operations in the region), proximity to growing consumer markets, and mild climate (USGAO, 1995; Iowa State University, 1998). The Southeast offers a number of economic advantages for hog producers, including lower energy costs to heat facilities and a closer proximity to end markets. The warmer climate of the Southeast also contributes to improved feed efficiency, which makes proximity to feed grain sources among Midwestern states less important. Compared with the Southeast, the Midwest continues to support smaller, traditional, independently owned farms (McBride, 1999; Iowa State University, 1998; Martinez, 1999).

Table 7-3. Geographic Distribution of Hog Operations by Major Producing State, 1997

Major Producing State	Marketed Head		Farms Reporting Sales	
	(thousands)	(percent)	(number)	(percent)
Iowa	21,040	20%	18,370	18%
North Carolina	16,735	16%	2,666	3%
Minnesota	9,197	9%	7,717	8%
Illinois	8,128	8%	7,447	7%
Missouri	7,443	7%	5,183	5%
Indiana	6,282	6%	6,623	6%
Nebraska	5,966	6%	6,296	6%
Oklahoma	3,846	4%	2,082	2%
Kansas	3,500	3%	2,873	3%
Ohio	3,050	3%	5,938	6%
South Dakota	2,305	2%	3,067	3%
Michigan	1,697	2%	2,690	3%
Wisconsin	1,554	1%	3,591	4%
Pennsylvania	1,536	1%	2,971	3%
Georgia	1,304	1%	1,561	2%
Texas	854	1%	3,659	4%
Tennessee	726	1%	1,579	2%
Mississippi	503	0%	425	0%
California	378	0%	1,193	1%
Florida	137	0%	971	1%
All Other	8,373	8%	15,204	15%
Top 5 states	**62,543**	**60%**	**41,383**	**41%**
Top 10 states	**85,187**	**81%**	**65,195**	**64%**
Top 20 states	**96,181**	**92%**	**86,902**	**85%**
Total U.S.	**104,554**	**100%**	**102,106**	**100%**

Source: USDA/NASS, 1999a and USDA/NASS, 1998e. Data are based on annual sales.

7.1.2.3 Supply and Demand Conditions

Total U.S. pork production (carcass weight basis) increased slightly between 1992 and 1997, reaching 17.3 billion pounds in 1997 (Table 7-4). During the same period, total domestic demand for pork products decreased. Expressed on a per-capita basis, adjusted for population growth, demand dropped by nearly 8 percent from 67.8 pounds per person in 1992 to 62.5 pounds per person per year in 1997 (Table 7-3). Compared to demand levels in the 1970s, when pork consumption exceeded 70 pounds per person per year, consumption is down by about 10 pounds per person (Table 7-3). Domestic consumption constitutes the bulk (94 percent) of U.S. annual pork supplies.

As shown in Table 7-4, U.S. pork exports nearly doubled during the 1990s (Putnam and Allshouse, 1997 and 1999). The U.S. is among the world's lowest cost producer of pork, but still ranks close to competitors Australia and Argentina in terms of cost of production (Iowa State University, 1998).

Table 7-4. Total U.S. Hog Supply and Demand (carcass weight basis), 1992-1997

Year	Production	Imports	Exports	Total Demand	Per Capita Demand
	(million pounds red meat carcass weight)				(lbs./person)
1992	17,234	645	552	17,330	67.8
1993	17,088	740	601	17,253	66.8
1994	17,696	743	549	17,811	68.2
1995	17,849	664	787	17,768	67.4
1996	17,117	618	970	16,795	63.0
1997	17,274	633	1,044	16,821	62.5
%92-97	**0.2%**	**-1.9%**	**89.1%**	**-0.3%**	**-7.8%**

Source: Putnam and Allshouse, 1997 and 1999. Supplemented with information from USDA/ERS, 1998c and 1997f. Excludes beginning and ending stocks and shipments to U.S. territories. Per-capita demand is shown to depict real demand growth, adjusting for growth in U.S. population (about 1 percent per year).

7.1.2.4 Farm Price Trends

Prices received by farmers tend to vary seasonally according to production cycles throughout the year and are also prone to wide fluctuations from year-to-year. Prices are often subject to periods of high instability according to changing market conditions or sharp shifts in supply in response to changing prices and/or input costs, among other factors. This is especially

true in the pork sector where prices may vary cyclically and seasonally and are highly dependent on market demand and current inventory or supply (NPPC, 1998; Schrader, 1998).

Cyclical variations in hog prices occur due to the biological time lags that are inherent in pork production. Because hogs take approximately a year to reach market weight, it is impossible to know if current breeding decisions will accurately reflect demand conditions a year later. Mismatches between the supply and demand for hogs when those hogs actually reach market will cause changes in hog prices that will signal farmers to adjust breeding decisions. To expand future meat supplies in response to expected profits, producers must hold back animals from market in the near term to build up the breeding herd, which will short the market and increase prices in the short run. Conversely, when low prices signal a reduction in production, the resulting herd sell-off will increase supplies and reduce prices in the short run (Kohls and Uhl, 1998). The market cycle caused by this biological lag can take three to four years before the market returns to equilibrium—barring other shocks to the market (Schrader, 1998).

Seasonal changes can also affect prices through extreme weather events that affect supply and through changes in consumer preferences that affect demand. Based on data for 1985 through 1996, Schrader (1998) shows that the seasonal variation in hog prices indicates a production-driven rather than market-driven system, based on average trends that show that production is high when prices are low. These variations in the production cycle and seasonal pricing patterns indicate that efficiency gains may be attained through closer coordination of production and marketing (Schrader, 1998). Indeed, the uncertainty and risk caused by these cycles has been a major factor in driving the trend towards coordination between producers and processors (Kohls and Uhl, 1998).

Table 7-5 presents actual quarterly and annual prices received by U.S. hog producers from 1992 through 1997. Following a decline in average prices during the mid-1990s when average hog prices were about $40 per hundredweight (cwt) and about $30 per cwt for sows, prices surged during the 1996-1997 period to over $50 per cwt for hogs and $40 per cwt for sows (Table 7-4).[1] Higher hog prices during 1996 and 1997 followed a contraction in domestic production in response to lower prices in 1994-1995 and also rapid growth in export demand (Table 7-4; Table 7-5). Hog prices dropped substantially in 1998, but lower feed prices during that year somewhat offset the price drop (USDA/ERS, 2000c).

The actual price a farmer receives will depend on whether the operation is an independent owner-operator or whether the operation grows animals under a production contract with a processor/integrator.

The contract price that the grower receives is often lower than the market price received by independent operators, thus contributing to lower gross revenues received by the contract grower compared to the independent operator. The North Carolina Pork Council report contract

[1]Expressed in real terms adjusted for producer price inflation, average gains in price are somewhat lower.

Table 7-5. Actual Average Quarterly and Annual Hog Prices Received by Farmers, Total U.S., 1992-1997

Year	Average Q1	Average Q2	Average Q3	Average Q4	Average Annual
Hogs Monthly Prices Received by Farmers ($/hundredweight or cwt)					
1993	43.9	46.8	46.9	43.3	45.2
1994	45.3	42.7	39.8	30.2	39.5
1995	37.9	38.3	47.8	43.0	41.8
1996	45.9	54.3	57.7	55.2	53.3
1997	52.0	56.6	54.9	44.7	52.0
Sows Monthly Prices Received by Farmers ($/hundredweight or cwt)					
1993	35.1	38.1	35.7	34.3	35.8
1994	36.9	35.4	28.7	21.0	30.5
1995	28.3	28.8	32.7	34.0	31.0
1996	33.3	40.8	47.5	49.2	42.7
1997	46.3	46.5	43.5	35.5	43.0

Source: USDA/NASS, 1998a.

hog prices in the range of $10 to $11 per hog (Farm Journal, 1998). Schiller (1998) report contract prices ranging from about $11.60 to $12.80 per hog. At $10 to $13 per hog (assuming a 250 pound finish weight), these prices translate to prices of about $4 to $5 per cwt, or roughly 10 percent of the average USDA-reported producer price (see Table 7-5). Nearly two-thirds of grow-finish operations that raise market hogs use contracts, whereas fewer than 2 percent of farrow-finish operations use contracts (USDA/ERS, 2000c).

With a production contract, the contract grower's lower price generally is offset by lower costs, since the integrator often pays for a substantial portion of the grower's annual variable cash expenses. Inputs supplied by the integrator may include feeder pigs, feed, veterinary services and medicines, technical support, and transportation of animals. These variable cash costs comprise a large component of annual costs, averaging more than 70 percent of total variable and fixed costs at livestock operations (USDA/ERS, 1999a). In addition, the grower faces reduced risk because the integrator guarantees the grower a fixed output price. By comparison, the independent operator must cover all production costs and anticipate market price fluctuations. Therefore, an independent operator faces relatively higher costs and also assumes greater production and price risks compared to a contract grower. Yet, because the grower's production costs are lower, the contract grower's net revenue or profits (gross revenue less costs) may be comparable to that of an independent operation.

7.1.3 Financial Characteristics of Hog Operations

7.1.3.1 Overview of Financial Characteristics

In 1997, commercial hog farms in the U.S. generated a total of $13.1 billion in annual revenue (USDA/NASS, 1999a).[2] As shown in Table 7-6, nearly 90 percent ($11.6 billion) of total revenues from commercial hog operations represent the sale of hogs and pigs. Secondary livestock revenues, including sales by farms that generate a portion of their total revenue from other livestock raised on-site totaled $0.5 billion (4 percent of total farm revenues). Crop sales from hog operations accounted for 8 percent ($1.0 billion) in 1997 (USDA/NASS, 1999a).

Approximately one-fourth of all commercial hog farms generate more than $0.5 million in revenue annually (USDA/NASS, 1999). See Table 7-6. The remaining three-fourths of farms generate revenues below $0.5 million. This revenue cut-off corresponds with the definition of a "small business" in the hog sector established by the Small Business Administration (SBA, 1998; USGPO, 2000). (Section 9 provides additional information on EPA's small business analysis.)

7.1.3.2 Income Statement and Balance Sheet Information

In recent years, hog farms have faced a number of financial and structural changes. It is expected that consolidation will continue in the face of negative farm returns to management and risk. The hog farms most susceptible to closure are small farms, high-cost farms, diversified single-manager operations, farms with older technology, and farms where the manager is approaching retirement age with no successor to manage the operation (Boehlje et al., 1997).

Table 7-7 presents average income statement and balance sheet data for commercial hog farms from 1993 through 1997. The average U.S. hog farm was in a favorable financial position from 1993 through 1997 with a positive net farm income and a debt-to-asset ratio ranging from 0.22 to 0.30. (USDA's farm performance criteria are described in Section 4.2.5.) While the national average income statement shows a positive net income, additional information show that between 1991 and 1994 about 30 percent of all hog farms experienced negative income (USDA/ERS, 1997b). Data from Yeske (1996) also show a wide distribution in the financial performance among hog operations, as indicated by an average breakeven market cost per pig estimated to range from $37 per pig to $108 per pig across operations. Operations in the poorer performing category likely are smaller operations that are not affected by the proposed CAFO regulations.

[2]USDA defines commercial farms as those with gross sales of $50,000 or more during a given year.

Table 7-6. Farm Revenue at Hog Farms (>$50,000 in Sales), by Revenue Category and Economic Class

Revenue Category/Economic Class	# Hog Farms (1,000's)	Revenues ($1,000)
Sales by Revenue Category (reported and percentage share)		
Primary Livestock	23,511	11,594,271
Secondary Livestock	3,130	510,494
Crop Sales	8,042	991,887
All Farms	**34,683**	**13,096,653**
Primary Livestock	68%	89%
Secondary Livestock	9%	4%
Crop Sales	23%	8%
All Farms	**100%**	**100%**
Sales by Economic Class (reported and percentage share)		
>$1 million in revenue	3,545	7,135,927
Between $0.5-$1.0	5,641	2,407,870
Between $0.25-$0.50	9,995	1,987,686
Between $0.10-$0.25	12,340	1,355,136
Between $0.05-$0.10	3,162	210,035
All Farms	**34,683**	**13,096,654**
>$1 million in revenue	10%	54%
Between $0.5-$1.0	16%	18%
Between $0.25-$0.50	29%	15%
Between $0.10-$0.25	36%	10%
Between $0.05-$0.10	9%	2%
All Farms	**100%**	**100%**

Source: USDA/NASS, 1999a (Table 50 and Table 51). Based on data for commercial farms with more than $50,000 in annual revenues. Excludes non-commercial farms with revenues below $50,000.
Primary Livestock: Hogs (NAICS 1122) and Poultry (NAICS 1123), respectively.
Secondary Livestock: Beef (beef farming, NAICS 112111, and beef feedlots, NAICS 112112), Dairy (NAICS 11212), miscellaneous categories (NAICS 1122, NAICS 1124, NAICS 1125), along with Hogs (NAICS 1122) and Poultry (NAICS 1123), respectively.
Crop Sales: Oilseed/Grains (NAICS 1111), Vegetables (NAICS 1112), Fruits/Nuts (NAICS 1113), Greenhouse (NAICS 1114) and other crops (NAICS 1119).

Table 7-7. Income Statement and Balance Sheet for Hog Farms (Sales >$50,000), 1993-97

Item	1993	1994	1995	1996	1997
	(dollars per farm)				
Income Statement					
Gross cash income	**$191,566**	**$195,594**	**$227,671**	**$330,160**	**$347,371**
Livestock sales	$144,676	$144,635	$170,508	$259,556	$272,782
Crop sales (incl. net CCC loans)	$27,577	$25,593	$34,850	$47,366	$35,356
Government payments	$10,094	$6,286	$6,128	$5,037	$4,635
Other farm-related income [a/]	$9,219	$19,080	$16,186	$18,201	$34,598
Less: Cash expenses	**$155,941**	**$163,433**	**$180,698**	**$245,610**	**$262,349**
Variable Cash expenses	$130,181	$138,166	$147,097	$208,878	$223,247
Fixed Cash expenses	**$25,760**	**$25,267**	**$33,601**	**$36,733**	**$39,102**
Equals: Net cash farm income	**$35,625**	**$32,160**	**$46,973**	**$84,549**	**$85,022**
Less: Depreciation	$17,092	$16,931	$20,466	$26,342	$26,937
Labor, non-cash benefits	$318	$463	$574	$458	$264
Plus: Value of inventory change	$3,939	$934	$12,662	$33,366	($2,510)
Non-money income [b/]	$3,972	$4,047	$3,866	$4,742	$3,960
Equals: Net farm income	**$26,126**	**$19,748**	**$42,461**	**$95,857**	**$59,271**
Balance Sheet					
Farm assets	**$538,454**	**$553,871**	**$564,979**	**$770,265**	**$647,007**
Current assets	$110,173	$124,963	$126,237	$183,716	$123,632
Non-current assets	$428,280	$428,908	$438,742	$586,549	$523,374
Farm liabilities	**$129,150**	**$130,321**	**$148,480**	**$167,792**	**$195,555**
Current liabilities	$43,772	$40,904	$53,559	$55,817	$48,904
Non-current liabilities	$85,377	$97,434	$94,921	$111,976	$146,651
Farm equity	**$409,304**	**$414,231**	**$416,499**	**$602,472**	**$451,452**
Debt/asset ratio	**0.24**	**0.25**	**0.26**	**0.22**	**0.30**

Source: USDA/ERS, 1997a.

[a/] Includes income from machine-hire, custom work, livestock grazing, land rental, contract production fees, outdoor recreation, and any other farm-related source.

[b/] Defined as home consumption and imputed rental value of farm dwellings owned by the farm operation.

Factors affecting the financial differences between operations include the size of operations, labor input, tenure of the operation, and whether the operation is owner-operated or under contract (Zulovich, 2000). The costs of raising a hog from farrowing to market weight are roughly the same whether the function is performed at one facility, e.g., farrow-finish, or at a series of specialized facilities (Foster, 2000a). Farrow-finish and grow-finish facilities differ slightly in their cost structure because of the life cycle stages they encompass. Farrow-finish total costs may tend to be higher than other facilities because they raise the hog through its whole life cycle and through a period that involves more veterinary care and labor. Alternately, average

costs at these facilities may be lower than at other operations because they raise the hog through the early weeks when weight gain is most rapid.

Grow-finish operations, which have on average more than twice the number of animals as farrow-finish operations, have smaller returns on a cwt gain basis because of higher operating costs for feeder pigs and marketing at grow-finish operations (USDA/ERS, 2000c; Doane's, 1995). Farrow-finish operations, however, have higher overhead costs. Overhead costs are higher at farrow-finish operations because they tend to have more buildings and equipment per hog produced, which results in higher depreciation costs. They also have more hired and unpaid labor, which results in higher labor overhead and opportunity costs of unpaid labor (USDA/ERS, 2000c; Doane's, 1995).

Data are available data from USDA's ERS cost of production data series that reflect differences among farrow-to-finish, farrow-to-feeder, and feeder-to-finish operations by select production regions (USDA/ERS, 2000c). These data are measured in terms of average dollars per hundredweight (cwt) gain among hog operations. Data for 1999 indicate that the total gross value of production is higher among grow-finish operations than among farrow-finish operations, estimated to average $38 per cwt compared to $31 per cwt, respectively (USDA/ERS, 2000c). This is due mostly to greater revenue per marketed hog at grow-finish operations. Average total revenue less operating expenses is also higher at grow-finish operations, despite higher total operating costs at these operation estimated at $42 per cwt in 1999 (compared to $25 per cwt at farrow-finish operations). Costs for feed and feeder pigs are higher at grow-finish operations, estimated at $38 per cwt or about 90 percent of total operating costs (USDA/ERS, 2000c). These broad differences in financial conditions among the types of hog operations are also shown in Table 7-8 which presents a summary of ERS' cost of production data for the hog sector, averaged over the 1993-1997 period.

Investments in equipment may also result in differing returns between farrow-finish and grow-finish operations. A report by the University of Missouri on hog manure technologies (1999) presents the difference in return on assets (ROA), where assets are the investment in manure technologies, for different sized farrow-finish and grow-finish operations. The ROA (net cost) for farrow finish operations with 150 to 1,200 sows ranges from 11 to 19 percent; the ROA at grow-finish operations with 2,000 to 4,000 hogs ranges from 9 to 11 percent (University of Missouri, 1999). These reported ROA percentages for relatively small investments in manure technologies at farrow finish and grow-finish operations are good by most standards. Average costs are lowest among operations that raise immature animals only (see data for "farrow-feeder" operations shown in Table 7-8; also, see USDA/ERS, 2000c, and Yeske, 1996).

Despite these differences in the financial conditions among the different types of hog operations, EPA uses average financial data across all hog operations since these are the data that are available from ARMS for this analysis. Specifically, EPA assesses impacts at grow-finish and farrow-finish operations using data for all hog operations. Based on the broad differences demonstrated by data shown in Table 7-8, EPA believes that these average data more or less approximate conditions equally across grow-finish and farrow-finish operations, particularly for

Table 7-8. Costs and Returns for Hog Farms by Facility Type, Average 1993-1997

Facility Type	Total	North[a/]	South[b/]
	(average $ per cwt. gain)		
All Hog Farms			
Total, gross value of production	54.62	54.40	55.52
Total, variable cash expenses	41.57	41.43	42.14
Total, fixed cash expenses	5.75	6.16	4.24
Total, cash expenses	47.33	47.59	46.38
Gross value of production less cash expenses	7.30	6.81	9.14
Economic (full ownership) costs	66.14	66.10	51.44
Residual returns to management and risk	**-11.52**	**-11.70**	**4.08**
Farrow-to-Finish Farms			
Total, gross value of production	48.89	48.77	49.33
Total, variable cash expenses	36.92	36.29	39.41
Total, fixed cash expenses	5.15	5.48	3.82
Total, cash expenses	42.08	41.77	43.23
Gross value of production less cash expenses	6.81	7.00	6.10
Economic (full ownership) costs:	60.43	59.89	62.48
Residual returns to management and risk	**-11.54**	**-11.12**	**-13.15**
Farrow-to-Feeder Farms			
Total, gross value of production	82.58	83.93	83.93
Total, variable cash expenses	66.76	65.21	65.21
Total, fixed cash expenses	11.17	10.53	10.53
Total, cash expenses	77.93	75.74	75.74
Gross value of production less cash expenses	4.65	8.18	8.18
Economic (full ownership) costs:	119.51	114.88	114.88
Residual returns to management and risk	**-36.93**	**-30.95**	**-30.95**
Feeder-to-Finish Farms			
Total, gross value of production	60.48	60.64	60.10
Total, variable cash expenses	49.89	52.45	44.27
Total, fixed cash expenses	5.56	6.23	4.01
Total, cash expenses	55.45	58.67	48.28
Gross value of production less cash expenses	5.03	1.97	11.82
Economic (full ownership) costs:	68.83	72.24	61.24
Residual returns to management and risk	**-8.36**	**-11.60**	**-1.14**

Source: Derived form USDA/ERS, 2000c.

[a/]North: IL, IN, IA, KS, MI, MN, MO, NE, OH, SD, and WI.

[b/]South: AL, AR, GA, KT, NC, SC, TN, TX, and VA.

the key financial criteria examined in this analysis (namely, gross revenue and net cash income). Among grow-finish operations, EPA's use of these average data likely overstate impacts at grow-finish operations since these operations generally have more favorable financial conditions than the average hog operation. As shown in Table 7-8, grow-finish operations tend to have higher average revenue and higher net cash income compared to the average across all operations. However, EPA's use of these average data may understate impacts at farrow-finish operations since financial conditions at these operations are generally less favorable than those for the average hog operation. As shown in Table 7-8, gross revenue and revenue less expenses may average 10 percent lower at farrow-finish operations compared to the average. Because farrow-finish operations account for more than 60 percent of all marketed hogs (USDA/APHIS, 1995b) and because the impacts may be understated using average data for this subsector, EPA conducts sensitivity analyses of these financial variables (provided in Appendix D of this report).

7.1.3.3 Baseline Conditions for Hog Operations

Tables 7-9 and 7-10 provide a summary of the financial baseline conditions assumed for this analysis. These data are aggregated from the 1997 ARMS data set and are obtained by USDA's ERS, as described in Section 4. These data are separated by select facility size and production region groupings (see Table 4-4), but do not reflect conditions separately across the different types of hog operations (i.e., grow-finish and farrow-finish operations, nurseries, farrow-to-wean, and wean-to-finish operations). Additional information on how these data differ by region are provided in the record (USDA/ERS, 1999a, see DCN 70063).

According to the 1997 ARMS data the average hog operation demonstrated a favorable financial position in 1997 with positive net income and a debt-to-asset ratio that ranged from 15 percent to 39 percent, across select operation sizes (USDA/ERS, 1999a). See Table 7-9. These debt-to-asset ratios indicate that—on average—hog operations are not in a vulnerable financial position and have a low potential for cash flow problems and a low relative risk of insolvency. Based on these data, EPA assumes that baseline (prior to regulation) net cash flow for all model types for the hog sector is positive, and baseline debt-to-asset ratios for all model types are 40 percent or less. All hog operations in this analysis, therefore, are considered financially healthy, on average, in the regulatory baseline.

Data shown in Table 7-9 are distributed by broad facility size groups. As shown, more than 90 percent of operations have fewer than 800 hogs and pigs, however, these operations only account for about 30 percent of all hogs raised annually (Table 7-9). There are fewer larger-sized operations with more than 2,500 head (2 percent of all farms), but these operations raise over 40 percent of all hogs annually (Table 7-9). Smaller hog operations with less than 800 head are more diversified than larger ones, with about 50 percent of all farm revenue from crops. This compares to hog operations with more than 2,500 hogs, where livestock comprises the bulk of all annual farm sales and only 13 percent of farm revenues are from crops (Table 7-9).

Table 7-9. Typical Financial Characteristics of Hog Operations, By Size of Operation

Item	All Farms	Less than 800 Head	800 to 2,500 Head	More than 2,500 Head
Number of farms	117,552	106,463	8,298	2,791
Percent of farms	100.0%	90.6%	7.1%	2.4%
Percent of value of production	100.0%	53.8%	21.5%	24.6%
Livestock value of production	62.8%	50.8%	65.3%	86.7%
Crop value of production	37.2%	49.2%	34.7%	13.3%
Number of hogs and pigs	40,562,697	13,074,799	10,896,454	16,591,444
Distribution of hogs and pigs	100.0%	32.2%	26.9%	40.9%
Percent of hogs and pigs owned	72.4%	79.1%	79.5%	62.4%
Percent of hogs and pigs not owned	27.6%	20.9%	20.5%	37.6%
Number of sample farms with hogs and pigs	986	648	185	153
Debt-to-Asset Ratios				
All Regions	0.1837	0.1509	0.2534	0.3927
Midwest	0.2079	0.1732	0.2511	0.4044
Mid-Atlantic	0.1300	0.0920	d	0.3095
EPA Derived Gross Cash Income Per Animal [a/]				
All Regions	$363.00	$643.63	$296.66	$185.43
Midwest	$377.10	$606.13	$303.89	$228.99
Mid-Atlantic	$174.47	$83.60	d	$383.18
EPA Derived Net Cash Income Per Animal [a/]				
All Regions	$69.54	$110.32	$63.86	$41.13
Midwest	$76.47	$118.64	$66.02	$46.51
Mid-Atlantic	$30.64	$30.98	d	$31.16

Source: USEPA and USDA/ERS, 1999a.

[a/]EPA derived gross cash and net cash income by dividing the average gross or net cash income line items by the average number of animals as for each size group and region.

d = Data insufficient for disclosure.

Table 7-10. Income Statement and Balance Sheet for Farms with Hogs and Pigs, by Size of Operation, 1997

Item	All Farms	<800 Hogs/ Pigs	800 to 2,500	>2,500 Hogs/ Pigs
Income Statement				
Gross cash income	**125,259**	**79,045**	**389,557**	**1,102,299**
Livestock income	73,644	40,322	244,989	835,301
Crop sales (incl. net CCC loans)	35,960	28,122	106,564	125,004a
Government payments	3,808	3,048	11,203	10,805
Other farm-related income [1/]	11,847	7,553	26,801	131,189a
Total variable expenses	**80,217**	**49,939**	**249,880**	**730,719**
Livestock purchases	7,561	3,582	28,405	97,357a
Feed	27,777	13,297	102,720	357,286
Other variable expenses [2/]	44,880	33,061	118,756	276,077a
Total fixed expenses	**21,046**	**15,557**	**55,819**	**127,056**
Equals: Net cash farm income	**44,880**	**33,061**	**118,756**	**276,077a**
Less: Depreciation and Other [3/]	11,491	8,011a	35,833a	71,861
Plus: Value of inventory change	4,203a	4,197a	12,079b	-18,991c
Plus: Nonmoney income [4/]	5,028	5,106	4,364	4,010
Equals: Net farm income	**21,736**	**14,842**	**64,467**	**157,682a**
Balance Sheet				
Farm assets	**484,506**	**419,939**	**944,775**	**1,578,920**
Current assets	65,984	49,424	197,938	305,330
Non-current assets	418,522	370,515	746,836	1,273,590
Land, buildings, and equipment [5/]	397,574	353,413	702,403	1,175,766
Farm liabilities	**89,007**	**63,365**	**239,367**	**620,057**
Current liabilities	25,885	18,944	72,192	152,953
Noncurrent liabilities	63,122	44,421	167,175	467,104a
Farm equity	**395,499**	**356,574**	**705,408**	**958,863**

Source: USDA/ERS, 1999a. Copies of these data are in the rulemaking record (DCN 70063).
[1/]Machine-hire, custom work, livestock grazing, land rental, contract fees, and other farm-related sources.
[2/]Incl. livestock leasing, custom feed processing, bedding, grazing, supply, transportation, storage, general business expenses, and registration fees. Footnote (a) refers to an RSE on "other livestock-related" portion of the total.
[3/]Includes labor, non-cash benefits. Footnote (a) refers to an RSE on "non-cash benefits" portion of the total.
[4/]The value of home consumption plus an imputed rental value of farm dwellings.
[5/]The value of the operator's dwelling and associated liabilities are included if the dwelling was located on the farm.

a = Relative standard error (RSE) of the estimate exceeds 25 percent, but no more than 50 percent.
b = RSE of estimate >50%, but <75%. c = RSE of estimate >75%. d = Data insufficient for disclosure.

Table 7-9 also shows the percentage of hogs and pigs owned by farmers compared to those not owned by farmers. EPA uses this information on animal ownership as an indication of the extent of production contract use in these sectors (see Section 2.3). Across all hog operations in 1997, about 30 percent of animals were not owned by farmers (USDA/ERS, 1999a). Percentages vary across farm sizes, with up to 38 percent of animals not owned by the farming operation for farms with more than 2,500 hogs and pigs, compared to 28 percent among smaller-sized operations (Table 7-9). This is consistent with other market information (Hayenga et al., 1996; Lawrence et al., 1998).

Table 7-10 presents average income statement and balance sheet information for hog operations in 1997, by size of operation. The financial data used for this analysis do not distinguish between operations with and without production contracts. Contract operations may have lower revenues, but lower costs as well. These data also do not distinguish between grow-finish and farrow-finish operations, as discussed in Section 7.1.3.2. EPA believes that some of these differences are addressed in its sensitivity analysis that examines varying some of the key input data used for this analysis, presented in Appendix D.

The data shown in Table 7-10 are differentiated by selected size categories and reveal differences among operations by size. The income statement data (as well as the data in Table 7-9) point to increasing specialization as the size of an operation increases. A larger proportion of animals are not owned at the largest operations than at the smallest operations. However, the smallest operations have proportionately smaller expenditures on livestock-related expenses than larger operations. Expenditures on livestock and feed average about one-third of total variable expenses at an average hog operation with less than 800 hogs; operations with more than 2,500 hogs are associated with expenditures on livestock and feed averaging two-thirds of total variable expenses (Table 7-10). Explanations for these differences may include differences in the degree of specialization and feeding strategies, and other factors.

Smaller and larger operations are also different in terms of government payments. As in most of the livestock and poultry sectors, the smallest operations receive a greater proportion of their gross cash income in the form of government payments–4 percent, compared with 1 percent for the largest operations. These differences may also reflect the greater diversity of smaller operations, which could be receiving crop subsidies.

Despite these differences, operating margins (measured in terms of average net cash farm income as a percentage of average gross cash income) among differently sized operations do not differ substantially: operations with less than 800 hogs show an operating margin of 17 percent, as compared to 22 percent at operations with more than 800 hogs (USDA/ERS, 1999a). However, the smallest operations show the lowest return on assets (measured as average net farm income to average farm assets): operations with less than 800 hogs show average a return on assets of 3.5 percent, as compared to 6.8 percent and 10 percent at operations with between 800 and 2,500 hogs and operations with more than 800 hogs, respectively (USDA/ERS, 1999a). See Table 7-10. The 1997 ARMS data include, among an average farm's assets, the value of the owner's home when it is located on the farm. Since smaller operations may be more likely to have the owner's

dwelling located on the farm than larger operations, if dwelling values were excluded, the returns on the "business" assets might be higher for these smallest operations.

Section 4 of this report presents key financial data used for this analysis, shown in Table 7-10, that are calculated onto a per-animal basis. For the hog sector, total gross farm revenues are estimated to range from $84 to $304 per head (includes revenue from other farm-related sources). Net cash income ranges from $31 to $66 per head among CAFO models, depending on facility size and region (see Tables 4-5 and 4-6).

7.2 PROFILE OF THE HOG PROCESSING SECTORS

Hog and poultry farms represent the beginning of the meat and egg products marketing chain that also includes meat packers, food processors, integrators, and retailers. Farms provide the raw materials to slaughterers, packers, and processors in the form of live hogs, which then are converted into cuts of meat and processed foods. These products are eventually sold to consumers at retail establishments. Because of seasonality of production, perishability, and limited resources among farmers to handle farm output, farmers are increasingly reliant upon industry middlemen such as processors, meat packers, and integrators.

Meat packers that slaughter hogs are identified in the 1997 Census of Manufactures under NAICS 311611, Animal (except Poultry) Slaughtering. Processors that further-process hogs are under NAICS 311612, Meat Processed from Carcasses. These codes correspond to the SIC codes of 2011—Meat Packing Plants, and 2013—Sausages and Other Prepared Meats.

Hog farms and packers linked by spot markets are the dominant form of coordination in the U.S. pork sector (Hayenga et al., 1996); however, vertical coordination, integration, and specialization through contract farming are rapidly becoming the norm in pork production, particularly in regions outside the Midwest. Many similarities exist between current changes in the pork industry and the changes that took place previously in the broiler industry. Martinez (1999) indicates that, similar to the broiler industry, the pork industry can use vertical integration to facilitate the adoption of new, cost-saving technologies. These new technologies are facilitated as a result of reduced transaction costs and increased access to capital, leading to lower processing costs and higher quality animals (Martinez, 1999).

While contracting is the primary method for marketing hogs in some states, it is not popular in all states. Kliebenstein and Lawrence (1995) summarize regional production comparisons in the hog farm sector as follows. Hog production in North Carolina is characterized by a highly coordinated system of contractual relationships by larger sized operations. Contracts specify activities and responsibilities such as feed formulations, production facilities, genetics, internal veterinary care, and management strategies. Coordination efforts in the more traditional Midwest have been less rapid but more diversified, and involve independent producers entering into networks that provide many of the same characteristics of the highly integrated systems (Kliebenstein and Lawrence, 1995). Small sellers generally used the spot market while larger

sellers used contracts (USDA/GIPSA, 1996a). Packers are expected to be more involved in influencing hog production and marketing decisions in the future through expanded use of long-term marketing contracts or less formal producer-packer relationships based on the quality of hogs produced or the herd health programs imposed by packers (Hayenga et al., 1996).

Use of marketing contracts between hog producers and meat packers has risen sharply in recent years, up from 11 percent of all hog marketings in 1993 to 57 percent of 1997 hog marketings (Lawrence, et al., 1998). Marketings above 50,000 head size class and operations outside of the Cornbelt had more than 75 percent of their hogs with a packer (Lawrence, et al., 1998). The emergence of the new "megaproducers" in North Carolina in the early 1990s and, more recently, in the western states of Utah, Oklahoma, and Texas, has encouraged the use of long-term marketing contracts to ensure procurement of hogs for daily slaughter. For large-scale specialized processing plants, the use of prearranged agreements ensures procurement will meet capacity on a day-to-day basis. For farms, it allows for risk sharing if prices drop. Based on a survey of hog producers, the dominant type of agreements are forward contracts that usually involve formula pricing tied to market prices in the Midwest, plus quality premiums and discounts (Hayenga et al., 1996). Some contracts allow for risk sharing by linking prices to production costs or by setting upper and lower price bounds.

The number of hogs under production contracts has also risen quickly. In 1997, an estimated 40 percent of the hogs farrowed and 44 percent of the hogs finished were by farms with production contracts (Lawrence, et al., 1998). This compares to about 30 percent in 1994, with most of the growth on the larger sized farms (over 500,000 head marketed). Most contract hogs are produced by large farms, especially in emergent regions. Production contracts provide producers with a means of procuring feeder pigs, feed, medication, and technical supervision through contractors (other producers, packers, or feed companies). Growers typically provide production facilities, labor, utilities, and waste disposal. Compensation is paid per head or per pound of grain with discounts and incentives for feed efficiency and death loss (Lawrence, et al., 1998).

A common situation in the hog industry is for an operation to establish a contract relationship to participate in only one of the production stages of raising livestock, such as livestock contracting for replacement breeding stock (USDA/ERS, 1996c). In the hog sector, such arrangements include both finishing and farrowing contracts. A farmer could contract with another to "finish" hogs by having the second operator feed weaner pigs raised by the first farmer until it was time to sell them to the processor. Use of these types of arrangements allows farm operators to increase business volume with limited facilities (USDA/ERS, 1996c). Genetic advances have helped the development of farrowing farms that specialize in breeding feeder pigs. Several large pork producers have procurement contracts set up with breeding farms. Among the largest producers, about 40 percent of market hogs are supplied through contracts with farrowing farms, while the other 60 percent are produced in their own facilities (Hayenga et al., 1996).

In addition to substantially increasing the use of contracts to ensure supply, the U.S. meatpacking industry has rapidly consolidated over the past 20 years, due in large part to the

economies of scale that can be achieved through consolidation. Large plants have significant advantages in slaughter costs, and the largest hog packers can deliver meat to buyers at costs 5 percent less than plants one-quarter as large (MacDonald et al., 2000). As market concentration and contract production increases, the hog industry may face the same price discovery concerns that the beef cattle industry is experiencing. Increased concentration in the processing sectors, especially among meat packers, has led to concerns about market competition, monopsonistic control, and noncompetitive pricing practices that fail to adequately compensate farmers for their production (Hayenga et al., 1996).

7.3 CAFO ANALYSIS

This section presents the results of EPA's CAFO level analysis for the hog sector. As discussed in Section 4, EPA uses a representative farm approach to estimate the impact of the proposed CAFO regulations on affected operations. Each model CAFO differs by facility size groupings and key farm production regions. For the hog sector, the production regions reflected in this analysis are the Mid-Atlantic (MA) and Midwest (MW) regions, as defined in Table 4-1 (Section 4). Section 4 provides a summary of how EPA developed the various financial models used for this analysis. The *Development Document* (USEPA, 2000a) provides additional information on the cost models developed by EPA.

Results presented in this section focus on the "BAT Option" that refers to EPA's proposed technology option for the CAFO regulations (described in Section 3). For the purpose of this discussion, the "*two-tier structure"* refers to the combination of BAT Option 5 for the swine subcategory and NPDES Scenario 4a that covers all operations with more than 500 AU. Where indicated, the two-tier structure may refer to the alternative threshold at 750 AU (Scenario 5). The "*three-tier structure"* refers to the combination of ELG Option 5 (swine subcategory) and NPDES Scenario 3 that covers operations down to 300 AU based on certain conditions. Results for other technology options and scoping scenarios considered by EPA as part of this rulemaking are also summarized. Table 3-1 summarizes EPA's proposed and alternative ELG Options and NPDES Scenarios discussed in this section.

Section 7.3.1 presents a summary of the cost input data EPA uses for this analysis, including (post-tax) per-animal and per-facility costs for EPA's model CAFOs. Section 7.3.2 presents EPA's estimate of the aggregate, national level costs of the proposed CAFO regulations for the hog sector. Section 7.3.3 presents EPA's predicted financial impacts to this sector in terms of the estimated number and percentage of CAFOs that are expected to experience financial stress as a result of the proposed CAFO regulations. EPA evaluates economic impacts to CAFOs in this sector two ways—assuming that a portion of the costs may be passed on from the CAFO to the consumer (Partial CPT) and assuming that no costs passthrough so that all costs are absorbed by the CAFO (Zero CPT).

7.3.1 Overview of Cost Input Data

Tables 7-11 and 7-12 presents estimated input costs that EPA uses to assess costs and impacts to the hog sector. These data include the post-tax annualized compliance costs, estimated on a per-animal and per-facility. These costs reflect the estimated capital costs, annual operating and maintenance costs, start-up or first year costs, and also recurring costs estimated by EPA (discussed in the *Development Document*, USEPA, 2000a). These facility costs are annualized using the approach described in Appendix A of this report. Appendix A shows the individual hog sector costs by model across all technology options.[3]

Other input data for this analysis include EPA's estimate of the number of affected CAFOs and baseline financial conditions at model CAFOs. EPA's estimate of the number of animal confinement operations that would be defined or designated as CAFOs is presented in Section 7.1.2.1 (see Table 7-2). Additional information is provided in Section 2 of this report. The average baseline financial conditions for model CAFOs that EPA assumes for this analysis are presented in Section 4. Tables 4-5 through 4-9 in that section present the financial data used in this analysis and include gross farm revenues, net cash flow, and debt-to-asset ratios for this sector, as derived by EPA using the 1997 ARMS data.

Table 7-11 presents the estimated post-tax annualized compliance costs per animal (in 1997 dollars) for the hog sector under the proposed BAT Option (Option 5). Table 7-12 presents cost estimates for an alternative to Option 5 (Option 5A). Option 5A is an option that EPA investigated only for the hog sector that adds additional requirements to Option 5 regarding dry manure handling systems.[4]

As shown in Table 7-11, post-tax costs for the BAT Option range from $4.50 per animal to $9.40 per animal for grow-finish hog operations and from $3.60 per animal to $8.20 per animal for farrow-finish hog operations. The range of costs for each type is explained by difference in the assumed availability of land for manure applications (see definition of Category 1, 2, and 3 in Section 4.1), as well as differences across production regions and facility size. Table 7-11 also presents the range of post-tax annualized compliance costs per CAFO in the grow-finish and farrow-finish hog sectors. Per CAFO compliance costs for the BAT Option (Option 5) range from $5,430 to $54,910 per year for grow-finish hog operations and from $4,360 to $80,660 per year for farrow-finish hog operations. As shown in Table 7-12, estimated costs for the alternative Option 5A are much higher than the BAT Option costs; estimated costs for Option 5A are estimated to range from $15.40 to $24.80 per animal.

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[3]The estimated costs are the same across the NPDES Scenarios, i.e., technology option costs do not change by scenario, although total costs change due to the difference in numbers of CAFOs affected under each scenario.

[4]This alternative option is described in Section VIII in the preamble and in the *Development Document* (USEPA, 2000a). As described in the preamble, EPA rejected this option on the basis of cost.

Table 7-11. Per-Animal and Per-Facility Post-tax Annualized Compliance Costs (Option 5)

Sector	Reg.	Size	Avg. Animals Per Facility	Cat. 1	Cat. 2	Cat. 3	Cat. 1	Cat. 2	Cat. 3
				Per Hog			Per Facility		
				($1997)					
Hog-GF	MW	M1(a)	900	$7.30	$6.03	$7.47	$6,573	$5,426	$6,723
		M1(b)	1,422	$6.82	$8.72	$7.00	$9,698	$12,395	$9,953
		M2	2,124	$5.69	$6.81	$5.90	$12,076	$14,468	$12,532
		L1	3,417	$5.68	$5.43	$6.20	$19,416	$18,539	$21,174
		L2	10,029	$5.02	$4.45	$5.48	$50,301	$44,674	$54,909
	MA	M1(a)	963	$7.53	$9.43	$7.34	$7,255	$9,084	$7,071
		M1(b)	1,521	$7.09	$5.79	$7.21	$10,777	$8,805	$10,972
		M2	2,184	$6.90	$8.55	$6.87	$15,068	$18,677	$15,014
		L1	3,554	$5.80	$7.55	$6.18	$20,610	$26,841	$21,975
		L2	8,893	$5.13	$4.97	$5.52	$45,578	$44,160	$49,066
Hog-FF	MW	Small	750	$5.80	NA	NA	$4,354	NA	NA
		M1(a)	814	$7.45	$6.64	$6.96	$6,061	$5,408	$5,667
		M1(b)	1,460	$6.79	$6.03	$6.37	$9,918	$8,801	$9,299
		M2	2,152	$5.68	$4.35	$5.35	$12,233	$9,351	$11,512
		L1	3,444	$5.68	$6.19	$5.61	$19,553	$21,326	$19,315
		L2	13,819	$4.63	$5.44	$4.58	$63,968	$75,202	$63,311
	MA	M1(a)	846	$7.69	$5.87	$6.92	$6,503	$4,967	$5,851
		M1(b)	1,518	$7.13	$8.18	$6.33	$10,823	$12,420	$9,614
		M2	2,165	$6.91	$8.10	$6.17	$14,961	$17,543	$13,358
		L1	3,509	$5.80	$7.05	$5.61	$20,339	$24,735	$19,677
		L2	17,118	$4.71	$3.63	$4.56	$80,657	$62,167	$77,991

Source: USEPA. See Table 4-1 for definitions of model regions and sizes. Costs reflect the estimated capital costs, annual operating and maintenance costs, start-up or first year costs, and also recurring costs assumed by EPA (see the *Development Document*, USEPA, 2000a) that are annualized using the approach described in Appendix A.

Table 7-12. Per-Animal and Per-Facility Post-tax Annualized Compliance Costs (Option 5A)

Sector	Reg.	Size	Avg Animals Per Facility	Cat. 1	Cat. 2	Cat. 3	Cat. 1	Cat. 2	Cat. 3
				Per Hog			Per Facility		
				($1997)					
Hog-GF	MW	M1	1,422	$19.38	$17.41	$16.09	$27,560	$24,756	$22,882
		M2	2,124	$23.48	$21.04	$19.59	$49,880	$44,684	$41,601
		L1	3,417	$22.96	$20.71	$19.47	$78,439	$70,753	$66,517
		L2	10,029	$22.48	$20.21	$19.44	$225,434	$202,681	$194,965
	MA	M1	1,521	$20.91	$18.99	$17.16	$31,800	$28,877	$26,096
		M2	2,184	$23.64	$21.49	$19.53	$51,634	$46,936	$42,660
		L1	3,554	$24.70	$22.80	$20.86	$87,768	$81,032	$74,133
		L2	8,893	$22.52	$20.98	$19.44	$200,314	$186,532	$172,897
Hog-FF	MW	M1	1,460	$18.49	$17.08	$15.35	$26,998	$24,932	$22,415
		M2	2,152	$23.49	$21.66	$19.58	$50,546	$46,607	$42,145
		L1	3,444	$23.04	$20.91	$19.47	$79,336	$72,002	$67,042
		L2	13,819	$22.63	$20.38	$19.44	$312,790	$281,575	$268,587
	MA	M1	1,518	$19.94	$18.30	$16.37	$30,276	$27,773	$24,846
		M2	2,165	$23.65	$21.73	$19.53	$51,208	$47,045	$42,291
		L1	3,509	$24.79	$22.95	$20.86	$87,002	$80,523	$73,196
		L2	17,118	$22.68	$21.10	$19.43	$388,182	$361,244	$332,669

Source: USEPA. See Table 4-1 for definitions of model regions and sizes. Costs reflect the estimated capital costs, annual operating and maintenance costs, start-up or first year costs, and also recurring costs assumed by EPA (see the *Development Document*, USEPA, 2000a) that are annualized using the approach described in Appendix A. For Option 5A, Medium 1 refers to Medium 1b costs. Costs for Medium 1a and Small are not estimated.

Compared to other regulatory analyses of the hog sector that have been conducted (NCSU,1999; Fleming et al., 1997; Babcock, et al., 1997; Environmental Defense, 2000), EPA's estimated costs used for this analysis reflect the upper end of other estimated per-unit costs. For example, a study by Environmental Defense compiled per-unit costs from a variety of available research and show estimated costs of alternative manure management technologies that range from a cost savings to an operation up to about $8 in costs per finished hog (Environmental Defense, 2000). Researchers at Iowa State University estimate an annualized cost for various manure storage and management practices of under $1 per animal to as much as$12 per sow and $7 per market hog (Fleming et al., 1997; Babcock et al. 1997). Researchers at North Carolina State

University also estimate costs for a range of practices, estimated at up to $10 per finished hog (NCSU, 1999). In general, these costs are amortized but do not take into account tax savings. EPA's equivalent pre-tax costs per animal would be roughly 40 percent greater than those shown in Table 7-11 and generally exceed other reported upper end values. As documented in the *Development Document* (USEPA, 2000a), EPA believes that its estimated costs are conservative.

The costs presented here are those assumed to be incurred by the regulated CAFO and do not account for the likelihood that some compliance costs will be passed on through the marketing levels in the industry.

Table 7-13 presents the range of per animal post-tax compliance costs in 1997 dollars for grow-finish and farrow-finish operations for each option, including the BAT Option and Option 5A. (The proposed and alternative ELG Option and NPDES Scenarios considered by EPA during this rulemaking are defined in Table 3-1.) As shown, for both farrow- and grow-finish hog operations, costs for options other than Option 5A range from under $0.10 to about $18 per animal. The proposed BAT Option costs fall between these ranges.

Table 7-13. Summary of the Range of Post-Tax Annualized Compliance Costs Per Hog, By Option

Option	Hog-GF		Hog-FF	
	Minimum	Maximum	Minimum	Maximum
	($1997)			
Option 1	$0.04	$10.20	$0.03	$9.01
Option 2	$1.69	$7.85	$1.53	$7.03
Option 3	$1.94	$18.74	$1.76	$18.08
Option 4	$2.21	$13.00	$1.94	$12.72
Option 5	$4.45	$9.43	$3.63	$8.18
Option 5A	$16.09	$24.70	$15.35	$24.79
Option 6	$1.36	$7.85	$1.93	$7.15
Option 7	$1.69	$13.00	$1.53	$10.53

Source: USEPA.

7.3.2 Estimates of National Annual Compliance Costs

Table 7-14 presents EPA's estimate of the aggregate national level compliance costs for the hog sector under the proposed BAT Option (Option 5) and the co-proposed two-tier structure (Scenario 4a at 500 AU threshold) and the three-tier structure (Scenario 3). Costs under the two-tier structure at the 750 AU threshold (Scenario 5) are also briefly discussed, along with other

regulatory alternatives considered by EPA during this rulemaking. The description of the proposed BAT Option and the co-proposed NPDES Scenarios is provided in Section 3.

For the hog sector, EPA estimates total incremental cost (post-tax) of the proposed BAT Option at $199 million per year under the two-tier structure at the 500 AU threshold (Table 7-14). About three-quarters of this total estimated cost is for operations with more than 1,000 AU. The cost of the proposed BAT Option under the three-tier structure is estimated at $184 million per year; about 80 percent of this cost is for operations with more than 1,000 AU (Table 7-14). Between the two modeled regions (MA and MW), the MW region bears the largest portion (65 percent) of the total costs under both of the co-proposed tier structures.

Table 7-14 also shows other estimated costs for this sector. The proposed BAT Option at the 750 AU threshold will cost the hog sector $170 million per year (Table 7-14). The costs of Option 5A are estimated at nearly $930 million annually.

Table 7-14. Total Estimated Post-Tax Compliance Costs

Scenario/Size	Option	Grow-Finish	Farrow-Finish
		($1997 millions, except where noted)	
>1,000 AU	Number of CAFOs	1,670	2,420
	BAT Option	$51.4	$97.3
	Alternative Options	$33.2-$51.4	$44.1-$97.3
Total Two-Tier Structure (>750 AU)	Number of CAFOs	2,300	3,460
	BAT Option	$60.0	$110.3
	Alternative Options	$36.1 - $60.0	$46.9 - $110.3
Total Two-Tier Structure (>500 AU)	Number of CAFOs	2,690	6,060
	BAT Option	$63.8	$135.1
	Alternative Options	$37.3-$63.8	$51.5-$135.1
Total Two-Tier Structure (>300 AU)	Number of CAFOs	4,920	9,590
	BAT Option	$78.5	$156.7
	Alternative Options	$42.0-$78.5	$56.2-$156.7
Total Three-Tier Structure (>300 AU)	Number of CAFOs	2,650	5,750
	BAT Option	$59.7	$124.7
	Alternative Options	$35.9-$59.7	$49.9-$124.7

Source: USEPA.
Numbers of CAFOs include defined CAFOs only. Costs include those for designated hog operations.

7.3.3 Analysis of CAFO Financial Impacts

EPA's impact analysis uses a representative farm approach to estimate the number of CAFOs that would experience affordable, moderate, or stress impacts as a result of the CAFO regulations, as described in Section 4. Economic achievability is determined by applying the proposed criteria, which include a sales test and also analysis of post-compliance cash flow and debt-to-asset ratio for an average model CAFO. EPA extrapolates impacts to all CAFOs in the hog sector using the estimated number of operations represented by each model CAFO.

As described in Section 4.2.5, if an average model facility is determined to incur economic impacts under regulation that are regarded as "Affordable" or "Moderate," then the proposed regulations are considered economically achievable. ("Moderate" impacts are not expected to result in closure and are considered to be economically achievable by EPA.) If an average operation is determined to incur "Stress," then the proposed regulations are not considered to be economically achievable. "Affordable" and "Moderate" impacts are associated with positive post-compliance cash flow over a 10-year period and a debt-to-asset ratio not exceeding 40 percent, in conjunction with a sales test result that shows that compliance costs are less than 5 percent of sales ("Affordable") or between 5 and 10 percent ("Moderate"). "Stress" impacts are associated with negative cash flow or if the post-compliance debt-to-asset ratio exceeds 40 percent, or sales test results that show costs equal to or exceeding 10 percent of sales.

Using this classification scheme, EPA's analysis indicates that some hog operations would experience financial stress as a result of the proposed CAFO regulations under the proposed BAT Option and both co-proposed scenario, assuming compliance costs cannot be passed through the marketing chain. Tables 7-15 and 7-16 present the results of EPA's analysis. A total of 1,420 hog operations (17 percent of defined CAFOs) are expected to experience financial stress under both of the co-proposed tier structures, including the two-tier structure at 750 AU. The hog operations with these impacts have more than 1,000 AU on site (i.e., no operations with between 300, 500, 750 and 1,000 AU fall in the stress category). No designated CAFOs are expected to experience financial stress under either co-proposed scenario. Based on these results, EPA proposes that the proposed CAFO regulations are economically achievable under the co-proposed scenarios.

EPA also evaluates financial impacts with an assumption of cost passthrough. For the purpose of this analysis, EPA assumes that the hog sector could pass through 46 percent of compliance costs. EPA derived these estimates from price elasticities of supply and demand for each sector reported in the academic literature (see Section 4). Assuming this level of cost passthrough, the magnitude of the estimated impacts decreases to the affordable or moderate impact category under the proposed BAT Option and the co-proposed scenarios (Table 7-15).

Section 5 provides additional information on how the co-proposed scenarios compare with the alternative scenarios EPA considered.

Table 7-15. Impacted CAFOs under ELG Options & NPDES Scenarios, Grow-Finish Hog Operations

Alternative ELG Options and NPDES Scenarios	Total # CAFOs	Affordable	Moderate	Stress	Aff.	Mod.	Stress
		Zero Cost Passthrough			Partial Cost Passthrough		
		(Number of Affected Operations)					
Two-Tier (>1000)							
BAT Option	1,670	680	180	810	1,670	0	0
Alt. ELG Options		680-1,230	180-290	180-810		0	0
Two-Tier (>750 AU, Scenario 5)							
BAT Option	2,300	1,310	180	810	2,300	0	0
Alt. ELG Options		1,230-1,850	180-370	180-810		0	0
Two-Tier (>500 AU, Scenario 4a)							
BAT Option	2,690	1,710	180	810	2,690	0	0
Alt. ELG Options		1,580-2,250	180-410	180-810		0	0
Two-Tier (>300 AU, Scenario 4b)							
BAT Option	4,920	3,900	210	810	4,920	0	0
Alt. ELG Options		3,180-4,470	210-980	180-810		0	0
Three-Tier (Scenario 3)							
BAT Option	2,650	1,660	190	810	2,650	0	0
Alt. ELG Options		1,440-2,210	190-500	180-810		0	0

Source: USEPA. Numbers may not add due to rounding. Option/Scenario definitions provided in Table 3-1 (Section 3). Category definitions ("Affordable," "Moderate" and "Stress") are provided in Table 4-13 (Section 4).

Tables 7-17 and 7-18 present a more detailed breakout of EPA's affordability results under the proposed BAT Option by model CAFO type, land availability, and type of operation (both grow-finish and farrow-finish). The results are the same for the two-tier and three-tier structure because only the numbers of CAFOs represented by each model type changes. The impacts are presented by model CAFO and indicate the level of impact under each of the economic affordability criteria. Zero cost passthrough is assumed.

Table 7-16. Impacted CAFOs under ELG Options & NPDES Scenarios, Farrow-Finish Hog Operations

Alternative ELG Options and NPDES Scenarios	Total # CAFOs	Affordable	Moderate	Stress	Aff.	Mod.	Stress
		Zero Cost Passthrough			Partial Cost Passthrough		
		(Number of Affected Operations)					
Two-Tier (>1000)							
BAT Option	2,420	1,780	30	610	2,420	0	0
Alt. ELG Options		1,650-2,270	30-190	130-630		0	0
Two-Tier (>750 AU, Scenario 5)							
BAT Option	3,460	2,820	30	610	3,460	0	0
Alt. ELG Options		2,650-3,300	30-220	130-630		0	0
Two-Tier (>500 AU, Scenario 4a)							
BAT Option	5,860	5,210	30	610	5,860	0	0
Alt. ELG Options		5,010-5,700	30-260	130-630		0	0
Two-Tier (>300 AU, Scenario 4b)							
BAT Option	9,450	8,810	30	610	9,450	0	0
Alt. ELG Options		7,940-9,290	30-890	130-630		0	0
Three-Tier (Scenario 3)							
BAT Option	5,710	5,070	30	610	5,710	0	0
Alt. ELG Options		4,590-5,550	30-520	130-630		0	0

Source: USEPA. Numbers may not add due to rounding. Option/Scenario definitions provided in Table 3-1 (Section 3). Category definitions ("Affordable," "Moderate" and "Stress") are provided in Table 4-13 (Section 4).

These tables show that the financial stress impacts for hogs are being driven by the debt-to-asset ratios and sales tests (a debt-to-asset ratio greater than 0.40 with a sales test greater than 3 percent is considered an indicator of the potential for financial stress, even if cash flow is positive). These results are associated with the Large 1 and 2 models in the MA region. Under an assumption of partial cost passthrough (not shown in the table), these same models show acceptable sales tests and debt-to-asset results, and all models indicate "affordable" impacts.

Table 7-17. Economic Affordability Results for Hog CAFOs, Grow-Finish Operations

Size	Category 1			Category 2			Category 3		
	Sales	**DCF**	**DA**	**Sales**	**DCF**	**DA**	**Sales**	**DCF**	**DA**
Hog-GF–Zero CPT									
MW Region									
Medium 1a	2.4%	Pass	0.29	2.0%	Pass	0.28	2.5%	Pass	0.29
Medium 1b	2.2%	Pass	0.29	2.9%	Pass	0.28	2.3%	Pass	0.29
Medium 2	1.9%	Pass	0.29	2.2%	Pass	0.28	1.9%	Pass	0.29
Large 1	2.5%	Pass	0.46	2.4%	Pass	0.45	2.7%	Pass	0.46
Large 2	2.2%	Pass	0.46	1.9%	Pass	0.45	2.4%	Pass	0.46
MA Region									
Medium 1a	4.3%	Pass	0.16	5.4%	Pass	0.16	4.2%	Pass	0.16
Medium 1b	4.1%	Pass	0.16	3.3%	Pass	0.15	4.1%	Pass	0.16
Medium 2	4.0%	Pass	0.16	4.9%	Pass	0.15	3.9%	Pass	0.16
Large 1	6.9%	Pass	0.41	9.0%	Pass	0.39	7.4%	Pass	0.41
Large 2	6.1%	Pass	0.41	5.9%	Pass	0.38	6.6%	Pass	0.41
Hog-GF–Partial CPT									
MW Region									
Medium 1a	1.3%	Pass	0.27	1.1%	Pass	0.27	1.3%	Pass	0.27
Medium 1b	1.2%	Pass	0.27	1.5%	Pass	0.27	1.2%	Pass	0.27
Medium 2	1.0%	Pass	0.27	1.2%	Pass	0.27	1.0%	Pass	0.27
Large 1	1.3%	Pass	0.44	1.3%	Pass	0.43	1.5%	Pass	0.44
Large 2	1.2%	Pass	0.44	1.1%	Pass	0.43	1.3%	Pass	0.44
MA Region									
Medium 1a	2.3%	Pass	0.15	2.9%	Pass	0.14	2.3%	Pass	0.15
Medium 1b	2.2%	Pass	0.15	1.8%	Pass	0.14	2.2%	Pass	0.15
Medium 2	2.1%	Pass	0.15	2.6%	Pass	0.14	2.1%	Pass	0.15
Large 1	3.7%	Pass	0.37	4.9%	Pass	0.35	4.0%	Pass	0.37
Large 2	3.3%	Pass	0.37	3.2%	Pass	0.35	3.6%	Pass	0.37

Source: USEPA.

Table 7-18. Economic Affordability Results for Hog CAFOs, Farrow-Finish Operations

Size	Category 1			Category 2			Category 3		
	Sales	**DCF**	**DA**	**Sales**	**DCF**	**DA**	**Sales**	**DCF**	**DA**
Hog-FF–Zero CPT									
MW Region									
Small	1.0%	Pass	0.29	NA	NA	NA	NA	NA	NA
Medium 1a	2.5%	Pass	0.29	2.2%	Pass	0.28	2.3%	Pass	0.29
Medium 1b	2.2%	Pass	0.29	2.0%	Pass	0.28	2.1%	Pass	0.29
Medium 2	1.9%	Pass	0.29	1.4%	Pass	0.28	1.8%	Pass	0.29
Large 1	2.5%	Pass	0.46	2.7%	Pass	0.45	2.4%	Pass	0.46
Large 2	2.0%	Pass	0.46	2.4%	Pass	0.45	2.0%	Pass	0.46
MA Region									
Medium 1a	4.4%	Pass	0.16	3.4%	Pass	0.16	4.0%	Pass	0.16
Medium 1b	4.1%	Pass	0.16	4.7%	Pass	0.15	3.6%	Pass	0.16
Medium 2	4.0%	Pass	0.16	4.6%	Pass	0.15	3.5%	Pass	0.16
Large 1	6.9%	Pass	0.41	8.4%	Pass	0.39	6.7%	Pass	0.41
Large 2	5.6%	Pass	0.41	4.3%	Pass	0.38	5.5%	Pass	0.41
Hog-FF–Partial CPT									
MW Region									
Small	0.5%	Pass	0.27	NA	NA	NA	NA	NA	NA
Medium 1a	1.3%	Pass	0.27	1.2%	Pass	0.27	1.2%	Pass	0.27
Medium 1b	1.2%	Pass	0.27	1.1%	Pass	0.27	1.1%	Pass	0.27
Medium 2	1.0%	Pass	0.27	0.8%	Pass	0.27	1.0%	Pass	0.27
Large 1	1.3%	Pass	0.44	1.5%	Pass	0.43	1.3%	Pass	0.44
Large 2	1.1%	Pass	0.44	1.3%	Pass	0.43	1.1%	Pass	0.44
MA Region									
Medium 1a	2.4%	Pass	0.15	1.8%	Pass	0.14	2.1%	Pass	0.15
Medium 1b	2.2%	Pass	0.15	2.5%	Pass	0.14	2.0%	Pass	0.15
Medium 2	2.1%	Pass	0.15	2.5%	Pass	0.14	1.9%	Pass	0.15
Large 1	3.7%	Pass	0.37	4.6%	Pass	0.35	3.6%	Pass	0.37
Large 2	3.0%	Pass	0.37	2.3%	Pass	0.35	2.9%	Pass	0.37

Source: USEPA.

7.4 PROCESSOR ANALYSIS

As discussed in Section 4.3, EPA does not conduct a detailed estimate of the costs and impacts that would accrue to individual co-permittees due to lack of data and market information. However, EPA believes that the framework used to estimate costs to CAFO provides a means to evaluate the possible upper bound of costs that could accrue to potential co-permittees, based on the potential share of (pre-tax) costs that may be passed on from the CAFO (described in Section 4.3). EPA is proposing that this amount approximates the magnitude of the costs that may be incurred by processing firms in those industries that may be affected by the proposed co-permitting requirements.

Table 7-19 presents the results of EPA's analysis. This analysis focuses on the potential magnitude of costs to co-permittees in the pork sector. As presented in Section 2, EPA estimates that about 94 hog processors may be subject to the proposed co-permitting requirements. Using the framework to estimate costs and impacts to regulated CAFOs, EPA calculates the estimated upper bound of costs that could accrue to hog processors based the estimated pre-tax cost estimated for CAFOs, assuming that either all or a portion of these costs are absorbed by processors as markets adjust to the proposed CAFO regulations. EPA's partial cost passthrough scenario assumes that 46 percent of all hog compliance costs are passed on to the food processing sectors. (For more information on this approach, see Section 4.2).

Using this approach, EPA estimates that the range of potential annual costs to hog processors is $135 million (partial cost passthrough, two-tier structure) to $306 million (full cost passthrough, three-tier structure). These costs, shown in Table 7-19, are expressed in 1999 pre-tax dollars.

To assess the magnitude of impacts that could accrue to processors using this approach, EPA compares the passed through compliance costs to both aggregate processor costs of production and to revenues (a sales test). The results of this analysis are shown in Table 7-19 and are presented in terms of the equivalent 1999 pre-tax compliance cost as compared to 1997 data from the Department of Commerce on the revenue and costs among processors in the hog industries. As shown, EPA estimates that, even under full cost passthrough, incremental cost changes are less than two percent and passed through compliance costs as a share of revenue are less than one percent.

This suggested approach does not assume any addition to the total costs of the rule as a result of co-permitting. This approach also does not assume that there will be a cost savings to contract growers as result of a contractual arrangement with a processing firm. This approach merely attempts to quantify the potential magnitude of costs that could accrue to processors that may be affected by the co-permitting requirements. Due to lack of data, EPA does not conduct a detailed analysis of the costs and impacts that would accrue to individual co-permittees. Additional limitations of this approach as recognized by EPA are discussed in Section 4.3.

Table 7-19. Impact of Passed Through Compliance Costs under Co-proposed Alternatives, Hog Sector

Sector	Passed Through Compliance Cost [a/]		1997 Revenues	1997 Delivered Cost [b/]	Passed through Cost-to-Revenues		Passed through Cost-to-Delivered Cost	
	Partial CPT	100% CPT			Partial CPT	100% CPT	Partial CPT	100% CPT
	($1999, million)		($1997, million)		(percent, comparing costs in $1997)			
Two-Tier	$135	$294	$38,500	$15,700	0.3%	0.7%	0.8%	1.8%
Three-Tier	$141	$306			0.4%	0.8%	0.9%	1.9%

Source: USEPA. 1997 processor revenues and costs are from the Department of Commerce (USDC, 1999a). Option/Scenario definitions provided in Section 3. Proposed BAT Option is Option 5. Estimated compliance costs are pre-tax.

[a/]Pre-tax compliance costs that are estimated to be passed from the production operation to the processors. CPT = Cost passthrough. Partial CPT assumes 46% CPT for the hog sector (see Section 4.2.6).

[b/]Delivered costs include all raw materials put into production during the year.

7.5 MARKET ANALYSIS

This section presents the results of EPA's market model analysis for the hog sector. The results presented in this section briefly compare the results of the two-tier (500 AU threshold) and the three-tier (Scenario 3) structures that are being co-proposed by EPA. These results measure changes for the pork industry as a whole and do not differentiate between the types of operations in the sector. Additional results on the alternative regulatory options and scenarios considered by EPA as part of this rulemaking are provided in Section 5.4. For further explanation of the market model and sources of the baseline input data, see Section 4.4 and Appendix B.

A summary of the key results of the market model is shown in Table 7-20 for the two-tier and three-tier structures indicating the predicted changes in farm and retail prices, quantities, national and regional employment, and national economic output.

Compared to a baseline producer price of $54.30 per hundredweight (cwt), EPA's market model predicts that the proposed CAFO regulations will raise producer prices by $0.59 per cwt to $0.64 per cwt, or less than 1.2 percent of the baseline producer price, depending on the co-proposed tier structure (Table 7-20). At the retail level, consumer prices for pork products will rise about 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 (Table 7-20). At the commodity level, EPA's market model predicts that U.S. pork imports will rise by about 0.2 percent, compared to baseline imports; U.S. pork exports will decrease by about 0.3 percent compared to baseline.

Absorption of compliance costs by the producers and small declines in quantities are expected to result in fewer jobs in the hog industry. Table 7-20 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 estimates changes in national aggregate employment to range from a total reduction of 6,380 to 6,880 jobs, measured in full-time equivalents (FTEs). This analysis also does not adjust for offsetting increases in other parts of the economy and other sector employment that may be stimulated as a result of the proposed regulations, such as the construction and farm services sectors.

EPA's projected job losses are estimated throughout the entire economy, using available modeling approaches described in Section 4, and are not attributable to the regulated community only. As shown in Table 7-20, about 80 percent of these estimated job losses are in the non-agricultural or farm services support industries (i.e., indirect or induced employment affects; see Section 4.4).

At the CAFO level, EPA predicts that job losses in the farming sector associated with the proposed CAFO regulations will range from 930 to 1,010 jobs under the proposed BAT Option, depending on tier structure (Table 7-20). These estimates include CAFO owner-operators and employed family members, as well as hired farm labor. This estimated reduction compares to an estimated total farm level employment of 195,900 FTEs in the hog sector nationwide (Table 2-17; Abel, Daft, and Earley, 1993, as updated by EPA). EPA estimates that job losses in the hog processing sectors will range from 250 to 270 (Table 7-20). These estimated losses compare to the more than 140,000 persons employed in hog processing in 1997 (USDC, 1999a).

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 disaggregates the national employment results to examine the potential regional employment impacts of the proposed CAFO regulations. The method EPA uses to allocate impacts is based on hog production and does not take into account existing environmental practices or other production factors (see Section 4.4). Table 7-20 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; about 70 percent of the estimated agricultural job losses in the hog sector are expected in the more traditional Midwest region (Table 7-20). Economy-wide employment losses are estimated at under 0.01 percent compared to the baseline.

Table 7-20. Summary of Market Model Results for the Hog Sector

Variable	Pre-Regulatory Value/Units	Two-Tier Structure		Three-Tier Structure	
		BAT Option	Range of Alternative Options	BAT Option	Range of Alternative Options
Farm Products					
Price	$54.30/cwt	$54.89	$54.56 - 54.89	$54.94	$54.55 - 54.94
Quantity Produced	23,542 mil. lbs.	23,472	23,472 - 23,511	23,467	23,467 - 23,512
Quantity Exported	14 mil. lbs.	14	14 - 14	14	14 - 14
Quantity Imported	814 mil. lbs.	819	814 - 819	820	816 - 820
Retail Products					
Price	$2.45/lb.	$2.46	$2.45 - 2.46	$2.46	$2.45 - 2.46
Quantity Demanded	17,274 mil. lbs.	17,229	17,229 - 17,254	17,225	17,225 - 17,256
Quantity Exported	1,044 mil. lbs.	1,041	1,041 - 1,042	1,041	1,041 - 1,043
Quantity Imported	633 mil. lbs.	634	634 - 634	634	634 - 634
Employment Reduction					
Direct Farm	195,900 FTEs [a/]	931	416 - 931	1,005	402 - 1,005
Direct Processor	84,723 FTEs	250	111 - 250	269	108 - 269
Total Economy	129.6 mil. FTEs	6,376	2,849 - 6,376	6,876	2,752 - 6,876
Output Reduction					
National	$ million	655	294 - 655	707	283 - 707
Regional Farm and Processing Employment Reduction					
Pacific	FTEs	6	3 - 6	6	2 - 6
Central	FTEs	88	39 - 88	94	38 - 94
Midwest	FTEs	753	336 - 753	812	325 - 812
South	FTEs	43	19 - 43	47	19 - 47
Mid-Atlantic	FTEs	292	130 - 292	315	126 - 315
Total	FTEs	1,181	528 - 1,181	1,274	510 - 1,274

Source: Post-regulatory changes are estimated by USEPA. Pre-regulatory prices, quantities, and trade volumes, see Table 4-16 (Section 4). Pre-regulatory employment, see Table 2-17 (Section 2).

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

SECTION EIGHT

SUMMARY OF ECONOMIC IMPACTS: BEEF AND DAIRY SUBCATEGORIES

This section presents a profile of the beef and dairy industry, including farmers (Section 8.1) and processors (Section 8.2) in the cattle and dairy industries. Following the industry profile, this section provides a detailed summary of EPA's economic analysis of the proposed CAFO regulations as it affects regulated CAFOs (Section 8.3), processors (Section 8.4), and national markets (Section 8.5).

8.1 PROFILE OF THE BEEF AND DAIRY PRODUCTION SECTORS

This section presents a profile of cattle and milk production operations and provides background information for analyzing the costs and benefits of the proposed CAFO regulations. The purpose of this profile is to provide a baseline description of the current activities, structure, and performance of the beef and dairy production industries. The following sections describe the types of operations in this sector and present an overview of the industry, describing the number and size of operations (including the subset of regulated operations), geographic distribution, supply and demand conditions, price trends, and the financial conditions that characterize this sector.

8.1.1 Industry Definition

Beef and Veal Operations

Beef cattle feedlots (includes veal) are identified as NAICS 112112 (SIC 0211). This sector comprises establishments primarily engaged in feeding cattle for fattening, including: beef cattle feedlots (except stockyards for transportation) and feed yards (except stockyards for transportation). This NAICS code includes operations where beef cattle sales account for the majority of revenues. USDA defines beef feedlots as those operations that fed any cattle over the previous year. Unless otherwise noted, EPA uses this broader USDA definition of beef feedlots throughout this report.

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

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

- *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 between 60 days to 6 months or until they reach a weight of about 400 pounds (Rasby et al., 1994).

- *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.

- *Cow-calf producers* typically maintain a herd of mature cows, some replacement heifers, and a few bulls, and 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.

As cow-calf and stocker/backgrounding operations primarily graze cattle and calves, their activities are not expected to be covered under the proposed CAFO regulations.

After slaughter, live cattle are converted into cuts of meat and various processed foods by meat packers and processors and sold to consumers at retail establishments. Other by-products, such as hides, lard, and offal, have value in the manufacture of clothing, foodstuffs, fertilizers, and other industrial products. By NAICS code, the beef processing sector includes animal slaughterers[1] (NAICS 311611), meat (from carcass) processors (NAICS 311612), and rendering and byproduct processing facilities (NAICS 311613). Additional information on the processing sector is presented in Section 8.2.

Dairy and Heifer Operations

Production operations that produce cow's milk are classified under NAICS 11212, dairy cattle and milk production (SIC 0241, dairy farms). Industry coverage between the NAICS and SIC classifications is not equivalent: NAICS 11212 does not include dairy heifer replacement farms but SIC 0241 does. Dairy heifer replacement is now classified under NAICS 112111, Beef Cattle Ranching and Farming. Therefore, the definition under NAICS is more focused on milk production. A dairy operation may have several types of animal groups present, including:

- *Calves* (0-5 months);

- *Heifers* (6-24 months);

[1]NAICS 311611 covers the slaughter of cattle, calves, steer, heifers, pork, sheep, and lamb.

- *Lactating dairy cows* (i.e., currently producing milk); and;
- *Cows close to calving and dry cows* (i.e., not currently producing milk); and
- *Bulls*.

Heifer replacement operations raise pre-calving cows themselves or under production contracts for all or part of the growing period from weaning to calving (USDA/APHIS, 1993). With increasing specialization, many large dairy operations contract out the raising of replacement heifers to focus on milk production (Faust, 1995). The use of heifer replacement operations allows dairies to expand their herd size on the existing facilities and specialize in the production of milk, thus potentially increasing profitability (USDA/APHIS, 1993). In 1991-92, an estimated 1.7 percent of dairy farmers had someone else raise their heifers on a contract basis, with larger operations contracting for replacement heifers more often than small operations (USDA/APHIS, 1993). Cady (2000) estimates that approximately 15 percent of dairy cows have been raised by a replacement operation at some stage in their lives, with approximately 1 million heifers being raised by replacement operations at any one time. Heifers can be raised either on pasture in warmer climates or in confinement in dry feedlots; however, the majority of operations with over 1,000 head are confined feedlot operations (Cady, 2000). Thus these operations may be defined as CAFOs under the proposed CAFO regulations and would be the only such CAFOs in the beef and dairy sector where production contracts are somewhat common.

Although heifer operations are typically characterized as part of the dairy industry, EPA's analysis groups heifer operations along with the beef cattle and veal operations.

USDA defines dairy farms as those farms that had any dairy cattle on farm during the previous year. Unless otherwise noted, EPA has used the broader USDA definition of a dairy farm throughout this report. Beyond the farm level, raw farm milk is converted into processed fluid milk and dairy products by dairy cooperatives and processing firms. By NAICS code, dairy processors are classified under dry, condensed and evaporated dairy manufacturing (NAICS 311514); fluid milk manufacturing (NAICS 311511); creamery butter manufacturing (NAICS 311512); cheese manufacturing (NAICS 311513); and ice cream and frozen dessert manufacturing (NAICS 3115120). Additional information on the processing sector is presented in Section 8.2.

8.1.2 Overview of the Beef and Dairy Industry

For the purpose of this industry profile, the cattle feeding sector covers operations that raise beef cattle, veal and heifers. Industry characteristics of these sectors are presented jointly in this overview. Industry characteristics of the dairy industry are discussed separately.

Over the past few decades, the total number of cattle feedlots has declined, while size of operation has increased. Fed cattle production is now dominated by large feedlots, which account for 2 percent of all feedlots but 85 percent of annual fed cattle sales. Improvements in technology and industrial-type entrepreneurial skills are cited as largely responsible for the increase in feedlot size (Krause, 1991). Fed cattle production is concentrated in the Great Plains states. Unlike operations in other livestock and poultry sectors, production contracting is not common among cattle feedlots, and cattle are owned by the beef operation at nearly 95 percent of all such operations (USDA/ERS, 1999a). Increasingly, the meat packing industry has become integrated with livestock feeding operations, either company-owned or through contracts with custom feedlots (Kohls and Uhl, 1998). Types of feedlots thus can be roughly divided into company-owned, custom, and independent feedlots. Custom feedlots are a small part of the industry. Less than 2 percent of beef operations operate under contracts (USDA/ERS, 1996a). About 20 to 25 percent of all cattle are vertically integrated through ownership of the feedlot or contract arrangements with packers, however (Kohls and Uhl, 1998).

The U.S. dairy industry has undergone significant structural change in recent years. The dominant trend in dairy operations has been towards increased consolidation and specialization, resulting in fewer, larger operations. Large-scale expansion among some producers has raised total U.S. milk production despite continued reductions in the nation's milk cow herd, indicating higher per-cow productivity and efficiency gains in the sector. The past few decades have also witnessed a major geographic shift in milk production from the more traditional producing states of the Midwest and Mid-Atlantic regions to the West and Southwest where operations are typified by larger herd size and greater use of technology (El-Osta and Johnson, 1998; McBride, 1999; Manchester and Blayney, 1997).

8.1.2.1 Trends in the Number and Size

USDA reports that in 1997 there were a total of 110,620 fed cattle and calf operations in the United States, based on sales (USDA/NASS, 1999a). The number of dairy operations totaled 116,880 farms based on year-end inventories (USDA/NASS, 1999a). See Table 8-1. These data on the number of farms include both commercial and non-commercial operations, as well as operations that confine and graze animals. This estimate includes all facility types, including operations that finish cattle for slaughter and operations that raise breeder stock.

Total cattle and calf operations in the U.S. (including grazing operations) totaled over 800,000 in 1997 (USDA/NASS, 1999a). Feedlot operations account for about one-fourth of total operations. Data on fed cattle operations are reported by USDA as operations with cattle and calves fattened on grain and concentrates (based on sales). In 1997, USDA data indicate that between 1982 and 1997, the number of cattle feeding operations dropped by more than one-half, from 240,015 operations to 110,620 operations (Table 8-1). Total sales at these operations remained fairly stable at above 27 million head. However, average herd size at these operations increased from about 120 head per operation to about 250 head per operation (Table 8-1).

(USDA/NASS, 1999a). Although fewer than 3 percent of cattle feedlots have capacity of more than 500 head, they dominate the market sales, accounting for nearly 90 percent of annual sales (Table 8-1).

Cattle feeding has become increasingly concentrated over the last few decades. Feedlots have decreased in number, but increased in size: in 1972, 104,300 feedlots in 13 states marketed 23.7 million cattle, while in 1995, 41,400 feedlots in these same states marketed 23.4 million cattle (Ward and Schroder, no date). Most of this decrease occurred at feedlots with less than 1,000 head. Meanwhile, feedlots with capacity greater than 1,000 head increased by about 30 percent (Krause, 1991). Also, commercial feedlots control a larger share of the number of cattle on feed, up from 43 percent of all fed cattle in 1980 to over 50 percent in 1990 (Bastian et al., 1994). The share of fed cattle raised by feedlots is dropping and accounted for under 20 percent of all fed cattle in 1990 (Bastian et al., 1994).

Table 8-1. Number of Beef and Dairy Operations and Animals, 1974-1997

Year	Operations	Total Animals	Average Herd	Percent of Farms	Percent of Animals
		(thousand)	(head)	(>500 head)	
Fed Cattle and Calves (fattened on grain and concentrates)					
1974	210,725	26,070	124	2.3%	69.1%
1978	247,114	29,722	120	2.5%	72.3%
1982	240,015	27,674	115	0.9%	76.8%
1987	190,008	27,818	146	2.4%	78.2%
1992	147,201	26,406	179	2.7%	82.4%
1997	110,620	27,328	247	3.0%	87.2%
Dairy Cows					
1974	403,754	10,655	26	0.2%	5.7%
1978	312,095	10,222	33	0.3%	7.1%
1982	277,762	10,850	39	0.4%	8.5%
1987	202,068	10,085	50	0.6%	11.7%
1992	155,339	9,492	61	1.1%	17.8%
1997	116,874	9,095	78	1.9%	27.6%

Source: USDA/NASS, 1999a. Cattle/calves fattened on grain and concentrates (sales); dairy (year-end inventory).

In the dairy sector, USDA reports that there were 116,900 dairy farms with a year-end inventory of 9.1 million milk cows producing 156.1 billion pounds of milk in 1997 (USDA/NASS, 1999a and 1999c). (See Table 8-1.) In comparison, in 1987, there were 202,100 dairy operations with 10.1 million cows, producing 142.7 billion pounds of milk (USDA/NASS, 1999a; NMPF, 1999). As these data show, although the number of operations dropped by nearly one-half and the number of milk cows also decreased slightly, production efficiency at U.S. dairy farms is increasing (Table 8-1). Average herd size at dairy farms is increasing, up from an average of under 30 cows per operation in 1974 to almost 80 cows per operation in 1997 (Table 8-1). This indicates that while the overall number of operations is dropping, the remaining operations are expanding (USDA/NASS, 1999a; NMPF, 1999). In spite of ongoing consolidation in this sector, the majority of farms are small in size. As shown in Table 8-1, operations with more than 500 cows accounted for under 2 percent of the total number of farms in 1997. These farms accounted for almost 30 percent of annual inventories, however (Table 8-1). Most of the operations exiting the dairy industry tend to be small in size: in 1987, there were 196,500 operations with fewer than 200 cows, compared to 109,700 dairy operations with fewer than 200 cows in 1997 (USDA/NASS, 1999a; NMPF, 1999).

For the purpose of this analysis, EPA estimates the number of confinement operations that may be subject to the proposed CAFO regulations using 1997 Census data that are aggregated by USDA's NASS. NASS developed a methodology for identifying farms likely to be CAFOs based on the Census survey information and estimated animal units on these operations based on reported data. A summary of these data are provided in the *Development Document*, USEPA, 2000a. These summary data reflect average herd size throughout the year, accounting for both animals sales and inventories. Where applicable, data are adjusted for the average number of marketing cycles (USEPA, 2000a). This avoids misrepresentation due to seasonal fluctuations in inventory and the number and timing of animals sold. From these data, EPA has estimated the number of confinement operations (referred to here as AFOs) using available data and other information from the Census as well as other USDA and industry publications (USDA/NASS, 1999a, 1999b and 1999c). These data may differ from that presented in Table 8-1.

Expressed on this basis, USDA estimates that there were more than 106,000 beef feedlots in 1997 (Table 8-2). EPA also estimates that there were 850 veal operations raising 0.3 million head and 1,250 stand-alone heifer operations raising 0.9 million head in 1997. Only a portion of these operations would be subject to the proposed regulations. Under the two-tier structure, EPA estimates that there are 3,080 beef feedlots with more than 500 head (500 AU of beef cattle). EPA also estimates that there are about 90 veal operations and 800 heifer operations that may be subject to the proposed regulations. Under the three-tier structure, EPA estimates that 3,210 beef feedlots, 140 veal and 980 heifer operations with more than 300 head (300 AU) would meet the "risk-based" conditions and thus require a permit. EPA expects that few operations that confine fewer than 500 AU of beef, veal, or heifers, would be designated by the permit authority. For the purpose of estimating costs, EPA assumes that no beef, veal, or heifer operations would be designated as CAFOs and subject to the proposed regulations under the three-tier structure.

Table 8-2. EPA's Estimate of the Number of CAFOs Affected under the Tier Structures

Sector	Total Number of AFOs	Number of CAFOs						
		>1,000 AU [a/]	Two-Tier Structure (500 AU Threshold)			Three-Tier Structure (Scenario 3)		
			500-1,000 AU	<500 AU	Total CAFOs	300-1,000 AU	<300AU	Total CAFOs
Fed Cattle	106,080	2,080	1,000	40	3,120	1,140	0	3,210
Veal	850	10	80	0	90	130	0	140
Heifers	1,250	300	500	0	800	680	0	980
Dairy	116,870	1,450	2,310	220	3,980	5,030	50	6,530
Sum	**225,050**	**3,830**	**3,890**	**260**	**7,980**	**6,970**	**50**	**10,860**

Source: USEPA, 2000a. See Section 2 for more information. See Table 3-1 for definitions of the options/scenarios.
"Layers: wet" are operations with liquid manure systems; "Layers: dry" are operations with dry systems. The number of operations shown eliminates double counting of operations with mixed animal types.
[a/] As defined for the proposed regulations, one AU is equivalent to one slaughter or feeder cattle, calf or heifer; 0.7 mature dairy cattle.

Under the two-tier structure, EPA assumes that about four beef feedlots located in the Midwest would be designated annually, or 40 beef feedlots projected over a 10-year period (Table 8-2).

In the dairy sector, USDA reports that there were 116,900 dairy operations with a year-end inventory of 9.1 million milk cows (USDA/NASS, 2000a). See Table 8-2. Only a portion of these operations would be subject to the proposed regulations. As shown in Table 8-2, under the two-tier structure, EPA estimates that there are 3,760 dairy operations that confine more than 350 milk cows (i.e., 500 AU equivalent). Under the three-tier structure, EPA estimates that 6,480 dairy operations with more than 200 head (i.e., 300 AU equivalent) would meet the "risk-based" conditions described in Section VII of the preamble and thus require a permit. Under the two-tier structure, EPA expects that designation of dairies with fewer than 350 milk cows would be limited to about 22 operations annually, or 220 dairies projected over a 10-year time period. Under the three-tier structure, EPA expects annual designation of dairies with fewer than 200 milk cows would be limited to about 5 operations, or 50 operations over a 10-year period. EPA expects that designated facilities will be located in more traditional farming regions.

As shown in Table 8-2, EPA estimates that a total of 3,120 beef operations, 90 veal operations, 800 heifer operations, and 3,980 dairy operations are estimated either to be defined (>500 AU) or designated (<500 AU) as CAFOs under the two-tier structure. A total of 1,140 beef operations, 140 veal operations, 980 heifer operations, and 6,530 dairy operations are estimated to be defined (>300 AU, subject to certain risk-based conditions) or designated (<300

AU) as CAFOs under the three-tier structure. Total CAFOs under either scenario are not adjusted for operations with more than a single animal type.

More information on how EPA estimated the number of affected animal confinement operations is presented in Section 2 of this report, along with additional estimates on the number of affected beef and dairy operations under other regulatory options considered by EPA.

8.1.2.2 Geographic Distribution

The cattle feeding industry is mostly spread across the Great Plains and Midwestern states, with the exception of a few states on the West Coast. During the 1970s and 1980s, fed cattle production shifted eastward from California and Arizona, and westward from Iowa and Illinois to the larger feedlots of the Great Plains states, where cattle feeding operations remain concentrated (McBride, 1997). The shift in cattle feeding to the Great Plains was in part attributed to technological development, including increased output of high-energy feed due to irrigation and crop improvements in these states (Krause, 1991). Enactment of restrictive statutes on corporate farming in states such as Iowa, Minnesota, South Dakota, Wisconsin, and Nebraska contributed to declines in cattle feeding in these states (Krause, 1991). Federal income tax laws during the mid-1970s may have also contributed to construction of large feedlots in the Plains states (Krause, 1991). The Plains states also provide a suitable environment for large-scale cattle feeding, with a mild, dry climate and a low population density (Krause, 1991). Feedlots in these states are also located close to suppliers of feeder cattle and slaughter plants.

Nearly 75 percent of all beef production is concentrated among the top five producing states (USDA/NASS, 1999a). In 1997, Texas and Kansas were the largest beef producing states, each representing about 20 percent of all beef production (Table 8-3). Nebraska accounted for another 18 percent of production. Colorado and Iowa were also among the top five producing states, accounting for about 10 percent and 6 percent of U.S. production, respectively. Other top ten producing states in 1997 included Oklahoma, California, Idaho, South Dakota, and Washington (Table 8-3). Combined, the top ten producing states accounted for 85 percent of U.S. beef production in 1997 (Table 8-3).

Over half of all milk production is concentrated among the top five producing states. In 1997, California and Wisconsin were the largest milk producing states, representing about 18 and 14 percent of all milk production, respectively (Table 8-4). New York accounted for another 7 percent of production. Pennsylvania and Minnesota were also among the top five producing states, accounting for about 7 percent and 6 percent of U.S. production, respectively. Other top ten producing states in 1997 included Texas, Michigan, Washington, Idaho, and Ohio (Table 8-4). Combined, the top ten producing states accounted for almost 70 percent of U.S. milk production in 1997 (Table 8-4).

Table 8-3. Geographic Distribution of Cattle and Calf Feedlots by Major Producing State, 1997

Major Producing State	Marketed Head		Beef Feedlots	
	(thousand)	(percent)	(number)	(percent)
Texas	5,800	22%	147	6%
Kansas	5,210	19%	195	0%
Nebraska	4,710	18%	5,100	5%
Colorado	2,555	10%	174	0%
Iowa	1,544	6%	13,310	13%
Oklahoma	907	3%	26	0%
California	575	2%	24	0%
Idaho	554	2%	60	0%
South Dakota	527	2%	3,214	3%
Washington	415	2%	16	0%
Arizona	398	1%	9	0%
Minnesota	310	1%	7,500	7%
Illinois	300	1%	6,300	6%
Ohio	300	1%	7,500	7%
Indiana	250	1%	6,500	6%
New Mexico	229	1%	10	0%
Wisconsin	220	1%	7,500	7%
Michigan	210	1%	4,100	4%
Missouri	120	0%	4,000	4%
North Dakota	80	0%	1,500	1%
All Other	1,625	6%	38,890	37%
Top 5 states	**19,819**	**74%**	**42,310**	**40%**
Top 10 states	**22,797**	**85%**	**65,024**	**61%**
Total U.S.	**26,839**	**100%**	**106,075**	**100%**

Source: USDA/NASS, 1999a and 1999b. Cattle/calves fattened on grain and concentrates (sales).

Table 8-4. Geographical Distribution of Dairy Operations by Major Producing State, 1997

Major Producing State	Milk Production		Dairy Farms	
	(million lbs.)	(percent)	(number)	(percent)
California	27,582	18%	2,800	2%
Wisconsin	22,368	14%	25,000	20%
New York	11,530	7%	9,000	7%
Pennsylvania	10,662	7%	11,300	9%
Minnesota	9,210	6%	10,500	8%
Texas	5,768	4%	3,500	3%
Michigan	5,410	3%	4,200	3%
Washington	5,305	3%	1,400	1%
Idaho	5,193	3%	1,400	1%
Ohio	4,415	3%	6,000	5%
New Mexico	4,011	3%	600	0%
Iowa	3,693	2%	4,500	4%
Arizona	2,664	2%	250	0%
Vermont	2,600	2%	2,000	2%
Florida	2,476	2%	650	1%
Missouri	2,362	2%	4,500	4%
Illinois	2,203	1%	2,400	2%
Indiana	2,189	1%	3,400	3%
Virginia	1,858	1%	1,800	1%
Kentucky	1,815	1%	3,600	3%
Top 5 States	**81,352**	**52%**	**58,600**	**47%**
Top 10 States	**107,443**	**69%**	**75,100**	**61%**
Top 20 States	**133,314**	**85%**	**98,800**	**80%**
Total U.S.	**156,091**	**100%**	**123,700**	**100%**

Source: USDA/NASS, 1999a (number of dairy farms); USDA/NASS, 1999c (milk production).

Among these top milk producing states, dairy operations can be divided between those in traditional and nontraditional dairy production states (Kaiser and Morehart, 1994; McBride, 1997). Traditional dairy production states include Wisconsin, Minnesota, Pennsylvania, and New York. Dairy operations in these states tend to be smaller and are less industrialized. These states remain competitive, in part, because local feed supplies are plentiful (McBride, 1997). Nontraditional dairy production states include California, Washington, Texas, New Mexico, and Idaho. Dairy operations in these states are larger and use newer technologies and production methods to take advantage of economies of scale, driving down production costs. These operations are typically more specialized and produce very little if any crops (Outlaw et al., 1996). Herd size also varies among regions, with larger sized operations being more common in the more nontraditional milk producing states. For example, in 1992, herd-size in the Pacific region averaged 240 cows per operation whereas average herd-size in the Midwest and Northeast states was less than 60 cows (Outlaw et al., 1996). Milk production in these emergent states is among the fastest-growing in the nation. By contrast, milk production has been contracting in many of the more traditional states (USDA/NASS, 1999c).

8.1.2.3 Supply and Demand Conditions

Total U.S. beef production (carcass weight basis) increased 10 percent between 1992 and 1997, reaching 25.5 billion pounds in 1997 (Table 8-5). During the same period, total domestic demand for beef products increased only 6 percent. Expressed on a per-capita basis, adjusted for population growth, demand rose slightly from 94.7 pounds per person in 1992 to 95.2 pounds per person per year in 1997 (Table 8-5). Compared to demand levels in the 1970s when beef consumption was in the range of 114 pounds per person per year, consumption is down by about 20 pounds per person. This change in consumption has been attributed to the loss of market share to poultry products in response to changes in consumer preferences and increased health and nutrition concerns, as well as recent food safety concerns (USDA/ERS, 1998a; USDC, 1999b).

Supply and demand for fluid milk and dairy foods is expressed in terms of total milk equivalent (total solids basis) (NMPF, 1999). From 1992 to 1997, U.S. dairy product supplies (milk production plus imports) rose 4 percent, reaching 156.1 billion pounds in 1997 (Table 8-5). During the same period, total utilization (domestic demand plus exports) also rose 6 percent and totaled 155.6 million pounds in 1997, resulting in a tightened dairy supply-demand situation. During the 1990s, demand for all fluid milk and dairy products has averaged around 570 pounds per person annually, expressed in milk equivalents. This represents a substantial recovery from the early 1970s when U.S. milk and dairy food production had reached a low of under 520 pounds per person per year—a substantial reduction compared to the 1950s. In part, recent gains in demand are attributable to improved domestic and export promotion (USDA/ERS, 1998a).

Table 8-5. Total U.S. Beef and Dairy Supply and Demand, 1992-1997

Year	Production	Imports	Exports	Total Demand	Per Capita Demand [c/]
Beef Products [a/]					
	(million pounds ready-to-cook, carcass weight)				(lbs./person)
1992	23,086	2,440	1,400	24,185	94.7
1993	23,049	2,401	1,337	23,944	92.7
1994	24,386	2,369	1,611	25,125	96.3
1995	25,222	2,103	1,821	25,533	96.8
1996	25,525	2,073	1,877	25,863	97.1
1997	25,490	2,343	2,136	25,609	95.2
%92-97	**10.4%**	**-4.0%**	**52.6%**	**5.9%**	**0.5%**
Milk and Dairy Products [b/]					
	(million pounds)	(million pounds milk equivalents on a total solids basis)			(lbs. ME/person)
1992	150,847	4,245	7,032	147,176	570
1993	150,636	4,341	6,898	147,795	566
1994	153,602	4,837	5,806	152,170	576
1995	155,292	4,236	7,088	154,792	574
1996	154,006	4,466	4,177	155,651	574
1997	156,091	4,383	5,244	155,606	569
%92-97	**3.5%**	**3.3%**	**-25.4%**	**5.7%**	**-0.2%**

Sources:

[a/] Putnam and Allshouse, 1997 and 1999. Supplemented with information in USDA/ERS 1998c and 1997f. Excludes beginning and ending stocks, and shipments to U.S. territories.

[b/] National Milk Producers Federation (NMPF, 1999). Utilization (demand and trade) is expressed in terms of the milk equivalent (M.E.), total solids basis (tsb), of the estimated milk content in all dairy products (e.g., fluid and dry milk, cheese, butter, ice cream, whey lactose, and other usable by-products).

[c/] Per capita demand is shown to depict real demand growth, adjusting for growth in U.S. population, which has grown, on average, at about 1% per year.

8.1.2.4 Farm Price Trends

Output and price cycles are common in the livestock sectors, given long production periods and the tendency to adjust future production to current prices (Kohls and Uhl, 1998). Biological time lags in beef production last about 2.5 years between the time a cow-calf operator decides to breed an animal and when its beef is ready for retail sale; if the operator wants to expand production and add more breeding herd, lags last about 4.5 years (Becker, 1996). Because it is impossible to know if current breeding decisions will accurately reflect demand conditions several years later, mismatches between supply and demand may cause changes in cattle prices that signal farmers to adjust breeding decisions. For example, to expand future meat supplies in response to expected profits, producers must hold back animals from market in the near term to build up the breeding herd, which shorts the market and increases prices in the short run. Conversely, when low prices signal a reduction in production, the resulting herd sell-off will increase supplies and reduce prices in the short run (Kohls and Uhl, 1998). The so-called "cattle cycle" refers to the approximate 10-year period it takes for beef cattle numbers to expand and contract in response to changes in prices and profitability (Becker, 1996).

Several factors outside the beef market can influence the severity of the cattle cycle (Matthews, et al., 1999). Weather affects both the quality of pasture and production of feed crops. High feed prices induce lower calf prices and reductions in herd size as the cost of raising the calf to market weight will be higher. A 27 percent drop in corn production contributed to the severity of the 1996 cattle sell off (Becker, 1996). Livestock exports and imports are related to the domestic price and provide alternative sources and markets (Matthews, et al., 1999). Commodity programs affect the cattle cycle by motivating changes from pasture to cropland (Matthews, et al., 1999). While there has been a trend toward decreasing per capita beef consumption, retail beef prices are also affected by the cattle cycle. Retailers change their shelf price more slowly than their costs to avoid disturbing consumers with frequent price changes (Becker, 1996) but Matthews, et al. (1999) found that this practice did not result in abnormally large price spreads during the 1996-97 low point in the cattle cycle.

Table 8-6 presents actual quarterly and annual fed cattle prices received by U.S. cattle producers from 1992 through 1998 (NCBA, 2000). Beef prices declined steadily throughout the 1990s from $75.27 per hundred weight (cwt) in 1992 to $66.09 per cwt in 1997, followed by a period low of $61.73 per cwt in 1998. The worst losses in the recent past were experienced in 1996 and 1997, which resulted in an overall loss in equity for the feedlot industry (Stott, 2000a). During those years, escalating feed grain prices, dust-bowl conditions, and unfavorable returns caused a shift in the industry from expansion toward liquidation, pushing the supply of cattle to its highest point since the mid-1970s—the high point of the 10-year cattle cycle (Becker, 1996). The subsequent drop in price from the abundant supply of beef caused farmers to further reduce herd size, resulting in additional liquidation (Uvacek, no date). High prices are expected to peak in 2002 (Stott, 2000a).

Table 8-6. Actual Average Quarterly and Annual Prices Received by Farmers, Total U.S., 1992-1997

Year	Average Q1	Average Q2	Average Q3	Average Q4	Average Annual
	(monthly prices received $/cwt)				
Beef					
1992	75.75	75.64	73.78	75.89	75.27
1993	80.55	79.53	73.78	71.70	76.40
1994	73.41	68.99	66.63	68.11	66.29
1995	72.39	65.20	62.62	66.07	66.57
1996	63.00	60.25	67.28	69.48	65.00
1997	66.18	66.31	65.12	66.75	66.09
Milk					
1992	13.0	12.9	13.5	13.2	13.2
1993	12.4	12.9	12.7	13.4	12.9
1994	13.5	13.0	12.5	13.0	13.0
1995	12.6	12.3	12.5	13.8	12.8
1996	14.0	14.4	16.0	15.4	15.0
1997	13.5	12.8	12.7	14.5	13.4

Sources: NCBA, 2000 (Choice Fed Steer) and USDA/NASS, 1998a (Milk sold to plants, eligible for fluid market. Includes surplus fluid grade milk diverted to manufacturing).

Fed cattle prices tend to vary seasonally according to production cycles throughout the year and are often subject to periods of high variability, particularly for feeder calves (Bliss and Ward, 1999). Calf prices typically average higher than fed cattle prices (Dyuvetter et al., 1998). Because returns in the feedlot sector are more dependent on buy-sell margins than absolute prices levels, there is very little correlation between returns and fed-cattle prices (Dyuvetter et al., 1998). Fed cattle prices are highly variable: between 1980 and 1997, quarterly average fed cattle prices averaged about $69 per hundredweight (cwt) and ranged from about $54 per cwt to $81 per cwt.

Milk prices also fluctuate throughout the year, reflecting seasonal variation due to annual production cycles (Table 8-6). For example, prices tend to drop during the summer months following the spring flush when demand tends to lessen. Prices often recover during the fall and winter months when milk supplies tighten due to increased demand from school use and holidays. Moreover, dairy pricing is influenced by storage considerations, given the perishability and flow characteristics of milk. Inventories of fluid milk and some dairy products cannot be held for long periods of time. Finally, farm level prices in general are often subject to periods of high instability

due to changing market conditions and/or sharp shifts in supply in response to changing farm prices and/or input costs, among other factors.

Table 8-6 presents actual quarterly and annual milk prices received by U.S. dairy farmers from 1992 through 1997. Averaged over the year, milk prices changed little over the period, averaging more than $13 per cwt. Quarterly fluctuations, however, show wide seasonal variability as well as cyclical market swings. For example, milk prices jumped sharply in 1996 in response to high feed grain costs and tightened supply-demand conditions. Moreover, measured in real terms (i.e., corrected for price inflation), farm level prices have been decreasing despite strong domestic demand and export growth for dairy foods.

Federal price supports for milk and also marketing contracts with cooperatives have protected producers from significant fluctuations in milk prices (McBride, 1997). Dairy pricing has also influenced by the negotiating power of milk cooperatives and other market factors. Cooperatives market the majority of milk in the U.S. and give farmers the ability to secure a milk price above federal market order minimum prices through collective bargaining with processors/manufacturers and/or retail operations (Wolf and Hamm, 1998).

Historically, the price of farm milk and some dairy products has been supported by an array of government programs and pricing policies. The government's role in dairy pricing has included Federal and state milk marketing orders and support programs, as well as purchases through various government programs. The government's role in dairy policies is decreasing, following deregulation under the 1996 Federal Agricultural Improvement and Reform (FAIR) Act (also known as the "Farm Bill").

8.1.3 Financial Data Characteristics of Beef and Dairy Operations

8.1.3.1 Overview of Financial Characteristics

USDA reports that sales of all cattle and calves from commercial operations with $50,000 or more annually totaled $32.4 billion in 1997 (USDA/NASS, 1999a).[2] (See Table 8-7.) This includes revenues generated at both feedlot and all other cattle and calf operations. Reported gross revenue from cattle and calves sold from facilities that "fatten cattle on grains and concentrates" totaled $20.4 billion in 1997 (USDA/NASS, 1999a). Among all beef farms, including feedlot operations, nearly 60 percent of total farm revenues are from the sale of cattle. Secondary livestock revenues, including sales by farms that generate a portion of their total revenue from the sale of milk and/or beef, dairy, and poultry products accounted for 37 percent of total farm revenues. Crop sales from these farms accounted for 5 percent in 1997 (USDA/NASS, 1999a). Supplemental information for beef feedlots only on the share of total revenue generated from beef versus other secondary income sources is not available, although indications are that feedlot operations tend to specialize in finishing cattle only and generate a smaller share of total revenue from other sources (Krause 1991; Kohls and Uhl, 1998).

[2]USDA defines commercial farms as those with gross sales of $50,000 or more during a given year.

Table 8-7 Farm Revenue at Beef Feedlots and Dairy Farms, by Revenue Category and Economic Class

Revenue Category/ Economic Class	All Beef Operations	Revenues ($1,000)	Dairy Farms	Revenues ($1,000)
Sales by Revenue Category (Reported and Percentage Share)				
Primary Livestock	9,709	$18,773,077	68,032	$17,624,762
Secondary Livestock	58,677	$11,869,096	3,314	$464,832
Crop Sales	15,296	$1,716,422	2,009	$254,645
All Farms	**83,682**	**$32,358,595**	**73,355**	**$18,344,239**
Primary Livestock	12%	58%	93%	96%
Secondary Livestock	70%	37%	4%	3%
Crop Sales	18%	5%	3%	1%
All Farms	**100%**	**100%**	**100%**	**100%**
Sales by Economic Class (Reported and Percentage Share)				
>$1 million in revenue	7,074	$21,425,530	3,359	$6,766,331
$0.5–$1.0 million	8,919	$3,039,924	4,761	$2,467,884
$0.25–$0.50 million	16,345	$3,099,380	12,890	$3,368,697
$0.10–$0.25 million	29,505	$3,329,680	35,845	$4,600,585
$0.05–$0.10 million	21,839	$1,464,079	16,500	$1,140,773
All Farms	**83,682**	**$32,358,593**	**73,355**	**$18,344,270**
>$1 million in revenue	8%	66%	5%	37%
$0.5–$1.00 million	11%	9%	7%	13%
$0.25–$0.50 million	20%	10%	18%	18%
$0.10–$0.25 million	35%	10%	48%	25%
$0.05–$0.10 million	26%	5%	22%	6%
All Farms	**100%**	**100%**	**100%**	**99%**

Source: USDA/NASS, 1999a. Based on data for commercial farms with more than $50,000 in annual revenues. Excludes non–commercial farms with revenues below $50,000.
Primary livestock: cattle (beef feedlots, NAICS 112112) and dairy (NAICS 11212), respectively.
Secondary livestock: beef (beef farming, NAICS 112111, and beef feedlots, NAICS 112112), dairy (NAICS 11212), miscellaneous categories (NAICS 1122, NAICS 1124, NAICS 1125), along with hogs (NAICS 1122) and poultry (NAICS 1123), respectively.
Crop sales: oilseed/grains (NAICS 1111), vegetables (NAICS 1112), fruits/nuts (NAICS 1113), greenhouse (NAICS 1114) and other crops (NAICS 1119).

Across all beef operations, about 7,000 operations (8 percent of all beef farms) generate more than $1 million in revenue annually (USDA/NASS, 1999a). (See Table 8-7.) This revenue cut-off is the nearest approximation to the Small Business Administration's small business size standard, which defines a "small business" among beef feedlots as an operation that generates less than $1.5 million annually in total entity revenue (SBA, 1998; USGPO, 2000). (Section 9 provides additional information on EPA's small business analysis.)

At dairy operations, USDA reports that commercial farms in the U.S. generated a total of $18.3 billion in annual revenue in 1997 (USDA/NASS, 1999a). Virtually all (96 percent) dairy farm revenues were from the sales of milk. Approximately $0.7 billion of all dairy farm revenue was generated from the sales of other livestock or crop production (Table 8-7). As shown in Table 8-7, approximately 11 percent of all commercial dairy farms generate more than $0.5 million in revenue annually (USDA/NASS, 1999a). The remaining farms generate revenues below $0.5 million. The $0.5 million threshold in annual farm revenues corresponds with SBA's definition of a "small business" in the dairy sector (SBA, 1998; USGPO, 2000).

8.1.3.2 Income Statement and Balance Sheet Information

Returns to finishing cattle in commercial feedlots are dependent on many factors and vary considerably from year to year. Returns are related to productivity (average daily gain, feed efficiency, etc.) and feed costs (Duyvetter et al., 1998). The estimated quarterly profit for feeding steers in a commercial feedlot has been about $15 per head, ranging from a low of -$86 per head to a high of $141 per head from 1980 through 1997 (Duyvetter et al., 1998). Returns of about $15 per head represents a profit margin of about 2 percent (Idaho Cattle Association, 1999). Other industry information indicate that over the past 20 years, the average loss per head of fed cattle was $1.56 (NCBA, 1999). Bliss and Ward (1999) also report negative average returns based on budgeted cattle feeding net margins in the Great Plains states from 1978 through 1987.[3] However, although budgeted profits are often negative, Bliss and Ward note that actual profits at these operations are positive because the feedlot often price cattle and grain using futures market contracts and options to manage price risk and manage the seasonal variations in profits (Bliss and Ward, 1999).

Limited financial data are available on cattle feedlot operations. Tables 8-8 and 8-9 present average financial data that characterize conditions at beef feedlot operations. These sources of publicly available data include RMA and Dun and Bradstreet. Table 8-10 provides additional financial information based on a survey conducted by National Cattlemen's Beef Association (NCBA).

[3]These estimates are prepared by USDA and represent the profits from selling a slaughter steer that achieves a 500-pound weight gain in 180 days.

Table 8-8. Composite Income Statement and Balance Sheet in SIC 0211, Feedlots–Beef Cattle, 1997

Size (in annual revenues)	0–$1 mill.	$1–3 mill.	$3–5 mill.	$5–10 mill.	$10–25 mill.	$25 mill.+
Net sales	**$550,625**	**$2,015,857**	**$3,832,778**	**$7,323,765**	**$15,884,320**	**$198,496,267**
Operating expenses	$519,239	$1,872,731	NA	$7,147,994	$15,407,790	$193,732,356
Operating profit	$31,386	$143,126	NA	$175,770	$476,530	$4,763,910
All other expenses (net)	$26,981	$20,159	NA	$65,914	$79,422	($396,993)
Profit before taxes	$4,405	$122,967	NA	$109,856	$397,108	$5,160,903
Farm Assets	**$1,572,000**	**$1,556,857**	**$2,553,333**	**$3,385,353**	**$7,544,480**	**$50,917,433**
Current assets	**$817,440**	**$832,919**	**NA**	**$2,369,747**	**$5,794,161**	**$36,405,965**
Cash and equivalents	$69,168	$84,070	NA	$108,331	$475,302	$2,800,459
Trade receivables (net)	$117,900	$233,529	NA	$809,099	$1,576,796	$12,983,945
Inventory	$529,764	$434,363	NA	$1,239,039	$3,606,261	$17,617,432
All other current	$99,036	$80,957	NA	$216,663	$143,345	$3,004,129
Non-current assets	**$756,132**	**$723,939**	**NA**	**$1,015,606**	**$1,750,319**	**$14,511,468**
Fixed assets	$589,500	$540,229	NA	$886,962	$1,486,263	$9,470,643
Intangibles	$0	$7,784	NA	$3,385	$30,178	$1,883,945
Other non-current assets	$166,632	$175,925	NA	$125,258	$233,879	$3,156,881
Farm Liabilities	**$1,572,000**	**$1,556,857**	**$2,553,333**	**$3,385,353**	**$7,544,480**	**$50,917,433**
Current liabilities	**$699,540**	**$784,656**	**NA**	**$1,845,017**	**$3,870,318**	**$23,523,854**
Notes payable in 1 year	$521,904	$558,912	NA	$1,198,415	$2,814,091	$14,155,046
Curr. Maturities--L/T/D	$12,576	$42,035	NA	$37,239	$52,811	$407,339
Trade payables	$26,724	$60,717	NA	$216,663	$520,569	$6,008,257
Income taxes payable	$9,432	$14,012	NA	$23,697	$15,089	$611,009
Other current liabilities	$128,904	$110,537	NA	$369,003	$460,213	$2,393,119
Non-current liabilities	**$103,752**	**$158,799**	**NA**	**$524,730**	**$724,270**	**$7,128,441**
Long term debt	$84,888	$105,866	NA	$402,857	$467,758	$4,480,734
Deferred taxes	$0	$23,353	NA	$33,854	$188,612	$661,927
Other non-current liab.	$18,864	$29,580	NA	$88,019	$67,900	$1,985,780

NA = Not available.
Source: RMA, 1998.

Table 8-9. Financial Information for Establishments in SIC 0211—Beef Cattle Feedlots, 1993-1997

Item	1993	1994	1995	1996	1997
Net Sales	**$7,459,116**	**$7,081,199**	**$7,162,299**	**$11,645,125**	**$12,169,927**
Gross Profit	$1,737,974	$1,642,838	$1,618,680	$2,282,445	$2,178,417
Net Profit After Tax	$164,101	$198,274	$322,303	$430,870	$352,928
Working Capital	$539,698	$614,119	$500,041	$752,076	$790,504
Total Assets	**$3,394,328**	**$3,198,540**	**$2,809,217**	**$4,043,420**	**$4,074,761**
Current Assets	**$2,104,483**	**$2,015,080**	**$1,702,386**	**$2,539,268**	**$2,632,296**
Cash	$169,716	$102,353	$176,981	$246,649	$240,411
Accounts Receivable	$780,695	$844,415	$640,501	$938,073	$973,868
Notes Receivable	$105,224	$102,353	$58,994	$105,129	$130,392
Inventory	$790,878	$758,054	$654,548	$901,683	$1,034,989
Other Current	$257,969	$207,905	$171,362	$347,734	$252,635
Non-current Assets	**$1,289,845**	**$1,183,459**	**$1,106,831**	**$1,504,153**	**$1,442,465**
Fixed Assets	$824,822	$713,274	$792,199	$1,035,116	$1,124,634
Other Non-current	$465,023	$470,185	$314,632	$469,037	$317,831
Total Liabilities	**$3,394,328**	**$3,198,540**	**$2,809,217**	**$4,043,420**	**$4,074,761**
Current Liabilities	**$1,564,785**	**$1,400,961**	**$1,202,345**	**$1,787,192**	**$1,841,792**
Accounts Payable	$339,433	$374,229	$266,876	$396,255	$456,373
Bank Loans	$20,366	$3,199	$14,046	$24,261	$20,374
Notes Payable	$454,840	$351,839	$286,540	$566,079	$631,588
Other Current	$750,146	$671,693	$634,883	$800,597	$733,457
Non-current Liabilities	**$1,829,542**	**$1,797,580**	**$1,606,872**	**$2,256,228**	**$2,232,969**
Other Long Term	$498,966	$438,200	$325,869	$485,210	$484,897
Deferred Credits	$3,394	$3,199	$5,618	$16,174	$12,224

Source: Dun & Bradstreet, 1993-1997.

Table 8-10. Financial Characteristics from NCBA Financial Survey (1994-1998)

Item	1994	1995	1996	1997	1998
Average					
Gross Cash Income (PHAO)	$638.81	$627.93	$700.39	$666.54	$601.32
Total Cash Expenses	$557.80	$566.91	$620.39	$556.85	$562.00
Net Cash Income	$16.47	$8.49	$19.94	$34.39	($28.54)
Depreciation	$28.22	$28.03	$27.18	$29.12	$28.31
Current Assets	$275.18	$261.30	$312.87	$418.32	$361.03
Current Liabilities	$208.80	$186.59	$235.40	$323.94	$278.57
Total Assets	$348.36	$329.98	$380.52	$479.62	$434.49
Total Liabilities	$256.93	$225.79	$272.62	$359.59	$329.99
Return on Equity	18.0%	8.2%	18.5%	28.6%	-27.3%
Return on Assets	4.7%	2.6%	5.2%	7.2%	-6.6%
Current Ratio	1.32	1.40	1.33	1.29	1.30
Debt to Equity Ratio	2.81	2.17	2.53	3.00	3.16
High					
Gross Cash Income (PHAO)	$965.00	$972.00	$1,085.00	$1,239.00	$1,074.00
Total Cash Expenses	$822.00	$793.00	$903.00	$851.00	$831.00
Net Cash Income	$61.23	$69.38	$62.48	$136.70	$56.73
Return on Equity	58.1%	114.8%	61.3%	119.2%	71.8%
Return on Assets	17.7%	67.2%	29.5%	51.5%	29.4%
Current Ratio	4.81	3.29	3.11	4.73	5.91
Debt to Equity Ratio	7.97	6.38	5.06	206.00 [/a]	6.56
Low					
Gross Cash Income (PHAO)	$277.88	$271.07	$207.86	$100.00	$211.56
Total Cash Expenses	$154.00	$169.00	$157.00	$102.00	$186.14
Net Cash Income	($24.00)	($87.07)	($49.79)	($38.00)	($125.37)
Return on Equity	-15.0%	-81.5%	-52.6%	-200.0%	-171.9%
Return on Assets	-7.3%	-15.9%	-13.1%	-10.4%	-26.1%
Current Ratio	0.31	-0.31	-0.39	0.51	-1.25
Debt to Equity Ratio	0.96	0.71	0.86	0.41	-4.28

Source: NCBA, 1999. Per head average occupancy (PHAO).

[a/]sic: NCBA table shows 206.00. Using stated total assets and liabilities debt to equity ratio is calculated as 7.25.

Table 8-8 presents average income statement and balance sheet data for companies in SIC 0211, Feedlots—Beef Cattle, for 1997, as reported by RMA (RMA, various years). RMA Annual Statement Studies are gathered from financial statements from RMA member bank customers. More than 150,000 financial statements from primarily small- and medium-sized companies are gathered annually. The RMA data represent companies' (not individual facilities') financial statements and also reflect financial statements for companies having less than $250,000 in total assets. Where available, these financial data are presented in six separate size classifications based on annual company revenues. These RMA data show relative financial health for beef feedlots for this period, with positive profits before taxes in each size class. These data indicate that while operations with less than $1 million in sales barely turn a profit and return less than one percent on assets, operations in the $1 to $3 million size class have a higher net profit margin before taxes, 6 percent, than any other size operation. Only the largest size class has a higher return on assets. For 1997, the $5 to $10 million size class has almost the same level of operating profit, $176,000, as the $1 to $3 million size class, $143,000 even though it has more than three times the sales for that year.

Table 8-9 presents financial data for establishments in SIC 0211—Feedlots—beef cattle from 1993-1997 from Dun & Bradstreet (Dun & Bradstreet, various years). The data from Dun & Bradstreet's "Industry Norms and Key Business Ratios" provide establishment-based financial data from the Dun & Bradstreet database and provide measures of financial profitability, efficiency, and solvency for the upper, lower, and median quartiles for each financial ratio within an SIC code group. These establishments, at the national-level of aggregation, all show positive net profits before and after tax. The financial data are not gathered by size breakdowns for the surveyed establishments. Total assets for 1993 through 1997 exceed $2.8 million. These data indicate that even though average net sales vary from $7.1 million to $12.2 million in the 5-year period, the gross profit margin varies only 5 percent, from 18 to 23 percent. This shows that much of the volatility in cattle prices is passed through from changes in feed and other costs of production. Sales were flat from 1993 to 1995; business turned around in 1995 and 1996 when net profit margins exceeded four percent and returns on assets were over ten percent (Table 8-9). By 1997 sales were up 72 percent from their 1994 low.

Table 8-10 presents data from a survey prepared by NCBA (NCBA, 1999). NCBA provided aggregated summary information on financial conditions at cattle feeding operations based on responses to a survey questionnaire of its membership. Like the Dun and Bradstreet data, the NCBA data show improving income from 1994 to 1997. The NCBA data also includes data for 1998 when cash income per head fell sharply and net income became negative for the average operation. High income operations continued to be profitable although their net cash income fell almost 60 percent from 1997 to 1998. Operating margins were less than 2 percent over the period (Table 8-10).

The least profitable respondents to the NCBA survey receive only about one-fifth as much per head as the most profitable. The lowest group carries losses every year but they are not as

highly leveraged as the top producers, i.e., they have lower debt-to-equity ratios, and thus may remain in business. Additional information on the NCBA data is provided in Section 8.1.3.3.

The reported range of values in the NCBA data likely also reflect differences across different types of operations (Stott, 2000a). There is a major distinction in what drives profitability at custom feedlots and company-owned feedlots. Occupancy rates at custom feedlots are the critical factor for profitability at these operations, whereas at company-owned feedlots, profits on cattle govern the overall profitability of the operation (Idaho Cattle Association, 1999). Presumably, the packer can optimize occupancy rates, whereas custom feedlots must compete for customers. Limited additional information on the distinctions between these types of operations is available.

Limited information is also available on veal and heifer operations (Duyvetter et al., 1998). Foster (2000b) reports that the basic costs of raising a heifer from weaning to 23 months are the same whether the animal is part of a dairy herd or in a specialized replacement heifer facility. Use of the specialized facility has advantages for both the dairy producer and the custom grower. The grower is able to use available crop land and facilities without committing to a complete milk herd while the dairy producer can focus his management skills on milk production and avoid tying up facilities with unproductive animals (Endsley, et al., 1996). If costs are estimated accurately, the custom grower can negotiate a fair contract payment rate.

Table 8-11 presents average income statement and balance sheet data for commercial dairy farms from 1993 through 1997. According to USDA, the average dairy farm demonstrated a favorable financial position with positive net income and a debt-to-asset ratio that ranged from 0.20 to 0.22 from 1993 to 1997 (USDA/ERS, 1998d). These debt-to-asset ratios indicate that—at the national level—average dairy farms are not in a vulnerable financial position because they have a low potential for cash flow problems and a low relative risk of insolvency. However, these national average data do not reflect differences by region, size, or type of operation, and may mask financial differences among dairy farms. Additional information from USDA show that between 1991 and 1994 about 30 percent of all beef and dairy farms experienced negative income (USDA/ERS, 1997b).

Regional differences in milk production costs and prices underlie financial differences among milk producing regions. For example, the upper midwest has lower cash expenses, in part because farmers there grow their own feed and have plentiful supplies of roughage in the region (Outlaw et al, 1996). Data from USDA's ERS cost of production data series also reflect the differences among the major milk production regions, given differences in production practices and technologies used, degree of specialization, and use of hired labor, among other factors (USDA/ERS, 1998d). Farm milk prices also play an important role in influencing financial differences among regions (Outlaw et al, 1996).

Table 8-11. Income Statement and Balance Sheet for Dairy Farms (Sales >$50,000), 1993-1997

Item	1993	1994	1995	1996	1997
	Dollars per Farm				
Income Statement					
Gross cash income	**$211,563**	**$243,568**	**$263,852**	**$277,181**	**$294,723**
Livestock sales	$194,214	$223,973	$245,286	$259,412	$273,863
Crop sales (incl. net CCC loans)	$6,635	$7,087	$8,738	$7,862	$5,820
Government payments	$4,737	$3,411	$2,722	$2,720	$2,645
Other farm-related income[a]	$5,976	$9,097	$7,107	$7,188	$12,395
Less: cash expenses	**$162,288**	**$193,732**	**$205,263**	**$214,980**	**$237,271**
Variable cash expenses	**$137,510**	**$165,350**	**$174,734**	**$185,020**	**$206,238**
Fixed cash expenses	**$24,778**	**$28,383**	**$30,530**	**$29,960**	**$31,033**
Equals: net cash farm income	**$49,275**	**$49,836**	**$58,589**	**$62,202**	**$57,452**
Less: Depreciation	$19,098	$24,358	$24,091	$26,066	$24,139
Labor, non-cash benefits	$867	$1,114	$1,440	$1,013	$1,024
Plus: Value of inventory change	$4,757	$7,340	$1,948	$3,374	$14,809
Non-money income[b]	$5,169	$5,404	$5,417	$6,216	$4,725
Equals: net farm income	**$39,236**	**$37,108**	**$40,424**	**$44,712**	**$51,823**
Balance Sheet					
Farm assets	**$678,433**	**$729,089**	**$725,261**	**$777,841**	**786,155**
Current assets	$91,749	$110,975	$109,833	$107,798	111,972
Non-current assets	$586,683	$618,133	$615,428	$670,043	674,183
Farm liabilities	**$133,125**	**$152,914**	**$158,466**	**$161,462**	**172,625**
Current liabilities	$36,500	$42,720	$55,374	$51,650	40,811
Non-current liabilities	$96,624	$110,194	$103,092	$109,812	131,815
Farm equity	**$545,308**	**$576,175**	**$566,794**	**$616,379**	**613,530**
Debt/asset ratio	**0.20**	**0.21**	**0.22**	**0.21**	**0.22**

Source: USDA/ERS, 1998d.

[a] Includes income from machine-hire, custom work, livestock grazing, land rental, contract production fees, outdoor recreation, and any other farm-related source.

[b] Defined as home consumption and imputed rental value of farm dwellings owned by the farm operation.

8.1.3.3 Baseline Conditions for Cattle and Dairy Operations

Tables 8-12 through 8-15 provide a summary of the financial baseline conditions assumed for this analysis. These data are aggregated from the 1997 ARMS data set and are obtained by USDA's ERS, as described in Section 4. These data are separated by select facility size and production region groupings for the beef and dairy sectors (see Table 4-4). Additional information on how these data differ by region are provided in the record (USDA/ERS, 1999a, see DCN 70063). EPA uses these average data to assess regulatory costs for fed cattle, veal, heifer, and dairy operations.

The average beef and dairy operation demonstrated a favorable financial position in 1997 with positive net income and debt-to-asset ratios under 40 percent. In the beef sector, estimated debt-to-asset ratios ranged from 9 percent (small operations) to 13 percent (medium operations), across select operation sizes; in the dairy sector, estimated debt-to-asset ratios ranged from 17 percent to 26 percent (USDA/ERS, 1999a). See Tables 8-12 and 8-14. These debt-to-asset ratios indicate that—on average—beef and dairy operations are not in a vulnerable financial position and have a low potential for cash flow problems and a low relative risk of insolvency. Based on these data, EPA assumes that baseline (prior to regulation) net cash flow for all model types for the beef and dairy sectors is positive, and baseline debt-to-asset ratios for all model types are 40 percent or less. All cattle and dairy operations in this analysis, therefore, are considered financially healthy, on average, in the regulatory baseline. Tables 8-13 and 8-15 present average income and balance sheet data for commercial beef and dairy operations in 1997, by size of operation.

Cattle Operations

Data shown in Table 8-12 are distributed by broad facility size groups. As shown, more than 96 percent of operations have fewer than 200 head. These operations account for about 67 percent of all beef cattle raised annually (Table 8-12). There are fewer larger-sized operations with more than 800 head (less than 1 percent of all farms), and these operations raise only 6.8 percent of all beef cattle annually (Table 8-12). Smaller beef operations with less than 200 head are more diversified than larger ones, with about 50 percent of all farm revenue from crops. This compares to beef operations with more than 800 head, where livestock comprises the bulk of all annual farm sales and only about 13 percent of farm revenues are from crops (Table 8-12).

Table 8-12 also shows the percentage of beef cattle owned by farmers compared to those not owned by farmers. EPA uses this information on animal ownership as an indication of the extent of production contract use in these sectors (see Section 2.3). Across all beef operations in 1997, only about 5 percent of animals were not owned by farmers (USDA/ERS, 1999a). Percentages do not vary noticeably across farm sizes (Table 8-12). This is consistent with other market information (USDA/GIPSA, 1999c).

Table 8-13 presents average income statement and balance sheet information for beef operations in 1997 and reflects the baseline financial conditions assumed by EPA for this analysis. The financial data used for this analysis do not distinguish between fed cattle operations and cow-calf operations. These data also do not distinguish between fed cattle, heifer, and veal operations.

Table 8-12. Typical Financial Characteristics of Fed Beef Operations, By Size of Operation

Item	All Farms	Less than 200 Beef Cows	200 to 800 Beef Cows	More than 800 Beef Cows
Number of farms	940,095	907,368	30,816	1,912
Percent of farms	100.0%	96.5%	3.3%	0.2%
Percent of value of production	100.0%	77.7%	16.4%	5.8%
Livestock value of production	56.0%	52.7%	60.8%	86.9%
Crop value of production	44.0%	47.3%	39.2%	13.1%b
Number of beef cows	39,623,169	26,422,578	10,511,161	2,689,430
Distribution of beef cows	100.0%	66.7%	26.5%	6.8%
Percent of beef cows owned	95.3%	96.0%	93.7%	94.1%
Percent of beef cows not owned	4.7%	4.0%	6.3%a	5.9%a
Number of sample farms with beef cows	4,132	3,548	495	89
Debt-to-Asset Ratios				
All Regions	0.0956	0.0916	0.1345	0.0931
Midwest	0.1447	0.1448	0.1700	d
Central	0.0893	0.0899	0.0797	d
EPA Derived Gross Cash Income Per Animal				
All Regions	$1,060.05	$1,073.81	$534.86	$861.83
Midwest	$1,011.78	$1,096.67	$501.99	$854.00
Central	$718.32	$709.65	$461.09	d
EPA Derived Net Cash Income Per Animal				
All Regions	$143.68	$127.31	$79.37	$256.28
Midwest	$190.39	$178.50	$80.71	$321.83
Central	$35.42	$22.80	$43.70	d

Source: USEPA and USDA/ERS, 1999a.
a = The relative standard error of the estimate exceeds 25 percent, but no more than 50 percent.
b = The relative standard error of the estimate exceeds 50 percent, but no more than 75 percent.
c = The relative standard error of the estimate exceeds 75 percent.
d = Data insufficient for disclosure.

Table 8-13. Income Statement and Balance Sheet for Farms with Beef Cows, by Size of Operation, 1997

Item	All Farms	Less than 200	200 to 800	More than 800
Income Statement				
Gross cash income	**44,679**	**35,030**	**242,478**	**1,436,244a**
Livestock income	21,202	15,107	148,993	854,011
Crop sales (incl. net CCC loans)	15,171	13,162	62,080a	212,917b
Government payments	1,958	1,658	d	d
Other farm-related income [1/]	6,348	5,103	d	d
Total variable expenses	**28,818**	**23,006**	**152,124**	**799,682a**
Livestock purchases	2,364	1,491	18,841	151,013b
Feed	4,789	3,743	23,415	200,870b
Other variable expenses [2/]	20,325	16,540	106,125a	434,771
Total fixed expenses	**9,805**	**7,871**	**54,372**	**209,476a**
Equals: Net cash farm income	**6,056**	**4,153**	**35,982**	**427,086a**
Less: Depreciation and Other [/3]	5,380	4,573	23,627	94,036a
Plus: Value of inventory change	5,034	4,132	44,296	-199,546c
Plus: Nonmoney income [4/]	4,419	4,358	6,206	4,606a
Equals: Net farm income	**10,130**	**8,069**	**62,856**	**138,110c**
Balance Sheet				
Farm assets	**420,235**	**358,236**	**1,735,700**	**8,642,843a**
Current assets	42,401	34,751	211,736	943,771
Non-current assets	377,834	323,485	1,523,964	7,699,072a
Land, buildings, and equipment [5/]	357,202	308,712	1,370,316	7,041,669a
Farm liabilities	**40,195**	**32,131**	**226,235**	**868,438a**
Current liabilities	13,627	10,083	86,646	518,852a
Noncurrent liabilities	26,568	22,049	139,590	349,586a
Farm equity	**380,041**	**326,105**	**1,509,465**	**7,774,405a**

Source: Based on USDA/ERS, 1999a. Copies of these data are in the rulemaking record (DCN 70063).
[1/]Machine-hire, custom work, livestock grazing, land rental, contract fees, and other farm-related sources.
[2/]Incl. livestock leasing, custom feed processing, bedding, grazing, supply, transportation, storage, general business expenses, and registration fees. Footnote (a) refers to an RSE on "other livestock-related" portion of the total.
[3/]Includes labor, non-cash benefits. Footnote (a) refers to an RSE on "non-cash benefits" portion of the total.
[4/]The value of home consumption plus an imputed rental value of farm dwellings.
[5/]The value of the operator's dwelling and associated liabilities are included if the dwelling was located on the farm. a = Relative standard error (RSE) of the estimate exceeds 25 percent, but no more than 50 percent.
b = RSE of estimate >50%, but <75%. c = RSE of estimate >75%. d = Data insufficient for disclosure.

Data shown in Table 8-13 are differentiated by selected size categories and reveal some differences among operations by size. The income statement data (and data in Table 8-12) point to increasing specialization as the size of an operation increases. There are no major differences in the proportion of animals not owned at the largest operations compared with that at the smallest operations. However, the smallest operations have proportionately lower expenditures on livestock-related expenses than larger operations. Expenditures on livestock and feed average about one-quarter of total variable expenses at an average beef operation with less than 200 head; operations with more than 800 head are associated with expenditures on livestock and feed averaging over 40 percent of total variable expenses (Table 8-13). These differences may be explained by differences in the degree of specialization and feeding strategies, and other factors.

Operating margins (measured in terms of average net cash farm income as a percentage of average gross cash income) among differently sized operations differ substantially: operations with less than 200 head show an operating margin of 12 percent, as compared to 30 percent at operations with more than 800 head (USDA/ERS, 1999a). However, the smallest operations show a relatively high return on assets (measured as average net farm income to average farm assets) compared with the largest operations: operations with less than 200 head show an average return on assets of 2.5 percent, as compared to 3.6 percent and 1.6 percent at operations with between 200 and 800 head and operations with more than 800 head, respectively (USDA/ERS, 1999a). See Table 8-13. The 1997 ARMS data include, among an average farm's assets, the value of the owner's home when it is located on the farm. Since smaller operations may be more likely to have the owner's dwelling located on the farm than larger operations, if dwelling values were excluded, the returns on the "business" assets might be higher for these smallest operations.

Section 4 of this report presents key financial data used for this analysis, shown in Table 8-15, that are calculated onto a per-animal basis. For the cattle sectors, total gross farm revenues are estimated to range from $500 to $860 per head (includes revenue from other farm-related sources). Net cash income ranges from $80 to $320 per head among CAFO models, depending on facility size and region (see Tables 4-5 and 4-6).

For the purpose of this analysis and because of lack of other statistically validated survey data, EPA uses the ARMS data for cow and calf operations to depict conditions at regulated cattle feeding operations. For the beef sectors, the data used by EPA reflect income and balance sheet information for farms with beef cows (shown in Tables 8-12 and 8-13). The National Cattlemen's Beef Association (NCBA) has expressed concern that the ARMS data are more reflective of cow-calf operations and represent few feedlots and, therefore, might not be representative of cattle feeding operations. Correspondence between EPA and NCBA on this issue is documented in the rulemaking record (Stott, 2000a; USEPA, 1999k and 2000m; NCBA, 1999). NCBA point out that the ARMS data reflect conditions across all cow and calf operations, both grazing and feedlots, and may not fully represent cattle feeding operations. Feedlot operations may be characterized by different financial conditions than grazing operations.

On the one hand, feedlots are more intensive finishing operations and might receive higher revenues per animal. On the other hand, feedlot operations might have lower non-livestock related revenues due to the highly specialize nature of these operations. Operating expenses and other financial indicators might also differ between the different types of operations in this sector. In addition, Stott (2000b) indicate that a low debt-to-asset ratio for cow-calf operations does not accurately represent conditions at cattle feedlots operate that tend to have higher debt due to cattle financing. Debt-to-asset ratios are higher at cattle feedlots than what is reported by USDA for cow-calf operations (Stott, 2000b).

As discussed in Section 8.1.3.2, financial data on cattle feeding operations is limited. To provide EPA with information on this sector, NCBA conducted a survey of its membership and provided aggregated summary information on financial conditions at cattle feeding operations (NCBA, 1999). As reported by NCBA, these data "are not intended as a statistical and conclusive financial analysis of the feedlot industry, but only a summary" (NCBA, 1999). The data provided to EPA include average, high, and low estimates of gross revenue, net cash income, assets, and liabilities, expressed on a per-head average occupancy (PHOA) basis and are not disaggregated by region or size of operation. NCBA also provided certain financial ratios for certain size categories: return on assets, current ratio, debt-to-equity, return on equity. These data are shown in Table 8-10 and are provided in the rulemaking record (NCBA, 1999, see—DCN 70073).

EPA did not base its analysis on these data since the data are not disaggregated by size and producing region and are inconsistent with EPA's modeling framework.[4] Also, EPA determined that the NCBA survey data, if used, might lead to difficulties in estimating impacts. This is particularly true with respect to debt-to-asset ratios derived from the NCBA data (USEPA, 2000n and ERG, 2000b). EPA calculates these ratios using average debt and average assets reported by NCBA (shown in Table 8-10). This results in debt-to-asset ratios that exceed 70 percent, compared to the 40 percent threshold for USDA's "vulnerable" category, as discussed in Section 4.2.5 (USDA/ERS, 2000g, 1977a and 1997e, Sommer et al., 1998). Without examining the actual underlying survey data provided by NCBA, EPA is not able to assess the validity of this derived ratio. Use of these data for this analysis, therefore, would typically lead to cattle feedlots being assumed as "baseline closures" based on the criteria developed for this EA. As such, these operations would be excluded from analysis since they would assume to close in the pre-regulatory baseline. Therefore, EPA believes that the USDA data may produce more usable data to estimate impacts for cattle operations than the NCBA data.

Additional reasons for not using these data in the analysis include: low response rate, lack of information on the statistical methodology used to compute averages, inability to reproduce some of the reported data, and various inconsistencies with other reported data by USDA, among

[4]NCBA reports that there is not a significant difference among cattle feeding operations by size and region (NCBA, 1999).

other factors. This assessment is contained in the rulemaking record (USEPA, 2000n; ERG, 2000b).

Although EPA does not to use these data, the NCBA data is useful, since it allows the Agency to evaluate how well the ARMS data for cow and calf operations data represent conditions at cattle feedyards. Compared to the ARMS data, the average NCBA survey data fall within the range of values for both of the revenue and expense categories reported in the average ARMS data. For example, average gross revenue reported by NCBA was $670 per head in 1997 (Table 8-10). This compares to a gross revenue range of $500 per head to $860 per head based on data in the 1997 ARMS (Table 4-5). The ARMS average data, however, do differ from the NCBA data for net cash income. For example, NCBA reports an average net cash income of $30 PHAO for 1999; this compares to a net cash income range of $80 to $320 per animal using the 1997 ARMS data (see Table 4-6). However, if the average NCBA data for revenue and expenses are used to calculate returns, the average net cash income values are about $110 PHAO (see data in Table 8-10), which is closer to the range of values based on USDA data for some model CAFOs. Given the lack of information about how these data are computed and the inability to reproduce the reported NCBA data, EPA is unable to fully evaluate these differences.

Dairy Operations

Data shown in Table 8-14 are distributed by broad facility size groups. As shown, more than 80 percent of operations have fewer than 100 milk cows. These operations account for about 40 percent of all milk cows (Table 8-14). There are fewer larger-sized operations with more than 500 milk cows (2 percent of all farms), and these operations raise only 6.8 percent of all beef cattle annually (Table 8-14). Smaller dairy operations with less than 100 milk cows are slightly more diversified than larger ones, with about 20 percent of all farm revenue from crops. This compares to dairy operations with more than 500 milk cows, where livestock comprises the bulk of all annual farm sales and only about 5 percent of farm revenues are from crops (Table 8-12).

Table 8-14 also shows the percentage of dairy cows owned by farmers compared to those not owned by farmers. EPA uses this information on animal ownership as an indication of the extent of production contract use in these sectors (see Section 2.3). Across all dairy operations in 1997, less than 2 percent of animals were not owned by farmers (Table 8-14) (USDA/ERS, 1999a).

Table 8-15 presents average income statement and balance sheet information for dairy operations in 1997, by size of operation. The data shown in Table 8-15 reveal some differences among operations by size. The income statement data (as well as the data in Table 8-12) point to some increasing specialization as the size of an operation increases. There are no major differences in the proportion of animals not owned at the largest operations compared with that at the smallest operations. Additionally, differences between the smallest operations and all operations on the basis of expenditures on livestock-related expenses are not large. Expenditures

Table 8-14. Typical Financial Characteristics of Dairy Operations, By Size of Operation

Item	All Farms	Less than 100	100 to 500	More than 500
Number of farms	129,034	104,863	21,678	2,492
Percent of farms	100.0%	81.3%	16.8%	1.9%
Percent of value of production	100.0%	45.3%	28.7%	26.0%
Livestock value of production	85.9%	82.3%	83.5%	94.8%
Crop value of production	14.1%	17.7%	16.5%	5.2%a
Number of milk cows	10,503,839	4,052,239	3,462,016	2,989,584
Distribution of milk cows	100.0%	38.6%	33.0%	28.5%
Percent of milk cows owned	98.6%	97.8%	98.3%	99.9%
Percent of milk cows not owned	1.4%	2.2%a	1.7%a	0.1%
Number of sample farms with milk cows	1,334	707	487	140
Debt-to-Asset Ratios				
All Regions	0.2000	0.1742	0.2185	0.2616
Pacific	0.2080	0.1271	0.2305	0.2366
Midwest	0.2115	0.2014	0.2260	d
EPA Derived Gross Cash Income Per Animal				
All Regions	$2,572.65	$2,584.26	$2,523.81	$2,612.95
Pacific	$2,672.05	$6,786.18	$2,342.77	$2,567.29
Midwest	$2,583.60	$2,619.74	$2,498.11	d
EPA Derived Net Cash Income Per Animal				
All Regions	$486.92	$543.20	$465.64	$435.17
Pacific	$371.59	$564.70	$224.73	$401.74
Midwest	$535.14	$598.06	$443.71	d

Source: USEPA and USDA/ERS, 1999a.

a = The relative standard error of the estimate exceeds 25 percent, but no more than 50 percent.

b = The relative standard error of the estimate exceeds 50 percent, but no more than 75 percent.

c = The relative standard error of the estimate exceeds 75 percent.

d = Data insufficient for disclosure.

Table 8-15. Income Statement and Balance Sheet for Dairy Operations, by Size of Operation, 1997

Item	All farms	Less than 100	100 to 500	More than 500
Income Statement				
Gross cash income	**209,423**	**99,864**	**403,057**	**3,134,685**
Livestock income	185,516	83,945	357,504	2,962,979
Crop sales (incl. net CCC loans)	10,941	8,161	d	d
Government payments	2,547	1,943	4,942	7,118a
Other farm-related income [1/]	10,419	5,815	d	d
Total variable expenses	**145,227**	**63,732**	**282,565**	**2,379,377**
Livestock purchases	1,300a	788	d	d
Feed	70,782	24,536	127,881	1,519,860
Other variable expenses [2/]	73,143	38,408	145,945	738,358
Total fixed expenses	**24,560**	**15,141**	**46,128**	**233,247**
Equals: Net cash farm income	**39,637**	**20,991**	**74,364**	**522,061a**
Less: Depreciation and Other [3/]	18,643	10,529a	36,688	203,110a
Plus: Value of inventory change	11,113	4,848	26,254	143,001a
Plus: Nonmoney income [4/]	4,468	4,327	4,993	5,828
Equals: Net farm income	36,574	19,637	68,923	467,780a
Balance Sheet				
Farm assets	**657,364**	**457,331**	**1,106,763**	**5,164,500**
Current assets	91,278	53,380	156,738	1,116,417
Non-current assets	566,086	403,952	950,025	4,048,083
Land, buildings, and equipment [5/]	474,209	358,787	603,425	2,168,935
Farm liabilities	**131,456**	**79,653**	**241,821**	**1,351,024**
Current liabilities	32,323	19,570	60,566	323,253
Farm equity	**525,908**	**377,679**	**864,942**	**3,813,476**

Source: Based on USDA/ERS, 1999a. Original data are in the rulemaking record (DCN 70063).

[1/]Machine-hire, custom work, livestock grazing, land rental, contract fees, and other farm-related sources.

[2/]Includes livestock leasing, custom feed processing, bedding, grazing, supply, transportation, storage, general business expenses, and registration fees.

[3/]Includes labor, non-cash benefits. Footnote a refers to non-cash benefits portion of the total.

[4/]The value of home consumption plus an imputed rental value of farm dwellings.

[5/]The value of the operator's dwelling and associated liabilities are incl. if the dwelling was located on the farm.

a = Relative standard error (RSE) of the estimate exceeds 25 percent, but no more than 50 percent.

b = RSE of estimate >50%, but <75%. c = RSE of estimate >75%. d = Data insufficient for disclosure.

on livestock and feed average about 40 of total variable expenses at an average dairy operation with less than 100 milk cows; all operations are associated with expenditures on livestock and feed averaging about 50 percent of total variable expenses (Table 8-14). These differences may be explained by the degree of specialization and feeding strategies, and other factors.

Operating margins (measured in terms of average net cash farm income as a percentage of average gross cash income) among differently sized operations do not differ substantially: operations with less than 100 milk cows show an operating margin of 21 percent, as compared to 17 percent at operations with more than 500 milk cows (USDA/ERS, 1999a). However, the smallest operations show a lower return on assets (measured as average net farm income to average farm assets) compared with the largest operations: operations with less than 100 milk cows show an average return on assets of 4.3 percent, as compared to 6.2 percent and 9.1 percent at operations with between 100 and 500 milk cows and operations with more than 500 milk cows, respectively (USDA/ERS, 1999a). See Table 8-15. The 1997 ARMS data include, among an average farm's assets, the value of the owner's home when it is located on the farm. Since smaller operations may be more likely to have the owner's dwelling located on the farm than larger operations, if dwelling values were excluded, the returns on the "business" assets might be higher for these smallest operations.

Section 4 of this report presents key financial data used for this analysis, shown in Table 8-15, that are calculated onto a per-animal basis. For the dairy sector, total gross farm revenues are estimated to range from $2,340 to $2,620 per head (includes revenue from other farm-related sources). Net cash income ranges from $230 to $600 per head among CAFO models, depending on facility size and region (see Tables 4-5 and 4-6).

8.2 PROFILE OF BEEF AND DAIRY PROCESSING SECTORS

Beef feedlots and dairy farms represent the beginning of the meat and dairy products marketing chain, which also includes meat packers, food processors, and retailers. Feedlots and dairy farms provide the raw materials to slaughterers, packers, and processors in the form of live cattle and raw farm milk. These are then converted into cuts of meat and various processed foods and milk and dairy products. These products are eventually sold to consumers at retail establishments.

By NAICS code, beef and dairy processors are classified under animal slaughtering (NAICS 311611); meat processed from carcasses (NAICS 311612); rendering and meat byproduct processing (NAICS 311613); dry, condensed and evaporated dairy manufacturing (NAICS 311514); fluid milk manufacturing (NAICS 311511); creamery butter manufacturing (NAICS 311512); and cheese manufacturing (NAICS 311513).

Additional information on the processing sectors in these industries is provided in Section 2, which also shows how EPA estimates the potential number of processors that may be

affected by the proposed regulations as co-permittees. As discussed in Section 2.4, EPA does not anticipate that processors within the beef and dairy industries would be subject to the proposed CAFO regulations as co-permittees. Largely, EPA's determination is based on the fact that production contracting accounts for only a small share of beef and milk production (USDA/ERS, 1999a and 1996c; Heffernan, et al., 1999). Also, animal ownership on beef and dairy farms is mostly by the farm operator (USDA/ERS, 1999a).

Contractual agreements in these sectors are typified by marketing contracts and animal ownership on beef and dairy farms is mostly by the farm operator (USDA/ERS, 1999a and 1996c). Less than two percent of all beef farms produced cattle and calves under contract in 1993, which consisted mostly of marketing contracts where farms or feedlots agree to sell packers a certain amount of cattle on a predetermined schedule (USDA/ERS, 1996c). In the dairy sector, milk is produced under marketing orders through verbal agreement with their buyer or cooperative. Although not technically a "contract" since quantity and a final price are not specified before the sale, milk production through use of such quasi-marketing contracts leaves management decision with farmers since ownership is retained while the commodity is produced.

There is limited use of production contracts in these sectors, but these are mostly used to specialize in one stage of livestock production, such as to raise stocker cattle (e.g., backgrounding operations) and to raise replacement heifers (USDA/ERS, 1996c). This allows both farm operators (i.e., contractor and contractee) to increase business volume with limited facilities through specialization. For example, custom feeding operations provide cattle feeding services but in some cases do not own the animals. In these cases, a beef feedlot operation may agree to fatten or "finish" cattle not owned by the operation for a fee based on weight gain prior to slaughter. Cattle backgrounding or stocker operations grow feeder cattle from any time between when calves are weaned until they are on a finishing ration in the feedlot (Rasby et al., 1994). Background cattle can be owned by a finishing feedlot, retained by ranchers or owned by the backgrounding feedlot (Duncan et al., 1997). The contractual agreements at these operations can also vary greatly with ownership retained by the rancher, backgrounding operation, or finishing feedlot. Stocker operations also typically combine calves from several cow-calf operations into a larger production unit (Ward, 1997).

In the dairy sector, farms may use production contracts with other operators to produce a stream of replacement heifers (USDA/ERS, 1996d). Heifer replacement operations raise pre-calving bovine cows under contract and may specialize in rasing calves, young heifers, breeding, or the entire cycle from weaning to calving (USDA/APHIS, 1993). These operations may have contracts to raise heifers for a period of time or may raise their own heifers to sell.

8.2.1 Structure of the Red Meat (Beef) Industry

One-half of all fresh and frozen meat received by retailers is supplied through own or group owned meat warehouses, some which have processing facilities on site. Meat packing

facilities supply the other one-half of all of all fresh and frozen meat received by retailers (USDA/GIPSA, 1996b).

The meat packing industry is composed of slaughterhouses, where livestock are slaughtered and further-processed, and specialized meat processors, which do not slaughter but manufacture sausage, luncheon meats, and other prepared products (Kohls and Uhl, 1998). These companies may cover all meat product types, including cattle, calves, steer and heifers, pork, and sheep and lambs. There are also rendering facilities that are involved in the manufacture of a wide variety of by-products, including hides, pelts, lard, offal, that have value in the manufacture of clothing, foodstuffs, fertilizers, and industrial products (Kohls and Uhl, 1998).

Unlike the poultry industry, where a chicken may be hatched, raised, slaughtered and processed all in the same complex or at least by the same company in a matter of weeks, the marketing chain for cattle involves ownership that may change hands a number of times, often across distant locations, e.g.; from a breeding farm in Georgia to foraging in Texas to an Iowa feedlot before being shipped off to slaughter. Because of obvious biological differences such as size, feed requirements, reproduction and growth, the same economies of scale that allow for complete integration in chicken production do not exist in producing a cow. Nevertheless, economies of scale are significant in the later stages of cattle production, such as at feeder lots where cattle are fed to market weight and at slaughter and packing facilities.

The marketing of cattle and calves is largely decentralized. Most cattle and calves are procured through private (non-public) arrangements and spot market agreements whereby farmers and feedlots sell their cattle directly to packers or use country dealers who buy and sell livestock for profit. In 1995, 86 percent of all cattle and 75 percent of all calves were procured on the open or spot market (USDA/GIPSA, 1996b). More traditional methods of procurement, such as public markets, terminal markets and auctions, comprised little more than one-tenth of all cattle purchases by meat packers in 1995 (USDA/GIPSA, 1996b). Use of public markets has been steadily declining, although use is higher in the areas of less concentrated production away from the Cornbelt. Public markets are more significant for exchange between farmers of breeder and feeder cattle than for trade in fattened cattle.

Although the beef industry is not as integrated as the poultry and hog sectors, the relationship between cattle producers and processors has become more interconnected, either through contractual arrangement or through actual ownership (integration) by processors (Bastian et al., 1994). Less common forms of procurement, such as formula pricing, forward contracting and marketing agreements,[5] are becoming more common in the beef sector, especially among larger beef packers. Backward integration of meat packers into livestock feeding either through packer ownership of feedlots or custom feeding by feedlots under contract to meat packers is also becoming more prevalent, such as packer feeding of calves.

[5]Marketing agreements are long-term purchase agreements in which the packer agrees to purchase a specified number of cattle per specified time period.

These methods of procurement, however, still comprise a relatively small share of overall cattle and calf procurement. A 1992-1993 survey by USDA's GIPSA (Grain Inspection, Packers and Stockyards Administration) of procurement methods commonly used by steer and heifer packers indicate that more than 82 percent of procurement transactions (lot purchases) were conducted through the open (spot) market (USDA/GIPSA, 1996c). Marketing agreements and forward pricing accounted for 8 percent and 7 percent, respectively, of purchases. Packer-fed or owned cattle accounted for under 3 percent of procurement transactions.

Two important trends influencing the meat packing industry have been specialization and decentralization. In the past, plants served centralized markets and consisted of large facilities that slaughtered most types of animals and also processed various meat products. Today, plants tend to specialize in slaughtering only one species of animal; processing is done in a separate facility (Kohls and Uhl, 1998). This shift is also marked by movement westward closer to fed cattle supplies, away from terminal markets, and an increase in direct selling to packers (USEPA, 1999h). Meat packers have not integrated forward into retailing operations, although there has been backward integration of meat packers into livestock feeding. Barriers such as little product differentiation, geographically dispersed components of production, and small, highly diverse production units, have prevented further vertical integration (Ward, 1997).

Additionally, rapid consolidation and mergers among packing companies have resulted in fewer and larger firms and a highly concentrated industry structure. In 1997, the top four largest meat packing firms slaughtering cattle controlled 68 percent of the market; these four firms slaughtering steers and heifers accounted for 80 percent of the market (USDA/GIPSA, 1996c and 1998). Consolidation is being driven by the large economies of scale possible in the meat packing industry. MacDonald (2000) reports that the largest plants have significant advantages in slaughter costs and the largest cattle packers can deliver beef to buyers at costs 3 percent below what plants one-quarter the size can.

Pricing issues for fed cattle remain a primary concern in the industry, particularly since cattle prices have been low in recent years. Rapid consolidation and mergers between packing companies have resulted in fewer and larger firms and a highly concentrated industry structure. In 1997, the top four largest meat packing firms slaughtering cattle controlled 68 percent of the market; the four-firm concentration ratio for the slaughter of steers and heifers accounted for 80 percent (USDA/GIPSA, 1996a and 1998). The largest beef packer, IBP Incorporated, alone controls nearly 40 percent of the market (USDA/GIPSA, 1996a). Such concentration has led to concerns that producers in most areas may have access to a single buyer, thus reducing the producers ability to bid up prices and enabling the packer to pay farmers less for their cattle. Of particular concern among cattle producers is the issue of "captive supplies" of beef held by packers and allegations that packers are engaging in price discrimination by using their own supply of fed cattle to undercut prices.

The ability for meat packers to exercise oligopsony or monopsony market power in the procurement of cattle has been the topic of extensive research and also congressional debate

(USDA/GIPSA, 1997). Most research, however, has failed to conclusively show that concentration in the meat packing industry has negatively affected farm prices paid for cattle (Nelson and Hahn, 1996). A study by USDA did conclude that higher levels of regional buyer concentration may have a negative and statistically significant effect on cattle prices; however, the change in prices paid is most likely small (USDA/GIPSA, 1997b).

8.2.2 Structure of the Milk and Dairy Foods Industry

Most milk enters marketing channels from dairy farms as raw farm milk and is processed as fluid milk and also a wide range of dairy products, including cheese, butter, ice cream and frozen desserts, "soft" manufactured products (yogurt, cottage cheese, sour cream, etc.), processed milk products (dry, evaporated, and condensed milk), and also milk by-products (lactose, whey, casein, etc.). The processing and manufacturing of dairy products from farm milk is performed primarily by either dairy cooperative or by investor-owned processing firms, such as Kraft and Dean Foods and also supermarkets like Safeway and Kroger.

Milk and dairy production has become increasingly specialized but has not experienced vertical integration in the same way as other livestock industries. In part this is attributable to the large role of farmer-owned, farmer-controlled dairy cooperatives in the industry. Cooperatives handle about 80 percent of milk delivered to plants and dealers, with the remaining milk produced by "independent" or "non-member" dairy farmers (Jacobson and Cropp, 1994). Cooperatives are farmer-owned, farmer-controlled for-profit corporations which operate at cost by allocating net margins back to milk producers on a patronage basis. In most cooperatives, milk producers enter a 1- to 3-year membership agreement committing the producer to marketing all milk through the cooperative (Jacobson and Cropp, 1994). Because farm milk must be collected daily and requires refrigeration and other special handling, this places dairy farmers at a marketing disadvantage and increases the likelihood that they will participate in a cooperative. Through the bargaining power of cooperatives, dairy farms can often secure prices above the minimum federal or state market order prices (Wolf and Hamm, 1998).

Cooperatives may either negotiate milk prices with processors or process milk themselves. There are two basic types of dairy cooperatives: bargaining-only and manufacturing/processing (Manchester and Blayney, 1994). Bargaining-only cooperatives accounted for 68 percent of dairy cooperatives in 1992. Such cooperatives negotiate prices and terms of trade for their members milk and tend to be smaller milk handlers, supplying approximately 25 percent of cooperative milk. Farmers are limited to producing raw milk and the role of the cooperative is to negotiate the best price for that milk. Manufacturing/processing cooperatives, on the other hand, own facilities to process milk and manufacture dairy products. Dairy cooperatives with processing facilities represented 32 percent of all cooperatives in 1992, but their share of all cooperative milk was 75 percent, most of which was produced by the large diversified cooperatives (Manchester and Blayney, 1994).

Markets for milk are often regional because of perishability and bulk and high handling costs. Fluid milk processing is characterized as an oligopolistic industry at the regional level, with most major cities served by a few processor firms (Kohls and Uhl, 1998). The number of fluid milk companies continues to decline. From 1982 to 1992, the number of fluid milk processors dropped from 853 to 525 companies (USDC, 1994). Economies of size in fluid milk processing and distribution and continued dairy company mergers and plant consolidation has contributed to farm-gate pricing concerns among dairy farmers. A USDA study of price transmission between the farm and retail sector for fluid milk from 1983 to 1990 indicate asymmetric pricing adjustment since retail prices tended to react more quickly and completely to farm price increases than to farm price decreases (Hansen et al., 1994). Other dairy products, such as cheese and ice cream, have a wider, more national market in which there is greater product differentiation and competition.

8.3 CAFO ANALYSIS

This section presents the results of EPA's CAFO level analysis for the dairy and cattle sectors, including fed cattle, veal and heifer operations. As discussed in Section 4, EPA uses a representative farm approach to estimate the impact of the proposed CAFO regulations on affected operations. Each model CAFO differs by facility size groupings and key farm production regions. For these sectors, the production regions reflected in this analysis are the Midwest (MW), Central (CE), and Pacific (PA) regions, as defined in Table 4-1 (Section 4). Section 4 provides a summary of how EPA developed the various financial models used for this analysis. The *Development Document* (USEPA, 2000a) provides additional information on the cost models developed by EPA.

Results presented in this section focus on the "BAT Option" that refers to EPA's proposed technology option for the CAFO regulations that would impose Option 3 requirements for the beef (including heifers) and the dairy subcategories and Option 5 requirements for veal subcategory (described in Section 3). For the purpose of this discussion, the "*two-tier structure"* refers to BAT Option 3 (beef, heifer, and dairy operations) and BAT Option 5 (veal) in combination with NPDES Scenario 4a that covers all operations with more than 500 AU. Where indicated, the two-tier structure may refer to the alternative threshold at 750 AU (Scenario 5). The "*three-tier structure"* refers to BAT Option 3 (beef, heifer, and dairy operations) and BAT Option 5 (veal) in combination with NPDES Scenario 3 that covers operations down to 300 AU based on certain conditions. Results for other technology options and scoping scenarios considered by EPA as part of this rulemaking are also summarized. Table 3-1 summarizes EPA's proposed and alternative ELG Options and NPDES Scenarios discussed in this section.

Section 8.3.1 presents a summary of the cost input data EPA uses for this analysis, including (post-tax) per-animal and per-facility costs for EPA's model CAFOs. Section 8.3.2 presents EPA's estimate of the aggregate, national level costs of the proposed CAFO regulations for the beef and dairy sectors. Section 8.3.3 presents EPA's predicted financial impacts to this

sector in terms of the estimated number and percentage of CAFOs that are expected to experience financial stress as a result of the proposed CAFO regulations. For some sectors, EPA evaluates economic impacts to CAFOs in this sector two ways—assuming that a portion of the costs may be passed on from the CAFO to the consumer (Partial CPT) and assuming that no costs passthrough so that all costs are absorbed by the CAFO (Zero CPT).

8.3.1 Overview of Cost Input Data

Tables 8-16 through 8-18 present estimated input costs that EPA uses to assess costs and impacts to the cattle and dairy sectors. These data include the post-tax annualized compliance costs, estimated on a per-animal and per-facility. These costs reflect EPA's estimated capital costs, annual operating and maintenance costs, start-up or first year costs, and also recurring costs (discussed in the *Development Document*, USEPA, 2000a). These facility costs are annualized using the approach described in Appendix A of this report. Appendix A shows the individual sector costs by model across all technology options.[6]

Other input data for this analysis include EPA's estimate of the number of affected CAFOs and baseline financial conditions at model CAFOs. EPA's estimate of the number of animal confinement operations that would be defined or designated as CAFOs is presented in Section 8.1.2.1 (see Table 8-2). Additional information is provided in Section 2 of this report. The average baseline financial conditions for model CAFOs that EPA assumes for this analysis are presented in Section 4. Tables 4-5 through 4-9 in that section present the financial data used in this analysis and include gross farm revenues, net cash flow, and debt-to-asset ratios for this sector, as derived by EPA using the 1997 ARMS data.

For beef, heifer, and dairy operations, Table 8-16 presents the estimated post-tax annualized compliance costs (in 1997 dollars) for these sectors under the proposed BAT Option (Option 3). For veal operations, Table 8-16 presents estimated compliance costs the proposed BAT Option for that subcategory (Option 5). Table 8-17 presents cost estimates for Option 3A that reflects the cost of additional requirements, such as liners, groundwater monitoring, and recordkeeping costs, for those facilities (beef, heifer, and dairy operations only) where there is a hydrologic link to surface waters. For this analysis, based on available data and information, EPA's analysis assumes that 24 percent of the affected operations have a hydrologic connection to surface waters, as described in the *Development Document* (USEPA, 2000a). Option 3 costs (Table 8-16) reflect average cost conditions across all operations—including those operations with and without a hydrologic link.[7]

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[6]The estimated costs are the same across the NPDES Scenarios, i.e., technology option costs do not change by scenario, although total costs change due to the difference in numbers of CAFOs affected under each scenario.

[7]Alternatively, estimated costs for "Option 3B" reflect representative facility level costs where no hydrologic link is present. Option 3, 3A, and 3B costs are provided in the *Development Document.*

As shown in Table 8-16, post-tax costs for the BAT Option (Option 3) range from $1.70 to $41.00 per animal for the beef sector, from $3.70 to $7.20 per animal for the veal sector (Option 5), from $3.50 to $27.70 per animal for the heifer sector, and from $16.80 to $61.50 per animal for the dairy sector. The range in costs is explained by differences in the assumed availability of land for manure applications (see definition of Category 1, 2, and 3 in Section 4.1.2), region, and size of CAFO. As these tables show, costs on a per-animal basis generally decrease as model CAFO size increases.

As shown in Table 8-17, the range of costs are much higher under Option 3A. Costs range from $13.80 to $80.10 per animal for the beef sector, from $18.18 to $60.86 for the heifer sector, and from $85.60 to $235.20 per animal for the dairy sector. Tables 8-16 and 8-17 also present compliance costs on a per-CAFO basis. Per CAFO compliance costs range from $3,180 (Option 3) to $725,868 (Option 3A) in the beef sector, from $2,010 to $2,880 (Option 5) in the veal sector, from $4,250 (Option 3) to $40,710 (Option 3A) in the heifer sector, and from $9,330 (Option 3) to $172,610 (Option 3A) in the dairy sector. In general, the annualized post-tax compliance costs per representative CAFO increase with model size.

When Option 3 costs are considered without the 3A component (the lower end of the ranges shown in Table 8-16), the costs per animal are generally within ranges that have been deemed affordable in several studies of regulatory impacts that focused on the dairy sector. In an analysis of the economic impacts on livestock producers from wastewater and runoff control requirements in coastal areas, incremental costs were reported on a per-animal basis (Heimlich and Barnard, 1995; DPRA, 1995). The range of estimated costs—$17 to $49 per dairy cow–was determined to be affordable for producers (DPRA, 1995). Similarly, researchers at Cornell University surveyed milk producers in New York who indicated that they would likely stay in business if they had to pay up to $50 per cow for environmental improvements (Poe, et al., 1999). In general, most studies may amortize costs but do not always account for tax savings. Therefore, EPA's estimates may reflect the upper-end of costs compared to other cost estimates. However, as documented in the *Development Document* (USEPA, 2000a), EPA believes that its estimated costs are conservative.

The costs presented here are those assumed to be incurred by the regulated CAFO and do not account for the likelihood that some compliance costs will be passed on through the marketing levels in the industry.

Table 8-18 presents the range of per animal post-tax compliance costs in 1997 dollars for the cattle and dairy sectors for each regulatory option, including the BAT Option and Option 3A. (The proposed and alternative ELG Option and NPDES Scenarios considered by EPA during this rulemaking are defined in Table 3-1.) As shown, for beef operations, option costs range from $0.10 to $80.30 per animal. For veal, costs range from $2.70 to $18.70 per animal (Option 5). For heifer operations, option costs range from $0.70 to $60.80 per animal. For dairies, the option costs range from $3.60 to $235.20 per animal. The proposed BAT Option costs (Option 3) has

Table 8-16. Per-Animal and Per-Facility Post-tax Annualized Compliance Costs (Option 3)

Sector	Reg.	Model	Average Animals Per Facility	Cat. 1	Cat. 2	Cat. 3	Cat. 1	Cat. 2	Cat. 3
				Per Animal			Per Facility		
				$1997					
Beef	MW	Small	112	$28.37	NA	NA	$3,178	NA	NA
		M1	455	$29.60	$32.26	$15.87	$13,470	$14,680	$7,221
		M2	777	$21.00	$23.29	$11.31	$16,317	$18,096	$8,791
		L1	1,877	$8.26	$15.31	$7.12	$15,501	$28,739	$13,357
		L2	30,003	$4.61	$7.79	$3.83	$138,195	$233,728	$114,866
	CE	M1	455	$31.74	$41.03	$10.81	$14,440	$18,669	$4,920
		M2	777	$24.12	$31.25	$7.21	$18,741	$24,282	$5,602
		L1	1,877	$9.39	$17.82	$3.37	$17,623	$33,445	$6,318
		L2	30,003	$4.52	$12.06	$1.65	$135,620	$361,844	$49,582
Veal	MW	M1	400	$7.20	NA	NA	$2,881	NA	NA
		M2	540	$3.72	NA	NA	$2,009	NA	NA
Heifers	PA	M1	400	$22.94	$27.72	$10.63	$9,178	$11,088	$4,254
		M2	750	$15.41	$17.43	$6.86	$11,555	$13,072	$5,142
		L1	1,500	$5.35	$7.79	$3.51	$8,032	$11,691	$5,265
	MW	M1	400	$24.14	$27.49	$14.13	$9,657	$10,997	$5,653
		M2	750	$16.11	$18.58	$9.37	$12,082	$13,936	$7,031
		L1	1,500	$5.74	$6.60	$5.04	$8,603	$9,901	$7,563
Dairy	PA	M1	235	$48.23	$53.78	$39.72	$11,334	$12,637	$9,334
		M2	460	$31.66	$47.34	$25.49	$14,563	$21,776	$11,724
		L1	1,419	$20.02	$41.09	$16.83	$28,406	$58,308	$23,883
	MW	Small	200	$60.39	NA	NA	$12,078	NA	NA
		M1	235	$58.74	$61.51	$50.50	$13,804	$14,454	$11,868
		M2	460	$39.99	$50.07	$34.05	$18,394	$23,031	$15,665
		L1	1,419	$27.37	$38.76	$24.32	$38,840	$55,004	$34,504

Source: USEPA. Costs are shown for the BAT Option: Option 3 (beef, heifers, and dairy operations) and Option 5 (veal operations). See Table 4-1 for definitions of model regions and sizes. Costs reflect the estimated capital costs, annual operating and maintenance costs, start-up or first year costs, and also recurring costs assumed by EPA (see the *Development Document*, USEPA, 2000a) that are annualized using the approach described in Appendix A.

Table 8-17. Per-Animal and Per-Facility Post-tax Annualized Compliance Costs (Option 3A)

Sector	Reg.	Model	Average Animals Per Facility	Cat. 1	Cat. 2	Cat. 3	Cat. 1	Cat. 2	Cat. 3
				Per Animal			Per Facility		
				$1997					
Beef									
Beef	MW	Small	112	$80.06	NA	NA	$8,967	NA	NA
		M1	455	$64.02	$67.24	$51.06	$29,127	$30,592	$23,232
		M2	777	$47.97	$50.56	$38.69	$37,276	$39,282	$30,065
		L1	1,877	$27.46	$34.65	$26.50	$51,549	$65,034	$49,740
		L2	30,003	$15.88	$19.08	$15.12	$476,586	$572,348	$453,566
	CE	M1	455	$70.62	$80.32	$50.31	$32,133	$36,544	$22,893
		M2	777	$54.64	$61.98	$38.06	$42,459	$48,162	$29,570
		L1	1,877	$30.06	$38.59	$24.19	$56,426	$72,441	$45,402
		L2	30,003	$16.65	$24.20	$13.79	$499,538	$725,968	$413,786
Veal	MW	M1	NA	NA	NA	NA	NA	NA	NA
		M2	NA	NA	NA	NA	NA	NA	NA
Heifers	PA	M1	400	$58.34	$60.86	$46.71	$23,337	$24,344	$18,686
		M2	750	$40.34	$43.96	$32.14	$30,259	$32,973	$24,105
		L1	1,500	$23.91	$27.14	$22.28	$35,870	$40,710	$33,421
	MW	M1	400	$53.46	$55.50	$44.33	$21,382	$22,200	$17,733
		M2	750	$36.78	$39.57	$30.50	$27,587	$29,680	$22,873
		L1	1,500	$18.66	$20.16	$18.18	$27,990	$30,235	$27,271
Dairy	PA	M1	235	$228.84	$235.23	$221.62	$53,778	$55,279	$52,080
		M2	460	$148.83	$164.88	$143.21	$68,462	$75,843	$65,879
		L1	1,419	$100.45	$121.64	$97.44	$142,544	$172,613	$138,268
	MW	Small	200	$228.08	NA	NA	$45,617	NA	NA
		M1	235	$183.75	$187.38	$176.79	$43,181	$44,034	$41,547
		M2	460	$126.14	$136.62	$120.80	$58,027	$62,845	$55,566
		L1	1,419	$88.44	$99.96	$85.57	$125,497	$141,838	$121,418

Source: USEPA. Costs are shown for the BAT Option: Option 3 (beef, heifers, and dairy operations) and Option 5 (veal operations). See Table 4-1 for definitions of model regions and sizes. Costs reflect the estimated capital costs, annual operating and maintenance costs, start-up or first year costs, and also recurring costs assumed by EPA (see the *Development Document*, USEPA, 2000a) that are annualized using the approach described in Appendix A.

Table 8-18. Summary of the Range of Post-Tax Annualized Compliance Costs Per Animal, By Option

Option	Beef		Veal		Heifer		Dairy	
	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.
	($1997)							
Option 1	$0.08	$16.69	$2.66	$3.61	$0.67	$16.85	$3.60	$41.79
Option 2	$0.08	$35.32	$3.72	$7.20	$0.67	$20.87	$3.60	$30.66
Option 3	$1.65	$80.32	$4.75	$7.78	$3.51	$60.86	$16.83	$235.23
Option 4	$1.77	$50.20	$12.86	$18.74	$6.43	$37.32	$19.22	$79.26
Option 5	$26.12	$68.12	$3.72	$7.20	$1.42	$23.68	$15.01	$51.41
Option 6	$0.08	$35.32	$3.72	$7.20	$0.67	$20.87	$3.98	$51.40
Option 7	$0.42	$35.32	$3.72	$7.20	$0.67	$21.92	$10.60	$50.30

Source: USEPA.

the highest maximum costs in the beef, heifer, and dairy sectors, reflecting estimated Option 3A costs. The minimum cost per animal for Option 3 generally ranges between the costs for alternative options. The maximum cost per animal for Option 3 (without Option 3A) also ranges between the maximum costs for alternative options.

8.3.2 Estimates of National Annual Compliance Costs

Table 8-19 presents EPA's estimate of the aggregate national level compliance costs for the proposed BAT Option (Option 3 for beef, heifer, and dairy operations and Option 5 for veal operations) and the co-proposed two-tier structure (Scenario 4a at 500 AU threshold) and the three-tier structure (Scenario 3). Costs under the two-tier structure at the 750 AU threshold (Scenario 5) are also briefly discussed, along with other regulatory alternatives considered by EPA during this rulemaking. The description of the proposed BAT Option and the co-proposed NPDES Scenarios is provided in Section 3.

Across all cattle and dairy operations, EPA estimates total incremental costs (post-tax) of the proposed BAT Option at $255 million and $302 million per year under the two-tier structure (500 AU) and the three-tier structure, respectively (Table 8-19). Under the two-tier structure at 750 AU threshold, estimated costs are $216 million per year. EPA estimates that the largest portion of total costs would be borne by the beef sector, estimated to incur roughly half of total costs to these sectors. Among fed cattle operations, EPA estimates that the cost of the BAT Option is $135 million and $144 million per year under each of the co-proposed structures; more than 80 percent of these costs are estimated to be borne by operations with more than 1,000 AU.

Table 8-19. Total Estimated Post-Tax Compliance Costs

Scenario/Size	Option	Fed Cattle	Veal	Heifers	Dairy
		($1997 millions)			
>1,000 AU	Number of CAFOs	2,080	10	300	1,450
	Cost of Proposed BAT Option	$118.5	$0.02	$2.8	$65.7
	Cost of Alternative Options	$40.2-$500.2	$0.01-$0.07	$0.5-$4.1	$39.2-$74.4
Total Two-Tier Structure (>750 AU)	Number of CAFOs	2,480	40	420	2,260
	Cost of Proposed BAT Option	$125.3	$0.07	$4.2	$86.9
	Cost of Alternative Options	$43.3 - $513.6	$0.05 - $0.24	$1.2 - $6.0	$53.2 - $96.3
Total Two-Tier Structure (>500 AU)	Number of CAFOs	3,080	90	800	3,760
	Cost of Proposed BAT Option	$135.0	$0.17	$8.6	$111.4
	Cost of Alternative Options	$47.8-$532.5	$0.12-$0.59	$3.6-$12.0	$60.7-$125.5
Total Two-Tier Structure (>300 AU)	Number of CAFOs	4,070	210	1,050	6,970
	Cost of Proposed BAT Option	$148.3	$0.50	$10.9	$152.4
	Cost of Alternative Options	$54.9-$555.2	$0.3-$1.5	$4.9-$15.4	$77.3-$180.4
Total Three-Tier Structure (>300 AU)	Number of CAFOs	3,210	140	980	6,480
	Cost of Proposed BAT Option	$143.5	$0.54	$10.6	$146.9
	Cost of Alternative Options	$48.6-$544.4	$0.2-$1.2	$4.5-$15.1	$72.2-$177.8

Source: USEPA. Costs are shown for the BAT Option: Option 3 (beef, heifers, and dairy operations) and Option 5 (veal operations). See Table 4-1 for definitions of model regions and sizes.
Numbers of CAFOs include defined CAFOs only. Costs include those for designated beef and dairy operations.

EPA estimates that the dairy sector would incur compliance costs of $111 million per year under the two-tier structure (500 AU threshold), with about 60 percent of these costs attributable to CAFOs with more than 1,000 AU. See Table 8-19. Under the three-tier structure, estimated costs are $147 million per year, with about 45 percent incurred by CAFOs with more than 1,000 AU. Between the two modeled regions (PA and MW), the Pacific region would bear the greatest proportion of compliance costs, estimated at more than 72 percent under the two-tier structure and 66 percent under the three-tier structure. Costs are more or less evenly split between the two modeled regions (CE and MW), but tend to be somewhat higher in the Midwest region.

A total of $9 million per year would be incurred by heifer operations under the two-tier structure; under the three-tier structure, compliance costs to heifer operations are estimated at $11 million per year (Table 8-19). The major portion of this cost would be borne by heifer operations with fewer than 1,000 AU (67 percent to 74 percent) under each of the proposed tier structures. Between the two modeled regions (CE and MW), the Central region incurs 86 percent of the costs to this sector under the two-tier structure (500 AU threshold) and 81 percent under the three-tier structure. At veal operations, EPA estimates that compliance costs would total $0.2 million per year under the two-tier structure and $0.5 million per year under the three-tier structure (Table 8-19). The major portion of this cost would be borne by veal operations with fewer than 1,000 AU, estimated at 71 percent to 95 percent of cost depending on scenario.

8.3.3 Analysis of CAFO Financial Impacts

EPA's impact analysis uses a representative farm approach to estimate the number of CAFOs that would experience affordable, moderate, or stress impacts as a result of the CAFO regulations, as described in Section 4. Economic achievability is determined by applying the proposed criteria, which include a sales test and also analysis of post-compliance cash flow and debt-to-asset ratio for an average model CAFO. Impacts are extrapolated to all CAFOs in the beef and dairy sector using the estimated number of operations represented by each model CAFO.

As described in Section 4.2.5, if an average model facility is determined to incur economic impacts under regulation that are regarded as "Affordable" or "Moderate," then the proposed regulations are considered economically achievable. ("Moderate" impacts are not expected to result in closure and are considered to be economically achievable by EPA.) If an average operation is determined to incur "Stress," then the proposed regulations are not considered to be economically achievable. "Affordable" and "Moderate" impacts are associated with positive post-compliance cash flow over a 10-year period and a debt-to-asset ratio not exceeding 40 percent, in conjunction with a sales test result that shows that compliance costs are less than 5 percent of sales ("Affordable") or between 5 and 10 percent ("Moderate"). "Stress" impacts are associated with negative cash flow or if the post-compliance debt-to-asset ratio exceeds 40 percent, or sales test results that show costs equal to or exceeding 10 percent of sales.

Using this classification scheme, EPA's analysis indicates that some beef and dairy operations would experience financial stress as a result of the proposed CAFO regulations under both the proposed BAT Option and co-proposed scenario, assuming compliance costs cannot be passed through the marketing chain.

As discussed previously, financial impacts are assessed to cattle and dairy operations assuming that 24 percent of these operations will incur costs associated with groundwater controls, such as liners, groundwater monitoring, and recordkeeping, where a hydrologic connection from the confinement areas to surface water is present (Option 3A). Tables 8-20 and 8-21 combine the results of the analysis of Option 3 and Option 3A

Table 8-20 presents the results of EPA's analysis for beef, veal, and heifer operations. Under the two-tier structure, 10 beef operations are expected to experience financial stress under the two-tier structure; no veal or heifer operations are expected to experience financial stress under this co-proposed scenario. Under the three-tier structure, 20 beef and 30 heifer operations are expected to experience financial stress under the three-tier structure; no veal operations are expected to experience financial stress (Table 8-20). No designated CAFOs in these sectors are expected to experience financial stress under either co-proposed scenario. All beef CAFOs that are estimated to experience financial stress are operations that are assumed to have a hydrologic link to surface water (i.e., assumed to incur estimated Option 3A costs). EPA did not evaluate economic impacts to cattle operations under a cost passthrough scenario.

Table 8-21 shows results for the dairy sector. Under the two-tier structure, EPA estimates that 320 dairy operations are expected to experience financial stress among defined CAFOs. Under the three-tier structure, EPA estimates that 610 dairy operations are expected to experience financial stress (Table 8-21). All dairies that are estimated to experience financial stress are operations that are assumed to have a hydrologic link to surface water. EPA also estimated that an additional 20 designated dairies would experience financial stress under both the co-proposed structures. The number of designated dairies that are expected to experience stress in this analysis are operations that are designated due to a groundwater link to surface waters and are projected over a 10-year period.

These results for the dairy sector assume that no costs are passed through to consumers. However, EPA expects that long-run market and structural adjustment by milk and meat producers will diminish the estimated impacts to these sectors as costs are passed through to consumers. To evaluate economic impacts to dairy operations under a cost passthrough scenario, EPA assumes a 67 percent cost passthrough assumption. More information on the method and data that EPA used to estimate this cost passthrough value is provided in Section 4.2.6.[8] Assuming this level of cost passthrough, EPA's analysis indicates that no dairy operations would

[8]However, EPA uses a different estimate of the long-run price elasticity of supply than that shown in Table 4-14. For this analysis, EPA uses an estimate reported by Buxton (1985) of by 0.501. This has the effect of lowering the "selected" CPT value from 86 percent (shown in Table 4-14) to 67 percent, assumed for this analysis.

Table 8-20. Impacted CAFOs Under ELG Options & NPDES Scenarios, Beef, Veal, and Heifer Operations

Alternative ELG Options and NPDES Scenarios	Beef			Veal			Heifers		
	Affordable	Moderate	Stress	Affordable	Moderate	Stress	Affordable	Moderate	Stress
	(Number of Affected Operations)								
Two-Tier (>1000)									
Number of CAFOs	2,080			10			300		
BAT Option	2,080	0	0	10	0	0	300	0	0
Alt. ELG Options	2,080	0	0	10	0	0	300	0	0
Two-Tier (>750 AU, Scenario 5)									
Number of CAFOs	2,480			40			420		
BAT Option	2,370	100	0	40	0	0	390	30	0
Alt. ELG Options	2,080-2,480	0-380	0 -20	40	0	0	300-420	0-120	0
Two-Tier (>500 AU, Scenario 4a)									
Number of CAFOs	3,080			90			800		
BAT Option	2,830	240	10	90	0	0	680	120	0
Alt. ELG Options	2,080-3,080	0-970	0 -30	90	0	0	300-800	0-500	0
Two-Tier (>300 AU, Scenario 4b)									
Number of CAFOs	4,080			210			1,050		
BAT Option	2,880	1,150	40	210	0	0	850	150	50
Alt. ELG Options	2,080-4,080	0-1,820	0-180	210	0	0	300-1,050	0-560	0-190
Three-Tier (Scenario 3)									
Number of CAFOs	3,210			140			980		
BAT Option	2,540	650	30	140	0	0	800	150	30
Alt. ELG Options	2,080-3,210	0-1,040	0-100	140	0	0	300-980	0-560	0-110

Source: USEPA. Impacts are shown for the BAT Option: Option 3 (beef, heifers, and dairy operations) and Option 5 (veal operations). See Table 4-1 for definitions of model regions and sizes. Results do not show estimated impacts to designated operations.

Table 8-21. Impacted CAFOs Under ELG Options & NPDES Scenarios, Dairy Operations

Alternative ELG Options and NPDES Scenarios	Total # CAFOs	Affordable	Moderate	Stress	Affordable	Moderate	Stress
		Zero Cost Passthrough			Partial Cost Passthrough		
		(Number of Affected Operations)					
Two-Tier (>1000)							
BAT Option	1,450	1,450	0	0	1,450	0	0
Alt. ELG Options		1,450	0	0	1,450	0	0
Two-Tier (>750 AU, Scenario 5)							
BAT Option	2,260	2,070	50	130	2,210	50	0
Alt. ELG Options		1,480-2,260	0-220	0-560	0-2,260	0-50	0
Two-Tier (>500 AU, Scenario 4a)							
BAT Option	3,760	3,240	200	320	3,550	200	0
Alt. ELG Options		1,580-3,760	0-850	0-1,330	0-3,760	0-200	0
Two-Tier (>300 AU, Scenario 4b)							
BAT Option	7,140	5,810	640	700	6,500	640	0
Alt. ELG Options		1,580-7,140	0-2,660	0-2,900	0-7,140	0-640	0
Three-Tier (Scenario 3)							
BAT Option	6,480	5,300	560	610	5,910	560	0
Alt. ELG Options		1,570-6,480	0-2,350	0-2,560	0-6,480	0-560	0

Source: USEPA. Impacts are shown for the BAT Option: Option 3 (beef, heifers, and dairy operations) and Option 5 (veal operations). See Table 4-1 for definitions of model regions and sizes. Results do not show estimated impacts to designated operations.

experience financial stress as a result of the proposed regulations (Table 8-21). Even without assumptions of cost passthrough, EPA's analysis shows that stress impacts would not be experienced by a substantial number of operations, as compared to the total number of affected confinement operations in these sectors.

Based on these results, EPA proposes that the proposed CAFO regulations are economically achievable under the co-proposed scenarios. Section 5 provides additional information that compares the co-proposed scenarios with other alternative scenarios.

Tables 8-22 through 8-24 present a more detailed breakout of EPA's affordability results under the proposed BAT Option by model CAFO type, land availability, and type of operation (beef, veal, heifer, and dairy). The results are the same for the two-tier and three-tier structure because only the numbers of CAFOs represented by each model type changes. The impacts are presented by model CAFO and indicate the level of impact under each of the economic affordability criteria. These results reflect a "zero" cost passthrough assumption.

These tables show that the financial stress impacts at beef operations in the Medium 1 and Medium 2 models for certain land availability categories in the CE region are being driven by the revenue test and cash flow criterion (revenue test of greater than 10 percent is considered an indication of financial stress). Heifer stress impacts are being driven by the revenue test and the discounted cash flow criterion in the Medium 1 model, MW region, for certain land availability categories. Dairy stress impacts are being driven by the revenue test and/or the discounted cash flow criterion in the Medium1 and Medium 2 models (all categories) in the PA region.

8.4 PROCESSOR ANALYSIS

EPA does not evaluate the potential costs to cattle and dairy processors because EPA does not expect that the proposed co-permitting requirements to affect meat packing and processing facilities in these industries, for reasons outlined in Section 2. A brief summary of the basis for EPA's assumption is provided in Section 8.2. As discussed, EPA's determination is based on the fact that production contracting accounts for only a small share of beef and milk production (USDA/ERS, 1999a and 1996c; Heffernan, et al., 1999). Also, animal ownership on beef and dairy farms is mostly by the farm operator (USDA/ERS, 1999a).

8.5 MARKET ANALYSIS

This section presents the results of EPA's market model analysis for the beef and dairy sectors. The results presented in this section briefly compare the results of the two-tier (500 AU threshold) and the three-tier (Scenario 3) structures that are being co-proposed by EPA. These results measure changes for the beef and dairy industries and do not differentiate between the types of operations within each sector. Additional results on the alternative regulatory options and scenarios considered by EPA as part of this rulemaking are provided in Section 5.4. For further explanation of the market model and sources of the baseline input data, see Section 4.4 and Appendix B.

Table 8-22. Economic Achievability Results for Beef/Heifer CAFOs (Option 3) and Veal CAFOs (Option 5)

CAFO Model	Category 1			Category 2			Category 3		
	Sales	DCF	DA	Sales	DCF	DA	Sales	DCF	DA
Beef									
MW Region									
Small	7.5%	Pass	0.11	NA	NA	NA	NA	NA	NA
Medium 1	5.5%	Pass	0.16	6.0%	Pass	0.17	3.0%	Pass	0.15
Medium 2	3.9%	Pass	0.16	4.4%	Pass	0.16	2.1%	Pass	0.15
Large 1	1.0%	Pass	0.10	1.8%	Pass	0.10	0.8%	Pass	0.10
Large 2	0.5%	Pass	0.10	0.9%	Pass	0.10	0.4%	Pass	0.10
CE Region									
Medium 1	6.3%	Pass	0.19	8.2%	Pass	0.20	2.2%	Pass	0.18
Medium 2	4.8%	Pass	0.19	6.2%	Pass	0.19	1.4%	Pass	0.18
Large 1	1.1%	Pass	0.10	2.1%	Pass	0.10	0.4%	Pass	0.10
Large 2	0.5%	Pass	0.10	1.4%	Pass	0.10	0.2%	Pass	0.10
Veal									
MW Region									
Medium 1	1.3%	Pass	0.13	NA	NA	NA	NA	NA	NA
Medium 2	0.7%	Pass	0.13	NA	NA	NA	NA	NA	NA
Heifer									
MW Region									
Medium 1	4.5%	Pass	0.16	5.1%	Pass	0.16	2.6%	Pass	0.15
Medium 2	3.0%	Pass	0.15	3.5%	Pass	0.15	1.8%	Pass	0.15
Large 1	0.7%	Pass	0.10	0.8%	Pass	0.10	0.6%	Pass	0.10
CE Region									
Medium 1	4.6%	Pass	0.18	5.5%	Pass	0.19	2.1%	Pass	0.18
Medium 2	3.1%	Pass	0.19	3.5%	Pass	0.19	1.4%	Pass	0.18
Large 1	0.6%	Pass	0.10	0.9%	Pass	0.10	0.4%	Pass	0.10

Source: USEPA.

Table 8-23. Economic Achievability Results for Dairy CAFOs (Option 3)

CAFO Model	Category 1			Category 2			Category 3		
	Sales	DCF	DA	Sales	DCF	DA	Sales	DCF	DA
PA Region									
Medium 1	2.1%	Pass	0.27	2.3%	Pass	0.27	1.7%	Pass	0.27
Medium 2	1.4%	Pass	0.26	2.0%	Pass	0.26	1.1%	Pass	0.26
Large 1	0.8%	Pass	0.26	1.6%	Pass	0.26	0.7%	Pass	0.26
MW Region									
Small	2.3%	Pass	0.27	NA	NA	NA	NA	NA	NA
Medium 1	2.4%	Pass	0.26	2.5%	Pass	0.26	2.0%	Pass	0.26
Medium 2	1.6%	Pass	0.25	2.0%	Pass	0.25	1.4%	Pass	0.25
Large 1	1.0%	Pass	0.30	1.5%	Pass	0.30	0.9%	Pass	0.30

Source: USEPA.

A summary of the key results of the market model is shown in Tables 8-25 and 8-26 for the two-tier and three-tier structures indicating the predicted changes in farm and retail prices, quantities, national and regional employment, and national economic output.

Compared to a baseline producer price of $66.09 per hundredweight (cwt), EPA's market model predicts that the proposed CAFO regulations will raise producer cattle prices by $0.21 per cwt to $0.23 per cwt, or less than 0.34 percent of the baseline producer price, depending on the co-proposed tier structure (Table 8-25). Raw milk prices will rise by under 10 cents per cwt from the baseline price of $13.38 per cwt. (All prices are in 1997 dollars.) At the retail level, consumer prices for beef products will rise less than one cent per pound. The retail dairy product price index rises by 0.61 to 0.78. These price increases are driven by slight changes in the amount produced at the farm level and thus available for consumption (Tables 8-25 and 8-26). At the retail commodity level, EPA's market model predicts that U.S. beef imports will rise by 0.2 percent, compared to baseline imports; U.S. beef exports will decrease by 0.1 percent compared to baseline. U.S. dairy product imports rise by 0.8 percent compared to baseline; U.S. dairy product exports decrease by 0.1 percent compared to baseline exports.

Table 8-24. Economic Achievability Results for Beef, Heifer, and Dairy CAFOs (Option 3A)

CAFO Model	Category 1			Category 2			Category 3		
	Sales	DCF	DA	Sales	DCF	DA	Sales	DCF	DA
Beef									
MW Region									
Small	7.5%	Pass	0.13	NA	NA	NA	NA	NA	NA
Medium 1	9.1%	Pass	0.21	9.5%	Pass	0.21	7.2%	Pass	0.20
Medium 2	6.4%	Pass	0.19	6.8%	Pass	0.20	5.2%	Pass	0.19
Large 1	2.3%	Pass	0.12	2.9%	Pass	0.12	2.2%	Pass	0.12
Large 2	1.3%	Pass	0.11	1.5%	Pass	0.11	1.2%	Pass	0.11
CE Region									
Medium 1	10.7%	Fail	0.25	12.1%	Fail	0.25	7.6%	Pass	0.23
Medium 2	7.8%	Pass	0.24	8.8%	Fail	0.24	5.4%	Pass	0.22
Large 1	2.5%	Pass	0.12	3.2%	Pass	0.12	2.0%	Pass	0.12
Large 2	1.3%	Pass	0.11	1.9%	Pass	0.11	1.1%	Pass	0.11
Heifer									
MW Region									
Medium 1	10.0%	Pass	0.19	10.4%	Pass	0.19	8.3%	Pass	0.18
Medium 2	6.9%	Pass	0.18	7.4%	Pass	0.18	5.7%	Pass	0.17
Large 1	2.2%	Pass	0.11	2.3%	Pass	0.11	2.1%	Pass	0.11
CE Region									
Medium 1	11.6%	Fail	0.24	12.1%	Fail	0.24	9.3%	Pass	0.22
Medium 2	8.0%	Pass	0.22	8.8%	Pass	0.22	6.4%	Pass	0.21
Large 1	2.8%	Pass	0.11	3.2%	Pass	0.11	2.6%	Pass	0.11
Dairy									
PA Region									
Medium 1	9.8%	Fail	0.42	10.0%	Fail	0.42	9.5%	Fail	0.41
Medium 2	6.4%	Fail	0.38	7.0%	Fail	0.38	6.1%	Fail	0.38
Large 1	3.9%	Pass	0.36	4.7%	Pass	0.36	3.8%	Pass	0.36
MW Region									
Small	8.7%	Pass	0.36	NA	NA	NA	NA	NA	NA
Medium 1	7.4%	Pass	0.34	7.5%	Pass	0.34	7.1%	Pass	0.34
Medium 2	5.0%	Pass	0.31	5.5%	Pass	0.31	4.8%	Pass	0.31
Large 1	3.4%	Pass	0.37	3.8%	Pass	0.37	3.3%	Pass	0.37

Source: USEPA.

Table 8-25. Summary of Market Model Results for the Beef Sector

Variable	Pre-Regulatory Value/Units	Two-Tier Structure		Three-Tier Structure	
		BAT Option	Range of Alternative Options	BAT Option	Range of Alternative Options
Farm Products					
Price	$66.09/cwt	$66.30	$66.17 - 66.89	$66.32	$66.17 - 66.91
Quantity [a/] Produced	47,967 mil. lbs.	47,902	47,724 - 47,944	47,898	47,717 - 47,943
Quantity Exported	331 mil. lbs.	330	328 - 331	330	328 - 331
Quantity Imported	2,400 mil. lbs.	2,408	2,403 - 2,429	2,408	2,400 - 2,410
Retail Products					
Price	$2.80/lb.	$2.80	$2.80 - 2.82	$2.80	$2.80 - 2.82
Quantity Demanded	25,824 mil. lbs.	25,795	25,715 - 25,814	25,793	25,712 - 25,813
Quantity Exported	2,136 mil. lbs.	2,134	2,129 - 2,135	2,134	2,129 - 2,135
Quantity Imported	2,343 mil. lbs.	2,347	2,344 - 2,356	2,347	2,344 - 2,356
Employment Reduction [b/]					
Direct Farm	336,700 FTEs	793	284 - 2,969	850	294 - 3,045
Direct Processor	145,617 FTEs	109	39 - 410	117	41 - 421
Total Economy	129.6 mil. FTEs	4,599	1,648 - 17,218	4,929	1,704 - 17,661
Output Reduction					
National	$ million	458	164 - 1,715	491	170 - 1,760
Regional Farm and Processing Employment Reduction					
Pacific	FTEs	49	18 - 184	53	18 - 189
Central	FTEs	409	147 - 1,533	439	152 - 1,573
Midwest	FTEs	439	157 - 1,646	471	163 - 1,688
South	FTEs	1	0 - 3	1	0 - 3
Mid-Atlantic	FTEs	3	1 - 13	4	1 - 13
Total	FTEs	902	323 - 3,379	967	334 - 3,466

Source: Post-regulatory changes are estimated by USEPA. Pre-regulatory prices, quantities, and trade volumes, see Table 4-16 (Section 4). Pre-regulatory employment, see Table 2-17 (Section 2).

[a/] Includes veal and heifer.

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

Table 8-26. Dairy Summary of Market Model Results for the Dairy Sector

Variable	Pre-Regulatory Value/Units	Two-Tier Structure		Three-Tier Structure	
		BAT Option	Range of Alternative Options	BAT Option	Range of Alternative Options
Farm Products					
Price	$13.38/cwt	13.44	$13.41 - 13.45	13.46	$13.42 - 13.48
Quantity Produced	156,100 mil. lbs.	155,907	155,883 - 155,994	155,852	155,792 - 155,975
Retail Products					
Price	145.50 Index	146.11	145.83 - 146.18	146.28	145.89 - 146.47
Quantity Demanded	156,100 mil. lbs.	155,907	155,883 - 155,994	155,852	155,792 - 155,975
Quantity Exported	5,244 mil. lbs.	5,239	5,238 - 5,241	5,237	5,235 - 5,241
Quantity Imported	4,383 mil. lbs.	4,411	4,398 - 4,414	4,419	4,401 - 4,427
Employment Reduction [a/]					
Direct Farm	483,800 FTEs	492	270 - 554	633	319 - 784
Direct Processor	141,400 FTEs	19	11 - 22	25	13 - 31
Total Economy	129.6 mil. FTEs	3,200	1,754 - 3,604	4,117	2,075 - 5,099
Output Reduction					
National	$ million	296	162 - 333	381	192 - 472
Regional Farm and Processing Employment Reduction					
Pacific	FTEs	262	144 - 295	337	170 - 418
Central	FTEs	152	83 - 171	195	98 - 241
Midwest	FTEs	30	17 - 34	39	20 - 49
South	FTEs	35	19 - 39	45	23 - 56
Mid-Atlantic	FTEs	32	18 - 37	42	21 - 52
Total	FTEs	512	280 - 576	658	332 - 815

Source: Post-regulatory changes are estimated by USEPA. Pre-regulatory prices, quantities, and trade volumes, see Table 4-16 (Section 4). Pre-regulatory employment, see Table 2-17 (Section 2).

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

Absorption of compliance costs by the producers and small declines in quantities are expected to result in fewer jobs in the beef and dairy industry. Tables 8-25 and 8-26 also present EPA's estimates of both the direct (i.e., farm and processor level) and total (i.e., national level)

reductions in employment for the beef and dairy sectors. Overall, changes in national aggregate employment in the beef sector are estimated to range from a total reduction of 4,600 to 4,930 jobs, measured in full-time equivalents (FTEs). EPA estimates employment losses in the dairy sector at 3,200 to 4,120 FTEs, depending on tier structure. This analysis also does not adjust for offsetting increases in other parts of the economy and other sector employment that may be stimulated as a result of the proposed regulations, such as the construction and farm services sectors.

EPA's estimated job losses are estimated throughout the entire economy, using available modeling approaches described in Section 4, and are not attributable to the regulated community only. As shown in Tables 8-25 and 8-26, about 80 percent of these estimated job losses are in the non-agricultural or farm services support industries (i.e., indirect or induced employment affects; see Section 4.4).

At the CAFO level, EPA predicts that job losses in the cattle production sector associated with the proposed CAFO regulations will range from 790 to 850 jobs under the proposed BAT Option, depending on tier structure (Table 8-25). Job losses in the dairy farming sector will range from 490 to 630 jobs. These estimates include CAFO owner-operators and employed family members, as well as hired farm labor. This estimated reduction compares to an estimated total farm level employment of 336,700 FTEs in the beef sector and 483,800 FTEs in the dairy sector nationwide (Table 2-17; Abel, Daft, and Earley, 1993, as updated by EPA). EPA estimates that job losses in the beef processing sectors will range from 110 to 120 (Table 8-25). In the dairy processing sector, EPA estimates 20 to 25 jobs (Table 8-26) will be lost. These estimated losses compare to the more than 145,000 persons employed in beef processing and 141,000 in dairy processing in 1997 (USDC, 1999a).

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 disaggregates the national employment results to examine the potential regional employment impacts of the proposed CAFO regulations. The method EPA uses to allocate estimated national level impacts is based on production shares across states and does not take into account existing environmental practices or other production factors (see Section 4.4). Table 8-25 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 (Table 8-25). Table 8-26 shows that the results of EPA's analysis indicate that the more recently developed dairy operations in the Pacific region will be most affected, followed by operations in the Central region. The loss in dairy agricultural employment is estimated at less than 0.01 percent of total regional employment; about half of the estimated agricultural job losses in the dairy sector are expected in the Pacific region (Table 8-26). Economy-wide employment losses are estimated at less than 0.015 percent for both sectors compared to the baseline.

SECTION NINE

INITIAL REGULATORY FLEXIBILITY ANALYSIS

9.1 THE REGULATORY FLEXIBILITY ACT (RFA) AS AMENDED BY THE SMALL BUSINESS REGULATORY ENFORCEMENT FAIRNESS ACT (SBREFA)

This section considers the effects that the proposed CAFO regulations may have on small livestock and poultry operations as required by 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). The purpose of the RFA is to establish as a principle of regulation that agencies should tailor regulatory and informational requirements to the size of entities, consistent with the objectives of a particular regulation and applicable statutes. The RFA generally requires an agency to prepare a regulatory flexibility analysis of 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."[1] Small entities include small businesses, small organizations, and governmental jurisdictions.

For this proposed rulemaking, EPA could not conclude that costs are sufficiently low to justify "certification." Instead, EPA complied with all RFA provisions and conducted outreach to small businesses, convened a Small Business Advocacy Review (SBAR) panel, and prepared an initial regulatory flexibility analysis (IRFA).[2] This analysis is detailed in this section and represents EPA's assessment of the impacts of the proposed CAFO regulations on small businesses in the livestock and poultry sectors. Section 9.2 outlines EPA's initial assessment of small businesses in the sectors affected by the proposed regulations. Section 9.3 presents EPA's analysis (IRFA) and summarizes the steps taken by EPA to comply with the RFA. Section 9.4 presents the data, methodology, and results of EPA's analysis of impacts to small businesses for this rulemaking.

9.2 INITIAL ASSESSMENT

EPA guidance on implementing RFA requirements suggests the following must be addressed in an initial assessment (USEPA, 1999i). First, EPA must indicate whether the proposal is a rule subject to notice-and-comment rulemaking requirements. EPA has determined

[1] The preparation of an IRFA for a proposed rule does not legally foreclose certifying no significant impact for the final rule (USEPA, 1999i).

[2] This analysis or a summary of the analysis must be published in the *Federal Register* at the time of publication of a proposal.

that the proposed CAFO regulations are subject to notice-and-comment rulemaking requirements. Second, EPA should develop a profile of the affected small entities. EPA has developed 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 also in Sections 6, 7, and 8 of this EA. Much of the profile information covered in these sections of this report applies to small businesses. Additional information on small businesses in the livestock and poultry sectors is provided in Sections 9.2 and 9.3. 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.

Section 9.2.1 reviews the SBA 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 9.2.2 then uses the definitions of small entities laid out in Section 9.2.1 to estimate the number of operations that meet this small business definition. Finally, using the information developed in Sections 9.2.1 and 9.2.2, Section 9.2.3 presents the results of EPA's initial assessment. This assessment provides a first level screen of potential impacts to small CAFO businesses and serves as a signal for additional analysis.

9.2.1 Definition of Small CAFO Businesses

The RFA defines a "small entity" as a small not-for-profit organization, small governmental jurisdiction, or small business. There are no small governmental operations that operate CAFOs. There may be a few not-for-profit organizations that operate CAFOs, but complete information is not available to warrant inclusion of not-for-profit organizations in this analysis. This analysis therefore focuses only on small businesses that are defined or designated as CAFOs. (Section 3 describes the circumstances under which an AFO is defined or designated as a CAFO and is subject to the proposed regulations.)

The RFA requires, with some exception, that EPA define small businesses according to its 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.[3]

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

[3] In September, 2000, SBA updated the basis for its size standard to NAICS codes from Standard Industrial Classification (SIC) codes (USGPO, 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.

Table 9-1 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, 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 $0.5 million per year (for the hog, dairy, broiler, and turkey sectors) to less than $1.5 million per year (for the beef feedlot sector), averaged over the most recent three fiscal years (USGPO, 1996; SBA, 1998). The exception is the revenue threshold for a small chicken egg operation (layer sector), which SBA has defined as a business that generates up to $9 million annually.

Table 9-1. SBA Revenue Size Standards for Small Livestock and Poultry Operations

NAICS Code (SIC Code)	NAICS Industry Description	SBA Size Standard [a/]	EPA-Proposed Revenue Cutoff
112112 (0211)	Cattle Feedlots	$1.5 million	same as SBA
11221 (0213)	Hog and pig farming	$0.5 million	same as SBA
11212 (0241)	Dairy cattle and milk production	$0.5 million	same as SBA
11232 (0251)	Broilers and other meat-type chickens	$0.5 million	same as SBA
11231 (0252)	Chicken egg production	$9.0 million	$1.5 million
11233 0253	Turkey production	$0.5 million	same as SBA

Source: SBA (1998); USGPO (1991a, 1991b and 1996); U.S. Census Bureau (2000).

[a/]SBA Size Standards by NAICS code (13 CFR Part 121) correspond to classifications under SIC classification.

EPA believes that the definition of small business for the egg laying sector (revenues of $9 million per year) might not truly characterize a small business in this sector. Therefore, EPA is proposing to use an alternative definition, as allowed by the RFA:

> "...an agency, after consultation with the Office of Advocacy of the Small Business Administration and after the opportunity for public comment, establishes one or more definitions of such term which are appropriate to the activities of the agency and publishes such definition(s) in the Federal Register." 5 U.S.C. §601(3).

EPA's alternative definition identifies a small business for egg laying operations as any operation that generates up to $1.5 million in annual revenue (see Table 9-1). Because this definition of a small business is not the definition established under the RFA, EPA is specifically seeking comment on the use of this alternative definition. EPA has also consulted with the SBA Chief Counsel for Advocacy on the use of this alternative definition (USEPA, 1999d). EPA believes this definition better reflects the agricultural community's sense of what constitutes a small business and more closely aligns with the small business definitions codified by SBA for other animal operations.

There are four broad reasons why EPA believes that its alternative definition of small egg laying operations is more appropriate for the purpose of this rulemaking. These include: (1) EPA's definition is more consistent with size classes used by USDA and industry; (2) EPA's definition reflects the financial and institutional realities of the egg industry; (3) EPA's definition reflects similarities among the sectors of the poultry industry; and (4) EPA's definition captures the relevant segments of the industry (USEPA, 1999d). The four reasons for using the alternative definition of small egg laying operations are summarized below. Additional supporting data and analysis are provided in the rulemaking Record (USEPA, 1999d; USEPA, 2000f).

First, EPA's alternative definition is more consistent with size classes used by USDA (Madison, 1999) and more generally accepted by the regulated community (Gregory, 1999; Staples, 1998). USDA describes size classes reflective of farm level conditions at egg laying operations in terms of the number of houses, where a house has approximately 100,000 to 110,000 hens. Based on USDA's size classes, a small farm has a single house; a medium farm has two to five houses; and a large farm has more than five houses (i.e., more than 500,000 hens). Using USDA data, EPA estimates that a "small" egg operation by USDA standards generates approximately $1.5 million in annual revenue (USEPA, 1999d and 2000f).[4]

In contrast, a definition of $9 million in annual revenue fails to reflect farm level conditions based on USDA size classes and matching opinions from the farming community. Such an operation corresponds to an operation with more than six houses (with approximately 600,000 hens). EPA does not believe an operation with six chicken houses should be characterized as "small" for the proposed CAFO regulations. EPA visited one such facility. The facility resides on more than 200 acres and has an annual production of over 180 million eggs. The facility's extensive customer base includes three major supermarket chains and the U.S. military. Its distribution system spans four states. A facility with such a high production level and extensive customer base is not a small business.[5] EPA's alternative definition would decrease confusion and facilitate communication with the regulated community (both large and small businesses) and with other stakeholders.

Second, EPA's alternative definition better reflects the financial and institutional realities of the egg industry. EPA focuses its regulatory analyses for the proposed CAFO regulations at the animal production level since it is the operator who directly incurs all costs associated with the management and disposal of manure generated from animals that are raised or housed onsite. EPA believes, based on a preliminary review of the background information supporting the SBA definition (USGPO, 1991a and 1991b) that the $9 million definition applies to entities at a different level in the marketing chain—e.g., to large cooperatives or integrators, rather than farms. The alternative definition would allow EPA to better focus on the needs and concerns of those

[4]EPA estimates are derived using USDA-reported 1997 data: average yield of 255 eggs per layer per year (USDA/NASS, 1998b) and average annual producer price of 66.7 cents per dozen (USDA/NASS, 1998a).

[5]Information on EPA's farm site visits is in the rulemaking record.

businesses that are most likely to experience economic hardship associated with regulatory compliance.

Third, EPA's alternative definition better reflects similarities among the sectors of the poultry industry. EPA's analysis focuses on three sectors: egg laying, broiler, and turkey meat. The SBA definitions differ substantially between the egg laying sector and the other two sectors. As shown in Table 9-1, the small-business definition for layer operations is $9 million in annual revenue; the small-business definition for both broiler and turkey operations is $0.5 million. At the farm level, however, there are structural similarities among these three sectors, suggesting that small business definitions should not be so disparate for these operations. The sectors use similar technologies and similar manure management techniques. They have similar costs of production. They have similar industrial organization and marketing arrangements. Measured at the animal production level, the SBA definition of a small broiler or turkey operation is consistent with USDA's definition of a small- or medium-sized operation (based on the number of animals and housing structures, as discussed above).

In fact, prior to 1991, the SBA definition for layer operations was much closer to the definitions for the other two poultry sectors. The earlier SBA definition for layer operations was $1.0 million. The definition was revised to $7 million in 1991, and then escalated to $9 million to account for inflationary changes (USGPO, 1991a and 1991b; Ray, 1999). One of the reasons cited for the 1991 increase was the "limited participation of small egg producers in government procurement" (USGPO, 1991a). For the regulatory flexibility assessment of the proposed CAFO regulations, EPA concludes that the alternative definition is more comparable to the definitions for other livestock sectors and is therefore more appropriate than the existing definition.

Finally, EPA's alternative definition is more appropriate in terms of capturing the relevant segments of the industry. Under EPA's alternative definition, small layer operations would account for roughly 60 percent of annual egg production (USEPA, 2000f). In contrast, under SBA's definition, small operations would account for approximately 90 percent of annual egg production. If EPA were to use SBA's definition, a very large share of total annual egg output would be generated from "small" operations. This would be inconsistent with the analysis of the broiler and turkey sector, where smaller operations represent roughly one-half of each sector's respective annual production. This would further contradict expectations by SBA in terms of the percent of sales attributable to small operations. According to SBA, about 99 percent of all farms in the economy are small and account for approximately 62 percent of sales (Perez, 2000; USEPA, 2000g). This agrees with the realities of the agricultural sector where the majority of farms are small, but account for a relatively small share of overall production. The trend in agriculture towards fewer, larger farms highlights that larger operations—while relatively few in number—represent a greater share of overall output.

EPA also considered another alternative definition for all six animal sectors based on the number of animals raised or housed at the CAFO site (USEPA, 2000e, 1999a, 1999l, and 1999n). Following discussions with representatives from both SBA and OMB during the SBAR Panel

process, EPA decided not to use this alternative definition for each of the animal sectors (USEPA, 2000g). A complete summary of EPA's correspondence with SBA on its proposal and use of an alternative definition is contained in the rulemaking record (see DCN 70509, DCN 70507, DCN 70473, DCN 70472, DCN 70511, DCN 70797, and DCN 93001).

9.2.2 Number of Small Businesses Affected by the Proposed CAFO Regulations

There are three steps for determining the number of small CAFO businesses that may be affected by the proposed 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 proposed, EPA estimates the number of small businesses that would be subject to the proposed requirements. These steps are described in the following sections.

9.2.2.1 Equating SBA Size Standards with Animal Inventory

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 of 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 on site at an equivalent small business in each sector. For egg laying operations, EPA's alternative revenue definition of small business is used.

EPA estimates the number of animals at an operation to match SBA's definitions using SBA's 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). (This calculation is shown below.) Per-animal financial data are calculated by multiplying the average value of the reported financial data per farm by the total number of farms and then dividing this by the total number of animals. (More information on this calculation is presented in Section 4.2.4.2 of this report.) The average per-animal revenues assumed for this analysis are shown in Table 9-2.

Financial data used by EPA are from the USDA's 1997 ARMS database. These data include farm financial data and corresponding summary information that match the reported average revenue to the total number of farms and the total number of animals in the sample set.

Table 9-2. Number of Small CAFOs That May Be Affected by the Proposed 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 Small AFOs	Two-Tier (500 AU) "Small" CAFO Businesses	Three-Tier "Small" CAFO Businesses
Cattle [c/]	$1.5	$1,060	1,400	106,450	2,280	2,600
Dairy	$0.5	$2,573	200	109,740	50	50
Hogs	$0.5	$363	1,400	107,880	300	300
Broilers	$0.5	$2	260,000	34,530	9,470	13,410
Egg Layers	$9.0	$25	365,000	ND	ND	ND
	$1.5		61,000	73,710	200	590
Turkeys	$0.5	$20	25,000	12,320	0	500
All AFOs [d/]	**NA**	**NA**	**NA**	**355,650**	**10,550**	**14,630**

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 layers.

[b/] Average revenue per head across all operations for each sector derived from data obtained from USDA's 1997 ARMS data (USDA/ERS, 1999a). See Section 4.

[c/] Includes fed cattle, veal and heifers.

[d/] Total adjusts for operations with mixed animal types and includes designated CAFOs (expressed over a 10-year period). See Section 2 of this document for estimates of the total number of AFOs.

These data were obtained with the assistance of staff at USDA's ERS (as described in Section 4.2.3.2).[6] 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). Use of total farm revenue corresponds to SBA's size standards that are expressed in terms of total annual business revenue (SBA, 1998; USGPO, 2000).

EPA uses the derived per-animal revenues shown in Table 9-2 to equate SBA's size standard (in revenues) with farm size based on the number of animals, as follows:

$$\frac{\text{Average \# Animals}}{\text{Farm}} = \frac{\text{SBA's Small Business Definition (\$ per year per farm)}}{\text{Average Total Revenue per head (\$/animal)}}$$

[6]As noted throughout this report, USDA periodically publishes aggregated data from the ARMS and Census databases and provides customized analyses of the data to members of the public and other government agencies. In providing such analyses, USDA maintains a sufficient level of aggregation to ensure the confidentiality of individual facility data.

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 9-2.

For the purpose of conducting its IRFA for this rulemaking, and based on the animal inventory thresholds discussed above, EPA is evaluating a "small business" for these sectors as an animal feeding operation that houses or confines less than: 1,400 fed beef cattle; 200 mature dairy cattle; 1,400 market hogs; 260,000 broilers; 61,000 layers; or 25,000 turkeys. Hereafter, all references to small CAFO businesses reflect the SBA definitions of "small" and the alternative definition proposed by EPA for small layer operations, applied on the basis of a calculated number of head.

9.2.2.2 Total Number of Operations that Match SBA Size Standards

Using the threshold sizes identified for small businesses in the livestock and poultry sectors (Table 9-2), EPA matches these thresholds with the number of operations associated with those size thresholds, based on available USDA data, to estimate the total number of small animal confinement operations in these sectors (step 2).

The 1997 Census constitutes the primary data source that EPA uses to match the small business thresholds to the number of operations by size. Other supplemental data used includes other published USDA data and information from industry and the state agriculture extension agencies. In some cases, EPA extrapolated between two size groupings to obtain an estimate of the number of small livestock and poultry operations. Additional information is also used to subdivide sector level data into subsectors. For example, the number of hog operations that are farrow-finish versus grow-finish are distinguished according to market share information (USDA/APHIS, 1995b). Information that differentiates the number of egg laying operations according to manure management system (wet versus dry) are approximated based on conversations with State Extension personnel for selected states, as described in the *Development Document* (USEPA, 2000a). The number of breeder and nursery pig operations and veal and heifer operations are approximated based on information obtained from state extension personnel and EPA's farm site visits (USEPA, 2000a).

For many of the animal sectors, it is not possible to estimate from available U.S. farm data what proportion of total livestock and poultry operations have feedlots and what proportion are grazing operations only. For the beef and hog sectors, the USDA has limited data on the number of operations that are feedlot operations only (USDA/APHIS, 1995b; USDA/NASS, 1999a and 1999b). For analytical purposes, EPA has assumed that all dairy and poultry operations potentially are confinement operations. More information on the farm size distribution data that EPA uses to match the size thresholds to the number of poultry and livestock operations is documented in the *Development Document* (USEPA, 2000a).

Table 9-2 shows EPA's estimates of the total number of small livestock and poultry operations using this approach. As shown, an estimated 355,650 animal confinement operations meet SBA's small business definition. This is 95 percent of the estimated total number of animal feeding operations (375,700 operations).

EPA recognizes that this approach may 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 10-house broiler operation with 260,000 birds would be a small business. Information from industry sources, however, suggest that a two-house broiler operation with roughly 50,000 birds is small (Madison, 1999; USEPA, 2000e). Therefore, it is likely that some medium- and large-size broiler operations are being considered small businesses (USEPA, 2000g).

On the other hand, it is possible that the resulting small business estimate may have failed to identify some small businesses as "small" in the other sectors. For example, EPA's approach identifies as a "small business" hog operations with less than 1,400 pigs and turkey operations with less than 25,000 turkeys, which account for less than 94 percent of all operations and less than 30 percent of sales in these sectors. These proportions are below SBA's presumed coverage rates that define as small about 99 percent of all operations that 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, 2000g).

9.2.2.3 Total Number of Small CAFOs Subject to the Proposed Regulations

Based on the regulatory thresholds for each co-proposed alternative, EPA estimates the number of small businesses that will be subject to the proposed requirements (step 3).[7] The 1997 Census constitutes the primary data source that EPA uses to match the small business thresholds (e.g., a small dairy operation has less than 200 milk cows) to the number of facilities that match that size group (e.g., the number of dairies with less than 200 cows, as reported by USDA). Other supplemental data used include other published USDA data and information from industry and the state extension agencies.

Table 9-2 shows the estimated total number of livestock and poultry operations that meet the SBA definition of a "small business" in each of the livestock and poultry sectors. Not all of small confinement operations would be subject to the proposed CAFO regulations, however. EPA's proposed regulations only apply to those operations that meet the regulatory definition of a CAFO or those that have been designated as a CAFO by the NPDES permitting authority due to risks posed to water quality and public health, as discussed in Section 3. The proposed changes *define* as a CAFO those operations that confine more than 300 or 500 AU (depending on co-

[7]In this section, EPA discusses numbers of affected CAFOs and impacts under the two-tier structure at 500 AU threshold (Scenario 4a) and three-tier structure (Scenario 3) only. "Two-tier structure" in this section refers to the 500 AU threshold, except where otherwise noted.

proposed scenario). The proposed requirements may also apply to an operation that confines fewer than 300 or 500 AU if it is *designated* as a CAFO by the NPDES permitting authority on a case-by-case basis, based on an on-site inspection.

Of the estimated 355,650 animal confinement operations that meet SBA's small business definition, EPA estimates that 10,550 operations that will be subject to the proposed requirements that are small businesses under the two-tier structure. Under the three-tier structure, an estimated 14,630 affected operations are small businesses. These estimates include expected designated facilities. The difference in the number of affected small businesses is among poultry producers, particularly broiler operations. See Table 9-2.

Table 9-3 presents the estimated number of livestock and poultry operations that may be subject to the proposed requirements under each co-proposed scenario that are also small businesses ("small CAFO businesses") by facility size category. The number of small CAFO businesses are shown as follows: (1) operations defined as CAFOs with more than 1,000 AU, (2) operations defined as CAFOs with between 300 to 1,000 AU or 500 to 1,000 AU, depending on scenario, and (3) operations that may be designated as CAFOs with fewer than 300 or 500 AU that may be designated (varies by co-proposed alternative). The number of small CAFO businesses in each of the three size categories is developed using the same data approach used to identify the total number of small operations, discussed in Section 9.2.2.2.

Based on estimates shown in Table 9-3, EPA estimates that there are 10,220 operations with more than 500 AU that may be defined as CAFOs that also meet the "small business" definition, under the two-tier structure. Under the three-tier structure, there are 14,530 operations with more than 300 AU that may be defined as CAFOs that are small businesses that meet the proposed risk-based conditions (described briefly in Section 3; more detail is provided in Section VII of the preamble). By broad facility size group, EPA estimates that about 4,000 operations have more than 1,000 AU, adjusting for operations with more than a single animal type. EPA estimates that about 6,000 operations have between 500 and 1,000 AU (two-tier structure) and about 10,000 operations have between 300 and 1,000 AU (three-tier structure), accounting for mixed operations. EPA's analysis assumes that all small businesses with 300 to 1,000 AU under the three-tier structure obtain a NPDES permit and that none certify out of the program.

Among operations that are defined as CAFOs, depending on co-proposed scenario, most small CAFO businesses are in the broiler and cattle sectors. As defined for this analysis, EPA expects that there are no small CAFO businesses in the dairy sector with more than 300 AU (see Section 9.2.2.1) and that small dairies will be subject to the regulations only if they are designated as a CAFO by the Permitting Authority. Also, as defined for this analysis, there are no small

Table 9-3. Total Number of Small CAFO Businesses Subject to Regulation

Sector	All "Small" AFOs		Two-Tier Structure			Three-Tier Structure		
	All	>1,000 AU	500-1,000 AU	<500 AU	Total	300-1,000 AU	<300 AU	Total
Fed Cattle	104,350	350	1,000	40	1,390	1,140	0	1,490
Veal	850	10	80	0	90	130	0	140
Heifers	1,250	300	500	0	800	680	0	980
Dairy	109,740	0	0	50	50	0	50	50
Hogs	107,800	0	100	200	300	250	50	300
Broilers	34,530	3,610	5,840	20	9,470	9,800	0	13,410
Layers	73,710	0	180	20	200	600	0	590
Turkeys	12,320	0	0	0	0	500	0	500
Sum Total	444,560	4,270	7,700	330	12,300	13,080	100	17,300
Total	**355,565**	**4,060**	**6,160**	**330**	**10,550**	**10,470**	**100**	**14,630**

Sources: Values presented in the table are EPA estimates, derived from published USDA data, including 1997 Census of Agriculture (USDA/NASS, 1999a) supplemented with other data, as described in the *Development Document* (USEPA, 2000a). All numbers are rounded to the nearest ten.
"Total" eliminates double counting of operations with mixed animal types. Based on survey level Census data, operations with mixed animal types account for roughly 25 percent of operations less than 1,000 AU; few operations with more than 1,000 AU have more than a single animal type.

grow-finish hog operations that may be defined as CAFO under either co-proposed scenario; also, there are no small CAFO businesses in the turkey sector under the two-tier structure (Table 9-3).

The majority (about 90 percent) of small confinement operations have fewer than 300 AU (Table 9-3). EPA's total estimate of small affected CAFOs includes an additional 330 small operations with fewer than 500 AU that may be designated as CAFOs under the two-tier structure over a 10-year period (consistent with the 10-year time frame used for EPA's financial model). As these facilities are designated, EPA did not adjust this total to reflect possible mixed animal operations. All of these operations are small businesses. Under the two-tier structure, designated operations are expected to consist of beef, dairy, hog, egg layer and broiler confinement operations that are located in more traditional farming regions and are determined to be significant

contributors of pollution.[8] Under the three-tier structure, EPA expects that 100 dairy and hog operations will be designated as CAFO and, therefore, subject to the proposed regulations.

These estimates are based on farm data for 1997. Due to continued consolidation and facility closure since 1997, EPA's estimates may overstate the actual number of small businesses in these sectors. In addition, ongoing trends are causing some existing small- and medium-size operations to expand their inventories to achieve scale economies. Some of the CAFOs considered here as small businesses may no longer be counted as small businesses because they now have higher revenues.

9.2.3 Results of the Initial Assessment

Early on in the development of this rulemaking, EPA conducted a preliminary assessment of the potential impacts to small CAFO businesses based on the results of a costs-to-sales test for operations with more than 500 AU. This screening test indicated the 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.

Table 9-4 presents the results of this screening test and indicates that about 80 percent (about 9,700) of the estimated number of small businesses with more than 500 AU that would be directly subject to the rule as CAFOs (two-tier) may incur costs in excess of three percent of sales. Compared to the total number of all small animal confinement facilities estimated by EPA (355,650 facilities), EPA estimates that operations that may incur costs in excess of three percent of sales comprise less than two percent of all small businesses in these sectors. (The cost and revenue data EPA uses for this assessment are presented in Section 9.4; more detailed information on these data is provided in Section 4 of this report.)

Based on the results of this initial assessment, EPA projected that the Agency 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 Small Business Advocacy Review 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 (see Sections 9.3 and 9.4).

[8]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 (300 AU to 500 AU) that are not covered by proposed CAFO revisions under the two-tier structure.

Table 9-4. EPA's Preliminary Assessment of Small Business Impacts using a Sales Test

Sector	Small AFOs	Small CAFOs (>500 AU)	Costs Exceed 3% of Revenues		
			#Small CAFOs	%Small CAFOS	%Small AFOs
Fed Cattle	104,350	1,350	80	6%	1%
Veal	850	90	10	1%	1%
Heifers	1,250	800	20	3%	2%
Dairy	109,736	0	0	0%	0%
Hog-FF	57,800	100	20	20%	1%
Hog-GF	50,000	0	0	0%	0%
Broilers	34,530	9,450	9,450	100%	28%
Layers-Wet	9,010	20	0	0%	0%
Layers-Dry	64,700	160	0	0%	0%
Turkeys	12,320	0	0	0%	0%
Sum Total	**444,560**	**11,970**	**9,580**	**80%**	**2%**

Source: USEPA. Total does not adjust for operations with mixed animal types, for comparison purposes. Includes CAFOs with more than 500 AU. Excludes designated operations. Sales test results are shown for the proposed BAT Option and NPDES Scenario 4a (described in Section 3).

9.3 EPA COMPLIANCE WITH RFA REQUIREMENTS

9.3.1 Outreach and Small Business Advocacy Review

As required by Section 609(b) of the RFA, as amended by SBREFA, EPA convened a Small Business Advocacy Review (SBAR) Panel for the proposed rule. 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* (USEPA, 2000g), or "Panel Report." This document is included in the public record (DCN 93001). Section XII.G of the preamble provides a summary of the Panel's activities and recommendations and describes the subsequent action taken by the Agency. Section XII of the preamble also details various outreach activities conducted by EPA that include outreach to small businesses in these sectors.

9.3.2 EPA's Initial Regulatory Flexibility Analysis

As required by Section 603 of the RFA, as amended by SBREFA, EPA has conducted a initial regulatory flexibility analysis. The IRFA must include a discussion of the reason the agency is considering the proposed rule, as well as the objectives and legal basis for the proposal. It must also include a description and estimate of the number of small businesses that will be affected. It must describe the reporting, recordkeeping, and other compliance requirements of the proposed rule and must identify any federal rules that may duplicate, overlap, or conflict with the proposed rule. Finally, the IRFA must describe any significant regulatory alternatives to the rule that would accomplish the stated objectives of the applicable statutes and which minimize impacts to small businesses. Sections 9.3.2.1 through 9.3.2.6 below address each of these requirements of the IRFA that EPA has prepared to support the proposed CAFO regulations.

Section 607 of the RFA further notes that to comply with the IRFA requirements, the Agency must "provide either a quantifiable or numerical description of the effects of a proposed rule or alternatives to the proposed rule, or more general descriptive statements if quantification is not practicable or reliable." For this rulemaking, EPA has prepared an economic analysis of the impacts to small CAFO businesses. This analysis is provided in Section 9.4. Based on the results of this analysis, EPA has determined that the proposed regulations will 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. Additional information and the detailed results of this analysis are presented in Section 9.4.2.

9.3.2.1 Reason EPA is Considering the Proposed Rule

Despite more than twenty years of regulation, there are persistent reports of discharge and runoff of manure and manure nutrients from livestock and poultry operations. The proposed 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 industry.

EPA's proposed 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 proposed revisions of 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 better clarify the conditions under which an AFO is a CAFO and, therefore, subject to the regulatory requirements.

Additional information on why EPA is revising the existing regulations is provided in Section IV of the preamble.

9.3.2.2 Objectives and Legal Basis for the Proposed Rule

A detailed discussion of the objectives and legal basis for the proposed CAFO regulations is presented in Sections I and III of the preamble.

9.3.2.3 Description and Estimate of Number of Small Entities Affected

As presented in Section 2, EPA estimates that there are about 375,700 livestock and poultry operations nationwide of which 355,650 (95 percent) are small (Table 9-2). Of these, the proposed CAFO regulations are expected to affect—and impose compliance costs on—approximately 10,550 operations or 14,630 operations (Table 9-3), depending on co-proposed scenario. Most (about 80 percent) of the estimated number of small CAFO businesses are in the poultry sectors, with the majority in the broiler sector. The cattle sector accounts for another 15 to 18 percent of small CAFO businesses, depending on tier structure. The remaining number of affected small CAFO businesses are in the hog and dairy sectors.

Tables 9-5 and 9-6 show the numbers of affected small businesses by EPA's model CAFO designation, which characterizes each of the small businesses by sector, size, and key production region. (Values shown in the tables do not adjust for operations with more than a single animal type.) These estimated CAFO numbers by model type are used to evaluate small business impacts, presented in Section 9.4 of this report.

Table 9-5. Numbers of Small CAFO Businesses by Sector, Size, and Region, Two-Tier Structure

Sector	Region	CAFOs <300AU	CAFOs "Medium 1"	CAFOs "Medium 2"	CAFOs "Large 1"	CAFOs "Large 2"
Fed Cattle	CE			160	70	
	MW		40	840	280	
Veal	MW			80	10	
Heifers	MW			500	300	
Dairy	MW	50				
	PA					
Hog: FF	MA					
	MW	50	150	100		
Hog: GF	MA					
	MW					
Layer: Wet	SO			40		
Layer: Dry	MW			60		
	SO			100		
Broiler	MA		740	1,190	980	70
	SO		1,280	2,650	2,300	260
Turkey	MA					
	MW					
Total		**100**	**2,210**	**5,720**	**3,940**	**330**

Source: USEPA. Size and region breakouts are based on 1997 Census data provided in the *Development Document* (USEPA, 2000a). Facility size and region definitions for model CAFOs are provided in Section 4, Table 4-1. Rounded to nearest ten. Numbers do not adjust for mixed animal types and include expected designated CAFOs (<500 AU under two-tier and <300 under three-tier structure) are included in the counts and are shown over a 10-year period. Shaded cells indicate that there are no small CAFO businesses that will be affected by the regulations that meet the SBA definition of a small business.

Table 9-6. Numbers of Small CAFO Businesses by Sector, Size, and Region, Three-Tier Structure

Sector	Region	CAFOs <300AU	CAFOs "Medium 1"	CAFOs "Medium 2"	CAFOs "Large 1"	CAFOs "Large 2"
Fed Cattle	CE		20	160	70	
	MW		120	840	280	
Veal	MW		50	80	10	
Heifers	MW		180	500	300	
Dairy	MW	50				
	PA					
Hog: FF	MA					
	MW	50	150	100		
Hog: GF	MA					
	MW					
Layer: Wet	SO		50	20		
Layer: Dry	MW		130	60		
	SO		230	100		
Broiler	MA		3210	1190	980	70
	SO		2750	2650	2,300	260
Turkey	MA		320			
	MW		180			
Total		**100**	**7,390**	**5,700**	**3,940**	**330**

Source: USEPA. See Table 9-5.

9.3.2.4 Description of the Proposed Reporting, Recordkeeping, and Other Requirements

The proposed CAFO regulations contain recordkeeping and reporting requirements. Costs associated with information collection include the recording of animal inventories, manure generation, findings from visual inspections of feedlot areas and fields, lagoon emptying, and other activities on a routine basis. Recordkeeping requirements also include collecting information on field application of manure and other nutrients (including amount, rate, method, incorporation, and dates), manure and soil analysis compilation, crop yield goals and harvested yields, crop rotations, tillage practices, rainfall and irrigation, and lime applications. Other

requirements include manure spreader calibration worksheets, manure application worksheets, maintenance logs, and soil and manure test results.

EPA has estimated the burden and costs associated with information collection imposed on CAFOs and states as a result of the proposed CAFO regulations. This analysis is provided in the Information Collection Request (ICR) document prepared by EPA (USEPA, 2000i). 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 ICR (USEPA, 2000i). The ICR also contains a summary of wage rate information from USDA, state agricultural extension agencies, and the Bureau of Labor Statistics, compiled by EPA for the purpose of this analysis. Additional information on the ICR is provided in Section XIII.F of the preamble to this rulemaking. A summary of the analysis of impacts to CAFO operators is provided below. Additional information on the estimated burden and costs to states is provided in the ICR.

EPA identifies five burden activities to CAFO operators, including start-up activities, permit application, permit nutrient plan development, best available technology requirements, and ground water monitoring for new facilities. Start-up activities are steps that a CAFO owner or operator must take in preparation to comply with the information collection requirements of the proposed 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 (or certify out of the program, under three-tier structure only), develop a PNP, and implement the other BAT requirements. PNPs must be reviewed annually and rewritten every five years. Permit application activities involve completing and submitting either an NOI under a general permit or an application for an individual permit. These activities will be conducted once every five years.

PNP development and implementation will require owners or operators of CAFOs to apply for a permit and notify their permitting authority when the PNP has been developed or modified. This notice must include the number of animals covered by the plan, the number of acres receiving waste, the nutrient content of the manure, the application schedule and rate, and

the quantity that will be transferred off site. As part of their recordkeeping responsibilities, CAFO operators will be required to keep the plan on site for inspections and make it available to the permitting authority on request.

To meet the proposed BAT requirements, CAFO owners or operators will perform various activities which will need to be recorded, such as visual inspections of the feedlot facilities, testing or calibration of manure application equipment, collection of soil samples, recording of volume of manure and process wastewater produced as well as off-site transfer, and employee training. Existing beef and dairy sources as well as all NSPS have requirements will involve documentation of whether ground water is hydrologically linked to surface water at the CAFO site and, if it is, records of monitoring of ground water quality. Monitoring records must be maintained to demonstrate that no discharge has occurred.

In addition to recordkeeping costs, EPA estimates the capital and operation and maintenance (O&M) costs associated with these burden activities. A CAFO will incur capital costs when it purchases equipment or builds structures that are needed for compliance with the rule's reporting and recordkeeping requirements that the facility would not use otherwise. Consistent with the overall cost analysis for the proposed rule, capital costs are annualized assuming a 10-year amortization period and a 7 percent interest rate. Capital costs for the proposed rule include purchasing a soil auger to collect soil samples and a manure sampler. CAFOs applying manure on site (assumed to be 100 percent, although land application does not occur at 100 percent of CAFOs) will need to obtain a scale to calibrate the spreader. Some facilities will also need to install depth markers in their lagoons, and certain sources with ground water linked to surface water will need to install monitoring wells. EPA's estimates also include the one time cost for the nutrient management course in this cost category. A facility incurs O&M costs when it regularly uses services, materials, or supplies needed to comply with the rule's reporting and recordkeeping 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 three years. O&M costs include laboratory analysis of soil, manure, and ground water samples, training of person responsible for manure application, and maintenance of ground water monitoring wells.

EPA estimates that the public burden for this information collection request will require 1.2 to 1.6 million labor hours for all CAFO respondents to comply with the proposed regulations (USEPA, 2000i). Information collection at a CAFO is associated with permit application, PNP development, inspection and sampling, and ground water assessment. 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 total costs to regulated CAFOs associated with reporting and recordkeeping requirements under the proposed CAFO regulations at $27 million annually (1999 dollars), under the two-tier structure. For the three-tier structure, EPA estimates costs to regulated CAFOs at $35 million annually (USEPA, 2000i). This estimate excludes NPDES burden for CAFOs covered by other ICR estimates, as well as NPDES burden for co-permittees and off-site manure recipients.

Under the two-tier structure, EPA estimates that there will be approximately 7,300 CAFO respondents and an average of 80,700 CAFO responses per year. Under the three-tier structure, EPA estimates that there will be approximately 9,600 CAFO respondents and an average of 107,800 CAFO responses. Thus, the average burden per CAFO respondent is 163 to 166 hours and the average burden per CAFO response is 14 to 15 hours. For this analysis, EPA assumes that the administrative burden assumptions are generally the same regardless of CAFO size. Only soil sampling and PNP development burdens would differ by CAFO size. Costs are assessed using a weighted average acreage for all affected CAFOs and do not contain a breakdown for CAFOs with more than or less than 1,000 AU. This estimate likely overstates the time requirements at small CAFO businesses, since it is an average over all operations both large and small.

More detailed information on the burden and associated costs for each of the activities described above is provided in the ICR (USEPA, 2000i).

9.3.2.5 Identification of Relevant Federal Rules that May Duplicate, Overlap, or Conflict with the Proposed Regulations

For this analysis, EPA assumes that all CAFOs are already in compliance with existing federal and state regulations affecting animal production facilities. The Small Business Advocacy Review Panel did not identify any federal rules that duplicate or interfere with the requirements of the proposed rule (USEPA, 2000g).

9.3.2.6 Significant Regulatory Alternatives

EPA proposes to focus the regulatory revisions in this proposal on the largest operations, which present the greatest risk of causing environmental harm, and in so doing, has minimized the effects of the proposed regulations on small livestock and poultry operations. First, EPA is proposing to establish a two-tier structure with a 500 AU threshold. Unlike the current regulations, under which some operations with 300 to 500 AU are defined as CAFOs, operations of this size under the revised regulations would be CAFOs only by designation. Second, EPA is proposing to raise the size standard for defining egg laying operations as CAFOs. Third, EPA is proposing to eliminate the "mixed" animal calculation for operations with more than a single animal type for determining which AFOs are CAFOs.

Under the two-tier structure, EPA is proposing to revise the threshold for being defined as a CAFO down to 500 AU and eliminate the "middle category" for operations with between 300 and 1000 AU. This proposal would provide relief to small businesses by removing from the CAFO definition operations with between 300 AU to 500 AU that under the current rules are defined as CAFOs. EPA estimates that under the co-proposed alternatives, between 64 percent (two-tier) and 72 percent (three-tier) of all CAFO manure would be covered by the regulation.

(See Section 2 of this report.) Under the two-tier structure, the inclusion of all operations with more than 300 AU instead of operations with more than 500 AU, the CAFO definition would result in 13,800 additional operations being regulated, along with an additional 8 percent of all manure. An estimated 80 percent of these additional 13,800 CAFOs are small businesses (about 10,870 CAFOs). EPA estimates that by not extending the regulatory definition to operations with between 300 and 500 AU, these 10,870 small businesses will not be defined as CAFOs and will therefore not be subject to the proposed regulations. EPA estimates the additional costs of extending the regulations to these small CAFO businesses at almost $150 million across all sectors. The difference in costs between the proposed BAT Option/Scenario and the proposed BAT Option and Scenario 4b combination may be approximated by comparing the estimated costs for these regulatory options, which are shown in Section 5.

Also, under the two-tier structure, EPA is proposing to raise the size standard for defining egg laying operations as CAFOs. This alternative would remove from the CAFO definition small egg laying operations with between 30,000 and 50,000 hens that under the current rules are defined as CAFOs, if they utilize a liquid manure management system. (The current regulations affects egg laying operations with more than 30,000 birds that use wet manure management systems only. Layer operations with dry manure systems are not covered by the regulations. EPA is proposing to regulate all layer operations of a certain size, regardless of the type of manure management systems used, as described in Section 3.) To provide relief to smaller operations, EPA is proposing to raise the size standard to apply to operations with more than 50,000 birds on-site. A higher size standard for egg laying operations is intended to avoid placing too much burden on small egg laying operations. These operations are virtually all small businesses (see Table 9-2). Most of these operations are concentrated in the Southern production regions. Data are not available to determine the number of egg laying operations with 30,000 to 50,000 layers. Therefore, EPA did not estimate the cost savings of raising the size standards for egg operations.

In addition, under both co-proposed alternatives, EPA is proposing to revise the threshold for being defined as a CAFO by eliminating the requirements for “mixed” operations (i.e., operations with more than a single animal type). Under the existing permit regulation, if a facility confines more than one animal type, each animal type is assigned a multiplication factor that is used to calculate the total number of animal units at the facility. Only poultry is excluded from this mixed animal type calculation under existing regulations. EPA is proposing to exclude mixed operations with more than a single animal type. The Agency determined that the inclusion of these operations would disproportionately burden small businesses while resulting in little additional environmental benefit. Since most mixed operations tend to be smaller in size, this exclusion represents important accommodations for small businesses. EPA expects that there are few large operations that confine more than a single animal type. If certain of these smaller operations are determined to be discharging to waters of the U.S., States can later designate them as CAFOs and subject them to the regulations. EPA’s decision not to include operations with more than a single animal type is also expected to simplify compliance and be more

administratively efficient, since the mixed operation multipliers were confusing to the regulated community and to enforcement personnel, and did not cover all animal types.

Overall, EPA's decision to mitigate the effects on small CAFO businesses through these scope considerations is intended to favor smaller—usually more traditional and often more sustainable—farm production systems where operators grow both livestock and crops and land apply manure nutrients. This is consistent with EPA's objectives under the USDA-EPA Unified National Strategy for Animal Feeding Operations, which targets only the largest operations since these pose the greatest *potential* risk to water quality and public health given the sheer volume of manure generated at these operations (USDA and USEPA, 1999). Larger operations that handle larger herds or flocks often do not have an adequate land base for manure disposal through land application. As a result, large facilities need to store significant volumes of manure and wastewater that have the potential, if not properly handled, to cause significant water quality impacts. In comparison, smaller operations manage fewer animals and tend to concentrate fewer manure nutrients at a single location. Smaller operations tend to be less specialized and are more diversified, engaging in both animal and crop production. These operations often have sufficient cropland and fertilizer needs to land apply manure nutrients generated at a livestock or poultry business.

9.4 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 9.4.1) and presents the results of this analysis (Section 9.4.2). This economic analysis supports the IRFA (Section 9.3) by quantifying the effects of the proposed CAFO regulations.

9.4.1 Data and Methodology

To examine the economic impacts of the proposed regulations on small CAFO businesses, EPA uses the same representative farm approach that is used to analyze impacts to all CAFOs (regardless of size), as described in Section 4 this EA. This approach evaluates impacts to 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 9.3.3) and, for each model CAFO, the costs of the proposed regulations and selected financial characteristics (see Section 4).

EPA's analysis evaluates the economic achievability of the proposed regulatory options at small CAFO businesses based on changes in representative financial conditions across three criteria. These criteria are: a comparison of incremental costs to total revenue (sales test), projected post-compliance cash flow over a 10-year period, and an assessment of an operation's debt-to-asset ratio under a post-compliance scenario.

EPA determines economic impacts to small businesses by applying the proposed economic achievability criteria described in Section 4.2.5, which are used to divide the impacts of the proposed CAFO regulations into three categories (see Table 4-11). Accordingly, if an average model facility is determined to incur economic impacts under the proposed CAFO regulations that are regarded as "Affordable" or "Moderate," then the results are considered to indicate economic achievability. "Moderate" impacts are not associated with operational change at the CAFO and are considered by EPA to indicate economic achievability. If an average operation is determined to incur "Stress," this result is considered to potentially indicate that the proposed regulations might not be economically achievable, subject to other considerations. "Affordable" and "Moderate" impacts are associated with positive post-compliance cash flow over a 10-year period and a debt-to-asset ratio not exceeding 40 percent, in conjunction with a sales test result that shows that compliance costs are less than 5 percent of sales ("Affordable") or between 5 and 10 percent of sales ("Moderate"). "Stress" impacts are associated with negative cash flow or a post-compliance debt-to-asset ratio exceeding 40 percent, or sales test results that show costs equal to or exceeding 10 percent of sales. More detail on this classification scheme, along with a discussion of the basis for EPA's determination of these criteria for this analysis, is provided in Section 4.2.5.

Table 9-7 shows EPA's estimated compliance costs for selected model CAFOs under the proposed BAT Option. Costs are not presented separately by facility model for each co-proposed scenario, since the only difference in costs between the two scenarios are associated with the difference in the numbers of regulated CAFOs. 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 assumed for this analysis. These 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. Ranges also reflect Option 3 and 3A costs.[9] Section 4.2.1 provides additional information on EPA's cost models. Unit costs shown in Table 9-7 are aggregated by the average number of animals assumed for each model CAFO to derive total entity compliance costs used in this analysis. Information on EPA's model CAFOs used for this analysis is provided in Section 4.2 of this report.

[9]Option 3 assesses average costs to operations if there is no direct hydrologic connection to surface waters; Option 3A reflects costs to operations where there is a determined groundwater hydrologic connection (assumed at 24 percent of all affected operations).

Table 9-7. Estimated Per-Head Facility Costs (BAT Option/Co-Proposed Scenarios) for Model CAFOs

Sector	Region	Model CAFOs <300AU	Model CAFOs "Medium 1"	Model CAFOs "Medium 2"	Model CAFOs "Large 1"	Model CAFOs "Large 2"
			300 - 1,000 AU		>1,000 AU	
		(incremental compliance costs $ per animal)				
Fed Cattle	CE		$10.81-$80.32	$7.21-$61.98	$3.37-$38.59	
	MW		$15.87-$67.24	$11.31-$50.56	$7.12-34.65	
Veal	MW		$2.65-$7.78	$2.54-$4.75	$2.50-$4.75	
Heifers	MW		$14.13-$55.50	$9.37-$39.57	$5.04-$20.16	
	PA		$10.63-$60.86	$6.86-$43.96	$3.51-$27.14	
Dairy	MW	$60.39-$222.08				
	PA					
Hog: FF	MA					
	MW	$5.80	$6.03-$7.45	$4.35-$5.65		
Hog: GF	MA					
	MW					
Layer: Wet	SO		$0.83	$0.39-$0.60		
Layer: Dry	MW		$0.02-$0.27	$0.02-$0.23		
	SO		$0.02-$0.18	$0.02-$0.15		
Broiler	MA	$0.07-$0.13	$0.07-$0.13	$0.07-$0.12	$0.07-$0.12	$0.05-$0.10
	SO	$0.07-$0.15	$0.07-$0.15	$0.07-$0.13	$0.06-$0.13	$0.05-$0.11
Turkey	MA		$0.07-$0.71			
	MW		$0.12-$0.83			

Source: USEPA. Annualized costs are shown in Appendix A; actual costs are in the *Development Document* (USEPA, 2000a). Facility size and region definitions for model CAFOs are provided in Section 4, Table 4-1. Large operations roughly correspond to CAFOs with >1,000 AU and Medium operations correspond to CAFOs with 300-1,000 AU. Shaded cells indicate that there are no CAFOs that will be affected by the proposed regulations and that meet the SBA definition of a small business.

EPA also developed costs to confinement operations with less than 300 or 500 AU that may be designated as CAFOs by scaling the estimated compliance costs for the available "medium" and "large" CAFO models. (See Tables 9-5 and 9-6 for expected designated facilities under each co-proposed alternative.) The resulting costs—derived on a per-head basis—are adjusted by the average head counts at operations with fewer than 500 AU or 300 AU to derive the annualized per-facility compliance cost. EPA assumes that CAFOs with fewer than 500 AU or 300 AU have sufficient cropland for all on-farm nutrients generated (identified in the cost model as Category 1 costs). More detailed cost information is provided in the *Development Document* (USEPA, 2000a).

As explained in Section 4.2 of this report, EPA evaluates the effect of incurred compliance costs based on the total number of CAFOs in each sector, including mixed operations. This approach avoids understating costs at operations with more than one animal type that meets the size threshold for a CAFO or is designated as a CAFO by the Permitting Authority, and thus may incur costs to comply with the proposed requirements for each type of animal that is raised on site. Therefore, EPA's compliance costs estimates likely represent the upper bound, since costs at facilities with more than a single animal type may, in some cases, be lower due to shared production technologies and practices across all animal types that are produced on site.

The financial data that EPA uses to analyze impacts on small CAFO businesses are from USDA's ARMS database (see Section 4.2). These data are available for 1997 by commodity sector, facility size (animal inventory), and production region. Available 1997 financial data that are used to characterize average model CAFOs include gross farm revenue, net cash income (used to project cash flow), and baseline debt-to-asset ratios. Table 9-8 shows the gross revenue that EPA assumes for this analysis, expressed on a per-animal basis. Unit revenues shown in Table 9-8 are aggregated by the average number of animals assumed for each model CAFO to derive total entity revenue used in this analysis. Estimated cash flow and debt-to-asset ratios for CAFO models are provided in Section 4 of this report (Tables 4-5 and 4-7).

As Table 9-8 shows, USDA data indicate that operations with fewer than 300 AU, on average, have higher gross revenues when expressed on a per-animal basis than operations with more than 300 AU. This is explained by the fact that smaller farming operations tend to be more diversified and engage in both livestock and crop production. In general, larger businesses tend to be more specialized and concentrate on a single enterprise only. Consistent with SBA's size standards that are expressed in terms of total annual business revenue (SBA, 1998), EPA assesses financial impacts at model CAFOs based on changes in *total* farm revenue. Total farm revenue, as reported in USDA's ARMS database, includes gross cash income from both livestock and crop sales (including net Commodity Credit Corporation loans), government payments, and other farm-related income (income from machine-hire, custom work, livestock grazing, land rental, contract production fees, outdoor recreation, and other farm-related sources) (USDA/ERS, 1999a).

Table 9-8. Estimated Per-Head Facility Revenues for Model CAFOs

Sector	Region	Model CAFOs <300AU	Model CAFOs "Medium 1"	Model CAFOs "Medium 2"	Model CAFOs "Large 1"	Model CAFOs "Large 2"
			300 - 1,000 AU		>1,000 AU	
		(incremental compliance costs $ per animal)				
Fed Cattle	CE		$502		$854	
	MW		$535		$862	
Veal	MW		$535		$862	
Heifers	MW		$535		$862	
	PA		$502		$854	
Dairy	MW	$2,620				
	PA					
Hog: FF	MA					
	MW	$606	$304			
Hog: GF	MA					
	MW					
Layer: Wet	SO		$25			
Layer: Dry	MW		$25			
	SO		$25			
Broiler	MA		$1.5		$1.1	
	SO		$1.4		$1.2	
Turkey	MA		$11.2			
	MW		$11.2			

Source: Derived from USDA/ERS, 1999a (see Section 4.2.4). Facility size and region definitions for model CAFOs are provided in Section 4, Table 4-1. Large operations roughly correspond to CAFOs with >1,000 AU and Medium operations correspond to CAFOs with 300-1,000 AU. Shaded cells indicate that there are no CAFOs that will be affected by the proposed regulations and that meet the SBA definition of a small business.

Higher total farm revenues per animal at smaller-sized farms (due to the inclusion of revenue from all farm-related sources) is demonstrated in the original USDA ARMS data that are presented in the individual subcategory sections of this report, including Section 6 (poultry), Section 7 (hogs), and Section 8 (cattle and dairy). Derived on a per animal basis, these data show that operations with less than 300 AU tend to generate a larger share of total revenue from other secondary sources, including other secondary livestock revenue as well as revenue from crop sales. Other sources of farm-related revenue that tend to be greater at operations with less than 300 AU, compared to operations with more than 300 AU, include other farm-related revenue, such as government payments and nonfarm income. Since EPA's small business analysis considers a business' total entity revenue, with SBA size standards, the derived per-unit revenues are relatively lower per-unit for model CAFOs with more than 300 AU compared to model CAFOs with fewer than 300 AU. EPA's analysis does not consider sources of non-farm revenue in its analysis, even though data from USDA indicate that nonfarm revenue often constitutes a significant share of total operating income (USDA/ERS, 2000d, 1996a and 1999a).

The same ARMS financial data, however, consistently indicate that per-unit cash expenses tend to be greater among smaller producers than among larger operations. This is consistent with expectations of economies of size in agricultural production. A review of the agricultural literature suggests that there may be a statistically positive relationship between farm size and per-unit production costs, such that as farm size (number of animals) increases, per-unit costs are lower (ERG, 2000d; Lazarus, et al., 1999). This may result in lower per-unit capital costs and create a competitive advantage among larger-sized operations relative to smaller ones. This literature review is provided in the rulemaking record (ERG, 2000d—see DCN 70641).

9.4.2 Economic Analysis Results

Using the proposed economic achievability criteria, discussed in Section 9.4.1, EPA's economic analysis indicates that the proposed 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 9-9 for each of the co-proposed tier structures. (Results for Scenario 5 (two-tier structure at 750 AU threshold) and Scenario 6 are not determined, but fall within the range of the results presented.)

Under both the two-tier and three-tier structures, EPA's analysis indicates that the proposed requirements will not impose stress impacts on any affected small businesses in the veal, dairy, hog, egg laying, and turkey sectors. Under the two-tier structure, the proposed requirements will not result in financial stress to affected small operations in the heifer sector. Operations in these sectors are expected to be able to absorb the costs associated with the

Table 9-9. Results of EPA's Small Business Analysis

Sector	Number of Small CAFOs	Affordable	Moderate	Stress	Affordable	Moderate	Stress
		Zero Cost Passthrough					
		(Number of Operations)			(% Affected Operations)		
Two-Tier Structure (Proposed BAT Option/Scenario 4a)							
Fed Cattle	1,390	1,130	250	10	81%	18%	1%
Veal	90	90	0	0	100%	0%	0%
Heifer	800	680	120	0	85%	15%	0%
Dairy	50	40	10	0	80%	20%	0%
Hogs	300	300	0	0	100%	0%	0%
Broilers	9,470	1,860	7,460	150	20%	79%	2%
Layers	200	200	0	0	100%	0%	0%
Turkeys	0	0	0	0	NA	NA	NA
TOTAL	**10,550**	**4,300**	**7,840**	**160**	**41%**	**74%**	**2%**
Three-Tier Structure (Proposed BAT Option/Scenario 3)							
Fed Cattle	1,490	1,100	380	10	74%	26%	1%
Veal	140	140	0	0	100%	0%	0%
Heifer	980	800	150	30	82%	15%	3%
Dairy	50	40	10	0	80%	20%	0%
Hogs	300	300	0	0	100%	0%	0%
Broilers	13,410	1,910	11,220	280	14%	84%	2%
Layers	590	590	0	0	100%	0%	0%
Turkeys	500	460	40	0	92%	8%	0%
TOTAL	**14,630**	**5,340**	**11,800**	**320**	**37%**	**81%**	**2%**

Source: USEPA. Impact estimates shown include impacts to designated operations. Option/Scenario definitions provided in Table 3-1. Category definitions ("Affordable," "Moderate" and "Stress") are provided in Table 4-13. Numbers may not add due to rounding. NA = Not Applicable.

Number of operations does not adjust for operations with mixed animal types, for comparison purposes, to avoid understating costs at operations with more than one animal type that may incur costs to comply with the proposed requirements for each type of animal that is raised on-site. The number of CAFOs includes designated facilities.

proposed CAFO regulations without having to rely on cost passthrough. EPA's analysis shows that operations across most sectors may experience moderate financial impacts (Table 9-9). Moderate impacts are not associated with operational change at the CAFO (i.e., will not result in facility or product line closure) and are considered by EPA to be economically achievable.

In the cattle and broiler sectors, however, EPA's analysis indicates that each of the co-proposed tier structures will result in financial stress on some small businesses in the fed cattle and broiler sectors, as will the three-tier structure on some small heifer operations. These small businesses may be vulnerable to closure. Overall, operations that may experience financial stress comprise about 2 percent of all affected small CAFO businesses. For the two-tier structure, EPA estimates that 10 small beef operations and 150 small broiler operations will experience financial stress. For the three-tier structure, EPA estimates that 40 small beef and heifer operations and 280 small broiler operations will experience financial stress. No designated operations under either co-proposed scenario are estimated to experience financial stress. Small broiler facilities with stress impacts are larger operations with more than 1,000 AU under both tier structures. Small cattle and heifer operations with stress impacts are those that have a ground water link to surface water. This analysis is conducted assuming that no costs are passed through between the CAFO and processor segments of these industries. Based on the results of this analysis, EPA is proposing that the proposed regulations are economically achievable to small businesses in these sectors.

EPA believes that the estimated financial impacts shown in Tables 9-9 are worst-case. These 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 5 of this report, if modest levels of cost passthrough are assumed in the broiler sectors, then the proposed regulations are affordable to all small broiler operations. EPA did not evaluate economic impacts to 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 assumptions 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 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 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 9.2. 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 since it classifies a

10-house broiler operation with 260,000 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 may reflect a number of medium and large size broiler operations being considered as small entities. As discussed in Section 9.2.1, 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 the use of 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, lower reported operating revenues in the broiler sector reflect the predominance of contract growers in this sector. Contract growers receive a pre-negotiated contract price that is lower than the USDA-reported producer price, thus contributing to lower gross revenues at these operations (USDA, 1999). Lower producer prices among contract growers are often offset by lower overall production costs at these operations, since 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, 1996b). These variable cash costs comprise a large component of annual operating costs, averaging more than 70 percent of total variable and fixed costs at livestock and poultry operations (USDA, 1999). The contract grower also faces reduced risk because the integrator guarantees the grower a fixed output price (see Section 2.3.1 for more details on contracting in animal agriculture). Because production costs at a contract grower operation are lower than 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. One source of cost offset 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. This reduction alone exceeds the level of cost passthrough (42 percent) assumed 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.

Another 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. The EQIP program provides cost-share assistance to all livestock and poultry operations, regardless of size, for terraces, filter strips, and runoff trenches, as well as technical assistance in formulating conservation plans. More importantly, operations with 1,000 or fewer AU in confinement, which

make up the majority of small CAFO businesses, are also eligible to receive funding for construction of animal waste storage and treatment facilities (e.g., lagoons, holding tanks). Additionally, many poultry operations with more than 1,000 AU are considered small under SBA definitions, fall below the EQIP size threshold, and are eligible for waste storage and treatment funding (e.g., poultry operations with less than 455,000 broilers or less than 250,000 layers). Although funding may be limited, it is expected that the majority of funds are likely to go to operations eligible for waste storage and treatment funding (ERG, 2000a).

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 animal feeding operations is provided in the rulemaking record (ERG, 2000a — DCN 70130).

Finally, this analysis does not take into account certain noneconomic factors that may 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 and 2000e). Of these, the majority (about 60 percent) are "limited-resource," "retirement," or "residential" operations where farming is not the primary source of income (USDA/ERS, 2000e and 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 may 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 may 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 excludes sources of nonfarm income at these operations. As noted in Section 4.2, 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 the inclusion of these operations may 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 proposed CAFO regulations will benefit the smallest businesses in these sectors, since the regulations may create a comparative advantage for smaller operations (less than 300 or 500 AU), especially those operations that are not subject to the regulations. Except for the few AFOs that are designated as CAFOs, these smaller operations will not incur costs associated with the proposed requirements and may benefit from eventual higher producer prices as these markets adjust to higher production costs in the longer term.

SECTION TEN

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 10.1 describes the administrative requirements of both EO 12866 and UMRA. Section 10.2 identifies the reasons why EPA has determined that the existing regulations need to be revised. Section 10.3 provides a summary of the total social costs of the proposed CAFO regulations. Section 10.4 briefly summarizes the pollutant reductions that are expected under the proposed CAFO regulations. Section 10.5 summarizes the monetized benefits that are expected to accrue under the proposed CAFO regulations and also provides a comparison of the estimated total social costs and benefits under the proposed CAFO regulations (Section 10.6).

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.

10.1 ADDITIONAL ADMINISTRATIVE AND REGULATORY

10.1.1 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 OMB review and the requirements of the Executive Order. The Order defines "significant regulatory action" as one that is likely to result in a rule that may:

(1) 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;

(2) create a serious inconsistency or otherwise interfere with an action taken or planned by another agency;

(3) materially alter the budgetary impact of entitlements, grants, user fees, or loan programs or the rights and obligations of recipients thereof; or

(4) 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 proposed CAFO rulemaking is a "significant regulatory action" under the terms of Executive Order 12866 because the total costs of the rule are estimated to exceed $100 million annually. As such, this action was submitted to OMB for review. Changes made in response to OMB 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 10.2 describes the reasons why EPA is revising the existing regulations, and Sections 10.3 through 10.6 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 this report, with additional information for each affected industry subcategory provided in more detail in Sections 6, 7, and 8. The proposed revisions to the existing CAFO regulations are discussed in detail in Sections VII and VIII of the preamble (briefly summarized in Section 3 of this EA).

10.1.2 Requirements of the Unfunded Mandates Reform Act (UMRA)

Title II of the Unfunded Mandates Reform Act of 1995 (UMRA), P.L. 104-4, establishes requirements for Federal agencies to assess the effects of their regulatory actions on State, local, and tribal 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, local, and tribal governments, in the aggregate, or to the private sector, of $100 million or more 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. Moreover, section 205 allows EPA to adopt an alternative other than the least costly, most cost-effective or least burdensome alternative, if the Administrator publishes with the final rule an explanation of why that alternative was not adopted.

Before 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.

EPA has determined that the proposed 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 10.3). 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 proposed regulations, as well as impacts on processors in these industries and other market affects. Appendix E presents information comparing the cost-effectiveness of the proposed regulatory alternatives. Additionally, EPA's *Benefits Analysis* (USEPA, 2000d) presents estimated monetary benefits that may accrue under the proposed regulations, as required under UMRA when costs of a federal mandate exceed $100 million in any one year.

In addition, EPA has determined that the proposed CAFO regulations do not include a federal mandate that may result in estimated costs of $100 million or more to either state, local, or tribal governments in the aggregate. Accordingly, the proposed 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 state and federal governments under the regulatory options being considered are presented in Section 10.3. 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 options considered include no regulatory requirements that might significantly or uniquely affect local governments.

10.2 NEED FOR THE REGULATIONS

Executive Order 12866 requires that the Agency identify the need for the regulation or regulations being proposed. The specific need for the proposed CAFO regulations are summarized throughout this report (Sections 1 and 9) and are presented in more detail in Section IV and V of the preamble of the proposed rulemaking. 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 last 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 the proposed CAFO regulations is presented in Sections I and II of the preamble.

10.3 TOTAL SOCIAL COSTS

This section provides a summary of the total pre-tax costs of the proposed CAFO regulations in 1999 dollars. Compliance costs are presented as post-tax costs (i.e., costs that the CAFOs would face) in Section 5 of this report. The pre-tax costs include the costs to state and federal government of foregone tax revenues. This section also provides additional details of how EPA calculated other costs to state and federal governments for administering the NPDES permitting program, as it applies to CAFOs. A full accounting of these administrative costs is provided in the *Development Document* (USEPA, 2000a). For comparison with benefits estimates, all cost estimates in this section are reported in 1999 dollars.

Table 10-1 presents a summary of EPA's estimated total costs of the proposed CAFO regulations. As shown, for the two-tier structure, EPA projects that the total costs of the proposed regulations are $847 million per year (1999 dollars, pre-tax). For the three-tier structure, EPA estimates that costs will total $949 million per year. Estimated total costs have several components, including costs to regulated CAFOs and to offsite recipients of CAFO manure, and costs to states and federal governments to administer the NPDES permitting program. These cost components are discussed in more detail in the following subsections.

Table 10-1. Annual Pre-Tax Costs of the Proposed BAT Option under the Co-Proposed Scenarios, $1999

Sector	Two-Tier Structure (BAT Option/Scenario 4a)		Three-Tier Structure (BAT Option/Scenario 3)	
	No. of Operations	Total Cost	No. of Operations	Total Cost
	(number)	($ millions)	(number)	($ millions)
Regulated CAFOs [a/]				
Beef	3,080	$216.4	3,210	$227.7
Veal	90	$0.3	140	$0.8
Heifer	800	$11.6	980	$14.4
Dairy	3,760	$177.6	6,480	$224.6
Hog	8,550	$294.0	8,350	$306.1
Broiler	9,780	$97.1	13,740	$116.6
Layer	1,640	$14.2	2,010	$15.3
Turkey	1,280	$19.6	2,060	$24.9
Subtotal	**25,540**	**$830.7**	**31,930**	**$930.4**
Other Farming Operations [a/]				
Offsite Recipients	**17,923**	**$9.6**	**21,155**	**$11.3**
Permitting Authority [b/]				
States	24,760	$5.9	30,650	$7.3
Federal	1,030	$0.4	21,460	$0.4
Subtotal	**25,590**	**$6.2**	**31,930**	**$7.7**
Total	**NA**	**$846.5**	**NA**	**$949.4**

Source: USEPA. NA = Not Applicable. Option/Scenario definitions are provided in Table 3-1. Numbers may not add due to rounding.

[a/]Number of affected facilities adjusts for operations with more than a single animal type, includes expected defined CAFOs only, and excludes designated facilities. Cost estimates include costs to designated CAFOs (see Section 5). Section 2 provides additional information on the number of affected facilities and offsite manure recipients.

[b/]Number of permits includes permits for designated facilities on an annualized basis. Table 10-2 provides additional information on estimated number of permits.

10.3.1 Costs to Industry (Regulated CAFOs and Offsite Recipients)

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 recordkeeping 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.

EPA projects that the total compliance cost to regulated CAFOs is $831 million per year (pre-tax) and $572 million (post-tax) under the two-tier structure ($1999). By comparison, under the three-tier structure, EPA estimates that the cost to industry is $930 million per year (pre-tax) and $658 million (post-tax). In addition, under the two-tier structure, EPA estimates that the compliance cost to off-site recipients of CAFO manure is $10 million per year. Under the three-tier structure, the annual compliance cost to off-site recipients of manure is $11 million per year. See Table 10-1.

With the addition of administrative costs, EPA projects that, in total under the two-tier structure, private and public sector costs due to compliance with the proposed CAFO regulations would be $847 million annually, of which $840 million is incurred by CAFO operators (pre-tax) and offsite recipients of CAFO manure (Table 10-1). For the three-tier structure, EPA estimates total costs of $949 million annually, of which $936 million is incurred by industry (Table 10-1).

Estimated costs to regulated CAFOs are presented in Section 5, but are incomplete for the purposes of meeting the requirements of EO 12866 and UMRA. The costs presented in Section 5 are the post-tax costs and represent the costs to industry after compliance costs have been expensed or depreciated for tax purposes and income taxes have been paid on earnings. These post-tax costs reflect the tax shield on compliance costs. The tax shield is the cost to the state and federal governments of subsidizing, in effect, the cost of the proposed CAFO regulations. Tax shields are also a cost to society and must be included in the estimate of social costs.

For the purpose of this analysis, estimated pre-tax compliance costs can be viewed as an estimate of the net output loss (not the gross output loss, which is presented in Section 5) 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.[1] 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.

Estimated costs to offsite recipients of CAFO manure, presented in Section 5, are expressed on an annualized basis. Additional detail on how these costs are estimated is provided in the *Development Document* (USEPA, 2000a).

10.3.2 Costs to the Permitting Authority (States and Federal Governments)

As discussed in Section 10.3.1, the overwhelming majority (about 99 percent) of the estimated total regulatory costs will accrue to industry and to state and federal governments in the form of foregone tax revenues. The remaining burden on state and federal governments is estimated to range from $6 million to $8 million, depending on the co-proposed alternative. For the two-tier structure, state and federal administrative costs to implement the permit program are estimated to be $6.2 million per year: $5.9 million for states and $350,000 for EPA (Table 10-1). For the three-tier structure, state and federal administrative costs to implement the permit program are estimated by EPA at $7.7 million per year, estimated at $7.3 million for states, and $416,000 for EPA (Table 10-1). These costs are expressed in 1999 dollars and are annualized over the 5-year permit life using a 7 percent discount rate.

Regulatory 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 proposed regulatory requirements. Expected administrative costs will be related to the development, issuance, and tracking of either general or individual permits. In most cases, general permits may be issued. Some circumstances may require that an individual permit be issued. Most of these costs would be incurred by state governments, since the majority of states are authorized to administer NPDES permits. As shown in Table 10-1, the bulk (95 percent) of estimated administrative costs are expected to be incurred by the state permitting authority.

This section presents EPA's estimate of the number of operations that will be required to apply for a permit (Section 10.3.2.1) and the expected unit costs that are used to estimate total administrative costs (Section 10.3.2.2). Unit costs for general permits and individual permits are discussed separately. Administrative costs are then aggregated using assumptions about the number of permits and the unit costs, along with assumptions of frequency of occurrence, to develop total state and federal costs for administering permits (Section 10.3.2.3).

[1]These liquidation costs include legal fees, broker fees, etc.

10.3.2.1 Total Number of Permits

Table 10-2 provides a summary of the total number of AFOs that will be required to apply for a permit (or certify they meet certain requirements, as required under the three-tier structure) for each of the co-proposed alternatives. Additional information on the estimated number of permits that would be required under other NPDES Scenarios considered by EPA during the development of this rulemaking are provided in the *Development Document* (USEPA, 2000a).

Table 10-2. Summary of the Number of CAFOs Required to Apply for a Permit, by Sector

Sector	All Scenarios	Two-Tier Structure			Three-Tier Structure		
	>1,000 AU	Total	Defined	5-year Designated	Total	Defined	5-year Designated
Beef	2,040	2,860	800	20	2,950	910	0
Veal	10	60	50	0	110	100	0
Heifers	300	700	400	0	840	540	0
Dairy	1,420	3,380	1,850	110	5,470	4,020	30
Swine	4,020	7,680	3,560	100	7,450	3,400	30
Broilers	3,880	8,560	4,670	10	11,720	7,840	0
Layers	630	1,440	800	10	1,730	1,100	0
Turkeys	360	1,090	730	0	1,710	1,350	0
Total	**12,660**	**25,770**	**12,860**	**250**	**31,970**	**19,260**	**50**

Source: USEPA, 2000a. Rounded to nearest ten. Designated facilities (<500 AU and <300 AU) are shown over a 10-year period (however, designated facilities are included in the "total" column projected over a 5-year permit cycle).

Under the two-tier structure, EPA estimates that 25,770 CAFOs would be permitted. This estimate consists of 24,760 state permits (17,320 General and 7,420 Individual permits) and 1,030 federal permits (720 General and 310 Individual permits). Under the three-tier structure, EPA estimates that 31,970 CAFOs would be permitted, consisting of 30,650 state permits (21,500 General and 9,190 Individual permits) and 1,280 federal permits (900 General and 380 Individual permits). The total number of permits shown includes permits to operations that are designated as CAFOs (operations with more than 500 AU and more than 300 AU). Designated facilities are included in the total number of permits column but are shown projected over a 5-year permit cycle. The total number also adjusts for operations with more than a single animal type (USEPA, 2000a).

EPA did not estimate the number of permits and associated administrative costs for Scenario 5 (two-tier structure at 750 AU threshold) and Scenario 6.

10.3.2.2 Administrative Unit Costs

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 Notice of Intent (NOI). These per-facility administrative costs include initial facility inspections and annual recordkeeping 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 may also be necessary. Unit permit costs assumed by EPA for this analysis are obtained from a number of state permitting employees. The cost assumptions used to develop, review, and approve permits and inspect facilities, as well as a comparison of administrative costs among the various NPDES Scenarios EPA considered during this rulemaking, is presented in the *Development Document* (USEPA, 2000a). These documents also provide detailed discussions on EPA's assumptions of wage rates.

Table 10-3 provides estimates of administrative costs associated with a general permit. Unit general permit costs for public hearings, public notifications, and response to comments were provided by a number of state permitting branch employees (USEPA, 2000a). The most pertinent of these costs came from the State of Maryland, which has recently developed a general permit. Although the State of Washington also provided costs on general permit development, the state incurred some exceptional expenses that were deemed unrepresentative (the state held 23 public meetings and took four years to answer all comments).

Information regarding costs (for both general and individual permits) is typically specified in terms of labor hours. Hours were monetized using estimated average wage rates. For states, the annual average salary is estimated at $42,000, or $20.19 per hour assuming 2,080 work hours per year. This rate was multiplied by 1.4 to account for benefits to obtain a final loaded hourly wage rate of $28.27. Federal wage rates are estimated based on an annual rate of $47,891 (GS 12, Step 1), which was divided by 2,080 and then multiplied by 1.6 to account for benefits, resulting in a final loaded hourly labor rate of $36.84 (USEPA, 2000a).

To calculate administrative costs, EPA estimates the overall administrative costs associated with a general permit and the per-facility administrative costs. Table 10-3 presents EPA's estimates of administrative costs associated with a general permit for both state and federal governments. State costs to issue one general permit and provide for public notification of applicants are estimated at approximately $35,820 per permit. EPA estimates that Federal administrative costs are higher at $40,630 per permit. The footnotes to Table 10-3 provide additional details on how the items associated with a general permit were costed.

Table 10-3. Administrative Costs Associated With a General Permit, $1999

Item	Range		Representative Average	State Cost [f/]	Federal Cost [g/]
	Low	High			
	(hours or $)				
General Permit Development/Administration Costs					
Permit development [a/]	100	300	200	$5,650	$7,370
Public notice/response to comments [b/]	90	8,000	120	$3,390	$4,420
Public hearing(s)[c/]	120	360	240	$6,780	$8,840
Quarterly public notification [d/]	$400	$8,000	$4,000	$20,000	$20,000
Total	—	—	—	$35,820	$40,630
General Permit Costs per Each Facility Covered					
Review/approve notice of intent	1	1	1	$30	$40
Facility inspection [e/]	$1,000	$1,000	$1,000	$1,000	$1,000

Source: USEPA, 2000a.

[a/]Permit development estimates were made based on the assumption that states would adopt, with minor changes, the EPA model permit. It is notable that some states have experienced much higher costs, but that is believed to be the result of developing a permit without adopting EPA's model. [b/]Public notice/response to comment estimates from MD and WA. MD mailed public notice to 10 newspapers (est. 10 hours). Responding to comments required 2 weeks of one FTE (80 hrs). MD total = 10 + 80 = 90 hrs. WA's costs for public notice were nominal. Responding to comments in WA took four FTE working 25% for 4 yrs (2080 x 4). It is assumed that this cost was unusually high and the MD experience would be more representative.

[c/]Public hearing estimates were based on estimated time/cost per meeting of 60 hours. Assumed states would have two to six meetings.

[d/]Cost for each state's permitting authority to publish in a newspaper a list of facilities that have submitted a NOI to be covered under a general permit. This notification must be made quarterly. Annual cost based on publication costs of $1,000 per quarter multiplied by 4 to represent annual publication, then multiplied by 5 to represent the five-year life of the permits. This estimate likely overestimates costs as there may be some quarters in which no NOIs are received and thus the permitting authority would not need to publish notification. It is also assumed that in states where EPA administers the program, EPA will also publish quarterly.

[e/]Based on an average cost per inspection of $1,000 (Reg. 6 and TX). Estimate that 10% of facilities will be inspected.

[f/]Hourly costs monetized using a loaded rate of $28.27 per hour. This is based on $42,000 (1999) per year or $20.19/hour assuming 2,080 work hours multiplied by 1.4 to account for benefits. Costs rounded to nearest $10.

[g/]Federal costs based on $46,744/year (GS 12, Step 1, 1999), divided by 2,080, then multiplied by 1.6 to account for benefits, resulting in a final loaded hourly labor rate of $36.84 (documented in the USEPA, 2000a and the rulemaking record).

Table 10-4 shows EPA's estimates of the administrative costs associated with individual permits for both states and the Federal government. Obtaining an individual permit requires a state or EPA to review the permit application, provide public notice, and possibly respond to public comments. In a percentage of cases (estimated in this analysis at 12 percent based on conversations with permitting authorities in Kansas, Indiana, Missouri, Ohio, and Wisconsin), a public hearing may be necessary. Additionally, an initial facility inspection may be necessary, estimated to cost the state or EPA approximately $1,000. Unit individual permit costs for permit review, public hearings, and inspections were provided by several state permitting branch contacts that issue individual permits (USEPA, 2000a). Additionally, public hearing costs were based on information obtained from general permit costs. As with the previous table, the footnotes to this table provide details as to how the individual permit costs were estimated.

Table 10-4. Administrative Costs Associated with an Individual Permit, $1999

Item	Range		Representative Average	State Cost [e/]	Federal Cost [f/]
	Low	High			
	(hours or $)				
Permit review/public notification/response to comments [a/]	60	80	70	$1,980	$2,580
Public hearing [b/]	100	300	200	—	—
% of applications requiring hearing [c/]	4	20	12	—	—
Avg. Public Hearing Cost/Permit	—	—	—	$680	$880
Total	**—**	**—**	**—**	**$2,660**	**$3,460**
Inspections [d/]	$1,000	$1,000	$1,000		

Source: USEPA, 2000a.

[a/]Response to comments estimates from KS. 2-3 FTEs dedicated to responding to comments – 4,160-6,240 hrs divided by 50-100 permits per year.[b/]Based on estimates from WA, which indicated each hearing required approximately 100-150 hrs of State employee time. Using best professional judgement, assume 1-2 public meetings/hearings per permit at 100-150 hours per hearing.

[c/]From Kansas (4-8%) and Indiana (15-20%).

[d/]Based on an average cost per inspection of $1,000 (Reg. 6 and TX). It is estimated that 10% of facilities will be inspected.

[e/]Hourly costs monetized using a loaded rate of $28.27 per hour. This is based on $42,000 (1999) per year or $20.19/hour assuming 2,080 work hours multiplied by 1.4 to account for benefits. Costs rounded to nearest $10.

[f/]Federal costs based on $46,744/year (GS 12, Step 1, 1999), divided by 2,080, then multiplied by 1.6 to account for benefits, resulting in a final loaded hourly labor rate of $36.84 (USEPA, 2000a). Costs rounded to nearest $10.

10.3.2.3 Total Administrative Costs

Under the two-tier structure (Scenario 4a), operations with more than 500 AU are CAFOs and must obtain a permit. Designated facilities with fewer than 500 AU must also obtain a permit.

In total EPA estimates that 25,770 facilities will be required to apply for a permit (Table 10-2). Table 10-5 presents EPA's estimate of state and Federal administrative costs to permit CAFOs under regulatory Scenario 4a.

Under the three-tier structure (Scenario 3), operations with more than 1,000 AU are CAFOs and must obtain a permit. Operations with between 300 and 1,000 AU are also defined as CAFOs and must either certify that they do not meet specific conditions or must obtain a permit. Designated facilities with fewer than 300 AU must also obtain a permit. In total, EPA estimates that 39,330 facilities will be required to apply for a permit or certify that they do not meet the criteria specified in the scenario. For purposes of estimating administrative costs, EPA assumes that 31,930 facilities will actually obtain a permit. (The actual number will be determined by the permitting authorities on a case-by-case basis.) Table 10-6 presents EPA's estimate of state and Federal administrative costs to permit CAFOs under regulatory Scenario 3.

The numbers presented in Tables 10-5 and 10-6 reflect the 42 states that are authorized to administer NPDES programs (and thus are associated with state level costs), and the 8 states whose programs are administered by EPA (and thus are associated with federal level costs). Other key assumptions that EPA uses to develop these estimated costs are that 70 percent of all CAFOs would be covered by general permits and 30 percent would be covered by individual permits; that inspections would be required for 10 percent of all CAFO applications; and that the authorized 42 states would account for 96 percent of all permits. See the *Development Document* (USEPA, 2000a) for more detailed discussions of the assumptions used in this analysis.

10.3.3 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 10.3.1 and 10.3.2. However, other costs might also be incurred under the proposed regulations and constitute the full range of total social costs. For example, costs may 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

Table 10-5. State and Federal Administrative Costs, Two-Tier Structure (Scenario 4a)

Item	State			Federal		
	Unit Cost	**Number Req.**	**Total Cost**	**Unit Cost**	**Number Req.**	**Total Cost**
General Permit						
General Permit Development Costs	$35,820	42	$1,504,440	$40,630	8	$325,040
General Permit Tracking Costs						
Notification of Intent	$30	17,320	$519,600	$40	720	$28,800
Inspections	$1,000	1,732	$1,732,000	$1,000	72	$72,000
Total Permit Costs	—	—	**$3,756,040**	—	—	**$425,840**
Individual Permit						
Permit Review/Approval	$2,660	7,420	$19,737,200	$3,170	310	$982,700
Inspections	$1,000	742	$742,000	$1,000	31	$31,000
Total Permit Costs	—	—	**$20,479,200**	—	—	**$1,013,700**
Grand Total	—	—	**$24,235,240**	—	—	**$1,439,540**
Annualized Total	—	—	**$5,910,750**	—	—	**$351,090**

Source: USEPA, 2000a.

Assumptions:

70% of all CAFOs are assumed to be covered by general permits & 30% by individual permits.

Inspections are estimated to be conducted for 10% of all CAFO permit applications.

The 42 authorized states are estimated to account for 96% of the total permits.

Costs are annualized using a 7% discount rate over a period of five years.

Total CAFOs permitted	25,770
State total	24,740
General (NOI)	17,320
Individual	7,420
Federal total	1,030
General (NOI)	720
Individual	310

Table 10-6. State and Federal Administrative Costs, Three-Tier Structure (Scenario 3)

Item	State			Federal		
	Unit Cost	Number Req.	Total Cost	Unit Cost	Number Req.	Total Cost
Certification						
Certification requirements	$30	6,300	$189,000	$40	260	$10,400
General Permit						
General Permit Development	$35,820	42	$1,504,440	$40,630	8	$325,040
General Permit Tracking						
Notification of Intent	$30	21,460	$643,800	$40	900	$36,000
Inspections	$1,000	2,146	$2,146,000	$1,000	90	$90,000
Total Permit Costs	**—**	—	**$4,483,240**	—	—	**$461,440**
Individual Permit						
Permit Review/Approval	$2,660	9,190	$24,445,400	$3,170	380	$1,204,600
Inspections	$1,000	919	$919,000	$1,000	38	$38,000
Total Permit Costs	—	—	**$25,364,400**	—	—	**$1,242,600**
Grand Total	**—**	—	**$29,847,640**	—	—	**$1,704,040**
Annualized Total	**—**	—	**$7,279,560**	—	—	**$415,600**

Source: USEPA, 2000a.

Assumptions:

70% of all CAFOs are assumed to be covered by general permits & 30% by individual permits.

Inspections are estimated to be conducted for 10% of all CAFO permit applications.

The 42 authorized states are estimated to account for 96% of the total permits.

Costs are annualized using a 7% discount rate over a period of five years.

Total CAFOs certifying and obtaining permits = 39,330

Total CAFOs permitted	31,970
State total	30,690
General (NOI)	21,500
Individual	9,190
Federal total	1,280
General (NOI)	900
Individual	380

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 and expects that these other costs to society that are not specifically addressed by the analyses presented in this report will be modest.

10.4 POLLUTANT REDUCTIONS

EPA's estimate of the pollutant reduction expected under the proposed regulations is presented in Appendix E of this report. For the two-tier structure, EPA estimates that the proposed regulations will result in pollutant reductions of 8.4 million toxic pounds-equivalent of priority pollutants, 182 million pounds of nitrogen, 377 million pounds of phosphorus, as well as removals of other pollutants, such as sediments and pathogens. For the three-tier structure, expected pollutant reductions are higher, estimated at 9.4 million toxic pounds-equivalent of priority pollutants, 206 million pounds of nitrogen, and 425 million pounds of phosphorus. These estimated removals are measured by EPA at the stream level, as described in Appendix E. More details on the expected pollutant removals is provided in the *Benefits Analysis* (USEPA, 2000d) and the *Development Document* (USEPA, 2000a).

Section 10.5 summarizes the monetized benefits that EPA expects will accrue under the proposed CAFO regulations, which is based on a more detailed assessment of these benefits in EPA's *Benefits Analysis* of the proposed rulemaking (USEPA, 2000d). Finally, Section 10.6 presents a comparison of these cost and benefit estimates.

10.5 BENEFITS ASSESSMENT

EPA estimates that the monetized benefits of the proposed regulations range from $146 million to $182 million annually, depending on the co-proposed approach (Table 10-7). Annual benefits range from $146 million to $165 million under the two-tier structure; under the three-tier structure, estimated benefits range from $163 million to $182 million annually. EPA is only able to monetize (i.e., place a dollar value on) a small subset of the range of potential benefits that may accrue under the proposed regulations. Data and methodological limitations restrict the number of benefits categories that EPA is able to reasonably quantify and monetize. The proposed regulations' benefits are primarily in the areas of reduced health risks and improved water quality, as shown in Table 10-7, which also provides a comparison of the estimated total social costs and benefits of the proposed CAFO regulations. These benefits categories are described in more detail as follows:

- **Improvements in Water Quality and Suitability for Recreational Activities:** This analysis estimates the economic value of improvements in inland surface water quality that would increase opportunities for recreational fishing and swimming.

Table 10-7. Total Annual Social Costs and Monetized Benefits, $1999

Total Social Costs	"Two-Tier" Structure (500 AU threshold)	"Three-Tier" Structure (Scenario 3)
Social Costs		
Industry Compliance Costs (pre-tax)	$830.7 million	$930.4 million
NPDES Permitting Costs	$6.2 million	$7.7 million
Offsite Recipients of CAFO Manure	$9.6 million	$11.3 million
Total Social Costs	***$846.5 million***	***$949.4 million***
Monetized Benefits		
Improved surface water quality	$108.5 million	$127.1 million
Reduced shellfish bed closures	$0.2 - 2.4 million	$0.2 - 2.7 million
Reduced fish kills	$0.2 - 0.4 million	$0.2 - 0.4 million
Improved water quality in private wells	$36.6 - 53.9 million	$35.4 - 52.1 million
Total Monetized Benefits	***$145.5 - 165.1 million***	***$163.0 - 182.3 million***

Source: USEPA, 2000d. Estimated costs are presented in this report (Sections 5 and 10). More details on EPA's offsite recipient costs are in the *Development Document* (USEPA, 2000a). EPA's benefits estimates are described in the *Benefits Analysis* (USEPA, 2000d).

- **Reduced Incidence of Fish Kills:** This analysis estimates the economic value of a potential reduction in the number of fish kills caused by AFO-related waste.

- **Improved Commercial Shellfishing:** This analysis characterizes the impact of pollution from AFOs on access to commercial shellfish growing waters and values the potential increase in commercial shellfish harvests that may result from improved control of that pollution.

- **Reduced Contamination of Private Wells:** This analysis examines the impact of the revised regulations on groundwater quality and values predicted improvements in the quality of aquifers that supply private wells.

These individual analyses are discussed in the *Benefits Analysis* (USEPA, 2000d). These categories cover a small subset of the broader range of potential benefits that will likely accrue under the proposed regulation. In addition to these monetized benefits, EPA expects that additional benefits will accrue under the regulations, including reduced drinking water treatment costs, reduced odor and air emissions, improved water quality in estuaries, and avoided loss in property value near CAFOs, among other benefits. These benefits are described in more detail in the *Benefits Analysis* (USEPA, 2000d) and other supporting documentation provided in the

record. These supporting documents also provide estimates of the benefits that would accrue under alternative regulatory approaches considered by EPA during the development of this rulemaking.

10.6 COMPARISON OF COST AND BENEFITS ESTIMATES

Table 10-7 compares the costs and benefits of the proposed CAFO regulations under the two-tier and three-tier structures. Under the two-tier structure, EPA estimates compliance costs at $847 million, while benefits are estimated at $146 to $165 million. Under the three-tier structure, EPA estimates costs at $949 million, while benefits are estimated at $163 to $182 million.

SECTION ELEVEN

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